Komoditas : Sorghum
Tahun 2004-2008 (428 judul)

Ioannis Dogaris, Sofia Karapati, Diomi Mamma, Emmanuel Kalogeris, Dimitris Kekos, Hydrothermal processing and enzymatic hydrolysis of sorghum bagasse for fermentable carbohydrates production, Bioresource Technology, Volume 100, Issue 24, December 2009, Pages 6543-6549, ISSN 0960-8524, DOI: 10.1016/j.biortech.2009.07.046.
(http://www.sciencedirect.com/science/article/B6V24-4X1GFW7-5/2/b00545f43c15e9613bd20f200edf0870)
Abstract:
Untreated and hydrothermally treated sorghum bagasse (SB) was hydrolyzed to simple sugars by the synergistic action of cellulases and hemicellulases produced by the fungi Fusarium oxysporum and Neurospora crassa. Synergism between the two lignocellulolytic systems was maximized with the application of higher fraction of N. crassa enzymes.
Hydrothermolysis of SB was studied at a wide range of treatment times and temperatures. At intense pretreatment conditions (210 [degree sign]C for 20 min; logR0 = 4.54), the residual hemicellulose percentage was 17.45%, while formation of inhibitory products, 5-hydromethyl-furfural (HMF), furfural, acetic and formic acid, (0.21, 0.51, 3.36 and 1.80 g/l, respectively) remained in acceptable levels.
Maximum conversion of cellulose and total polysaccharides of the untreated SB were 23.18% and 18.79%, respectively. Combining hydrothermal treatment and enzymatic hydrolysis of released oligosaccharides and insoluble solids resulted in improvement of cellulose (approximately 15% increase) and total polysaccharides (two fold) hydrolysis compared to that of untreated SB.
Keywords: Sorghum bagasse; Hydrothermal pretreatment; Severity factor; Enzymatic hydrolysis; Cross-synergism

David W. Lamb, Mark G. Trotter, Derek A. Schneider, Ultra low-level airborne (ULLA) sensing of crop canopy reflectance: A case study using a CropCircle(TM) sensor, Computers and Electronics in Agriculture, Volume 69, Issue 1, November 2009, Pages 86-91, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.07.004.
(http://www.sciencedirect.com/science/article/B6T5M-4WY5BC1-1/2/2c4fafb7394b8d29bc1d8e10a35f3ee5)
Abstract:
Operational airborne and satellite remote sensing in agriculture remains constrained by matching platform availability to suitable daytime weather and illumination conditions, crop development, and availability of ground staff. An ultra low-level aircraft carrying an active NIR/Red CropCircle(TM) sensor was successfully deployed to record and subsequently map crop vigour via the simple ratio (SR) index over a field of sorghum. Given the logging frequency of [approximate]20 Hz and the presence of alternate rows of bare soil, the Moire effect reduced the contrast between crop and bare soil skip-rows. Such effects would not be expected to occur in non-skip-row crops. The ultra low-level airborne (ULLA)-SR map derived from the 20 m transect records compared favorably with the SR map derived from a meter-resolution airborne digital multispectral image that was re-sampled to a similar spatial resolution. This case study, involving a CropCircle(TM) sensor mounted in a low-level aircraft demonstrates another deployment option for users of this class of sensor. Moreover, an ULLA configuration offers the potential for greater flexibility in scheduling compared to airborne imaging, given it can be flown at any sun-angle, under cloud, at night, and may easily be incorporated into aircraft already conducting low-level operations, for example crop dusting and reconnaissance, over agricultural fields.

Keywords: Active optical sensor; CropCircle; NDVI; SR; Crop vigour; Ultra low-level airborne (ULLA)

Steven R. Larson, Chantel Scheuring, Parminder Kaur, Paul F. Cliften, Ivan W. Mott, B. Shaun Bushman, Jenifer J. Dong, Yang Zhang, Xiaojun Zhang, Mahanz Kiani, Yen-Hsuan Wu, Yun-Hua Liu, Hong-Bin Zhang, N. Jerry Chatterton, Richard R.-C. Wang, BAC library development for allotetraploid Leymus (Triticeae) wildryes enable comparative genetic analysis of lax-barrenstalk1 orthogene sequences and growth habit QTLs, Plant Science, Volume 177, Issue 5, November 2009, Pages 427-438, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2009.07.006.
(http://www.sciencedirect.com/science/article/B6TBH-4WV77PW-1/2/f1c1bb80600996ae5ef5bd4ff76bd80b)
Abstract:
Tall-caespitose basin wildrye (Leymus cinereus) and rhizomatous creeping wildrye (Leymus triticoides) are perennial Triticeae relatives of wheat and barley. Quantitative trait loci (QTLs) controlling rhizome proliferation were previously detected on homoeologous regions of LG3a and LG3b in two full-sib families derived from allotetraploid hybrids. Triticeae homoeologous group 3 aligns to rice chromosome 1, which contains the rice lax panicle and maize barrenstalk1 orthogene responsible for induction of axillary branch meristems, but this gene has not been mapped or sequenced in Triticeae. We developed bacterial artificial chromosome (BAC) libraries representing 6.1 haploid equivalents of the tetraploid Leymus genome (10.7 Mb). Overgo probes designed from the lax-barrenstalk1 orthogene hybridized to 12 Leymus BAC clones. Deduced amino-acid sequences from seven BAC clones were highly conserved with the rice, maize, and sorghum lax-barrenstalk1orthogenes. Gene specific primers designed from two of the most divergent BAC clones map to homoeologous regions of Leymus LG3a and LG3b and align with the lax-barrenstalk1 orthogene on rice 1L. Comparisons of genomic DNA sequences revealed two other conserved regions surrounding the Leymus LG3a, rice, and sorghum lax-barrenstalk1 ortholoci, and one of these regions was also present in maize and Leymus LG3b sequences. Comparisons of Leymus LG3a and LG3b lax-barrenstalk1 coding sequences and flanking genomic regions elucidate molecular differences between subgenomes.
Keywords: Axillary branch meristem; Bacterial artificial chromosome (BAC) library; Basic helix-loop-helix (bHLH) domain; Homoeologous loci; Orthologous loci; Transcription factor

Spurthi N. Nayak, Jayashree Balaji, Hari D. Upadhyaya, C. Tom Hash, P.B. Kavi Kishor, Debasis Chattopadhyay, Lina Maria Rodriquez, Matthew W. Blair, Michael Baum, Kenneth McNally, Dominique This, David A. Hoisington, Rajeev K. Varshney, Isolation and sequence analysis of DREB2A homologues in three cereal and two legume species, Plant Science, Volume 177, Issue 5, November 2009, Pages 460-467, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2009.07.009.
(http://www.sciencedirect.com/science/article/B6TBH-4WXSJW1-2/2/fcdcca44bab26a5f21107b9d54822351)
Abstract:
The transcription factor, DREB2A, is one of the promising candidate genes involved in dehydration tolerance in crop plants. In order to isolate DREB2A homologues across cereals (rice, barley and sorghum) and legumes (common bean and chickpea), specific or degenerate primers were used. Gene/phylogenetic trees were constructed using a non-redundant set of 19 DREB1A and 27 DREB2A amino acid sequences and were combined with taxonomic/species tree to prepare reconciled phylogenetic trees. In total, 86 degenerate primers were designed for different clades and 295 degenerate primer combinations were used to amplify DREB homologues in targeted crop species. Successful amplification of DREB2A was obtained in case of sorghum. In parallel, gene-specific primers were used to amplify DREB2A homologues in rice, barley, common bean and chickpea. Seven to eight diverse genotypes from targeted species were used for sequence analysis at DREB2A locus identified/isolated. A maximum of eight SNPs were found in the

common bean DREB2A, indicating two distinct haplotypes, three SNPs with five haplotypes were observed in barley whereas a single SNP was observed in rice, sorghum and chickpea. Parsimony based phylogenetic tree revealed distinct clustering of cereals and legumes. Furthermore, alignment of corresponding amino acid sequences showed conservation of AP2 domain across the targeted species.
Keywords: DREB; Candidate gene; Drought stress; SNP; Haplotype

Nadia Boudries, Naima Belhaneche, Boubekeur Nadjemi, Claude Deroanne, Mohamed Mathlouthi, Barbara Roger, Marianne Sindic, Physicochemical and functional properties of starches from sorghum cultivated in the Sahara of Algeria, Carbohydrate Polymers, Volume 78, Issue 3, 15 October 2009, Pages 475-480, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2009.05.010.
(http://www.sciencedirect.com/science/article/B6TFD-4W9XG81-3/2/9be3fc8d48e8b828f4520c97121ef40f)
Abstract:
Pure starches were isolated from white and red sorghum cultivated in Tidikelt, a hyper arid region situated in south Algeria. Amylose content, X-ray pattern and rheological properties of starches were examined. The amylose content in white sorghum starch (27.1%) was slightly higher than that in red sorghum (24.8%). The swelling power and the solubility behavior of both starches were nearly similar below 65 [degree sign]C. At higher temperatures, starch isolated from the white sorghum cultivar showed higher swelling power and lower solubility index than pigmented sorghum starch. The pasting properties of starches determined by RVA, Rapid Visco Analyser showed different viscosity peaks. Red sorghum starch had a higher value (4731 cP) than white sorghum starch (4093 cP). For both sorghum, X-ray diffractograms exhibit an A-type diffraction pattern, typical of cereal starches and the relative degrees of crystallinity were estimated at 22.72% and 28.91%, respectively, for local white and red sorghum starch. DSC analysis revealed that sorghum starches present higher temperatures at the peak (70.60 and 72.28 [degree sign]C for white and red sorghum starches, respectively) and lower gelatinization enthalpies (9.087 and 8.270 J/g for white and red sorghum starches, respectively) than other cereal starches.
The results showed that physicochemical and functional properties of sorghum cultivar starches were influenced by the genotype and the environment.
Keywords: Sorghum starch; Starch color; Amylose content; Rheology; X-ray pattern

Calvin Onyango, Gunter Unbehend, Meinolf G. Lindhauer, Effect of cellulose-derivatives and emulsifiers on creep-recovery and crumb properties of gluten-free bread prepared from sorghum and gelatinised cassava starch, Food Research International, Volume 42, Issue 8, October 2009, Pages 949-955, ISSN 0963-9969, DOI: 10.1016/j.foodres.2009.04.011.
(http://www.sciencedirect.com/science/article/B6T6V-4W741X6-2/2/5d8e7c279d90f959c9f0b882ac9cfb92)
Abstract:
The effect of cellulose-derivatives and emulsifiers on the creep-recovery behaviour of gluten-free dough prepared from gelatinised cassava starch and sorghum was studied. Cellulose treated doughs, except the treatment with 2.4% w/w fwb CMC, had lower resistances to deformation (range 10-33%) than emulsifier-treated doughs (range 3-13%). The higher elastic recovery of emulsifier-treated doughs corresponded to lower compliances and higher zero shear viscosities than for doughs treated with cellulose-derivatives. Addition of egg white powder (6.7% w/w fwb) eliminated several textural defects associated with gluten-free bread. Cellulose-derivatives did not decrease crumb firmness or staling rate when compared to the control. Though increasing emulsifier concentration (from 0.4% to 2.4% w/w fwb) decreased crumb firmness, crumbs treated with 2.4% w/w fwb emulsifiers, except diacetyl tartaric acid esters of mono- and diglycerides, were weak and difficult to handle after slicing. Nevertheless, all gluten-free breads treated with 2.4% w/w fwb emulsifiers staled at a slower rate than the control.

Keywords: Cassava; Cellulose-derivatives; Creep-recovery; Emulsifiers; Gluten-free bread; Sorghum

Katleen J.R. Vallons, Elke K. Arendt, Effects of high pressure and temperature on the structural and rheological properties of sorghum starch, Innovative Food Science & Emerging Technologies, Volume 10, Issue 4, October 2009, Pages 449-456, ISSN 1466-8564, DOI: 10.1016/j.ifset.2009.06.008.
(http://www.sciencedirect.com/science/article/B6W6D-4WPTXR3-1/2/0203ebd32d4ab51fea984b52e0a71d53)
Abstract:
Pressure-induced gelatinisation of sorghum starch was studied and compared to heat-induced gelatinisation. Starch suspensions were treated at increasing pressure (200-600 MPa) or temperature (60-95 [degree sign]C) for 10 min. The degree of gelatinisation was determined using differential scanning calorimetry, changes in birefringence and damaged starch measurements. Furthermore, the pasting behaviour and structural changes during gelatinisation were investigated using rheology and microscopy. The pressure-induced as well as the temperature-induced gelatinisation curves were sigmoid-shaped. Gelatinisation occurred between 300 MPa and 600 MPa or between 62 [degree sign]C and 72 [degree sign]C. No significant differences were found between the rheological properties and the microstructure of the pressure-treated samples and the temperature-treated samples within the gelatinisation intervals. Granules lost their birefringence, but granular structure was maintained; however, when heated beyond the endpoint of gelatinisation, the formation of a 'sponge-like' structure was observed. This change in structure at very high temperatures was reflected by a decrease in complex viscosity.Industrial relevance
In order to apply high pressure as an alternative to temperature in the structural engineering of starch-based systems, a full understanding of the pressure-induced gelatinisation process is necessary. No rheological and ultra-structural differences were observed between pressure- and temperature-induced gelatinisation of sorghum starch. These results indicate that pressure treatment can be utilised as a replacement technology for temperature during processing of complex starch-containing products.
Keywords: Sorghum starch; High pressure; Gelatinisation; Microscopy

J.W. Veldman, B. Mostacedo, M. Pena-Claros, F.E. Putz, Selective logging and fire as drivers of alien grass invasion in a Bolivian tropical dry forest, Forest Ecology and Management, Volume 258, Issue 7, 15 September 2009, Pages 1643-1649, ISSN 0378-1127, DOI: 10.1016/j.foreco.2009.07.024.
(http://www.sciencedirect.com/science/article/B6T6X-4WXBTPY-2/2/6210fa9b38788a0768fdae58d618e92a)
Abstract:
Logging is an integral component of most conceptual models that relate human land-use and climate change to tropical deforestation via positive-feedbacks involving fire. Given that grass invasions can substantially alter fire regimes, we studied grass distributions in a tropical dry forest 1-5 yr after selective logging, and experimentally tested the effect of forest fire on populations of invasive grasses. In unlogged forests and in microhabitats created by selective logging we found a total of four alien and 16 native grass species. Grasses covered 2% of unlogged and 4% of logged forest, with grass cover in logged forest concentrated in areas directly disturbed by logging; log landings and roads had relatively greater grass cover (37% and 17%, respectively) than did skid trails (10%) and felling gaps (8%). Total grass cover and grass species richness increased with canopy openness and were greatest in sites most severely disturbed by logging. The grass flora of these disturbed areas was composed mostly of native ruderal species (e.g., Digitaria insularis, Leptochloa virgata), a native bamboo (Guadua paniculata), and Urochloa (Panicum) maxima, a caespitose C4 pasture grass introduced from Africa. Urochloa maxima formed monodominant

stands (up to 91% cover and 2-3 m tall) and grew on 69% of log landings and 38% of roads. To better understand the potentially synergistic effects of logging and fire on the early stages of grass invasion, we tested the effect of a 12-ha experimental fire on U. maxima populations in a selectively logged forest. Three years after the fire, the area covered by alien grass in burned forest increased fourfold from 400 m2 (pre-fire) to 1660 m2; over the same period in a logged but unburned (control) area, U. maxima cover decreased from 398 m2 to 276 m2. Increased canopy openness due to fire-induced tree mortality corresponded with the greater magnitude of grass invasion following fire. Selective logging of this dry forest on the southern edge of the Amazon Basin promotes alien grass invasion; when coupled with fire, the rate of invasion substantially increased. Recognition of the grass-promoting potential of selective logging is important for understanding the possible fates of tropical forests in fire-prone regions.
Keywords: Chiquitania; Cynodon nlemfuensis; Disturbance; Invasive exotics; Megathyrsus maximus; Panicum maximum; Poaceae; Savanna; Sorghum halepense; Urochloa brizantha

Lakkana Laopaiboon, Sunan Nuanpeng, Penjit Srinophakun, Preekamol Klanrit, Pattana Laopaiboon, Ethanol production from sweet sorghum juice using very high gravity technology: Effects of carbon and nitrogen supplementations, Bioresource Technology, Volume 100, Issue 18, September 2009, Pages 4176-4182, ISSN 0960-8524, DOI: 10.1016/j.biortech.2009.03.046.
(http://www.sciencedirect.com/science/article/B6V24-4W386XT-2/2/ea5af69f32a3f0b1c911284c8792d2e6)
Abstract:
Ethanol production from sweet sorghum juice by Saccharomyces cerevisiae NP01 was investigated under very high gravity (VHG) fermentation and various carbon adjuncts and nitrogen sources. When sucrose was used as an adjunct, the sweet sorghum juice containing total sugar of 280 g l-1, 3 g yeast extract l-1 and 5 g peptone l-1 gave the maximum ethanol production efficiency with concentration, productivity and yield of 120.68 +/- 0.54 g l-1, 2.01 +/- 0.01 g l-1 h-1 and 0.51 +/- 0.00 g g-1, respectively. When sugarcane molasses was used as an adjunct, the juice under the same conditions gave the maximum ethanol concentration, productivity and yield with the values of 109.34 +/- 0.78 g l-1, 1.52 +/- 0.01 g l-1 h-1 and 0.45 +/- 0.01 g g-1, respectively. In addition, ammonium sulphate was not suitable for use as a nitrogen supplement in the sweet sorghum juice for ethanol production since it caused the reduction in ethanol concentration and yield for approximately 14% when compared to those of the unsupplemented juices.
Keywords: S. cerevisiae; Ethanol production; VHG fermentation; Sweet sorghum juice; Sugarcane molasses

J.W. Moore, M. Ditmore, D.O. TeBeest, The effects of cropping history on grain sorghum yields and anthracnose severity in Arkansas, Crop Protection, Volume 28, Issue 9, September 2009, Pages 737-743, ISSN 0261-2194, DOI: 10.1016/j.cropro.2009.04.008.
(http://www.sciencedirect.com/science/article/B6T5T-4WC4WGH-1/2/b1266ac620c45f9cb73f0eeb06acbed1)
Abstract:
Sorghum anthracnose, caused by Colletotrichum sublineolum, is found in most grain sorghum producing areas in the U.S.A., including Arkansas. High incidences and severities of anthracnose are infrequent and often limited to portions of some Arkansas fields. However, sporadic epidemics have occurred over many hectares and grain yield losses have been severe on susceptible sorghum hybrids suggesting that better management strategies are needed to improve and maintain high sorghum yields. The objective of this research was to evaluate the effect of previous cropping history on grain sorghum yields and on the severity of sorghum anthracnose in several agricultural environments in Arkansas. Replicated field experiments were conducted in 2005 and 2006 to evaluate sorghum following sorghum, sorghum following maize, sorghum following soybeans, and sorghum following rice on grain yields and anthracnose severity for 30 sorghum

hybrids in 2005 and ten hybrids in 2006. The results show that the severity of anthracnose ranged from 0% to >23% and planting sorghum in fields one year after maize, soybeans, or rice appeared to significantly reduce the severity of sorghum anthracnose on most of the sorghum hybrids evaluated in both years. Although anthracnose severity varied across years in these experiments, the data show significant yield increases for most of the sorghum hybrids when sorghum was planted after rice, soybeans or maize, but not when sorghum was planted in the same field in which sorghum was grown in the previous year. Grain yields ranged from 0 kg ha-1 to more than 9500 kg ha-1. These results demonstrate that planting sorghum after sorghum significantly increases anthracnose on most hybrids, that planting sorghum after rice, maize or soybeans can successfully reduce sorghum anthracnose, and that the economic benefits (yields) of these cropping sequences are partially dependent upon the year, the severity of the disease and the hybrid. Other management strategies such as sanitation, elimination of alternative hosts and planting clean, healthy seed or seed treated with an appropriate fungicide, coupled with disease resistance should be helpful and perhaps sufficient to avoid or reduce serious losses from grain sorghum anthracnose.
Keywords: Grain sorghum; Colletotrichum sublineolum; Sorghum anthracnose

Anna Muratova, Sergey Golubev, Lutz Wittenmayer, Tatyana Dmitrieva, Anastasia Bondarenkova, Frank Hirche, Wolfgang Merbach, Olga Turkovskaya, Effect of the polycyclic aromatic hydrocarbon phenanthrene on root exudation of Sorghum bicolor (L.) Moench, Environmental and Experimental Botany, Volume 66, Issue 3, September 2009, Pages 514-521, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2009.03.001.
(http://www.sciencedirect.com/science/article/B6T66-4VVR1WF-4/2/7095008dd76aac9da3eccd84d10a4874)
Abstract:
The objective of this work was to study the effect of two concentrations (10 and 100 mg kg-1) of phenanthrene, a ubiquitous polycyclic aromatic hydrocarbon (PAH), on root exudation of the remediating plant Sorghum bicolor (L.) Moench under controlled conditions in a pot experiment. It was found that the phenanthrene concentration of 10 mg kg-1 did not cause significant effects on plant survival and growth but had little stimulating effect on carbohydrate exudation. The contamination with phenanthrene at 100 mg kg-1 inhibited accumulation of plant shoot and root biomass, decreasing the carboxylic acid, carbohydrate, and amino acid amounts released by sorghum root into the rhizosphere. However, root exudation per unit of root surface was not changed significantly with increasing phenanthrene concentration. There were no differences in qualitative composition of root exudates under the influence of PAH were found. The observed alterations in the ratio between the main root-exuded components are assumed to manifest adaptive alterations occurring in the plant as a response to pollutant stress. The activity of three oxidoreductases (oxidase, peroxidase, and tyrosinase) released by sorghum roots was clearly progressive to the increasing phenanthrene concentration in the substrate. Under the influence of phenanthrene, the population of phenanthrene-degrading microorganisms in sorghum root zone increased, and their share in the total number of culturable heterotrophs increased as well. The main promotional factor was the pollutant; however, the stimulating effect of the plant root exudates was also involved. The increased pollutant-degrading microbial population and activity of the extracellular root enzymes are presumed to be important for the rhizodegradation of PAH.
Keywords: Polycyclic aromatic hydrocarbons; Root exudates; Sorghum bicolor

Linda Dykes, Larry M. Seitz, William L. Rooney, Lloyd W. Rooney, Flavonoid composition of red sorghum genotypes, Food Chemistry, Volume 116, Issue 1, 1 September 2009, Pages 313-317, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2009.02.052.
(http://www.sciencedirect.com/science/article/B6T6R-4VP4TPY-H/2/f850028cd457edee396a84415493ab29)

Abstract:
The effect of genotype on flavonoid composition was investigated in 13 sorghum varieties using HPLC-DAD. Sorghums with red/purple secondary plant colour had the highest levels of 3-deoxyanthocyanins (32-680 [mu]g/g) with the black pericarp sorghums having the highest. Sorghums with red secondary plant colour had a high proportion of apigeninidin compounds (66-89%), which suggested that secondary plant colour affects 3-deoxyanthocyanin composition. Red pericarp sorghums with tan secondary plant colour had the highest levels of flavones (60-386 [mu]g/g). Flavanones were also detected in all sorghums with a red pericarp (8-48 [mu]g/g) and secondary plant colour did not affect their levels ($p > 0.05$). The elevated 3-deoxyanthocyanin levels in the black sorghums were due to their pericarp colour. Black sorghum panicles that were exposed to sunlight during their development had three times more 3-deoxyanthocyanins (617 [mu]g/g) than those that were covered with a paper bag (212 [mu]g/g). This study showed that flavonoid levels and composition were affected by sorghum genotype. This information will help sorghum breeders to produce sorghum genotypes with maximum levels of desired flavonoids.
Keywords: Sorghum; Flavonoids; 3-Deoxyanthocyanins; Flavones; Flavanones

Abd Elmoneim O. Elkhalifa, Dominique M.R. Georget, Susan A. Barker, Peter S. Belton, Study of the physical properties of kafirin during the fabrication of tablets for pharmaceutical applications, Journal of Cereal Science, Volume 50, Issue 2, September 2009, Pages 159-165, ISSN 0733-5210, DOI: 10.1016/j.jcs.2009.03.010.
(http://www.sciencedirect.com/science/article/B6WHK-4WB3NB8-4/2/623589ce3358f162f17413eb08569e52)
Abstract:
Kafirin and protein bodies were extracted from a condensed tannin-free white Sudanese cultivar of sorghum (Dabar). The extracted materials were characterized by SDS-PAGE. The potential of kafirin as a tablet matrix for pharmaceutical applications was studied. Tablets composed of kafirin, calcium hydrogen orthophosphate, caffeine and magnesium stearate were prepared by direct compression. The tablets showed appropriate levels of hardness and friability. Drug release studies showed that caffeine dissolution was greater in 0.1 M HCl than in either phosphate buffer (pH = 6.8) or distilled water. Deamidation of the protein in acid conditions might explain this observation.
FTIR analysis showed that the secondary structure of kafirin was found to be mainly governed by [alpha] helices with some [beta] sheets. Upon tabletting, there was a change in protein conformation, which was recovered upon dissolution irrespective of the dissolution media. This might be explained by the loss of protein coil to coil interaction during tabletting (possibly due to the diluting effect of calcium hydrogen orthophosphate). This was later recovered when tablets were dissolved due to the hydrophobic interactions between the kafirin proteins.
In summary, this work has shown that kafirin has a potential for use as a tablet for drug delivery.
Keywords: Sorghum; Kafirin; Protein body; Tablets; Mechanical properties; Drug release

Ghaid J.S. Al-Rabadi, Robert G. Gilbert, Michael J. Gidley, Effect of particle size on kinetics of starch digestion in milled barley and sorghum grains by porcine alpha-amylase, Journal of Cereal Science, Volume 50, Issue 2, September 2009, Pages 198-204, ISSN 0733-5210, DOI: 10.1016/j.jcs.2009.05.001.
(http://www.sciencedirect.com/science/article/B6WHK-4WD1BYY-1/2/f9748fc8b83fdf31564fdc010350f781)
Abstract:
The influence of milled grain particle size on the kinetics of enzymatic starch digestion was examined. Two types of cereals (barley and sorghum) were ground, and the resulting grounds separated by size using sieving, with sizes ranging from ~0.1 to ~3 mm. In vitro enzymatic digestion was performed, using pancreatic alpha-amylase, amyloglucosidase and protease, to

determine fractional-digestion rates over 24 h. The resulting glucose production rate data were well fitted by simple first-order kinetics. For each sieve screen size, the digestion rate of barley was always higher than that of sorghum. The rate coefficients for digestion showed a decrease with increasing size, and could be well fitted by an inverse square relationship. This is consistent with the supposition that starch digestion in these systems is controlled by diffusion of enzyme through the grain fragment. Apparent diffusion coefficients of alpha-amylase obtained by fitting the size dependence were 0.76 (sorghum) and 1.7 (barley) x 10-7 cm2 s-1, 9 (sorghum) and 4 (barley) times slower than predicted for a molecule of the size of alpha-amylase in water.
Keywords: Starch digestion; alpha-Amylase; Grain particle size; Diffusion

Lur Epelde, Iker Mijangos, Jose M. Becerril, Carlos Garbisu, Soil microbial community as bioindicator of the recovery of soil functioning derived from metal phytoextraction with sorghum, Soil Biology and Biochemistry, Volume 41, Issue 9, September 2009, Pages 1788-1794, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2008.04.001.
(http://www.sciencedirect.com/science/article/B6TC7-4SG5304-2/2/b00bf61ed47d59725c75ccbe2f68a220)
Abstract:
A three-month microcosm study was carried out in order to evaluate: (i) the capacity of sorghum plants to phytoextract Cd (50 mg kg-1) and Zn (1000 mg kg-1) from artificially polluted soil and (ii) the possibility of biomonitoring the efficiency of phytoremediation using parameters related to the size, activity and functional diversity of the soil microbial community. Apart from plant and soil (total and bioavailable) metal concentrations, the following parameters were determined: soil physicochemical properties (pH, OM content, electrical conductivity, total N, and extractable P and K), dehydrogenase activity, basal- and substrate-induced respiration (with glucose and a model rhizodeposit solution, both adjusted to 800 mg C kg-1 DW soil and 45.2 mg N kg-1 DW soil), microbial respiration quotient, functional diversity through community level physiological profiles and, finally, seed germination toxicity tests with Lepidium sativum. Sorghum plants were highly tolerant to metal pollution and capable of reaching high biomass values in the presence of metals. In the first two harvests, values of shoot Cd concentrations were higher than 100 mg Cd kg-1 DW, the threshold value for hyperaccumulators. Nonetheless, in the third harvest, the bioconcentration factor was 1.34 and 0.35 for Cd and Zn, respectively, well below the threshold value of 10 considered for a phytoextraction process to be feasible. In general, microbial parameters showed lower values in metal polluted than in control non-polluted soils, and higher values in planted than in control unplanted pots. As a result of the phytoextraction process, which includes both plant growth and metal phytoextraction, the functioning of the phytoremediated soil, as reflected by the values of the different microbial parameters here determined, was restored. Most importantly, although the phytoextracted soil recovered its function, it was still more phytotoxic than the control non-polluted soil.
Keywords: Bioindicators; Biomonitoring; Metal pollution; Phytoextraction; Phytoremediation; Phytotoxicity; Soil health

Prafulla Kumar Naik, Shashi Saijpaul, Neelam Rani, Effect of ruminally protected fat on in vitro fermentation and apparent nutrient digestibility in buffaloes (Bubalus bubalis), Animal Feed Science and Technology, Volume 153, Issues 1-2, 26 August 2009, Pages 68-76, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2009.06.008.
(http://www.sciencedirect.com/science/article/B6T42-4WSR0R2-1/2/01a84b9042b835b4a8fea39cbcd93e82)
Abstract:
Experiments were conducted to evaluate effects of supplementation of calcium salts of long chain fatty acids (Ca-LCFA) as a rumen inert fat (PF) on in vitro fermentation and apparent nutrient digestion in adult buffaloes fed wheat straw based diets. For the in vitro fermentation study, five

total mixed rations (TMR) consisting of a concentrate mixture (CM), green Sorghum bicolor, WS and supplemented without (C) or with 30 g/kg dry matter (DM) rice bran fatty acid oil (RBO) (30 RBO) or 20 g/kg RBO + 10 g/kg PF (20 RBO/10 PF) or 10 g/kg RBO + 20 g/kg PF (10 RBO/20 PF) or 30 g/kg PF in the DM in the ratio of 340:50:580:30 were prepared. The in vitro DM degradability (IVDMD), TN, trichloro acetic acid precipitable N (TCA-N), non-protein N (NPN) and ammonia N (NH3-N) were similar among groups. Within the fat supplemented groups, total volatile fatty acid (TVFA) concentration increased linearly (P=0.025) with PF supplementation. Apparent nutrient digestibility was determined on 20 adult buffaloes divided into five equal groups fed CM supplemented without (C) or with 300 g RBO (30 RBO) or 200 g RBO + 100 g PF (20 RBO/10 PF) or 100 g RBO + 200 g PF (10 RBO/20 PF) or 300 g PF (30 PF) along with limited green S. bicolor and WS maintaining forage: concentrate ratio of 650:350. Fat supplementation had no effect on the DM intake and apparent digestibilities of DM, organic matter (OM), crude protein (CP), total carbohydrate (TCHO) and neutral detergent fiber (aNDF). Within fat supplemented groups, inclusion of PF increased digestibilities of DM, OM, ether extract (EE), TCHO, aNDF and ADF. Supplemental fat also increased the digestible energy (DE) and metabolizable energy (ME) content of the diet, which also increased linearly with PF supplementation. All buffaloes were in positive N, Ca and P balances. We conclude that 200-300 g supplemental PF in the form of Ca-LCFA can be included in straw based diets fed to buffaloes to increase its energy density without adversely affecting DM intake and digestibility.
Keywords: Concentrate mixture; Protected fat; Rice bran fatty acid oil; Total mixed rations

Hyun Young Yu, Farooqahmed S. Kittur, David R. Bevan, Asim Esen, Determination of [beta]-glucosidase aggregating factor (BGAF) binding and polymerization regions on the maize [beta]-glucosidase isozyme Glu1, Phytochemistry, In Press, Corrected Proof, Available online 25 August 2009, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2009.07.026.
(http://www.sciencedirect.com/science/article/B6TH7-4X35K1N-3/2/a8933f6064aaaf1c6e06536829e65643)
Abstract:
[beta]-Glucosidases (Glu1 and Glu2) in maize specifically interact with a lectin called [beta]-glucosidase aggregating factor (BGAF). We have shown that the N-terminal (Glu50-Val145) and the C-terminal (Phe466-Ala512) regions of maize Glu1 are involved in binding to BGAF. Sequence comparison between sorghum [beta]-glucosidases (dhurrinases, which do not bind to BGAF) and maize [beta]-glucosidases, and the 3D-structure of Glu1 suggested that the BGAF-binding site on Glu1 is much smaller than predicted previously. To define more precisely the BGAF-binding site, we constructed additional chimeric [beta]-glucosidases. The results showed that a region spanning 11 amino acids (Ile72-Thr82) on Glu1 is essential and sufficient for BGAF binding, whereas the extreme N-terminal region Ser1-Thr29, together with C-terminal region Phe466-Ala512, affects the size of Glu1-BGAF complexes. The dissociation constants (Kd) of chimeric [beta]-glucosidase-BGAF interactions also demonstrated that the extreme N-terminal and C-terminal regions are important but not essential for binding. To confirm the importance of Ile72-Thr82 on Glu1 for BGAF binding, we constructed a chimeric sorghum [beta]-glucosidase, Dhr2 (C-11, Dhr2 whose Val72-Glu82 region was replaced with the Ile72-Thr82 region of Glu1). C-11 binds to BGAF, indicating that the Ile72-Thr82 region is indeed a major interaction site on Glu1 involved in BGAF binding.
Keywords: [beta]-Glucosidase; [beta]-Glucosidase aggregating factor (BGAF); Protein-protein interaction; Binding site; Gel-shift assay; Pull-down assay; Frontal affinity chromatography (FAC)

Hyun Young Kil, Eun Soo Seong, Bimal Kumar Ghimire, Ill-Min Chung, Soon Sung Kwon, Eun Jeong Goh, Kweon Heo, Myong Jo Kim, Jung Dae Lim, Dokyoung Lee, Chang Yeon Yu, Antioxidant and antimicrobial activities of crude sorghum extract, Food Chemistry, Volume 115, Issue 4, 15 August 2009, Pages 1234-1239, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2009.01.032.

(http://www.sciencedirect.com/science/article/B6T6R-4VDS8M7-H/2/d0f1d1a1c0f6e9dc38c32b12362a0f01)
Abstract:
Here, we report the antioxidant and antimicrobial activities of sorghum (Sorghum bicolor Moench) extracts prepared from 25 cultivars from South Korea. Four cultivars of sorghum were extracted with methanol, then further fractioned with n-hexane, ethyl acetate, n-butanol, and water. The RC50 (the concentration of antioxidant required to achieve absorbance equal to 50% that of a control containing no antioxidants) value of the DPPH method and reducing power showed higher efficiency in the BuOH layer of all selected cultivars except Neulsusu. The various fractions were then examined for antimicrobial activity by a serial two fold dilution assays using the paper disc method. The methanol extracts showed higher levels of antimicrobial activity than the other fractions. Our results indicate that sorghum extracts could be used as a source of antioxidant and antimicrobial ingredients in the food industry.
Keywords: Antioxidant activity; Antimicrobial activity; MeOH extracts; Sorghum

Simone Gisele de Oliveira, Telma Teresinha Berchielli, Ricardo Andrade Reis, Maria Eliane Vechetini, Marcio dos Santos Pedreira, Fermentative characteristics and aerobic stability of sorghum silages containing different tannin levels, Animal Feed Science and Technology, In Press, Corrected Proof, Available online 14 August 2009, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2009.07.003.
(http://www.sciencedirect.com/science/article/B6T42-4X0MPBJ-2/2/b4f2c5ca0bc547c3412e0db693982821)
Abstract:
Two experiments were conducted to evaluate effects of tannin levels in sorghum silages supplemented, or not, with polyethylene glycol (PEG) on silage chemical composition and fermentative characteristics as well as aerobic stability of silages supplemented with urea or concentrate. A completely randomized experimental design was applied in both experiments. Silages without PEG had higher CP levels and lower ammonia N concentration (81.8 g/kg DM and 55.3 g/kg N, respectively) as compared to silages with PEG (70.6 and 63.4, respectively). High-tannin sorghum levels were not able to maintain silage aerobic stability, probably due to their low concentrations in the silages.
Keywords: Conserved forage; Fermentation; Polyethylene glycol; Polyphenols

L.O. Abdelhadi, J.M. Tricarico, Effects of stage of maturity and microbial inoculation at harvest on nutritive quality and degradability of grain sorghum whole-plant and head-chop silages, Animal Feed Science and Technology, Volume 152, Issues 3-4, 6 August 2009, Pages 175-185, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2009.04.014.
(http://www.sciencedirect.com/science/article/B6T42-4WBH59S-2/2/898aac274afd827d5923a75be1381107)
Abstract:
Grain sorghum silage is an attractive supplement for cattle grazing marginal areas where sorghum has agronomic advantages with respect to corn. The objective of this study was to evaluate a microbial inoculant as a management tool to improve the quality of whole-plant (WP) and head-chop (HC) grain sorghum silages. A completely randomized design with a 2 x 2 factorial arrangement of treatments was used in two experiments to evaluate effects of a commercial bacterial inoculant (Sil-All, Alltech Inc., Nicholasville, KY, USA) on DM recovery, OM degradation (OMD), fermentation, chemical composition and aerobic stability of WP ensiled at the milk stage (MS) of grain maturity and HC ensiled at the MS and dough stage (DS) of grain maturity. Both cultivars were ensiled with or without bacterial inoculant for 90 d in triplicate mini-silos constructed from PVC pipe. Samples were collected before ensiling, after ensiling for 3 months (POST), and after exposing 3-month old silage to air for 3 d (PAE). Samples were analyzed for pH, DM, CP,

aNDF, WSC, NH3-N and OMD after incubation with ruminal fluid for 72 h. In Experiment 1, the ensiling process reduced the DM (P=0.007) and WSC (P=0.004) content and increased the aNDF (P=0.022) content of WP sorghum. Ensiling for 90 d also increased the lag time (P=0.032) required for OM degradation of WP sorghum to begin. In Experiment 2, inoculation increased HC grain sorghum silage DM recovery over the control at MS (0.925 vs. 0.979, P=0.056 interaction between maturity at harvest and inoculation) but had no effect on DM recovery at the DS of maturity. Ensiling HC at MS resulted in lower (P<0.001) DM and WSC content, and higher (P<0.001) CP content than ensiling at DS. Microbial inoculation reduced (P=0.004) the rate of OMD in HC sorghum ensiled at the MS stage of grain maturity, and improved aerobic stability of HC sorghum silage regardless of grain maturity at harvest as indicated by lower (P<0.003) temperature after 3 d for inoculated PAE silage. Microbial inoculation is most beneficial in HC sorghum silage ensiled at MS, but improves aerobic stability of sorghum silage regardless of maturity at harvest.
Keywords: Silage; Grain sorghum; Head-chop; Whole-plant; Inoculant

Giovanni Piccinni, Jonghan Ko, Thomas Marek, Terry Howell, Determination of growth-stage-specific crop coefficients (KC) of maize and sorghum, Agricultural Water Management, In Press, Corrected Proof, Available online 5 August 2009, ISSN 0378-3774, DOI: 10.1016/j.agwat.2009.06.024.
(http://www.sciencedirect.com/science/article/B6T3X-4WXRDM0-1/2/4c3660cd1957fa4fcdd4f4eeb083dd50)
Abstract:
A ratio of crop evapotranspiration (ETC) to reference evapotranspiration (ETO) determines a crop coefficient (KC) value, which is related to specific crop phenological development to improve transferability of the KC values. Development of KC can assist in predicting crop irrigation needs using meteorological data from weather stations. The objective of the research was conducted to determine growth-stage-specific KC and crop water use for maize (Zea Mays) and sorghum (Sorghum bicolor) at Texas AgriLife Research field in Uvalde, TX, USA from 2002 to 2008. Seven lysimeters, weighing about 14 Mg, consisted of undisturbed 1.5 m x 2.0 m x 2.2 m deep soil monoliths. Six lysimeters were located in the center of a 1-ha field beneath a linear-move sprinkler system equipped with low energy precision application (LEPA). A seventh lysimeter was established to measure reference grass ETO. Crop water requirements, KC determination, and comparison to existing FAO KC values were determined over a 3-year period for both maize and sorghum. Accumulated seasonal crop water use ranged between 441 and 641 mm for maize and between 491 and 533 mm for sorghum. The KC values determined during the growing seasons varied from 0.2 to 1.2 for maize and 0.2 to 1.0 for sorghum. Some of the values corresponded and some did not correspond to those from FAO-56 and from the Texas High Plains and elsewhere in other states. We assume that the development of regionally based and growth-stage-specific KC helps in irrigation management and provides precise water applications for this region.
Keywords: Crop coefficient; ET measurement; Weighing lysimeter

Abraham J. Escobar-Gutierrez, Didier Combes, Miroslava Rakocevic, Christophe de Berranger, Annie Eprinchard-Ciesla, Herve Sinoquet, Claude Varlet-Grancher, Functional relationships to estimate Morphogenetically Active Radiation (MAR) from PAR and solar broadband irradiance measurements: The case of a sorghum crop, Agricultural and Forest Meteorology, Volume 149, Issue 8, 3 August 2009, Pages 1244-1253, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2009.02.011.
(http://www.sciencedirect.com/science/article/B6V8W-4VXJVRB-1/2/e58c79b59fcbfb1ebc8781a52bfb5e25)
Abstract:

Light quality plays a key role in higher plants' morphogenesis. In most plant models, light is considered as a consumable resource and plants are assumed blind to light signals. However, prior to any effort for modelling photomorphogenetic mechanisms, it is necessary to characterise the spatial distribution of the Morphogenetically Active Radiation (MAR) over and within plant canopies. Measurements of local photosynthetic photon flux density (PPFD) and broadband irradiance (Es) are easy to carry out by using small sensors. Thus, the distribution of the MAR within a canopy can be estimated whenever the functional relationships between these measurements and the photon flux within any spectral band are known. The objective of this work was to determine these functional relationships from the light spectra received above and at various positions around a target plant within a growing sorghum crop. The MAR components considered in this work are related either to photon flux densities in various wavebands between 330 and 950 nm or to the ratio between two photon flux densities. A part of the photon flux-related variables is strictly included in the PAR band and might be estimated from PPFD measurements using linear relationships. The other variables are related to both PPFD and Es by multiple linear relationships. The phytochrome photoequilibrium and the red to far-red ratios were related to the relative transmitted PPFD and to the ratio PPFD/Es within the canopy using a non-linear model. Models were validated against an independent set of data. We demonstrate that the MAR components within a sorghum crop can be accurately estimated with the functional relationships presented in this paper.
Keywords: Light quality; Phytochrome; Cryptochrome; Photomorphogenesis; Sorghum; Model

Dilys S. MacCarthy, Rolf Sommer, Paul L.G. Vlek, Modeling the impacts of contrasting nutrient and residue management practices on grain yield of sorghum (Sorghum bicolor (L.) Moench) in a semi-arid region of Ghana using APSIM, Field Crops Research, Volume 113, Issue 2, 3 August 2009, Pages 105-115, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.04.006.
(http://www.sciencedirect.com/science/article/B6T6M-4WF2NHT-1/2/3c9ac2a1c4373b59dc23b664e6c83162)
Abstract:
The cropping systems model APSIM (Agricultural Production Systems sIMulator) was applied to assess the response of sorghum grain yield to inorganic fertilizers applications and residue retention in diverse farmers' management systems (homestead fields and bush farms). The model was parameterized using data collected from experiments under optimum growth conditions (limited water or nutrient stress). Independent data from field experiments with three levels of P and four levels of N fertilizers conducted at two different locations and soils were used to evaluate the model. Soil water and fertility parameters measured were used for simulations while same starting conditions were assumed for unmeasured parameters for all trials. APSIM predicted the grain yield response of sorghum to both N and P applications with an overall modified internal coefficient of efficiency of 0.64. Following model parameterization, a long-term simulation study was conducted using a stochastic weather data derived from historical weather data to assess the effects of crop residue management on grain production. A gradual decline in sorghum grain yield was simulated over the 30-year simulation period in both the homestead fields and the bush farms, with yields being much lower in the latter under farmers' management practices. Half the amount of mineral N fertilizer used in the bush farms was needed in the homestead fields to produce the average grain yields produced on the bush farm with full fertilization, if crop residues were returned to the fields in the homestead. Year-to-year variability in grain yield was consistently higher with the removal of crop residues, irrespective of management systems. APSIM was responsive to both organic and inorganic fertilizer applications in the study area and also highlighted the essential role of crop residues and inorganic fertilizer in influencing the temporal sorghum grain production and hence the impact of farmers' management practices on food security. This was evident in the rapid decline in soil organic carbon (SOC) accompanied by a decline in grain yield over the 30 years of

cropping. The use of inorganic fertilizer and retention of crop residues (SOC) are critical for attaining food security in the study area.
Keywords: Grain yield; Crop residues; Smallholder farming systems; Sorghum

Andrea Monti, Alessandro Zatta, Root distribution and soil moisture retrieval in perennial and annual energy crops in Northern Italy, Agriculture, Ecosystems & Environment, Volume 132, Issues 3-4, August 2009, Pages 252-259, ISSN 0167-8809, DOI: 10.1016/j.agee.2009.04.007.
(http://www.sciencedirect.com/science/article/B6T3Y-4W7HNV3-3/2/5ee8ebefc64794ec3014de54284f541a)
Abstract:
This study focused on root size and distribution of energy crops which may be a reliable indicator of the capability of these crops to accumulate significant C stocks in the soil. Alike, understanding root size and distribution may provide new insights into the knowledge of mechanisms involved in soil water uptake. The present research was performed in North Italy, Po Valley (32 m a.s.l., 44[degree sign]33'N, 11[degree sign]21'E). The assessment of root distribution and biomass of Panicum virgatum (switchgrass = S), Miscanthus x giganteus (miscanthus = M), Arundo donax (giant reed = G) and Sorghum bicolor (fibre sorghum = FS), in a soil profile of 1.2 m depth, aimed at providing new insights into carbon storage and water capture capacity. Despite a similar above ground biomass production, perennial crops exhibited different total root biomass, root shape and water uptake. G accumulated considerably higher total root biomass (13.6 Mg ha-1, d.w. basis), while FS, being annual, produced clearly the lowest root biomass (2.1 Mg ha-1). Root biomass distribution was described using the [beta] model, through the relationships between root length density (RLD) and soil depth. In summary, M had a very superficial root shape ([beta] = 0.931) with almost 90% of total root biomass concentrated in the top 0.35 m soil, while G and S exhibited a relative even root distribution ([beta] = 0.979 and 0.984, respectively). RLD and root weight showed diverse patterns among crops and along the soil profile due to different root diameters and root bulk densities of the crops. Root water capture capacity ([phi]) was determined according to the King model through the relationship between soil moisture and RLD in vertically succeeding soil layers. Differences in [phi] among crops were expressed through the constant k, which resumes many physiological and environmental details driving water uptake. Briefly, high k means a faster water uptake for a given RLD. M showed the highest k (2.50) followed by FS (1.02), G (0.54) and S (0.31). Importantly, k and [beta] were closely and negatively related which would mean that top-rooted crops, though being more subjected to drought risks, have significant higher abilities in recovering soil water. This is an assertion which is consistent with the previous studies that showed M being highly productive under wet environment, but very sensitive to water shortage. This study shows that energy crops can greatly differ in terms of water capture and root distribution, a fact that should be taken into great account in optimizing the land use change.
Keywords: Miscanthus; Giant reed; Sorghum; Switchgrass; Root length density; Bioenergy; Carbon; Soil moisture

R. Ghali, K. Hmaissia-khlifa, H. Ghorbel, K. Maaroufi, A. Hedili, HPLC determination of ochratoxin A in high consumption Tunisian foods, Food Control, Volume 20, Issue 8, August 2009, Pages 716-720, ISSN 0956-7135, DOI: 10.1016/j.foodcont.2008.09.004.
(http://www.sciencedirect.com/science/article/B6T6S-4TGS7CP-1/2/3bf343ec41ab87a4b560dc4c17176cec)
Abstract:
Samples (180) of high consumption food commodities from various regions of Tunisia were analysed to determine ochratoxin A contamination levels. A high performance liquid chromatography method for ochratoxin A determination was optimized. Samples were extracted with acetonitrile/water (80:20, v/v) solution and purified by immunoaffinity column. Average recoveries at 0.5 and 2 ng/g levels ranged from 84 +/- 3.1 to 94 +/- 1.2% with a between-day

coefficient of variation (RSDR) of 3.8%. The method detection limit was 0.1 ng/g and ochratoxin identity was confirmed by methyl ester formation. The whole procedure was simple and fast if compared with other existing procedures. Performed analysis indicates that 45% of monitored samples were contaminated with levels ranging from 0.11 to 33.9 ng/g. The most contaminated commodities were barley, sorghum and wheat.
Keywords: Foods; Ochratoxin A; HPLC-FLU; Immunoaffinity

Hemlata M. Kotkar, Priya J. Sarate, Vaijayanti A. Tamhane, Vidya S. Gupta, Ashok P. Giri, Responses of midgut amylases of Helicoverpa armigera to feeding on various host plants, Journal of Insect Physiology, Volume 55, Issue 8, August 2009, Pages 663-670, ISSN 0022-1910, DOI: 10.1016/j.jinsphys.2009.05.004.
(http://www.sciencedirect.com/science/article/B6T3F-4WD0W44-1/2/96e6bc463b5b8f48fbd54a9669030e52)
Abstract:
Midgut digestive amylases and proteinases of Helicoverpa armigera, a polyphagous and devastating insect pest of economic importance have been studied. We also identified the potential of a sorghum amylase inhibitor against H. armigera midgut amylase. Amylase activities were detected in all the larval instars, pupae, moths and eggs; early instars had lower amylase levels which steadily increased up to the sixth larval instar. Qualitative and quantitative differences in midgut amylases of H. armigera upon feeding on natural and artificial diets were evident. Natural diets were categorized as one or more members of legumes, vegetables, flowers and cereals belonging to different plant families. Amylase activity and isoform patterns varied depending on host plant and/or artificial diet. Artificial diet-fed H. armigera larvae had comparatively high amylase activity and several unique amylase isoforms. Correlation of amylase and proteinase activities of H. armigera with the protein and carbohydrate content of various diets suggested that H. armigera regulates the levels of these digestive enzymes in response to macromolecular composition of the diet. These adjustments in the digestive enzymes of H. armigera may be to obtain better nourishment from the diet and avoid toxicity due to nutritional imbalance. H. armigera, a generalist feeder experiences a great degree of nutritional heterogeneity in its diet. An investigation of the differences in enzyme levels in response to macronutrient balance and imbalance highlight their importance in insect nutrition.
Keywords: Helicoverpa armigera larvae; Diet; Midgut amylase; Amylase inhibitors; Proteinases

D. Sola-Oriol, E. Roura, D. Torrallardona, Use of double-choice feeding to quantify feed ingredient preferences in pigs, Livestock Science, Volume 123, Issues 2-3, August 2009, Pages 129-137, ISSN 1871-1413, DOI: 10.1016/j.livsci.2008.10.015.
(http://www.sciencedirect.com/science/article/B7XNX-4V3S590-1/2/3c5103ee3e9657774eaee93ae03dd0f9)
Abstract:
Four experiments were conducted to evaluate the palatability of sorghum, maize, rye and lupine for pigs. Diets containing sorghum, maize, rye or lupine (test diets) were offered in a series of double choice tests against a reference diet. To prepare the reference diets, white broken rice in the experiments with cereals, and SBM-56 (a soy protein product low in anti-nutritional factors) in the experiment with lupine, were used as the cereal and the protein source of reference, respectively. Six test diets containing sorghum, maize or rye were prepared by replacing either 250 or 500 g kg- 1 of broken rice from the reference diet. Similarly, two test diets containing lupine were prepared by replacing 75 or 150 g kg- 1 of SBM-56 from the reference diet. Additionally, the pure ingredients were also evaluated against pure broken rice (sorghum, maize or rye) and pure SBM-56 (lupine). In each experiment, the corresponding ingredient was tested at two levels of inclusion and in pure form, using both newly weaned pigs and pigs at four weeks post-weaning. The palatability for each test diet expressed as % of preference was calculated as the percentage

contribution of the test diet to total feed intake (test + reference diets). The preferences obtained ranged between 16 and 29% for sorghum, 16 and 35% for maize and 19 and 49% for rye. Except for rye at 500 g kg- 1 (49%), preference values were significantly different from 50% which indicates a higher preference for the broken rice in the reference diet than for sorghum, maize and rye. Preference for lupine ranged between 39 and 56% and no difference in preference was observed between the lupine in the test diets and the SBM-56 in the reference diets. The dietary preferences could already be observed in the first days of experiment, and they did not change substantially thereafter. The levels of inclusion tested did not have an effect on preference for any of the ingredients. The age of the animals did not affect preference and the values obtained in newly weaned and post-weaned pigs were generally in good agreement. However the use of the older animals resulted in higher feed intakes and more accurate measurements. It is concluded that feedstuff palatability can be quantified with a double choice protocol using a reference diet. This should allow the formulation of feeds for weaning pigs taking into account the palatability of the ingredients, in addition to other nutritional criteria. Preference evaluation may become a useful tool to improve the palatability of the diets and facilitate piglets feed initiation at weaning.
Keywords: Cereals; Double-choice; Preference; Pigs; Protein sources

Maria G. Salas Fernandez, Philip W. Becraft, Yanhai Yin, Thomas Lubberstedt, From dwarves to giants? Plant height manipulation for biomass yield, Trends in Plant Science, Volume 14, Issue 8, August 2009, Pages 454-461, ISSN 1360-1385, DOI: 10.1016/j.tplants.2009.06.005.
(http://www.sciencedirect.com/science/article/B6TD1-4WSJ9KW-2/2/b0e5d26b701bafb81e3de9e417ca9b26)
Abstract:
The increasing demand for lignocellulosic biomass for the production of biofuels provides value to vegetative plant tissue and leads to a paradigm shift for optimizing plant architecture in bioenergy crops. Plant height (PHT) is among the most important biomass yield components and is the focus of this review, with emphasis on the energy grasses maize (Zea mays) and sorghum (Sorghum bicolor). We discuss the scientific advances in the identification of PHT quantitative trait loci (QTLs) and the understanding of pathways and genes controlling PHT, especially gibberellins and brassinosteroids. We consider pleiotropic effects of QTLs or genes affecting PHT on other agronomically important traits and, finally, we discuss strategies for applying this knowledge to the improvement of dual-purpose or dedicated bioenergy crops.

Q. Liu, C.S. Dong, H.Q. Li, W.Z. Yang, J.B. Jiang, W.J. Gao, C.X. Pei, J.J. Qiao, Effects of feeding sorghum-sudan, alfalfa hay and fresh alfalfa with concentrate on intake, first compartment stomach characteristics, digestibility, nitrogen balance and energy metabolism in alpacas (Lama pacos) at low altitude, Livestock Science, In Press, Corrected Proof, Available online 16 July 2009, ISSN 1871-1413, DOI: 10.1016/j.livsci.2009.05.013.
(http://www.sciencedirect.com/science/article/B7XNX-4WSG310-1/2/291ce0411898402e6b9a398d24670008)
Abstract:
The objective was to evaluate effects of feeding sorghum-sudan- or alfalfa-based diets on intake, first compartment stomach characteristics, digestibility, nitrogen balance and energy metabolism in alpacas at low altitude (793 m). Six mature alpacas (42 +/- 2.3 kg of body weight) were used in a replicated 3 x 3 Latin square experiment. The treatments were: sorghum-sudan diets (SSD), alfalfa hay diets (AHD) and fresh alfalfa diets (FAD), respectively. Alpacas were housed in metabolism crates and diets were fed for 21 days with 11 d of adaptation and 10 d of sampling. Alpaca was supplemented concentrate with 160 g per alpaca per day and forages were fed at 12 h intervals with water provided ad libitum. First compartment stomach pH and ammonia N were unaffected by forage source, whereas total VFA concentration was different between diets, with the least for FAD (46.8 mM), followed by AHD (51.8 mM) and the highest for SSD (56.1 mM). Ratio of acetate to

propionate was greater for AHD and SSD than for FAD diets. The molar proportion of acetate decreased, whereas the molar proportion of propionate increased for FAD relative to AHD and SSD. Redox potential was lower for SSD than for FAD. Surface tension was greater for FAD than for SSD and AHD. Osmolality was lower for FAD than for SSD and AHD. First compartment pressure and methane production tended to be higher for FAD than for SSD ($P < 0.06$) and AHD ($P < 0.07$). Digestibilities of DM, OM and EE were not different between diets. However, the digestibility of CP was lower for AHD relative to SSD and FAD. Digestibilities of NDF and ADF were greater for SSD than for AHD and FAD. Intakes of gross energy (GE) and N were greater for AHD than for FAD and SSD. Digestible energy (DE) was the highest in AHD followed by SSD and FAD. Metablizable energy (ME) was different with the lowest for FAD (3.9 MJ/day), followed by SSD (5.4 MJ/day) and the highest for AHD (8.1 MJ/day). Energy retained was followed the same trend as ME. The results demonstrate variable responses of alpacas to feeding sorghum-sudan or alfalfa diets in terms of dry matter intake, first compartment stomach characteristics, digestibility, nitrogen balance and energy metabolism at low altitude.
Keywords: Alpacas; First compartment stomach characteristics; Digestibility; Nitrogen balance; Energy metabolism

M.J.Rob Nout, Rich nutrition from the poorest - Cereal fermentations in Africa and Asia, Food Microbiology, In Press, Corrected Proof, Available online 15 July 2009, ISSN 0740-0020, DOI: 10.1016/j.fm.2009.07.002.
(http://www.sciencedirect.com/science/article/B6WFP-4WS9BMM-1/2/d1aacc15f3ae26cdcdfe5c89ef5db241)
Abstract:
Cereal fermentations in Africa and Asia involve mainly the processing of maize, rice, sorghum and the millets. Lactic acid bacteria (Lactobacillus, Pediococcus), Enterobacter spp., yeasts (Candida, Debaryomyces, Endomycopsis, Hansenula, Pichia, Saccharomyces and Trichosporon spp.) and filamentous fungi (Amylomyces, Aspergillus, Mucor, and Rhizopus spp.) contribute to desirable modifications of taste, flavour, acidity, digestibility, and texture in non-alcoholic beverages (e.g., uji, and ben-saalga), porridges (e.g., mawe) and cooked gels (e.g., kenkey, idli, and mifen). In addition, alcoholic beverages (beers such as tchoukoutou and jnard; and spirits e.g. jiu) are obtained using malt, or using amylolytic mixed microbial starter cultures as generators of fermentable substrates. Wet processing, marketing of multi-purpose intermediate products, co-fermentation for texture and nutrition, and mixed culture fermentations as practiced in indigenous fermentation processes are of interest for industrial innovation and for better control of natural mixed culture fermentation systems. On the other hand, the nutritional properties of traditional cereal fermented products can be enhanced by increasing their nutrient and energy density, as well as by increasing their mineral status by combining mineral fortification and dephytinization.
Keywords: Maize; Sorghum; Millet; Rice; Lactic acid bacteria; Yeasts; Filamentous fungi; Mixed fermentation; Co-fermentation; Micronutrients; Digestibility; Mineral fortification; Phytic acid; NaFeEDTA

Ram C. Dalal, Iain Gibson, Diane E. Allen, Neal W. Menzies, Green waste compost reduces nitrous oxide emissions from feedlot manure applied to soil, Agriculture, Ecosystems & Environment, In Press, Corrected Proof, Available online 10 July 2009, ISSN 0167-8809, DOI: 10.1016/j.agee.2009.06.010.
(http://www.sciencedirect.com/science/article/B6T3Y-4WR5NJV-4/2/d9933316a87c808a561443a7e6ab2047)
Abstract:
Australia produces in excess of 1 million tonnes of feedlot manure (FLM) annually. Application of FLM to grain cropping and grazing soils could provide a valuable nutrient resource. However, because of high nutrient concentration, especially of N (>2%), FLM has the potential for

environmental pollution, for example, N pollution to the water bodies and N2O emission to the atmosphere. Therefore, controlling N supply from FLM is essential for the judicious utilisation of FLM in the field as well as reducing N2O emission to the atmosphere. We utilised the low N concentration green waste compost (GWC, about 3 million tonnes produced annually) as a potential management tool to assess its effectiveness in regulating N release from FLM and controlling the rates of N2O emission from field application when both FLM and GWC were applied together to sorghum (Sorghum bicolor Moench) grown on a Vertisol. We measured N2O emission rates during the sorghum crop and clean fallowing over one-year period in the field. Annual soil N2O emissions were 5.0 kg N2O ha-1 from urea applied at 150 kg N ha-1, 5.1 and 5.5 kg N2O ha-1 from FLM applied at 10 and 20 t ha-1 respectively, 2.2 kg N2O ha-1 from GWC applied at 10 t ha-1, 4.3 kg N2O ha-1 from FLM and GWC applied together at 10 t ha-1 each, and 3.3 kg N2O ha-1 from the unamended soil. Thus, we found that GWC application reduced N2O emissions below those from an unamended soil while annual emission rate from FLM approached that from fertiliser N application (~0.7% N2O emission factor). A mixture of FLM + GWC applied at 10 t ha-1 each reduced N2O emission factor by 64% (the emission factor was 0.22%), most likely by reducing the amount of mineral N in the soil because soil NH4-N and NO3-N and the rate of N2O emission were significantly correlated in this soil. Since the global warming potential of N2O is 298 times that of CO2, even a small reduction in N2O emission from GWC application has a significant and positive impact on reducing global warming.
Keywords: Nitrous oxide; Green waste compost; Feedlot manure; Vertisol; Subtropics

S.A. Saseendran, D.C. Nielsen, D.J. Lyon, L. Ma, D.G. Felter, D.D. Baltensperger, G. Hoogenboom, L.R. Ahuja, Modeling responses of dryland spring triticale, proso millet and foxtail millet to initial soil water in the High Plains, Field Crops Research, Volume 113, Issue 1, 10 July 2009, Pages 48-63, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.04.008.
(http://www.sciencedirect.com/science/article/B6T6M-4W80C8H-2/2/c8ceacde5d4c29c77f50eb89b2cf2e2b)
Abstract:
Dryland farming strategies in the High Plains must make efficient use of limited and variable precipitation and stored water in the soil profile for stable and sustainable farm productivity. Current research efforts focus on replacing summer fallow in the region with more profitable and environmentally sustainable spring and summer crops. In the absence of reliable precipitation forecasts for the crop growing season, farmers rely mainly upon knowledge of plant available water (PAW) in the soil profile at planting for making crop choice decisions. To develop a decision support strategy for crop selection based on initial PAW, experiments were conducted with spring triticale (X Titicosecale Wittmack), proso millet (Panicum miliaceum L.), and foxtail millet (Setaria italica L. Beauv.) under artificially controlled Low, Medium, and High initial PAW levels during 2004 and 2005 at Akron, Colorado, and Sidney, Nebraska. The objectives of this study were to adapt an existing cropping systems model for the simulation of triticale and millet and to evaluate simulations from the adapted model by comparing results with field data collected under varying initial PAW conditions. The Root Zone Water Quality Model with DSSAT v4.0 crop growth modules (RZWQM2) was used. Specifically, the Cropping System Model (CSM)-CERES-Wheat module was adapted for simulating triticale, and CSM-CERES-Sorghum (v4.0) module was adapted for simulating proso millet and foxtail millet. Soil water, leaf area index, grain yield, and biomass data for the highest PAW treatment from one crop season for each of the three crops were used to adapt and calibrate the crop modules. The models were then evaluated with data from the remaining PAW treatments. The proso millet module was further tested with four years of data from a crop rotation experiment at Akron from 2003 to 2006. Simulation results indicated that the adapted and calibrated crop modules have the potential to simulate these new crops under a range of varying water availability conditions. Consequently, these models can aid in the

development of decision support tools for the season-to-season management of these summer fallow replacement crops under dryland conditions in semi-arid environments.
Keywords: Biomass; Crop simulation; DSSAT; Leaf area; Millet; Modeling; RZWQM; Soil water; Triticale; Yield

O.N. Di Marco, M.A. Ressia, S. Arias, M.S. Aello, M. Arzadun, Digestibility of forage silages from grain, sweet and bmr sorghum types: Comparison of in vivo, in situ and in vitro data, Animal Feed Science and Technology, In Press, Corrected Proof, Available online 3 July 2009, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2009.06.003.
(http://www.sciencedirect.com/science/article/B6T42-4WNPDJK-1/2/523031872bcd0aa15e13c8026123b6e8)
Abstract:
Three forage silages from grain (G), sweet (S) and bmr (B) sorghum types were evaluated in terms of chemical composition: ash, CP, aNDF, ADF and lignin(pm), in vivo digestibility of DM, OM and aNDF, in situ DM disappearance at 0, 3, 6, 9, 12, 24, 48 and 72 h of incubation and in vitro apparent DM and aNDF digestibility at 24 and 48 h of incubation. Forage silages did not differ in chemical composition, except for lignin(pm) content, which was lower in S than in G and B. The in vivo digestibility of DM (0.517) and OM (0.575) did not differ among forage silages, but the in vivo aNDF digestibility was higher in S (0.533) than in B and G (average 0.453). The in situ degradable fraction and the DM degradation rate were also higher in S than in the other two forage silages. The in vitro apparent DM digestibility at 24 h of incubation was the only indirect methodology that matched the corresponding in vivo data in all silages. In situ DM disappearance agreed with the in vivo DM digestibility at 24 h of incubation in B and G, but in S this agreement occurred at 12 h of incubation. In vitro incubation for 24 h underestimated of the in vivo digestion of aNDF in all forage silages. In vitro aNDF digestibility at 48 h of incubation agreed with in vivo data in G and B, but overestimated it in S. Although forage silages did not differ in DM or OM in vivo digestibility, the forage silage from the sweet genotype had superior in vivo aNDF digestibility. Over all forage silages, only the 24 h in vitro apparent DM digestibility consistently provided accurate estimates of the in vivo DM digestibility. In general, the capability of in situ and in vitro methodologies to accurately predict in vivo data depended upon incubation length, which was variable across feedstuffs, suggesting that caution should be exercised when using these techniques to estimate the digestibility of different feedstuffs at fixed incubation lengths.
Keywords: Sorghum; Stover silage; In vivo digestibility; Ruminal degradability; In vitro apparent digestibility

Christopher Rasmann, James H. Graham, Daniel O. Chellemi, Lawrence E. Datnoff, John Larsen, Resilient populations of root fungi occur within five tomato production systems in southeast Florida, Applied Soil Ecology, In Press, Corrected Proof, Available online 2 July 2009, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2009.05.007.
(http://www.sciencedirect.com/science/article/B6T4B-4WNGD7Y-1/2/3333521b1ea760be2762dea216192964)
Abstract:
Farming practices are known to impact arbuscular mycorrhizal (AM) fungi and other soil microbial communities in agroecosystems. The effects of divergent land management strategies on the incidence and infectivity of AM and other fungal root endophytes were evaluated in a 5-year tomato (Lycopersicon esculentum Mill.) cropping systems study. Two of the five treatments utilized farming practices considered detrimental to AM fungal populations, including the tillage-mediated elimination of vegetation and soil fumigation. The remaining three treatments used practices thought to be more conducive to the presence of AM fungi, including organic production methods, bahiagrass pasture and undisturbed weed fallow. In years four and five of the study tomato roots and rhizosphere soil were collected. Roots were examined for colonization by AM and other fungal

root endophytes, and rhizosphere soil was assayed to measure the amount of infective inoculum present based on maize (Zea mays L.) seedling infection. Tomato roots and rhizosphere soil were also analyzed for the AM fungal fatty acid biomarker 16:1[omega]5c. Sudangrass (Sorghum sudanense (Piper) Stapf) trap cultures were initiated using field soil to assess the diversity of AM fungal spore morphotypes. Soil disturbance and phosphorus (P) levels had the greatest influences on AM fungal infectivity and abundance. All plots had high levels of available soil P, resulting in low levels of colonization across treatments. Bahiagrass (Paspalum notatum Flugge) pasture was the only treatment without repeated, intensive soil mixing, and had the highest level of field root colonization by AM fungi. Field roots were more heavily colonized by other fungal endophytes than by AM fungi in all treatments. Tomato roots from organic plots were apparently unique in encouraging colonization by fungi that appeared to be Microdochium bolleyi (R. Sprague) de Hoog & Herm.-Nijh. Infection by AM and other fungal root endophytes were positively correlated in all studies. Flooding and a shortened growing season likely contributed to reduced infection potentials in all treatments except for organic plots in year five compared to year four. Areas of high disturbance from frequent tillage had the lowest levels of primary inoculum, but recovery to levels comparable to less disturbed treatments occurred after a single season of host root growth. Diversity of AM fungal morphotypes was typical of agricultural fields, with at least 10 spore morphotypes present across treatments; Glomus spp. were the dominant spore type recovered in all treatments.
Keywords: Arbuscular mycorrhizal fungi; Fungal root endophyte; Tillage; Phosphorus; Flooding; Signature fatty acid

K. Mahasukhonthachat, P.A. Sopade, M.J. Gidley, Kinetics of starch digestion in sorghum as affected by particle size, Journal of Food Engineering, In Press, Corrected Proof, Available online 2 July 2009, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2009.06.051.
(http://www.sciencedirect.com/science/article/B6T8J-4WNGW3D-1/2/e5c79e4b380a5f15b5cdc36b19ae2703)
Abstract:
The mechanisms of starch digestion in cryomilled and hammer-milled sorghum grain were investigated by an in vitro procedure using 10 particle sizes ([congruent with]120-560 [mu]m). The samples exhibited essentially monophasic digestograms, and three digestion models (Duggleby, first-order kinetic and Peleg models) were tested for describing the digestograms. Irrespective of the particle size, starch digestion followed first-order kinetics, and the modified first-order exponential model and Peleg model adequately (mean relative deviation modulus < 10%) described the digestograms. With or without an intercept, there was a significant linear relationship ($r2 > 0.61$; $p < 0.01$) between the reciprocal of the digestion rate constant and the square of the particle size consistent with digestion proceeding by a diffusion-controlled mechanism. The reciprocal of the slope of the relationship 0.4-0.9 x 10-7 cm2 s-1 provides an estimate of the diffusion coefficient of [alpha]-amylase within the milled grains. Particle size affected digestion kinetics, water absorption index (WAI), pasting properties, and water solubility index (WSI) of the samples, as did hammer-milling. However, differential scanning calorimetry showed no significant effects of the hammer-milling on starch gelatinisation properties. Although particle size was the primary determinant of digestion properties, small but detectable changes to the grain particle structure due to the hammer-milling affected digestion kinetics, presumably because of additional frictional heat and mechanical effects. Suggestions were made on how to modulate starch digestion, for example to achieve efficient energy delivery to animals from sorghum-based feed.
Keywords: First-order kinetics; Peleg model; Diffusion mechanisms; Digestogram; Cryomilling; Hammer-milling; Functional properties; In-vitro starch digestion

Narendra Reddy, Yiqi Yang, Natural cellulose fibers from soybean straw, Bioresource Technology, Volume 100, Issue 14, July 2009, Pages 3593-3598, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.09.063.
(http://www.sciencedirect.com/science/article/B6V24-4W09GG8-4/2/14831bdc94bc6f2a44c5c8af0b7712b0)
Abstract:
This paper reports the development of natural cellulose technical fibers from soybean straw with properties similar to the natural cellulose fibers in current use. About 220 million tons of soybean straw available in the world every year could complement the byproducts of other major food crops as inexpensive, abundant and annually renewable sources for natural cellulose fibers. Using the agricultural byproducts as sources for fibers could help to address the concerns on the future price and availability of both the natural and synthetic fibers in current use and also help to add value to the food crops. A simple alkaline extraction was used to obtain technical fibers from soybean straw and the composition, structure and properties of the fibers was studied. Technical fibers obtained from soybean straw have high cellulose content (85%) but low% crystallinity (47%). The technical fibers have breaking tenacity (2.7 g/den) and breaking elongation (3.9%) higher than those of fibers obtained from wheat straw and sorghum stalk and leaves but lower than that of cotton. Overall, the structure and properties of the technical fibers obtained from soybean straw indicates that the fibers could be suitable for use in textile, composite and other industrial applications.
Keywords: Biofiber; Soybean straw; Cellulose; Biomass; Properties

P.K. Ghosh, A.K. Tripathi, K.K. Bandyopadhyay, M.C. Manna, Assessment of nutrient competition and nutrient requirement in soybean/sorghum intercropping system, European Journal of Agronomy, Volume 31, Issue 1, July 2009, Pages 43-50, ISSN 1161-0301, DOI: 10.1016/j.eja.2009.03.002.
(http://www.sciencedirect.com/science/article/B6T67-4W7HP4Y-1/2/e19b98f62eed8ca23d37a61c7e1d1c21)
Abstract:
Intercropping system of cereals with legume is common in semi-arid tropics of India. However, little attention has been paid to assessing nutrient competition in the system. Seasonal changes in relative dry matter yield (RDY), relative nitrogen yield (RNY), relative phosphorus yield (RPY) and relative potassium yield (RKY) are useful indices to estimate the N, P and K status in intercropping system. The competitive effect of soybean (Glycine max L.) in association with sorghum (Sorghum bicolor L. Moench) was assessed using these indices under six nutrient treatments (0, 75% NPK, 100% NPK, 75% NPK + 5 Mg farmyard manure, 75% NPK + 5 Mg phosphocompost and 75% NPK + 1.5 Mg poultry manure) from a 5-year field experiment conducted in a N and P deficient Vertisol of Central India. The RDY and RNY of sorghum were greater than the values of RDY and RNY of soybean indicating inter-species competition for N between component crops, peak competition being at 80 days after sowing (DAS). Using the concept of RDY and RNY, it was observed that having coincided the maturity period and peak demand for N of both the crops, soil N was exhausted by sorghum because of its strong competitive ability and N was liming for soybean at 80 DAS. Strong competitive ability of sorghum was also evident from higher biomass, root mass, root length density and contribution to the mixture yield. Once sorghum entered its maturity phase, its competitive effect on soybean was greatly reduced. Competition for P between two species is more prominent up to 60 DAS and P was not limiting to none of the species after 60 DAS as the RPY values were equal to corresponding RDY values. Based on RKY value, none of the component species suffered from K deficiency at any stage even if it was not applied. This implied that competition exists for soil N and P but not for K up to 60-80 DAS in soybean/sorghum intercropping system. The result showed that competition between two crops measured in terms of RNY, RPY and RKY under organic-fertilizer was less; however, recorded higher soybean equivalent yield and monetary advantage index than inorganic-fertilizer. The study thus suggests

that in soybean/sorghum intercropping system to minimize competition between two crops in N and P deficient Vertisol, application of 75% NPK + FYM/poultry manure/phosphocompost is a viable nutrient management option.
Keywords: Nutrient competition; Intercropping; Legume; Vertisol

Cristina Patane, Valeria Cavallaro, Salvatore L. Cosentino, Germination and radicle growth in unprimed and primed seeds of sweet sorghum as affected by reduced water potential in NaCl at different temperatures, Industrial Crops and Products, Volume 30, Issue 1, July 2009, Pages 1-8, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.12.005.
(http://www.sciencedirect.com/science/article/B6T77-4VH8Y2N-1/2/811dc44d113c78865138e49958924599)
Abstract:
The effects of reduced water potential ([psi]) in NaCl and pre-osmopriming in PEG, on seed germination and early radicle growth at different temperatures were assessed in the laboratory for sweet sorghum [Sorghum bicolor (L.) Moench] cv. Roce. Five salt solutions (with a [psi] of 0-control, -0.22, -0.42, -0.82 or -1.23 MPa) and four temperatures of 10, 15, 25 or 35 [degree sign]C were used for germination tests. Daily and final germination, seed moisture at 4 and 24 h of imbibition and radicle length 2 days after initial germination were recorded. Sorghum seeds seem to be more tolerant to reduced [psi] at optimum temperature. Indeed, at 25 [degree sign]C, down to -0.82 MPa seed germination was not affected. The increase in incubation temperature to 35 [degree sign]C determined a greater seed water content and a faster germination than at 25 [degree sign]C at all [psi]s, despite the lower final germination percentage. With the lowering of temperature to 15 [degree sign]C, germination percentage significantly declined with the decrease of [psi] and at -0.82 MPa it reduced to less than 50%. At 10 [degree sign]C seeds failed to germinate at [psi] < -0.22 MPa due to combined depressive effects of reduced [psi] and low temperature. Seed priming enhanced germination and shortened the delay in germination time due to the increase in saline stress, at suboptimal temperatures only. This effect could be explained by the faster water absorption occurring in primed seeds as compared to those unprimed, at these temperatures, regardless of salt concentration of the solution.
Root growth was more sensitive than germination to salt stress. Indeed, the increase in NaCl concentration adversely affected root elongation at all temperatures. The beneficial effects of PEG-osmopriming were evident on root growth at all temperatures except the optimal one.
From a practical point of view, when early sowings of sweet sorghum are requested, the use of primed seeds is suggested, as PEG-osmopriming is helpful in overcoming the negative effect imposed by reduced water potential upon seed germination under suboptimal thermal conditions. When saline water is available for irrigation at sowing, it may be useful to sow when optimal or nearly optimal temperature may be encountered in the soil in order to avoid the combined stress of temperature and salinity.
Keywords: Sweet sorghum (Sorghum bicolor L. Moench); Seed germination; Water potential; Salt stress; Temperature; PEG-osmopriming

A.M. Matalanis, O.H. Campanella, B.R. Hamaker, Storage retrogradation behavior of sorghum, maize and rice starch pastes related to amylopectin fine structure, Journal of Cereal Science, Volume 50, Issue 1, July 2009, Pages 74-81, ISSN 0733-5210, DOI: 10.1016/j.jcs.2009.02.007.
(http://www.sciencedirect.com/science/article/B6WHK-4W3HX64-1/2/3ad79ed71de8219bbffa1f7d833b1dcc)
Abstract:
Storage retrogradation behavior and properties of sorghum, maize, and rice starches were compared to better understand the relationship of amylopectin fine structure to quality issues. Long-term changes in texture of starch gels were attributed to amylopectin retrogradation. In starch pastes aged 7 days at 4 [degree sign]C, change in the storage modulus ([Delta]G') during

heating (representing intermolecular associations) was highly and positively correlated ($r = 0.93$, $p < 0.01$) with the proportion of fraction I (FrI) long chains from debranched amylopectin. One sorghum cultivar, Mota Maradi, showed a dramatic increase in the storage modulus (G') over the 7 day storage period that was related to its high proportion of FrI. Pastes/gels made from starches with normal (20-30%) amylose content and higher proportions of FrI long chains from debranched amylopectin tended to become firmer with more syneresis during extended storage. Both degree of polymerization measurements and previous models for amylopectin structure indicate that FrI represents long B chains of amylopectin. Cereal cultivars having amylopectin structures with lower proportion of long B chains were speculated to give improved quality products with lower rates of retrogradation and staling. This is particularly an issue in sorghum foods where products generally lack storage stability and tend to stale relatively quickly.
Keywords: Starch retrogradation; Amylopectin; Paste and gel rheology; Cereals

Janet Taylor, John R.N. Taylor, Peter S. Belton, Amanda Minnaar, Formation of kafirin microparticles by phase separation from an organic acid and their characterisation, Journal of Cereal Science, Volume 50, Issue 1, July 2009, Pages 99-105, ISSN 0733-5210, DOI: 10.1016/j.jcs.2009.03.005.
(http://www.sciencedirect.com/science/article/B6WHK-4W6Y5HT-1/2/001522c1c615d0999ef6e5319b3ef7fe)
Abstract:
Protein microparticles (microspheres) have numerous food and pharmaceutical applications. However, generally preparation of prolamin protein microparticles involves aqueous ethanol as a solvent. An ethanol-free method of making microparticles from kafirin with a novel structure was devised. Glacial acetic acid or other organic acids were used as kafirin solvent and the microparticles formed by phase separation on addition of water. The kafirin microparticles were characterised by light microscopy, scanning electron microscopy and transmission electron microscopy and their size distribution was measured. The kafirin microparticles prepared by phase separation from organic acid were spherical or irregular shaped, between 1 and 10 [mu]m in diameter, with rough, porous outer surfaces and many internal holes or vacuoles. The holes seem to be the footprint of air bubbles which were entrapped during microparticle preparation. With an increase in the final concentration of acetic acid, the structure of the microparticles changed from porous spheres to an open matrix, with a concomitant change in kafirin secondary structure from [alpha]-helical to [beta]-sheet, indicative of protein aggregation. These highly vacuolated and open matrix type microparticles appear to have potential as encapsulating agents and support structures.
Keywords: Sorghum; Kafirin; Microparticles; Microscopy

Cristina Chuck-Hernandez, Esther Perez-Carrillo, Sergio O.Serna-Saldivar, Production of bioethanol from steam-flaked sorghum and maize, Journal of Cereal Science, Volume 50, Issue 1, July 2009, Pages 131-137, ISSN 0733-5210, DOI: 10.1016/j.jcs.2009.04.004.
(http://www.sciencedirect.com/science/article/B6WHK-4W9XBBK-1/2/26ff3c311e6e8da11a2ddf5be67bef08)
Abstract:
The aim was to study the effect of steam-flaking of sorghum and maize on bioethanol production and the performance of their ground meals during liquefaction, saccharification and yeast fermentation. A bifactorial experiment with a level of confidence of $P < 0.05$ was designed to study differences between sorghum and maize and the effectiveness of steam-flaking. Grains were steam-flaked to increase starch bioavailability and disrupt the protein matrix that envelopes starch granules. The steam-flaked sorghum had significantly higher and faster starch hydrolysis compared to the regular kernel during liquefaction. This hydrolysate contained about 33% more reducing sugars compared to the untreated counterpart and similar amounts compared to both

maize treatments. At the end of saccharification, the sorghum spent grains contained more residual starch compared to the maize counterparts. Steam-flaking significantly reduced residual starch especially in steam-flaked sorghum. The final glucose concentration in steam-flaked sorghum was similar to the concentration obtained in both maize mashes and 26.5% higher compared to the untreated sorghum. The yield of ethanol in steam-flaked sorghum was 44.2% higher compared to the untreated counterpart and similar to both maize treatments. Therefore, steam-flaking is a treatment useful to increase ethanol production especially in sorghum due to the higher starch bioavailability.
Keywords: Steam-flaking; Sorghum; Maize; Ethanol

Joseph M. Awika, Liyi Yang, Jimmy D. Browning, Abdul Faraj, Comparative antioxidant, antiproliferative and phase II enzyme inducing potential of sorghum (Sorghum bicolor) varieties, LWT - Food Science and Technology, Volume 42, Issue 6, July 2009, Pages 1041-1046, ISSN 0023-6438, DOI: 10.1016/j.lwt.2009.02.003.
(http://www.sciencedirect.com/science/article/B6WMV-4VKP479-1/2/8abffdf0c4d985abdc54346911d8ffe6)
Abstract:
Epidemiological evidence has linked consumption of sorghum with reduced incidences of gastrointestinal cancer, especially cancer of esophagus. No information is available on how sorghum may effect the chemoprotective properties. We investigated in vitro potential of eight sorghum varieties to induce phase II detoxifying enzymes using the NAD(P)H:quinone oxidoreductase (NQO) enzyme assay, and also inhibit proliferation of esophageal, OE33, and colon, HT-29, carcinoma cells using the PicoGreen and 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assays; these properties were compared to phenolic profile and antioxidant activity of the sorghum. Black sorghum extract high in 3-deoxyanthocyanins was the most potent NQO inducer, doubling NQO activity at 5.0 [mu]g/mL and maximally inducing the enzyme activity by 3.0 times. White sorghum was a moderately strong inducer, maximally increasing NQO activity by 80%; tannin-containing sorghums were non-inducers. On the other hand, the tannin-containing sorghum extracts had strongest antiproliferative activity against both OE33 and HT-29 cells (IC50, 38-105 [mu]g/mL); the white sorghum extract was the least potent (IC50, 389->800 [mu]g/mL). Antiproliferative activity correlated with antioxidant activity whereas NQO-inducer capacity did not. Sorghum extracts have strong chemoprotective potential which is partially independent of their antioxidant properties. They may thus be valuable health-promoting ingredients in whole-grain based products.
Keywords: Sorghum; Antioxidant capacity; Chemoprevention; Esophageal cancer

R. Ghali, I. Belouaer, S. Hdiri, H. Ghorbel, K. Maaroufi, A. Hedilli, Simultaneous HPLC determination of aflatoxins B1, B2, G1 and G2 in Tunisian sorghum and pistachios, Journal of Food Composition and Analysis, In Press, Accepted Manuscript, Available online 30 June 2009, ISSN 0889-1575, DOI: 10.1016/j.jfca.2009.04.009.
(http://www.sciencedirect.com/science/article/B6WJH-4WN2XS6-1/2/623139051de4c396fd3c708ff37c2dd4)
Abstract:
A rapid and sensitive reversed-phase high-performance liquid chromatographic method has been used for the determination of aflatoxins (AFs) B1, B2, G1 and G2 in Tunisian sorghum and pistachios. Samples were extracted with methanol/water solution and cleaned by immunoaffinity column. HPLC separation was performed on a C18 Spherisorb analytical column with a mobile phase consisting of water: methanol: acetonitri1e (60:20:20, v/v/v). The method proved to be rapid, selective and reproducible. In-house performance characteristics were established; calibration curves were linear from 0.12 to 8 ng/g for AFs B1 and G1 and from 0.06 to 4 ng/g for AFs B2 and G2. Quantification limits were found to be significantly lower than Tunisian and European aflatoxin

regulatory limits. They were 0.16 for AFB1 and 0.08 ng/g for AFs B2, G1 and G2, respectively. Aflatoxin recoveries in sorghum and pistachios samples spiked at 0.5 and 2 ng/g varied from 68.3 to 87.7%. AFs were detected and quantified in investigated commodities. The incidences were 52.5 and 62%, respectively, for pistachios and sorghum samples, with respective average contamination levels of 21.8 +/- 38.0 and 9.9 +/- 11.5 ng/g.
Keywords: Aflatoxins; HPLC; Immunoaffinity clean-up; Sorghum; Pistachios; Food analysis; Food composition

Narasimha P. Reddy, Akbar P. Ali Khan, Uma K. Devi, Hari C. Sharma, Annette Reineke, Treatment of millet crop plant (Sorghum bicolor) with the entomopathogenic fungus (Beauveria bassiana) to combat infestation by the stem borer, Chilo partellus Swinhoe (Lepidoptera: Pyralidae), Journal of Asia-Pacific Entomology, In Press, Corrected Proof, Available online 13 June 2009, ISSN 1226-8615, DOI: 10.1016/j.aspen.2009.06.001.
(http://www.sciencedirect.com/science/article/B8JJN-4WHFDDB-1/2/401bb04a2acb1f7d66bc0dd544b316f4)
Abstract:
Experiments were done to test if Beauveria bassiana can become an endophyte in sorghum and confer protection from stem borer. Four-week-old sorghum seedlings were treated with B. bassiana. The plants were examined for endophytic presence of B. bassiana, 30 and 60 days after treatment. Stem cultures from treated plants showed growth of B. bassiana. PCR amplification using fungal specific primers for a conserved region of [beta] tubulin gene yielded identical 360 bp products from both B. bassiana and treated sorghum plants. In a subsequent experiment, B. bassiana treated and untreated (control) sorghum plants were artificially infested with stem borer (Chilo partellus) larvae 15 days post treatment and the extent of damage was compared. About 40% of the control plants developed dead heart while no plant in the B. bassiana treated plot did. In the surviving control plants, stem tunneling by shoot borer was significantly higher compared to B. bassiana treated sorghum plants.
Keywords: Sorghum; Entomopathogenic fungus; Beauveria bassiana; Endophytism; Chilo partellus; Reduction in stem tunneling

E. Yosef, A. Carmi, M. Nikbachat, A. Zenou, N. Umiel, J. Miron, Characteristics of tall versus short-type varieties of forage sorghum grown under two irrigation levels, for summer and subsequent fall harvests, and digestibility by sheep of their silages, Animal Feed Science and Technology, Volume 152, Issues 1-2, 10 June 2009, Pages 1-11, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2009.01.018.
(http://www.sciencedirect.com/science/article/B6T42-4W6N2S2-1/2/13496b175a3e620ef89bed368954ead4)
Abstract:
Changes in the response of short (Tal) and tall (FS-5) types of forage sorghum varieties to irrigation level during summer and subsequent fall growth were measured with respect to crop yield, assimilate partitioning, chemical composition and digestibility. The digestibility by sheep of silages made from Tal or FS-5 plants grown for summer and fall harvests was also investigated. During summer cycle, FS-5 plants attained maximal height of 3.2 m and stem diameter of 2-2.1 cm, whereas the upper height of Tal plants was lower (1.7-1.8 m, $P<0.05$), and their stems were thinner (diameter of 1.7 cm, $P<0.05$). Within each genotype, plants morphology and chemical composition were not affected by irrigation from 180 to 250 mm. Dry matter (DM) yields of the summer plants ranged from 25.3 to 30.1 t DM/ha and was not affected by genotype or irrigation level. Yield of the fall harvests attained to lower levels of 12.5-14.6 t DM/ha. Crude protein (CP) content was higher in Tal than in FS-5 biomass. During the ensilage process, differences in composition that were found in the green forages, disappeared in the two genotypes, resulting in similar in vitro DM digestibility (0.59-0.61) for both growth cycles. During ensilage most of the

soluble carbohydrates and in the case of Tal also part of the solubilized hemicelluloses were converted mainly into lactate, acetate and ethanol, resulting in similar and low pH values (3.7-4.0). High DM recovery during ensilage was found in all the genotypes. Voluntary intake by sheep of DM and NDF from diets based on the fall silages was higher than that of the summer silages however, there was no difference in forage intake between the two genotypes. In vivo DM digestibility by sheep was similar (0.61-0.64) in the two genotypes irrespective of the growth season, and reflected their similarity in NDF (0.51-0.55) and cellulose (0.61-0.64) digestibility. The main difference between genotypes was observed in CP intake and digestibility that were higher ($P<0.05$) in Tal than in FS-5 silages grown in both cycles.
Keywords: Tal and FS-5 sorghum; Ensiling; Digestibility; Sheep; Sorghum composition

Harinder Singh, Navdeep Singh Sodhi, Narpinder Singh, Characterisation of starches separated from sorghum cultivars grown in India, Food Chemistry, In Press, Corrected Proof, Available online 9 June 2009, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2009.05.086.
(http://www.sciencedirect.com/science/article/B6T6R-4WGK4NG-1/2/87582108d4fc7bc25d0eb7593680e608)
Abstract:
Starches from 15 Indian sorghum cultivars were separated and evaluated for physicochemical, morphological, thermal, retrogradation, pasting and textural properties. The morphological characterisation revealed the presence of irregular-polyhedral as well as spherical shaped granules. A wide variation in amylose content ranging from 11.2% to 28.5% was observed. Thermal, retrogradation, pasting and textural characteristics also showed significant differences amongst all the starch cultivars. Principal component analysis was carried out to extract five principal components that could explain 75% of the total variance. The first two principal components PC1 (To, Tp, Tc and [Delta]Hgel) and PC2 (amylose content, range of gelatinisation, PHI and pasting and textural properties) could explain a cumulative variance of 44%, indicating the importance of amylose, thermal and textural properties on the sorghum starch functionality.
Keywords: Sorghum starch; Physico-chemical; Morphological; Thermal; Retrogradation; Pasting; Texture

J. Mark Powell, Michael P. Russelle, Dairy heifer management impacts manure N collection and cycling through crops in Wisconsin, USA, Agriculture, Ecosystems & Environment, Volume 131, Issues 3-4, June 2009, Pages 170-177, ISSN 0167-8809, DOI: 10.1016/j.agee.2009.01.012.
(http://www.sciencedirect.com/science/article/B6T3Y-4VP1CHF-1/2/30bbf758c80f44d9e47ccaf75da3cb4b)
Abstract:
Escalating energy and fertilizer N prices have renewed farmer interests in methods that reduce manure management costs and enhance the fertilizer value of manure. At the same time, air quality legislation seeks to mitigate ammonia loss from animal operations. We compared two dairy heifer management practices on manure N capture and recycling through crops: the conventional practice of barn manure collection and land application, and corralling heifers directly on cropland. Heifers were kept in a barn for two (B2) or four (B4) days and manure was hauled to fields, or heifers were corralled directly on cropland for two (C2) or four (C4) days. Four successive manure application seasons, spring-summer (SS), fall-winter (FW), summer (S) and winter (W) were evaluated over 2 years. Each season was followed by 3-year crop rotations: SS and S by wheat (Triticum spp. L.), sudangrass (Sorghum bicolor (L.) Moench), winter rye (Secale cereale L.), corn (Zea mays L.), winter rye, and corn; and FW and W by corn, winter rye, corn, winter rye, and corn. Corralling resulted in 50-65% greater N applications than barn manure. In barn N losses (% of excreted manure N, ExN) were greater from B4 (30%) than B2 (20%). Apparent N recovery of applied manure N (ANR) by wheat ranged from 13% to 25% at the lower (B2 and C2) application rates and 8-14% at the higher (B4 and C4) rates. First-year corn following FW had ANR of 13-32%

at the lower (B2 and C2) application rates and 9-20% of applied N at the higher (B4 and C4) rates. As a percent of ExN, ANR over the 3 year rotation from C2 was 50%, B2 35%, C4 30% and B4 22%. Overall results demonstrated that corralling dairy heifers on cropland reduces ammonia loss and improves urine N capture and recycling through crops.
Keywords: Heifers; Manure; Feces; Urine; Manure management; Nitrogen cycling

Carlos Aguilar-Perez, Juan Ku-Vera, Fernando Centurion-Castro, Philip C. Garnsworthy, Energy balance, milk production and reproduction in grazing crossbred cows in the tropics with and without cereal supplementation, Livestock Science, Volume 122, Issues 2-3, June 2009, Pages 227-233, ISSN 1871-1413, DOI: 10.1016/j.livsci.2008.09.004.
(http://www.sciencedirect.com/science/article/B7XNX-4TKNJFC-1/2/0f901aecf6d93acfa0c30967a4241b95)
Abstract:
This study was designed to evaluate the role of supplementation with a cereal-based concentrate on energy balance, milk production and reproduction of suckling crossbred cows, grazing star grass in the tropics. Forty-eight Holstein x Zebu cows were used in a 2 x 2 factorial design from calving to 98 days post-partum. Treatment factors were diet (Control vs. Supplemented) and season of calving (dry vs. rainy). The supplement consisted of sorghum (69%), soya bean meal (14%), wheat bran (15%) and minerals (2%), contained 878 g/kg dry matter (DM), 168 g/kg DM crude protein (CP) and 11.8 MJ/kg DM metabolisable energy (ME), and was offered at 0.9% of live weight. There was no interaction between diet and season. Supplementation increased ($P < 0.001$) intakes of DM, ME and CP, and increased milk yield by 30% ($P < 0.001$). Supplementation eliminated negative energy balance (NEB) on day 21 post-calving (3.3 vs. - 22.9 MJ/day) and on day 84 post-calving (1.1 vs. - 12.1 MJ/day). The proportion of cows that showed oestrus was higher ($P = 0.025$) for Supplemented cows (74%), compared with Control cows (39%) and the proportion of cows that ovulated tended to be greater ($P = 0.073$) for Supplemented (58%) than for Control (30%) cows. Supplemented cows had a greater ($P = 0.003$) population of large ovarian follicles (0.6 vs. 0.3), shorter ($P = 0.025$) calving to first oestrus interval (62.8 +/- 6.9 days vs. 68.2 +/- 3.8 days) and tended to have ($P = 0.079$) a higher pregnancy rate at 90 days (47% vs. 22%). It is concluded that grazing crossbred cows in the tropics may experience a period of NEB post-partum, which can be reduced using cereal-based concentrates, whilst improving milk production and reproductive performance.
Keywords: Energy use; Dual-purpose; Milk yield; Reproductive performance; Concentrate

Marcio dos Reis Martins, Jose Eduardo Cora, Ricardo Falqueto Jorge, Adolfo Valente Marcelo, Crop type influences soil aggregation and organic matter under no-tillage, Soil and Tillage Research, Volume 104, Issue 1, June 2009, Pages 22-29, ISSN 0167-1987, DOI: 10.1016/j.still.2008.11.003.
(http://www.sciencedirect.com/science/article/B6TC6-4V8FF96-1/2/97b4f1b1abc4116d6f91b299777a3dab)
Abstract:
The adaptation of no-tillage system in tropical regions depends on the suitable choice of summer and winter crops which should contribute to improvement of soil properties. The aim of the present study was to determine the effect of crop sequences on soil aggregation and contents of organic C and polysaccharides in aggregates of a Rhodic Eutrudox under no-tillage. The treatments consisted of the combination of four summer crop sequences and seven winter crop sequences. The summer crop sequences were: maize monocrop (Zea mays L.) (MM); soybean monocrop (Glycine max (L.) Merrill) (SS); crop sequence of soybean/maize/soybean/maize (SM); crop sequence of rice (Oryza sativa L.)/bean (Phaseolus vulgaris L.)/cotton (Gossypium hirsutum L.)/bean (RB). The winter crops were: maize, sunflower (Helianthus annuus L.), radish (Raphanus sativus L.), pearl millet (Pennisetum americanum (L.) Leeke), pigeon pea (Cajanus cajan (L.)

Millsp), grain sorghum (Sorghum bicolor (L.) Moench) and sunn hemp (Crotalaria juncea L.). The highest total organic C, total polysaccharides and dilute acid-extracted polysaccharides contents were found in 2.00-1.00 mm water-stable aggregates and the lowest contents were found in <0.25 mm aggregates. The maize monocrop provided the highest water-stability of soil aggregates. This crop sequence provided the highest content of total organic C and dilute acid-extracted polysaccharides in aggregates with diameter of 6.30-2.00 mm. This indicates that the influence of crops on the stability of aggregates is mediated by total organic C and easily hydrolysable polysaccharides (polysaccharides other than cellulose) in the soil. There were no differences among effects of the winter crops (maize, sunflower, oilseed radish, pearl millet, pigeon pea, grain sorghum and sunn hemp) on the soil aggregation.
Keywords: Soil aggregation; Soil carbohydrates; Soil structure; Crop rotation; Cover crops

T.M. Agbede, S.O. Ojeniyi, Tillage and poultry manure effects on soil fertility and sorghum yield in southwestern Nigeria, Soil and Tillage Research, Volume 104, Issue 1, June 2009, Pages 74-81, ISSN 0167-1987, DOI: 10.1016/j.still.2008.12.014.
(http://www.sciencedirect.com/science/article/B6TC6-4VH32X7-1/2/5e94ecdcc1467177435ccbf0498b5dcc)
Abstract:
The data on tillage methods, mulching and manuring are needed to identify strategies for sustainable management of soils and for improving agronomic productivity. Hence, three field experiments were carried out at two locations in late-season 2004, early 2005 and late-season 2006, respectively, on Alfisol (Oxic Tropuldalf) at Owo in the forest-savanna transition zone of southwest Nigeria to evaluate the effects of different tillage methods and poultry manure on soil fertility and sorghum grain yields. The treatments consisted of five tillage methods (zero tillage with mulch, zero tillage without mulch, ploughing, ploughing plus harrowing and ploughing plus harrowing twice), and two rates of poultry manure at 0 and 7.5 Mg ha-1. These were factorially combined and arranged in a randomized complete block design and replicated three times. The surface soils (0-15 cm) were analysed for chemical properties before and after second and third experiments. There was a percentage decrease of soil organic C, total N, available P, exchangeable K, Ca, and Mg concentrations in ascending order for zero tillage with mulch, zero tillage without mulch, ploughing, ploughing plus harrowing and ploughing plus harrowing twice while percentage increases were recorded in a descending order for all the various combinations of tillage with poultry manure in that order. Zero tillage with mulch, zero tillage without mulch, ploughing, and ploughing plus harrowing out-yielded ploughing plus harrowing twice by 33.7, 30.5, 18.9 and 17.9%, respectively. Poultry manure application in combination with tillage increased grain yield by 39.5% compared with tillage only. The manure-zero tillage methods increased grain yields by 15% compared with manure-mechanized tillage methods. The study indicates that sorghum can be grown sustainably in the forest-savanna transition zone of southwest Nigeria by employing zero tillage with mulch and zero tillage without mulch in combination with 7.5 Mg ha-1 poultry manure.
Keywords: Tillage; Poultry manure; Soil nutrient; Sorghum; Nigeria

Isaac Olusanjo Adewale, Ayomide Oladejo, Properties of the isoforms of [alpha]-amylase from kilned and unkilned malted sorghum (Sorghum bicolor), Carbohydrate Polymers, Volume 77, Issue 1, 22 May 2009, Pages 105-109, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.12.011.
(http://www.sciencedirect.com/science/article/B6TFD-4V70R9P-5/2/e6a515b6bad82b25d8541e5c62b76d8a)
Abstract:
We have previously reported the presence of a relatively heat-stable [alpha]-amylase with a low Km for starch in kilned malted sorghum. In order to establish the industrially useful and more efficient isoforms, we have separated this [alpha]-amylase into different isoforms using both cation

and anion-exchange chromatographies. Unkilned malted [alpha]-amylase crude was separated into three different isoforms (a1, a2 and a3) whereas kilned samples were separated into two (a1 and a2). Apparently one isoform (a3) was lost during kilning due to heat lability. a1 isoform which appears to have a neutral pI and constitute about 60% of the total [alpha]-amylases protein that were induced during germination, have the lowest Km for starch. They are more generally stable than other isoforms at all the temperatures studied. These isoforms lost only 10% activity at 80 [degree sign]C for 30 min and still had some residual activity at 100 [degree sign]C incubation for 30 min. a1 isoform could therefore be adapted for industrial starch conversion processes which are carried out within this range of gelatinizing temperatures because of its properties.
Keywords: [alpha]-Amylase; Kilned malted sorghum; Temperature stability; Low Km

Nawal M.M. Ali, Abdullahi H. El Tinay, Abd Elmoneim O. Elkhalifa, O.A. Salih, N.E. Yousif, Effect of alkaline pretreatment and cooking on protein fractions of a high-tannin sorghum cultivar, Food Chemistry, Volume 114, Issue 2, 15 May 2009, Pages 646-648, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.10.001.
(http://www.sciencedirect.com/science/article/B6T6R-4TMBPY1-F/2/4d68ca866050649423055cb7ebbecc42)
Abstract:
A high-tannin sorghum cultivar (Karamaka) was used to study the effect of soaking in distilled water or 0.05%, 0.10% and 0.20% NaOH for 8 h, and soaking in distilled water or NaOH followed by cooking, on proximate composition, tannin content and protein fractions. Results showed that soaking the sorghum grains in water or NaOH for 8 h caused a slight increase in crude protein, whilst the tannin content significantly (p [less-than-or-equals, slant] 0.05) decreased. The highest drop in tannin content was observed after soaking sorghum in 0.20% NaOH for 8 h at ambient temperature. Combining soaking and cooking further lowered the tannin content of sorghum, with a maximum reduction of 83.9%. Soaking in NaOH and cooking caused significant (p [less-than-or-equals, slant] 0.05) increases in the albumin and globulin fractions, accompanied by a significant reduction in the glutelin fraction. This readjustment of sorghum protein fractions would indicate improvement in the quality of sorghum proteins.
Keywords: Sorghum; Tannin; Soaking; Sodium hydroxide; Cooking; Protein fractions

M.R. Khaledian, J.C. Mailhol, P. Ruelle, P. Rosique, Adapting PILOTE model for water and yield management under direct seeding system: The case of corn and durum wheat in a Mediterranean context, Agricultural Water Management, Volume 96, Issue 5, May 2009, Pages 757-770, ISSN 0378-3774, DOI: 10.1016/j.agwat.2008.10.011.
(http://www.sciencedirect.com/science/article/B6T3X-4V4625P-1/2/09ba8e1a3171eb36cdcee36e39cb922d)
Abstract:
Crop models are useful tools for integrating knowledge of biophysical processes governing the plant-soil-atmosphere system. But few of them are easily usable for water and yield management especially under specific cropping systems such as direct seeding. Direct seeding into mulch (DSM) is an alternative for conventional tillage (CT). DSM modifies soil properties and creates a different microclimate from CT. So that, we should consequently consider these new conditions to develop or to adapt models. The aim of this study was to calibrate and validate the PILOTE [Mailhol, J.C., Olufayo, A.A., Ruelle, P., 1997. Sorghum and sunflower evapotranspiration and yield from simulated leaf area index. Agric. Water Manag. 35, 167-182; Mailhol, J.C., Zairi A., Slatni A., Ben Nouma, B., El Amami, H., 2004. Analysis of irrigation systems and irrigation strategies for durum wheat in Tunisia. Agric. Water Manag. 70, 19-37], an operative crop model based on the leaf area index (LAI) simulation, for corn and durum wheat in both DSM and CT systems in Mediterranean climate. In DSM case, simple model modifications were proposed. This modified PILOTE version accounts for mulch and its impact on soil evaporation. In addition root

progression was modified to account for lower soil temperatures in DSM for winter crops. PILOTE was calibrated and validated against field data collected from a 7-year trial at the experimental station of Lavalette (SE of France). Results indicated that PILOTE satisfactorily simulates LAI, soil water reserve (SWR), grain yield, and dry matter yield in both systems. The minimum coefficient of efficiency for SWR was 0.90. This new version of PILOTE can thus be used to manage water and yield under CT and DSM systems in Mediterranean climate.
Keywords: Crop model; Soil water balance; Direct seeding; Conventional tillage

Marcia R.R. Coelho, Ivanildo E. Marriel, Sasha N. Jenkins, Clare V. Lanyon, Lucy Seldin, Anthony G. O'Donnell, Molecular detection and quantification of nifH gene sequences in the rhizosphere of sorghum (Sorghum bicolor) sown with two levels of nitrogen fertilizer, Applied Soil Ecology, Volume 42, Issue 1, May 2009, Pages 48-53, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2009.01.010.
(http://www.sciencedirect.com/science/article/B6T4B-4VS3NYJ-1/2/1652c04519f7f449a30c731f2cbf2087)
Abstract:
Denaturing gradient gel electrophoresis (DGGE) and SYBR Green I quantitative real-time PCR (qPCR) approaches were used to assess respectively the molecular diversity and the quantity of the nifH gene sequences in the rhizospheres of two cultivars of sorghum sown in Cerrado soil with contrasting levels of nitrogen fertilizer. DGGE fingerprinting showed that for both cultivars the presumptive nitrogen-fixing populations in the rhizospheres were more diverse than in bulk soil. Sequencing of nifH gene fragments obtained from DGGE bands revealed that members of the order Rhizobiales were prevalent among the dominant diazotrophs. Discriminant analysis of DGGE profiles resulted into three groups formed by (i) cultivar BRS 308 sown with high level of nitrogen, (ii) cultivar BRS 308 sown with low level of nitrogen and cultivar BRS 310 sown either with low or high levels of nitrogen and (iii) bulk soil, showing that the nitrogen fertilization influenced the nifH gene sequence diversity only in the rhizosphere of cultivar BRS 308. When the quantity of the nifH gene sequences was determined by q-PCR, 2.4 x 105 to 1.3 x 107 copies/g of soil were detected. The highest number of nifH gene copies was observed in the rhizosphere of cultivar BRS 308 treated with low amount of fertilizer, and a reduction in nifH density was observed in the rhizospheres of both sorghum cultivars when high levels of nitrogen were applied. Thus, both the amount of nitrogen fertilizer and the cultivar are important factors influencing the structure and amount of diazotrophs in sorghum.
Keywords: Real-time PCR; DGGE; nifH gene; Sorghum bicolor; Diazotrophs

Leo Stroosnijder, Modifying land management in order to improve efficiency of rainwater use in the African highlands, Soil and Tillage Research, Volume 103, Issue 2, Contains papers from HighLand 2006: Land Degradation and Soil and Water Conservation in Tropical Highlands, Mekelle, Ethiopia, 21-25 September 2006, May 2009, Pages 247-256, ISSN 0167-1987, DOI: 10.1016/j.still.2008.05.019.
(http://www.sciencedirect.com/science/article/B6TC6-4TF69BH-2/2/0aae98e24855c966723086b9d608ac48)
Abstract:
Water scarcity and drought in Africa are often in the news. The widespread tendency to relate farmers' notion of drought to changes in the occurrence of dry spells is misguided: several recent studies have yielded little evidence of an increase in the length and/or frequency of such spells. The farmers' concept of drought is contextual and an indirect result of land degradation. Plant production suffers because water is not available due to deteriorated physical properties of soil. Farmers' perception of drought refers to the Green Water Use Efficiency (GWUE), i.e. the fraction of rain that is used for plant transpiration. GWUE in Africa is remarkably low: in sub-Saharan Africa, only 15% of the terrestrial rainwater is used by plants for the production of food, fodder and

fibre. Although a millet crop grown under traditional circumstances uses only 50 mm in transpiration, the crop frequently suffers from agricultural drought due to excessive losses of rainwater.
A range of land management practices is available to help improve GWUE. They can be classified according to their function. Hedgerow barriers and terraces can mitigate runoff; infiltration rates below hedgerows in Kenya were found to be three to eight times higher than where the crop was grown. Mulch that triggers soil fauna can improve water availability; mulching with straw from a local perennial grass in Burkina Faso doubled the water use efficiency from 1 kg mm-1 without fauna to 2 kg mm-1 with fauna. Water harvesting and water-nutrient synergy can improve water use; in case permeable barriers combined with the use of compost Sorghum yield in Burkina Faso was 2.3 times higher than in the control plots and the plots with the barriers only.
Green water deserves more attention from policy makers, planners, land users, water engineers and managers.
Keywords: Africa; Drought; Water balance; Farmers; Green water

N. Ochanda, J. Yu, P.J. Bramel, A. Menkir, M.R. Tuinstra, M.D. Witt, Selection before backcross during exotic germplasm introgression, Field Crops Research, Volume 112, Issue 1, 30 April 2009, Pages 37-42, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.01.012.
(http://www.sciencedirect.com/science/article/B6T6M-4VS3P17-1/2/2a06a4262e77026e55906599f197ca29)
Abstract:
Introgression of genes from exotic germplasm into breeding populations can broaden the genetic base of crop improvement. Only a very small percentage of genetic variability has been used in crop breeding programs. Traditionally, F1 plants are used to backcross to the adapted lines or populations. An alternative approach is to backcross the F2 individuals selected for agronomic acceptability. Our objective was to determine whether selection before backcross would lead to more progenies with both high yield and acceptable levels of agronomic performance than direct backcross without selection. To test the feasibility of the proposed approach, we conducted parallel experiments in which two exotic sorghum accessions were crossed to two adapted sorghum parents and further backcrossing was conducted with either F1 or selected F2 plants. Fifty random S1 families were evaluated in three test environments. Although selection before backcross resulted in a higher frequency of families with maturity equal to or earlier than those of the adapted parents, no consistent changes in grain yield and plant height were observed between populations with and without selection. Similar results were found with either an inbred or a population as the recurrent parents. Given these findings and the extra generation required, we do not recommend selection before backcross in the process of introgression of exotic germplasm.
Keywords: Backcross; Breeding method; Introgression; Plant breeding; Selection

Teng-Hsu Wang, Min-Hsiung Lee, Nan-Wei Su, Screening of lectins by an enzyme-linked adsorbent assay, Food Chemistry, Volume 113, Issue 4, 15 April 2009, Pages 1218-1225, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.08.024.
(http://www.sciencedirect.com/science/article/B6T6R-4T708F1-3/2/c06f6367185b8f425fdaa495b23b1fab)
Abstract:
This study provides a new strategy to detect the specific carbohydrate binding capability of lectins. A sugar-polymer based enzyme-linked adsorbent assay was established by applying different monosaccharide-polyacrylamide conjugates as capturing agents for screening lectins in biological samples. Four model lectins, concanavalin A (Con A), wheat germ agglutinin (WGA), soybean agglutinin (SBA) and Ulex europaeus agglutinin I (UEA I), were employed as the comparative lectins against each corresponding sugar. The results suggested that this assay is more sensitive than the conventional hemagglutinating methods. On the screening of specific carbohydrate

binding capability from biological materials, extracts of papaya (Carica papaya) seeds, longan (Euphoria longana) seeds and sorghum (Sorghum bicolor) were shown various specific monosaccharide binding capabilities which had not been reported before. In conclusion, the assay provides an alternative and efficacious detection for the specific carbohydrate binding substances in biological samples.
Keywords: Lectin; Screening; ELISA; Monosaccharide; Hemagglutination

D.N. Ledgerwood, E.J. DePeters, P.H. Robinson, S.J. Taylor, J.M. Heguy, Assessment of a brown midrib (BMR) mutant gene on the nutritive value of sudangrass using in vitro and in vivo techniques, Animal Feed Science and Technology, Volume 150, Issues 3-4, 14 April 2009, Pages 207-222, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2008.10.001.
(http://www.sciencedirect.com/science/article/B6T42-4TXDXHM-2/2/9bdf69d3051f8eb9801f51a0613b8f98)
Abstract:
The brown midrib (BMR) gene has been reported to reduce the lignin concentration in plants, which contributed to increased fiber digestion in ruminants. Three studies were completed to compare the digestibility of a BMR mutant of sudangrass (sorghum bicolor subsp. Drummondii) versus a non-BMR (`Piper') variety when included in diets fed to sheep (Study 1), to complete a rumen in vitro assessment of sheep and lactating cow diets (Study 2), and to compare digestibility when included in the diet fed to lactating dairy cows (Study 3). Four wether sheep were used in a 2 x 2 Latin square experiment (Study 1) with total fecal collection to determine total tract apparent digestibility of pelleted Piper (P) and BMR (P-BMR) sudangrass hays. Forage pellets consisted of either P-BMR or P hay with added urea to meet the maintenance crude protein (CP) requirement of the sheep. Digestibility of organic matter (OM; P<0.01), dry matter (DM; P<0.01), acid detergent fiber (ADF; P<0.05), and neutral detergent fiber (aNDFom; P<0.07) was higher for P-BMR than P sudangrass. In vitro rumen digestibility of aNDFom using cattle rumen fluid was higher at 24 (P<0.01), 48 (P<0.01) and 72 h (P<0.01) of fermentation for P-BMR versus P (Study 2). Four lactating Holstein dairy cows (251 +/- 30 days in milk) and fitted with ruminal and duodenal cannulae were used in a 4 x 4 Latin square experiment. Total mixed rations (TMR) contained 180 g/kg DM shredded sudangrass hay and 180 g/kg sliced alfalfa hay, but the proportion of P to P-BMR sudangrass varied as 100:0, 66:34, 34:66, or 0:100. Yields of milk and milk protein were highest at the 66:34 level (Quadratic: P=0.06 and 0.07, respectively), but composition of milk fat, protein and lactose, as well as DM intake, did not differ (Study 3), probably because forestomach and total tract apparent digestion of aNDFom and OM did not differ due to sudangrass source.
Keywords: Brown midrib; Sudangrass; Forage

A. Mendez-Albores, J. Veles-Medina, E. Urbina-Alvarez, F. Martinez-Bustos, E. Moreno-Martinez, Effect of citric acid on aflatoxin degradation and on functional and textural properties of extruded sorghum, Animal Feed Science and Technology, Volume 150, Issues 3-4, 14 April 2009, Pages 316-329, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2008.10.007.
(http://www.sciencedirect.com/science/article/B6T42-4V11K0B-2/2/e4a8504eeebba839141efa13935236b6)
Abstract:
Sorghum contaminated with a total concentration of aflatoxin B1 (AFB1) and aflatoxin B2 (AFB2) at 140 +/- 7.3 ng/g was extrusion-cooked in a single screw extruder. The temperature profile in the barrel sections of the extruder was 80-150-200 [degree sign]C. The flour moisture content (M.C.) was adjusted at 200, 250 and 300 g/kg by means of aqueous citric acid at concentrations of 0, 0.5, 1, 2, 4 and 8N. The barrel temperature profile, in combination with the M.C. and the citric acid concentration, significantly affected the extent of aflatoxin reduction in the extruded sorghum. The recovered aflatoxin decreased with an increase in M.C. and acid concentration. The maximum percentage of aflatoxins degraded from cooking the milled sorghum ranged from 17 to 92%. Even

when using a severe extrusion condition combined with high citric acid concentrations, acceptable product colour, viscosity, functional and textural properties were obtained.
Keywords: Aflatoxins; Citric acid; Sorghum; Extrusion; Detoxification

Andrew McDonald, Susan Riha, Antonio DiTommaso, Arthur DeGaetano, Climate change and the geography of weed damage: Analysis of U.S. maize systems suggests the potential for significant range transformations, Agriculture, Ecosystems & Environment, Volume 130, Issues 3-4, April 2009, Pages 131-140, ISSN 0167-8809, DOI: 10.1016/j.agee.2008.12.007.
(http://www.sciencedirect.com/science/article/B6T3Y-4VH8XYH-1/2/cf0268f60b128998f4464f4741403987)
Abstract:
By the end of the century, climate change projections under a 'business-as-usual' emissions scenario suggest a globally averaged warming of 2.4-6.4 [degree sign]C. If these forecasts are realized, cropping systems are likely to experience significant geographic range transformations among damaging endemic weed species and new vulnerabilities to exotic weed invasions. To anticipate these changes and to devise management strategies for proactively addressing them, it is necessary to characterize the environmental conditions that make specific weed species abundant, competitive, and therefore damaging the production of particular crops (i.e. defining the damage niche). In this study, U.S. maize is used as a model system to explore the implications of climate change on the distribution of damaging agricultural weeds. To accomplish this, we couple ensemble climate change projections of annual temperature and precipitation with survey data of troublesome weed species in maize. At the state scale, space-for-time substitution techniques are used to suggest the potential magnitude of change among damaging weed communities. To explore how the geography of damage for specific species may evolve over the next century, bioclimatic range rules were derived for two weed species that are pervasive in the Northern (Abutilon theophrasti Medicus, ABUTH) and Southern (Sorghum halepense (L.) Pers., SORHA) U.S. Results from both analyses suggest that the composition of damaging weed communities may be fundamentally altered by climate change. In some states, potential changes in the coming decades are commensurate to those possible by the end of the century. Regions such as the Northeastern U.S. may prove particularly vulnerable with emerging climate conditions favoring few weed species of present-day significance. In contrast, regions like the mid-South are likely to experience fewer shifts even with a similar magnitude in climate change. By the end of the century in the U.S. Corn Belt, cold-tolerant species like A. theophrasti may be of minor importance whereas S. halepense, a predominantly Southern U.S. weed species at present, may become common and damaging to maize production with its damage niche advancing 200-600 km north of its present-day distribution.
Keywords: Biogeography; Global warming; Pests

G. Wang, M.E. McGiffen Jr., E.J. Ogbuchiekwe, L. Butler, Economic return of purple and yellow nutsedge management in vegetable production of southern California, Crop Protection, Volume 28, Issue 4, April 2009, Pages 319-326, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.11.011.
(http://www.sciencedirect.com/science/article/B6T5T-4V64YHC-1/2/daad26289abd53200c6c4810557da85e)
Abstract:
The economic return of a standard low desert crop rotation of spring cantaloupe (Cucumis melo L.)-summer fallow-winter broccoli (Brassica oleracea L.) infested with purple nutsedge (Cyperus rotundus L.) or yellow nutsedge (Cyperus esculentus L.) was compared to alternative rotations that included: cultivation (hand-hoeing), a smother crop of wheat (Triticum aestivum L.) and sudangrass (Sorghum sudanense L.), a smother crop of wheat followed by solarization, and sweet corn (Zea mays L.) with halosulfuron application followed by sudangrass in southern California from 2001 to 2003. After two growing seasons, broccoli was planted without any nutsedge control.

Purple and yellow nutsedge tubers increased dramatically in the untreated plots and purple nutsedge reduced crop yield and economic returns. Solarization was the most effective treatment for reducing purple nutsedge populations, but had a negative economic return above variable costs. Multiple hand-hoeing also controlled purple nutsedge effectively and resulted in a net return of $3069/ha. The halosulfuron and the smother crop treatments did not control purple nutsedge and had negative economic returns. Yellow nutsedge did not affect crop yield significantly during the course of the experiment. All methods controlled yellow nutsedge effectively, especially when there were no crops growing in the summer. However, the economic return of the treatments varied significantly. The net return of the cultivation treatment in the yellow nutsedge field was $9219/ha, while the net returns of the halosulfuron and smother crop treatments were negative. When the final broccoli crop was grown without nutsedge control from October 2003 to January 2004, solarization was the only treatment to be profitable in the purple nutsedge field. The cultivation and the solarization treatments had the highest economic return in the yellow nutsedge field, while the only treatment with negative economic return in the yellow nutsedge field was the smother crop treatment. For both purple and yellow nutsedge, planting sudangrass in the summer had the lowest broccoli yield and economic return.
Keywords: Cost-benefit analysis; Crop rotation; Sustainable agriculture

Ya Li Zhao, Abdughani Dolat, Yosef Steinberger, Xin Wang, Amarjan Osman, Guang Hui Xie, Biomass yield and changes in chemical composition of sweet sorghum cultivars grown for biofuel, Field Crops Research, Volume 111, Issues 1-2, 15 March 2009, Pages 55-64, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.10.006.
(http://www.sciencedirect.com/science/article/B6T6M-4V3S526-2/2/1d3d531777eced58c78d1836f8219015)
Abstract:
This investigation was carried out in order to evaluate changes in biomass, carbohydrates, and calculated ethanol yield (CEY) from anthesis to 40 days after anthesis (DAA) of five sweet sorghum (Sorghum biocolor (L.) Moench) cultivars with a crop cycle length of 111-165 days in Beijing (39[degree sign]56'N, 116[degree sign]20'E). Aboveground dry weight (AGDW) and total soluble sugar yield (TSSY, 1.3-10.5 t ha-1) increased with time after anthesis and with crop cycle length. Cellulose and hemicellulose contents at anthesis varied between 205-277 g kg-1 and 187-232 g kg-1, respectively, and were significantly ($p < 0.05$) higher than either 20 DAA or 40 DAA. Cellulose and hemicellulose yields changed between 1.6 and 6.6 t ha-1 from anthesis to 40 DAA. The stems comprised major sinks of soluble sugar, with 79.4-94.6% of TSSY, and major sinks of insoluble sugar, with 55.9-75.9% of the total cellulose and hemicellulose yield. The hybrids exhibited higher TSSY, cellulose, hemicellulose and grain yield, and therefore also CEY than the inbred cultivars with a similar crop cycle length. Total CEY from the carbohydrates increased with time after anthesis and with crop cycle length, ranging between 4867 and 13032 L ha-1 on 40 DAA during the two years. It is concluded that the effects of each factor of year, harvest time, and genotype on biomass, carbohydrates yield, and CEY are highly significant. The interaction of genotype with year (environment) has significant effects on the total CEY. We recommend beginning the harvest of sweet sorghum upon the early maturity of the cultivars from around 20 DAA. This will result in a harvest period of around two months until grain maturity of the late cultivars for ethanol production in North China.
Keywords: Sweet sorghum; Biomass; Sugar; Starch; Cellulose; Ethanol yield

Zhanguo Xin, Rob Aiken, John Burke, Genetic diversity of transpiration efficiency in sorghum, Field Crops Research, Volume 111, Issues 1-2, 15 March 2009, Pages 74-80, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.10.010.
(http://www.sciencedirect.com/science/article/B6T6M-4V4M2VY-1/2/42ba6dc462280de5da575cb000d50d1d)

Abstract:
Sorghum is the fifth most important grain crop and is becoming increasingly important as a biofuel feedstock due to its superior tolerance to water-deficit stress. Sorghum is commonly grown under rain-fed conditions in the Southern Plains in the U.S.A. and other semi-arid regions in the world. Thus, its production is strongly affected by the availability of soil water during the growing season. Enhancing transpiration efficiency (TE), defined as biomass accumulation per unit water transpired, may be an effective approach to increasing sorghum yield in arid and semi-arid regions under no or limited irrigation. In this report, we surveyed 341 sorghum accessions for variation in TE. A selection of 25 lines was used to confirm the initial survey and these accessions were studied in a greenhouse experiment over 2 years. TE in these selected lines varied from year to year; however, similar rank was observed in both studies. Several accessions with consistent high or low TE were identified. TE based on biomass production was strongly correlated with increased biomass accumulation rather than with reduced water use. Gas-exchange analysis indicated that low internal CO2 concentration and enhanced photosynthetic capacity may be a factor accounting for the high TE in some lines; other physiological processes also contribute to the TE based on integrated biomass. The result suggests that considerable genetic variation in TE exists in the sorghum germplasm collection and that TE is strongly influenced by environment. The sorghum lines with contrasting TE may serve as an important genetic resource for identification of physiological mechanisms regulating TE and for improvement of this trait in sorghum breeding.
Keywords: Sorghum; Transpiration efficiency; Drought

S. Ravi Kumar, Graeme L. Hammer, Ian Broad, Peter Harland, Greg McLean, Modelling environmental effects on phenology and canopy development of diverse sorghum genotypes, Field Crops Research, Volume 111, Issues 1-2, 15 March 2009, Pages 157-165, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.11.010.
(http://www.sciencedirect.com/science/article/B6T6M-4VCH3FD-1/2/d951ea104b6c52d232b98df4e37b301a)
Abstract:
The ability to predict phenology and canopy development is critical in crop models used for simulating likely consequences of alternative crop management and cultivar choice strategies. Here we quantify and contrast the temperature and photoperiod responses for phenology and canopy development of a diverse range of elite Indian and Australian sorghum genotypes (hybrid and landrace). Detailed field experiments were undertaken in Australia and India using a range of genotypes, sowing dates, and photoperiod extension treatments. Measurements of timing of developmental stages and leaf appearance were taken. The generality of photo-thermal approaches to modelling phenological and canopy development was tested. Environmental and genotypic effects on rate of progression from emergence to floral initiation (E-FI) were explained well using a multiplicative model, which combined the intrinsic development rate (Ropt), with responses to temperature and photoperiod. Differences in Ropt and extent of the photoperiod response explained most genotypic effects. Average leaf initiation rate (LIR), leaf appearance rate and duration of the phase from anthesis to physiological maturity differed among genotypes. The association of total leaf number (TLN) with photoperiod found for all genotypes could not be fully explained by effects on development and LIRs. While a putative effect of photoperiod on LIR would explain the observations, other possible confounding factors, such as air-soil temperature differential and the nature of model structure were considered and discussed. This study found a generally robust predictive capacity of photo-thermal development models across diverse ranges of both genotypes and environments. Hence, they remain the most appropriate models for simulation analysis of genotype-by-management scenarios in environments varying broadly in temperature and photoperiod.
Keywords: Ontogeny; Model; Floral initiation; Flowering; Leaf appearance; Temperature; Photoperiod

Yajun Wang, Zhongkui Xie, Sukhdev S. Malhi, Cecil L. Vera, Yubao Zhang, Jinniu Wang, Effects of rainfall harvesting and mulching technologies on water use efficiency and crop yield in the semi-arid Loess Plateau, China, Agricultural Water Management, Volume 96, Issue 3, March 2009, Pages 374-382, ISSN 0378-3774, DOI: 10.1016/j.agwat.2008.09.012.
(http://www.sciencedirect.com/science/article/B6T3X-4TTNCDR-1/2/7d56bff93747fe612415c24d212f94a7)
Abstract:
In semi-arid areas, crop growth is greatly limited by water. Amount of available water in soil can be increased by surface mulching and other soil management practices. Field experiments were conducted in 2005 and 2006 at Gaolan, Gansu, China, to determine the influence of ridge and furrow rainfall harvesting system (RFRHS), surface mulching and supplementary irrigation (SI) in various combinations on rainwater harvesting, amount of moisture in soil, water use efficiency (WUE), biomass yield of sweet sorghum (Sorghum bicolour L.) and seed yield of maize (Zea mays L.). In conventional fields without RFRHS, gravel-sand mulching produced higher biomass yield than plastic-mulching or straw-mulching. In plastic-mulched fields, an increasing amount of supplemental irrigation was needed to improve crop yield. There was no effect of RFRHS without plastic-covered ridge on rainwater harvesting when natural precipitation was less than 5 mm per event. This was due to little runoff of rainwater from frequent low precipitation showers, and most of the harvested rainwater gathered at the soil surface is lost to evaporation. In the RFRHS, crop yield and WUE were higher with plastic-covered ridges than bare ridges, and also higher with gravel-sand-mulched furrows than bare furrows in most cases, or straw-mulched furrows in some cases. This was most likely due to decreased evaporation with plastic or gravel-sand mulch. In the RFRHS with plastic-covered ridges and gravel-sand-mulched furrows, application of 30 mm supplemental irrigation produced the highest yield and WUE for sweet sorghum and maize in most cases. In conclusion, the findings suggested the integrated use of RFRHS, mulching and supplementary irrigation to improve rainwater availability for high sustainable crop yield. However, the high additional costs of supplemental irrigation and construction of RFRHS for rainwater harvesting need to be considered before using these practices on a commercial scale.
Keywords: Ridge and furrow rainwater harvesting; Mulch; Irrigation; Loess Plateau

Jianliang Yu, Xu Zhang, Tianwei Tan, Optimization of media conditions for the production of ethanol from sweet sorghum juice by immobilized Saccharomyces cerevisiae, Biomass and Bioenergy, Volume 33, Issue 3, March 2009, Pages 521-526, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.08.020.
(http://www.sciencedirect.com/science/article/B6V22-4TVJ01K-2/2/9ece130464167645595897da4c8d3d79)
Abstract:
In order to obtain high ethanol yield and fermentation rate, response surface methodology (RSM) was employed to study the effect of culture medium on the ethanol productivity from stalk juice of sweet sorghum by immobilized yeast. A 23 central composite design (CCD) was chosen to explain the combined effects of the medium constituents, viz. nitrogen (adjusted by adding (NH4)2SO4), phosphorus (adjusted by adding KH2PO4), and pH. A mathematical correlation about the influence of the nitrogen, phosphorus, and pH on the ethanol productivity was established. It predicted that the maximum ethanol production rate (119.12 g/l h) was observed for a medium consisting of 0.77 g/l phosphorus, 2.15 g/l nitrogen, and pH = 6.39. Under this condition, the ethanol fermentation rate was 122.85 g/l h.
Keywords: Ethanol; Response surface methodology; Sweet sorghum juice; Medium optimization

A. Pantaleo, A. Pellerano, M.T. Carone, Potentials and feasibility assessment of small scale CHP plants fired by energy crops in Puglia region (Italy), Biosystems Engineering, Volume 102, Issue 3, March 2009, Pages 345-359, ISSN 1537-5110, DOI: 10.1016/j.biosystemseng.2008.12.002.
(http://www.sciencedirect.com/science/article/B6WXV-4VH3359-1/2/eb37d42eeaf540cc9a7d6b5374da3301)
Abstract:
The proposed work aims to assess the energy crop suitability of Puglia Region (Southern Italy), the techno-economic feasibility of small scale CHP plants fired by energy crops, and the environmental performances of the proposed CHP plants. In the first part of the work, a GIS model is defined and applied to evaluate the land suitability for energy crops in the Puglia region. In the second part, a financial appraisal of small scale CHP plants under Italian legislative framework (feed in tariffs) is proposed; the two case studies of bio-oil fired internal combustion engine (ICE) coupled to vegetable oil mill plant and fed by oil seeds (brassica carinata seeds) and syngas fired engine coupled to a pellet production unit and fed by herbaceous energy crops bales (fibre sorghum) are investigated. In the third part, the energy balance and the CO2 emissions of the whole bioenergy routes are assessed, in order to calculate the costs for the community (in terms of subsidies) to save a tons oil equivalent (TOE) of primary energy and to avoid a tCO2 in the atmosphere by these small scale routes.
The results report a potential in Puglia Region of about 293 and 729 kt y-1 of brassica carinata seeds and fibre sorghum bales, respectively; the financial appraisal of the proposed chains, under the Italian legislative framework, reports an internal rate of return (IRR) of 38% and 17%, respectively, while the energy balance assessment reports an overall efficiency of the bioenergy routes of 2.72 and 2.95, respectively.

Chiraz Zaied, Salwa Abid, Lazhar Zorgui, Chayma Bouaziz, Salwa Chouchane, Mohamed Jomaa, Hassen BACHA, Natural occurrence of ochratoxin A in Tunisian cereals, Food Control, Volume 20, Issue 3, March 2009, Pages 218-222, ISSN 0956-7135, DOI: 10.1016/j.foodcont.2008.05.002.
(http://www.sciencedirect.com/science/article/B6T6S-4SH0XV4-1/2/8f7ca87b83e3735dcdc29af69980c430)
Abstract:
Ochratoxin A (OTA) is a mycotoxin produced by several fungal species from Aspergillus and Penicillium genera. It is widespread in food and feed and its occurrence has been reported in cereals, cereal-derived products, dried fruits and spices. This mycotoxin was implicated in several human and animal pathologies such as the Balkan Endemic Nephropathy (BEN) and the Tunisian Chronic Interstitial Nephropathy (CIN) of unknown cause. In Tunisia, a clear correlation has been established between the consumption of OTA contaminated food and the induction of specific pathologies. Thereby, OTA was detected in human blood and tissues. The aim of our study was to investigate the presence of OTA in widely consumed cereals commercialized in Tunisia. The analytical methods used in our study involved the extraction of OTA by acidified toluene, immunoaffinity (IAC) clean-up and HPLC quantification with fluorescence detection. Levels and percentages of OTA contamination in different types of cereals, 110 wheat, 103 barley, 113 sorghum and 96 rice samples, were evaluated with incidences of 38%, 40%, 38% and 28%, respectively. The average of contamination by OTA found were 55, 96, 44 and 117 [mu]g/kg, respectively, for wheat, barley, rice and sorghum. Our results showed that contamination percentages and levels in the period from 2004 to 2005 were higher then usual norms (5.0 [mu]g OTA/kg) established by the European commission in 2002. The present report is the first one ever carried out on the natural occurrence of OTA in cereals, largely consumed by the Tunisian population.
Keywords: Ochratoxin A; Cereals; Occurrence; Tunisia

Ioannis Dogaris, George Vakontios, Emmanuel Kalogeris, Diomi Mamma, Dimitris Kekos, Induction of cellulases and hemicellulases from Neurospora crassa under solid-state cultivation for bioconversion of sorghum bagasse into ethanol, Industrial Crops and Products, Volume 29, Issues 2-3, March 2009, Pages 404-411, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2008.07.008.
(http://www.sciencedirect.com/science/article/B6T77-4TGGCP3-1/2/38bf8d876811b31e5b78620a040ee963)
Abstract:
The cellulolytic and hemicellulolytic system from the mesophilic fungus Neurospora crassa was produced under solid-state cultivation (SSC) on wheat straw and wheat bran mixtures. Following optimization of nitrogen source, pH and initial moisture of the growth medium, yields as high as 492.8, 1.08, 26.7, 297.8 and 0.132 (in U g-1 of carbon source) were obtained for endoglucanase, exoglucanase, [beta]-glucosidase, xylanase and [beta]-xylosidase, respectively. The potential of the multienzyme system was demonstrated for hydrolysis of sorghum bagasse (SB) into fermentable carbohydrates. N. crassa cells were found able to assimilate the majority of the released sugars and generated limited levels of other metabolic products during simultaneous saccharification and fermentation of this valuable substrate into ethanol.
Keywords: Neurospora crassa; Solid-state cultivation; Cellulase; Hemicellulase; Wheat straw; Sorghum bagasse; Bioethanol

R. Zhao, S.R. Bean, D. Wang, S.H. Park, T.J. Schober, J.D. Wilson, Small-scale mashing procedure for predicting ethanol yield of sorghum grain, Journal of Cereal Science, Volume 49, Issue 2, March 2009, Pages 230-238, ISSN 0733-5210, DOI: 10.1016/j.jcs.2008.10.006.
(http://www.sciencedirect.com/science/article/B6WHK-4TX33KN-1/2/79e7ae4541652d28db6b931ec5767789)
Abstract:
A small-scale mashing (SSM) procedure requiring only 300 mg of samples was investigated as a possible method of predicting ethanol yield of sorghum grain. The initial SSM procedure, which was conducted similarly to the mashing step in a traditional fermentation test, hydrolyzed just 38.5-47.2% of total sorghum starch to glucose. The initial procedure was simplified to contain only one liquefaction step, which did not influence subsequent saccharification. Thereafter, parameters such as temperature, pH, enzyme dosage, and saccharification time were optimized. Results showed that 91.2-97.5% of the total starch in 18 sorghum hybrids had been hydrolyzed to glucose using the following conditions: liquefaction at 86 [degree sign]C for 90 min, 20 [mu]L of [alpha]-amylase per 30 g of sample; pH adjustment by adding 50 [mu]L of 2 M acetate buffer at pH 4.2 to each microtube; saccharification at 68 [degree sign]C for 90 min, 200 [mu]L of amyloglucosidase per 30 g of sample. There were strong linear correlations between completely hydrolyzed starch (CHS) from SSM and ethanol yields from both traditional (R2 = 0.86) and simultaneous saccharification and fermentation (SSF, R2 = 0.93) procedures. CHS was a better indicator for predicting ethanol yield in fermentation than total starch.
Keywords: Sorghum; Starch; Mashing; Glucose; Ethanol; Fermentation; SSF; HPLC

Joel Mutisya, Chuanxin Sun, Sara Rosenquist, Yona Baguma, Christer Jansson, Diurnal oscillation of SBE expression in sorghum endosperm, Journal of Plant Physiology, Volume 166, Issue 4, 1 March 2009, Pages 428-434, ISSN 0176-1617, DOI: 10.1016/j.jplph.2008.06.017.
(http://www.sciencedirect.com/science/article/B7GJ7-4TF69B4-1/2/2bc7e79ab98564fa3f6235470a0ef801)
Abstract: Summary
Spatial and temporal expression patterns of the sorghum SBEI, SBEIIA and SBEIIB genes, encoding, respectively, starch branching enzyme (SBE) I, IIA and IIB, in the developing endosperm of sorghum (Sorghum bicolor) were studied. Full-length genomic and cDNA clones for sorghum were cloned, and the SBEIIA cDNA was used together with gene-specific probes for

sorghum SBEIIB and SBEI. In contrast to sorghum SBEIIB, which was expressed primarily in endosperm and embryo, SBEIIA was also expressed in vegetative tissues. All three genes shared a similar temporal expression profile during endosperm development, with a maximum activity at 15-24 d after pollination. This differed from barley and maize, in which SBEI gene activity showed a significantly later onset compared to that of SBEIIA and SBEIIB. Expression of the three SBE genes in the sorghum endosperm exhibited a diurnal rhythm during a 24-h cycle.
Keywords: Barley; Endosperm; Oscillation; SBE; Sorghum

Josphat Kutyauripo, Wilson Parawira, Sharai Tinofa, Ivy Kudita, Clement Ndengu, Investigation of shelf-life extension of sorghum beer (Chibuku) by removing the second conversion of malt, International Journal of Food Microbiology, Volume 129, Issue 3, 28 February 2009, Pages 271-276, ISSN 0168-1605, DOI: 10.1016/j.ijfoodmicro.2008.12.008.
(http://www.sciencedirect.com/science/article/B6T7K-4V4KPK5-1/2/b46cadee4de6339c1398d5960adda804)
Abstract:
The effect of removing the second step of malt conversion in the brewing of Chibuku beer was investigated with the intention of extending the shelf-life of the product. Chibuku was brewed in the laboratory scale fermenters using Delta Beverages' standard brewing procedure. A variation was made where the second malt conversion was not conducted on one brew. The effect of increasing pasteurisation time was also investigated. The extension of shelf-life was determined by following the physicochemical and the sensory profile of the products for a period of ten days under sub-tropical ambient conditions. Ethanol productions were similar between the control and test beers (without second conversion malt). A product with overall acceptability of 70% was made from the brew without the second malt conversion and with 15 min pasteurisation at 80 [degree sign]C. The product was, however, low in bite and head retention, but had less bacterial load, decreased acid production, and improved keeping quality by at least two days. However, due to contamination of the pitching yeast with lactic acid bacteria (LAB), total acids rapidly increased after 168 h and caused unacceptable sourness. Increasing pasteurisation time to 20 min reduced bacterial load of the wort to figures as low as 2 x 103 cfu/ml. General hygiene levels of the brewery were acceptable and no coliforms were detected in the product or contact surfaces along the production line. Bacterial contamination of the product mainly comes from the raw materials with pasteurisation greatly reducing this load. If improved, the procedure has the potential of extending the shelf-life of the beer to beyond 168 h.
Keywords: Sorghum opaque beer; Fermentation; Second conversion malt; Shelf-life

Amardeep Singh Virdi, Aditi Thakur, Som Dutt, Sanjay Kumar, Prabhjeet Singh, A sorghum 85 kDa heat stress-modulated protein shows calmodulin-binding properties and cross-reactivity to anti-Neurospora crassa Hsp 80 antibodies, FEBS Letters, Volume 583, Issue 4, 18 February 2009, Pages 767-770, ISSN 0014-5793, DOI: 10.1016/j.febslet.2009.01.025.
(http://www.sciencedirect.com/science/article/B6T36-4VG5DHM-4/2/214a0e5df1adcc949519c495b9e4d316)
Abstract:
The present study, carried out to identify stress-modulated calmodulin (CaM)-binding proteins in sorghum, resulted in the isolation of several proteins, which showed binding to CaM-Sepharose matrix. Calmodulin gel overlay assay and MALDI-ToF MS analysis revealed that an 85 kDa protein (Hsp85), which interacted with calmodulin, cross-reacted with anti-N. crassa Hsp80 antibodies. Since these antibodies bind to plant Hsp90, sorghum Hsp85 is likely to be a member of the Hsp90 family. This study provides the first evidence that a member of Hsp90 (Hsp85) in plants exhibits CaM-binding properties.
Keywords: Calmodulin; Calmodulin-binding protein; Hsp; Heat shock; Sorghum

Lakshmi Nimmagadda, Guruprasad Kadur Narayanaswamy, Cryptic red light signal regulates ascorbic acid in soybean, Journal of Plant Physiology, Volume 166, Issue 3, 15 February 2009, Pages 329-332, ISSN 0176-1617, DOI: 10.1016/j.jplph.2008.06.006.
(http://www.sciencedirect.com/science/article/B7GJ7-4TDJG4X-1/2/b6a53a5a6d4be7ad2aab7226d56dced8)
Abstract: Summary
The regulation of endogenous level of ascorbic acid in soybean (Glycine max L. Merrill) by cryptic red light signal (CRS) was studied. CRS is a cellular signal induced by red light pre-irradiation that amplifies the action of phytochrome, and is known to enhance anthocyanin synthesis in sorghum. A phytochrome-enhanced endogenous level of ascorbic acid in soybean seedlings was amplified by CRS. The lifetime of CRS was from 0 to 2 h and the peak of enhancement was between 16 and 24 h of dark incubation after the end of treatment.
Keywords: Ascorbic acid; Cryptic red light signal; Glycine max; Phytochrome; Ultraviolet-B

Teodoro Suarez-Dieguez, Manuel Soriano-Garcia, Irasema Anaya-Sosa, Maria Teresa Cruz y Victoria, Comparative studies of two [alpha]-amylases acting on two Sorghum hybrids starches (Montecillos hybrid 2 and 3) and their significant differences in their catalytic activities, Carbohydrate Polymers, Volume 75, Issue 3, 11 February 2009, Pages 538-540, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.09.015.
(http://www.sciencedirect.com/science/article/B6TFD-4TH4284-1/2/71e0622bd7384f8157e34c93ad4b6dbe)
Abstract:
Starchy substances constitute the major part of the human diet for most people in the world. [alpha]-Amylases are widely distributed enzymes that initiate the hydrolysis of starch into low molecular weight maltodextrins. The effect of pH on the rate of hydrolysis of both sorghum (Montecillo 2 and 3) hybrids starches by industrial bacterial amylase (IBA) and Aspergillus oryzae [alpha]-amylase(AOA) was studied. This result suggests that both IBA and AOA [alpha]-amylases had slightly high affinity for soluble starch of sorghum Montecillo 3 and 1 hybrids, respectively. Using the structural information available, the theoretical pKa values of its ionizable residues directly involved in the catalytic region were determined. Both our experimental data and prediction studies indicated that the average pKa values are in good agreement.
Keywords: Aspergillus oryzae amylase; Industrial bacterial amylase; [alpha]-Amylases; Sorghum starches

Bongani Ncube, John P. Dimes, Mark T. van Wijk, Steve J. Twomlow, Ken E. Giller, Productivity and residual benefits of grain legumes to sorghum under semi-arid conditions in south-western Zimbabwe: Unravelling the effects of water and nitrogen using a simulation model, Field Crops Research, Volume 110, Issue 2, 10 February 2009, Pages 173-184, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.08.001.
(http://www.sciencedirect.com/science/article/B6T6M-4TJTTK6-1/2/24670ced51ed67cabcd7a14397d02724)
Abstract:
The APSIM model was used to assess the impact of legumes on sorghum grown in rotation in a nutrient-limited system under dry conditions in south-western Zimbabwe. An experiment was conducted at Lucydale, Matopos Research Station, between 2002 and 2005. The model was used to simulate soil and plant responses in the experiment. Sequences of cowpea (Vigna unguiculata), pigeonpea (Cajanus cajan), groundnut (Arachis hypogaea) and sorghum (Sorghum bicolor) were used in the rotations. Legumes accumulated up to 130 kg of N ha-1 which was potentially available for uptake by sorghum in the following season. The APSIM model predicted total biomass, grain and N yields of the legume phase within the experimental error and performed well in predicting sorghum yield and N supplied in the rotation after cowpea and groundnut. The model

generally under-predicted sorghum total biomass and grain yield after pigeonpea. Observed patterns of crop water use, evaporative losses during the dry season and re-charge of soil profile at the start of the rainy season were generally well predicted by the model. An assessment of output on sorghum N and water stresses in the rotation indicated that the legume-cereal rotation is more driven by soil nitrogen availability than water availability even under semi-arid conditions. Further legume-cereal rotation analysis using the model will assist in the understanding of other processes in the rotations in dry environments.
Keywords: APSIM; Nitrogen uptake; N2-fixation; Stress factors

Liangzhi You, Stanley Wood, Ulrike Wood-Sichra, Generating plausible crop distribution maps for Sub-Saharan Africa using a spatially disaggregated data fusion and optimization approach, Agricultural Systems, Volume 99, Issues 2-3, February 2009, Pages 126-140, ISSN 0308-521X, DOI: 10.1016/j.agsy.2008.11.003.
(http://www.sciencedirect.com/science/article/B6T3W-4VC7452-1/2/6c285626ef38df9bd9978aeb3048f592)
Abstract:
Large gaps exist in our knowledge of the current geographic distribution and spatial patterns of performance of crops, and these gaps are unlikely to be filled. In addition, even the spatial scale of many sub-national statistical reporting units remains too coarse to capture patterns of spatial heterogeneity in crop production and performance that are likely important from a policy and investment planning perspective. To fill these spatial data gaps we have developed and applied a meso-scale model for the spatial disaggregation of crop production. Using a cross-entropy approach, our model makes plausible pixel-scale assessments of the spatial distribution of crop production within geopolitical units (e.g. countries or sub-national provinces and districts). The pixel-scale allocations are performed through the compilation and judicious fusion of relevant spatially-explicit data, including: production statistics, land use data, satellite imagery, biophysical crop 'suitability' assessments, population density, and distance to urban centers, as wells as any prior knowledge about the spatial distribution of individual crops. The development, application and validation of a prior version of the model in Brazil strongly suggested that our spatial allocation approach shows considerable promise. This paper describes efforts to generate crop distribution maps for Sub-Saharan Africa for the year 2000 using this approach. Apart from the empirical challenge of applying the approach across many countries, the application includes three significant model improvements: (1) the ability to cope with production data sources that provided different degrees of spatial disaggregation for different crops within a single country; (2) the inclusion of a digital map of irrigation intensity as a new input layer; and (3) increased disaggregation of rainfed production systems. Applying the modified spatial allocation model we generated 5 min (approximately 10 km) resolution grid maps for the following 20 major crops across Sub-Saharan Africa: barley, dry beans, cassava, cocoa, coffee, cotton, cow peas, groundnuts, maize, millet, oil palm, plantain, potato, rice, sorghum, soybeans, sugar cane, sweet potato, wheat, and yam. The approach provides plausible results but also highlights the need for much more reliable input data for the region, especially with regard to sub-national production statistics and satellite-based estimates of cropland extent and intensity.
Keywords: Sub-Sahara Africa; Cross entropy; Satellite image; Spatial allocation; Agricultural production; Crop suitability

Albert S. Bennett, Robert P. Anex, Production, transportation and milling costs of sweet sorghum as a feedstock for centralized bioethanol production in the upper Midwest, Bioresource Technology, Volume 100, Issue 4, February 2009, Pages 1595-1607, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.09.023.
(http://www.sciencedirect.com/science/article/B6V24-4TRR8PY-3/2/ad725b05ce726ebba0114548d453507b)

Abstract:
Sweet sorghum has been identified as a possible ethanol feedstock because of its biomass yield and high concentration of readily fermentable sugars. It has found limited use, however, because of poor post-harvest storage characteristics and short harvest window in cooler climates. Previous research (Bennett, A.S., Anex, R.P., 2008. Farm-gate production costs of sweet sorghum as a bioethanol feedstock. Transactions of the ASABE 51(2), 603-613) indicates that fermentable carbohydrates (FC) can be produced at less expense from sweet sorghum than from corn grain. Previous research, however, did not include costs associated with off-farm transportation, storage, or capital costs associated with milling and energy recovery equipment that are required to provide FC suitable for biological conversion. This study includes these additional costs and reevaluates sweet sorghum as a biocommodity feedstock.
A total of eight harvest-transport-processing options are modeled, including 4-row self-propelled and 2-row tractor-pulled forage harvesters, two different modes of in-field transport, fresh processing, on-farm ensilage and at-plant ensilage. Monte Carlo simulation and sensitivity analysis are used to account for system variability and compare scenarios.
Transportation costs are found to be significant ranging from $33 to $71 Mg-1 FC, with highest costs associated with at-plant ensilage scenarios. Economies of scale benefit larger milling equipment and boiler systems reducing FC costs by more than 50% when increasing annual plant capacity from 37.9 to 379 million liters. Ensiled storage of high moisture sweet sorghum in bunkers can lead to significant losses of FC (>20%) and result in systems with net FC costs well above those of corn-derived FC. Despite relatively high transport costs, seasonal, fresh processed sweet sorghum is found to produce FC at costs competitive with corn grain derived FC.
Keywords: Sweet sorghum; Ethanol; Harvest cost; Fermentable carbohydrate; Ensiled storage

Elsiddig A.E. Elsheikh, Somya S.M. Salih, Adil A. Elhussein, Elfadil E. Babiker, Effects of intercropping, Bradyrhizobium inoculation and chicken manure fertilisation on the chemical composition and physical characteristics of soybean seed, Food Chemistry, Volume 112, Issue 3, 1 February 2009, Pages 690-694, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.06.037.
(http://www.sciencedirect.com/science/article/B6T6R-4SVC5SN-2/2/0501219826a7b4b34c988a1777207256)
Abstract:
A field experiment was carried out to investigate the effect of two Bradyrhizobium strains (local and imported), chicken manure fertilisation (7 t/ha) and intercropping with sorghum on the chemical composition and physical characteristics of soybean seed. For both monocropping and intercropping systems, moisture content slightly increased for both systems and for all treatments, while ash, fibre and carbohydrate contents fluctuated for both systems and treatments. The protein content of the seeds was significantly (p [less-than-or-equals, slant] 0.05) increased for all treatments. Tannin content was increased significantly (p [less-than-or-equals, slant] 0.05) with a concomitant decrease in protein digestibility for both systems and for all treatments. The seed weight (100 seeds), hydration coefficient and cookability were increased for all treatments. Mineral composition of the seeds was increased and the increment varied with different treatments.
Keywords: Intercropping; Inoculation; Fertilization; Chemical composition; Soybean

Xianzeng Niu, William Easterling, Cynthia J. Hays, Allyson Jacobs, Linda Mearns, Reliability and input-data induced uncertainty of the EPIC model to estimate climate change impact on sorghum yields in the U.S. Great Plains, Agriculture, Ecosystems & Environment, Volume 129, Issues 1-3, January 2009, Pages 268-276, ISSN 0167-8809, DOI: 10.1016/j.agee.2008.09.012.
(http://www.sciencedirect.com/science/article/B6T3Y-4TY3XS7-1/2/83dccb0adf1cb26d7405d904ff3ba5d0)
Abstract:

Crop simulation models are frequently used to estimate the impact of climate change on crop production. However, few studies have evaluated the model performance in ways that most researchers practiced in climate impact studies. In this article, we examined the reliability of the EPIC model in simulating grain sorghum (Sorghum bicolor (L.) Moench) yields in the U.S. Great Plains under different climate scenarios, namely in years with normal or extreme temperature and precipitation. We also investigated model uncertainties introduced by input data that are not site-specific but commonly used or available for climate change studies. Historical field trial data of sorghum at the Mead Experimental Center, NE, were used for model evaluations. The results showed that overall model reliability was about 56%. The mean absolute relative error (absRE) was about 29%. The degree of accuracy and reliability varied with climate-classes and nitrogen (N)-treatments. The largest bias occurred in drought years (RE = -25%) and the most unreliable results were found in N-0 treatment (reliability = 32%). There was more than 69% probability that input-data-induced uncertainties were limited to less than 20% of absRE. Our results support the application of the EPIC model to climate change impact studies in the U.S. Great Plains. However, efforts are needed to improve the accuracy in simulating crop responses to extreme water- and nitrogen-stressed conditions.
Keywords: Reliability; Uncertainty; EPIC; Sorghum yield; Climate change impact

Fang He, Weiming Yi, Jianwen Zha, Measurement of the heat of smoldering combustion in straws and stalks by means of simultaneous thermal analysis, Biomass and Bioenergy, Volume 33, Issue 1, January 2009, Pages 130-136, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.05.006.
(http://www.sciencedirect.com/science/article/B6V22-4SWG0D8-1/2/b2c6695e554fc975eb64f0ae1b2a6131)
Abstract:
In order to investigate reaction heat of agro-stalks smoldering, wheat straw, corn stalk, cotton stalk, millet straw, sorghum stalk and sweet potato rattan powder were smoldered and pyrolyzed in a simultaneous thermal analyzer (STA). The samples were placed in a platinum crucible ([empty set]5 mmx5 mm) with a lid (with a [empty set]1 mm hole) on a high-accuracy differential scanning calorimetry-heat capacity (DSC-cp) holder in the furnace of an STA and heated from 303 to 1073 K at a heating rate of 10 K min-1. Sweeping gas with a flow rate of 25 ml min-1 was air and nitrogen during smoldering and pyrolysis, respectively. Results showed that the heat emission characteristic of the smoldering process differed remarkably from the pyrolysis process. Based on the analysis of the DSC curves, oxidative polymer degradation heat and char oxidation heat were obtained from experimental data. It showed that the oxidative polymer degradation heat of the agro-stalks is more than 6.92 MJ kg-1 consumed matter, higher than that of cellulose paper. And char oxidation heat is around 23 MJ kg-1 consumed matter, similar to that of cellulose paper, but higher than that of cigarette. Total net heat emission of smoldering in STA was also obtained. These data can be used as reference data in analyzing smoldering of agro-stalks under similar conditions.
Keywords: Reaction heat; Smoldering; STA; Agro-stalks: Triticum aestivum L.; Zea mays L.; Gossypium hirsutum L.; Setaria italica L.; Sorghum vulgare Pers.; Ipomoea batatas (L.) Lam

L. Xing, L.J. Chen, L.J. Han, The effect of an inoculant and enzymes on fermentation and nutritive value of sorghum straw silages, Bioresource Technology, Volume 100, Issue 1, January 2009, Pages 488-491, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.06.017.
(http://www.sciencedirect.com/science/article/B6V24-4T29WFM-3/2/7b613b4e3fe41e26082b6a30f704a40e)
Abstract:
The objectives of this study were to determine the effect of inoculant, enzymes and inoculant-enzymes mixture on fermentation quality, nutritive value, and microbial changes of sorghum straw silage. Sorghum straws were collected and treated with distilled water (control), inoculant,

enzymes and inoculant + enzymes prior to ensiling. Three bag silos for each silage (denoted C, I, E and I + E, respectively) were opened after 3, 7, 11, 15, 30 and 60 days for chemical and microbial analyses. For all the silages, there was a rapid decline in pH during the first 3 days of ensiling. Relative to silage C, all the treatment (I, E and I + E) had higher ($P < 0.05$) lactic acid concentration at all ensiling periods. Population of LAB during all ensiling time was numerically greater for treated than control silages. Separate addition of two additives, especially for enzymes, can effectively ($P < 0.05$) decrease aNDF and ADF concentration. Treatments with enzymes (E, I + E) can also improve significantly silage IVDMD and IVNDFD concentration. These results indicated that the addition of additives can improve the sorghum straw silage fermentation quality at different extent.
Keywords: Enzymes; Fermentation; Inoculant; Nutrient digestibility; Sorghum straw silage

Mandira Malhotra, Sheela Srivastava, Stress-responsive indole-3-acetic acid biosynthesis by Azospirillum brasilense SM and its ability to modulate plant growth, European Journal of Soil Biology, Volume 45, Issue 1, Ecology and application of Azospirillum and other plant growth promoting bacteria (PGPB), January-February 2009, Pages 73-80, ISSN 1164-5563, DOI: 10.1016/j.ejsobi.2008.05.006.
(http://www.sciencedirect.com/science/article/B6VR7-4SVD596-1/2/72f0e23dfd5a760e2269174a08ffc774)
Abstract:
Plant growth promotion by Azospirillum brasilense SM has been attributed to its indole-3-acetic acid (IAA) production. Analysis of IAA biosynthesis by this strain under nutrient stresses, likely environmental fluctuations and long-term batch cultures suggested that they significantly influenced this function, with some conditions (fluctuations in temperature) triggering IAA accumulation. In long-term batch cultures (of 30 days), the bacterial population was maintained at a specific cell density and produced IAA even after a sharp decline in population size, albeit fluctuations were observed in both the parameters. Long-term bacterial cultures under nitrogen starvation showed the same trend in cell viability; however, a continuous increase in IAA accumulation was seen over time. This study has shown that A. brasilense strain SM has the potential to be a competent rhizospheric bacterium as it can beneficially influence the growth of sorghum. Further, it also has the ability to promote the growth of a number of other plants like mung bean, maize, and wheat. The benefit of this characteristic of strain SM can be directly accrued to a range of plants with which it may associate so as to improve their yield.
Keywords: Indole-3-acetic acid; Plant growth promotion; Tryptophan; Environment stress; Long-term stationary phase

Joshua H. Wong, Tsang Lau, Nick Cai, Jaswinder Singh, Jeffrey F. Pedersen, William H. Vensel, William J. Hurkman, Jeff D. Wilson, Peggy G. Lemaux, Bob B. Buchanan, Digestibility of protein and starch from sorghum (Sorghum bicolor) is linked to biochemical and structural features of grain endosperm, Journal of Cereal Science, Volume 49, Issue 1, January 2009, Pages 73-82, ISSN 0733-5210, DOI: 10.1016/j.jcs.2008.07.013.
(http://www.sciencedirect.com/science/article/B6WHK-4T8HHDH-1/2/5826fb1f4623d04b97be7a1be28fca52)
Abstract:
Although a principal source of energy and protein for millions of the world's poorest people, the nutritional value of sorghum (Sorghum bicolor L. Moench) is diminished because of low digestibility of grain protein and starch. To address this problem, we analyzed the properties of two sorghum lines that have a common pedigree but differ in digestibility. Consistent with results based on a ruminal fluid assay, the protein and starch of one line (KS48) was more thoroughly digested than that of the other (KS51) using in vitro assays based on pepsin and [alpha]-amylase. The indigestibility of KS51 relative to KS48 was shown to be due to (i) a greater abundance of

disulfide-bonded proteins; (ii) presence in KS51 of non-waxy starch and the accompanying granule-bound starch synthase; and (iii) the differing nature of the protein matrix and its interaction with starch. The current findings suggest that each of these factors should be considered in efforts to enhance the nutritional value of sorghum grain.
Keywords: Disulfide proteins; Starch-protein interface; Granule-bound starch synthase I; Sorghum

J.A. Tolk, T.A. Howell, Field water supply:yield relationships of grain sorghum grown in three USA Southern Great Plains soils, Agricultural Water Management, Volume 95, Issue 12, December 2008, Pages 1303-1313, ISSN 0378-3774, DOI: 10.1016/j.agwat.2008.05.009.
(http://www.sciencedirect.com/science/article/B6T3X-4SXS39C-1/2/fcbc757ebc641737c74efc309cf75053)
Abstract:
Field water supply (FWS) combines the three sources of water used by a crop for evapotranspiration (ET), and consists of available soil water at planting (ASWP), rainfall, and irrigation. Examining the grain yield and FWS relationship (Yg:FWS) may provide insight into the reported variability in crop water production functions such as water productivity (WP) and irrigation water productivity (IWP). Since water is most productive when entirely consumed in ET, diversion of FWS into non-ET losses such as drainage and excessive soil water evaporation results in declines in WP and IWP. The objective of this experiment was to examine the Yg:FWS and Yg:ET relationships of grain sorghum grown under a range of irrigation treatments (0, 25, 50, and 100% replacement of ET), beginning soil water contents, evaporative demands, in the Amarillo, Pullman, and Ulysses soils of the Great Plains. The purpose was to determine the amount of FWS beyond which declines in WP and IWP began to occur due to non-ET losses as indicated by a change in the slope and intercept of the Yg:FWS and Yg:ET relationships. Large amounts of non-ET irrigation application losses occurred in the finer-textured soils in the T-100 irrigation treatment. In both years, the T-100 irrigation application amounts and ASWP resulted in a FWS ranging from 750 to 870 mm which exceeded the maximum ET requirement of 530-630 mm and which reduced WP and IWP. Piecewise regression analysis of the Yg:FWS and Yg:ET relationships for the crops in the Pullman and Ulysses soils identified the knot point, or change in slope and intercept, in the FWS where both WP and IWP tended to be optimized. This was about 500 mm in both soils, and involved the utilization of about 250 mm in ASWP, irrigation applications averaging about 250 mm, and about 60-130 mm remaining in the soil at harvest. For the coarser-textured Amarillo soil, the yield response to increasing FWS was linear, because non-ET application losses such as drainage gradually increased with the irrigation application amount. The linear Yg response in the sandy Amarillo soil and the piecewise Yg responses in the clay and silt loams of the Pullman and Ulysses soils to FWS also reflected the difference in water-holding capacities of the soils that affected the amount of available water as irrigation increased. Irrigating without considering FWS resulted in non-ET irrigation application losses and declines in WP and IWP.
Keywords: Water productivity; Irrigation water productivity; Water use efficiency; Irrigation water use efficiency; Evapotranspiration; Lysimeter; Deficit irrigation

R.M. Jingura, R. Matengaifa, The potential for energy production from crop residues in Zimbabwe, Biomass and Bioenergy, Volume 32, Issue 12, December 2008, Pages 1287-1292, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.03.007.
(http://www.sciencedirect.com/science/article/B6V22-4SM0XDM-2/2/cf3efd3e87ca9fbee4385733586e804e)
Abstract:
There is increasing interest in Zimbabwe in the use of renewable energy sources as a means of meeting the country's energy requirements. Biomass provides 47% of the gross energy consumption in Zimbabwe. Energy can be derived from various forms of biomass using various

available conversion technologies. Crop residues constitute a large part of the biomass available from the country's agriculture-based economy. The potential for energy production of crop residues is examined using data such as estimates of the quantities of the residues and their energy content. The major crops considered are maize, sugarcane, cotton, soyabeans, groundnuts, wheat, sorghum, fruits and forestry plantations. Quantities of residues are estimated from crop yields by using conversion coefficients for the various crops. Long-term crop yields data from 1970 to 1999 were used. Total annual residue yields for crops, fruits and forestry plantations are 7.805 Mt, 378 kt and 3.05 Mt, respectively. The crops, fruits and forestry residues have energy potential of 81.5, 4.9 and 44.3 PJ per year, respectively. This represents about 44% of the gross energy consumption in Zimbabwe. The need to balance use of crop residues for both energy purposes and other purposes such as animal feeding and soil fertility improvement is also highlighted.
Keywords: Biomass; Energy; Crop residues; Agro-ecological zones; Forestry residues; Residue factors

Andrea Mojzes, Tibor Kalapos, Leaf gas exchange responses to abrupt changes in light intensity for two invasive and two non-invasive C4 grass species, Environmental and Experimental Botany, Volume 64, Issue 3, December 2008, Pages 232-238, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2008.06.003.
(http://www.sciencedirect.com/science/article/B6T66-4STB0G5-1/2/ce5ab3c7e15f79861c9ce0cc558d0ecd)
Abstract:
Transient and steady state responses of leaf gas exchange (photosynthesis (A) and stomatal conductance to water vapor (gs)) to marked changes in photosynthetic photon flux density (PPFD) were studied for two invasive [Cynodon dactylon (L.) Pers. and Sorghum halepense (L.) Pers.] and two non-invasive, native [Bothriochloa ischaemum (L.) Keng and Chrysopogon gryllus (Torn.) Trin.] perennial C4 grass species from semiarid temperate grasslands or croplands. Following an abrupt drop in PPFD from 1300 to 270 [mu]mol photon m-2 s-1, the two invasive species reduced gs to a greater extent than A, resulting in higher intrinsic photosynthetic water use efficiency (PWUE = A/gs) at low, compared to high-light conditions. For non-invasives, a comparable drop in gs and A led to invariant PWUE, which was lower than that for the invasive group under low light. The duration and speed of stomatal closure was similar for the four species. However, unlike the other grasses, the noxious weed S. halepense exhibited a negligible net loss in PWUE during the high-to-low light transition. Responses of the native B. ischaemum were mostly intermediate between those of the two invasive species and the non-invasive C. gryllus, which is in agreement with the species' ecological intermediacy: non-invasive but often reaches local dominance following a disturbance. With a sudden reverse change in PPFD photosynthetic light induction was not faster for invasives than for non-invasives. These results indicate more efficient water use under variable light for invasive compared to non-invasive perennial C4 grasses which may contribute to their success in semiarid temperate habitats with a heterogeneous light regime. Yet, rapid photosynthetic light induction appears to be of less importance in such environments.
Keywords: Bothriochloa ischaemum; Chrysopogon gryllus; Cynodon dactylon; Photosynthetic induction; Sorghum halepense; Water use efficiency

Niels Agerbirk, Suzanne I. Warwick, Paul R. Hansen, Carl E. Olsen, Sinapis phylogeny and evolution of glucosinolates and specific nitrile degrading enzymes, Phytochemistry, Volume 69, Issue 17, December 2008, Pages 2937-2949, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2008.08.014.
(http://www.sciencedirect.com/science/article/B6TH7-4TVX5DW-1/2/34b0991778b1fc28db17ace931377a00)
Abstract:

Levels of sinalbin (4-hydroxybenzylglucosinolate) and 28 other glucosinolates were determined in leaves and roots of 20 species that were either phylogenetically close to Sinapis alba, Sinapis arvensis, or Sinapis pubescens (tribe Brassiceae, Brassicaceae), or were expected to contain arylalkyl nitrilase activity. Comparison with a molecular phylogenetic tree based on ITS DNA sequences identified two separate occurrences of sinalbin. The first in a group of species related to S. alba (including members of the genera Coincya and Kremeriella); and the second in S. arvensis, nested among sinalbin deficient species. Significant 4-hydroxyphenylacetonitrile degrading enzyme activity was found in both S. alba and S. arvensis, but in S. alba the major product was the corresponding carboxylic acid, while in S. arvensis the major product was the amide. Both investigated enzyme activities, nitrilase and nitrile hydratase, were specific, accepting only certain arylacetonitriles such as 4-hydroxy and 4-methoxyphenylacetonitrile. Only the S. alba enzyme required an oxygen in para position of the substrate, as found in sinalbin. Indole-3-acetonitrile, arylcyanides, and arylpropionitriles were poor substrates. The nitrilase activity of S. alba was quantitatively comparable to that reported in the monocot Sorghum bicolor (believed to be involved in cyanogenic glycoside metabolism). Glucosinolates derived from methionine were found in all Sinapis clades. Glucosinolate patterns suggested a complex evolution of glucosinolates in the investigated species, with several apparent examples of abrupt changes in glucosinolate profiles including chain length variation and appearance of glucosinolates derived from branched-chain amino acids. NMR data for desulfated homosinalbin, 9-methylsulphonylnonylglucosinolate, 3-methylpentylglucosinolate and related glucosinolates are reported, and a facultative connection between sinalbin and specific nitrilases is suggested.
Keywords: Brassica; Branched-chain glucosinolate; Coincya; Evolution; Glucosinolate; Homosinalbin; Kremeriella; Metabolism; Nitrilase; Nitrile hydratase; Nitrile specifier protein; Sinalbin; Sinapis; Sorghum

James Todd, Steven Screen, James Crowley, Jiexin Peng, Scott Andersen, Todd Brown, Qungang Qi, Brad Fabbri, Stephen M.G. Duff, Identification and characterization of four distinct asparagine synthetase (AsnS) genes in maize (Zea mays L.), Plant Science, Volume 175, Issue 6, December 2008, Pages 799-808, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2008.08.004.
(http://www.sciencedirect.com/science/article/B6TBH-4T8JX91-1/2/c419618a382466349774bc447c63d7d6)
Abstract:
Four distinct full-length cDNA clones encoding asparagine synthetase (AS; EC 6.3.5.4) were isolated from maize (Zea mays). Detailed analysis of two these genes suggested the previously published maize AsnS gene (gi 984262) is possibly a chimera. In silico analysis identified additional members of this new monocot-specific class in rice genomic DNA and sorghum EST collections. The presence of these new AsnS genes suggests maize has a representative from each of the major classes (class I, class II, and class III). TaqMan(R) expression analysis indicates Zm-AsnS1 and Zm-AsnS4 are ubiquitously expressed in the tissue panel tested, Zm-AsnS3 is largely restricted to root and root crown tissues and Zm-AsnS2 is largely absent from above-ground green tissue. Expression of all four distinct AsnS genes in maize root tissues raises the possibility that earlier studies on the enzymology of AsnS in maize root tips reported results obtained from a pool of different AsnS activities in the root.
Keywords: Synthetase; Gene expression; Amino acids; Chimeric gene; Zea mays

Solmaz Barazesh, Paula McSteen, Hormonal control of grass inflorescence development, Trends in Plant Science, Volume 13, Issue 12, December 2008, Pages 656-662, ISSN 1360-1385, DOI: 10.1016/j.tplants.2008.09.007.
(http://www.sciencedirect.com/science/article/B6TD1-4TV7YNX-2/2/9d1bd838b43e1cc2afd7a71ffafceca4)
Abstract:

Grass inflorescences produce the grain that feeds the world. Compared to eudicots such as Arabidopsis (Arabidopsis thaliana), grasses have a complex inflorescence morphology that can be explained by differences in the activity of axillary meristems. Advances in genomics, such as the completion of the rice (Oryza sativa) and sorghum (Sorghum bicolor) genomes and the recent release of a draft sequence of the maize (Zea mays) genome, have greatly facilitated research in grasses. Here, we review recent progress in the understanding of the genetic regulation of grass inflorescence development, with a focus on maize and rice. An exciting theme is the key role of plant growth hormones in inflorescence development.

I.K. Das, S. Indira, A. Annapurna, Prabhakar, N. Seetharama, Biocontrol of charcoal rot in sorghum by fluorescent pseudomonads associated with the rhizosphere, Crop Protection, Volume 27, Issue 11, November 2008, Pages 1407-1414, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.07.001.
(http://www.sciencedirect.com/science/article/B6T5T-4T9BXD2-1/2/f5ea08ef127b6b03e15201b9446be81e)
Abstract:
Charcoal rot of sorghum caused by Macrophomina phaseolina is a disease of economic importance for which a high level of genetic resistance is not available. Therefore, we made an effort to manage this disease with fluorescent pseudomonads associated with field-grown sorghum crops. One hundred and twenty-six fluorescent Pseudomonas spp. from different sorghum growing regions of India were isolated, selected and evaluated for in vitro antifungal activities and three selected strains were further tested for management of charcoal rot under field conditions. Antifungal activities (inhibition of growth, biomass, microsclerotia production, spore germination) of the secondary metabolites and the cell-free culture filtrates of the selected fluorescent pseudomonad strains (SRB129, SRB288 and Pseudomonas chlororaphis SRB127) were studied in detail. SRB127, SRB129 and SRB288 inhibited mycelial growth of M. phaseolina ranging from 30.5 to 76.5% in dual culture assay. The cell-free culture filtrates of these strains at 20% (v/v) concentration significantly reduced the formation and germination of microsclerotia of M. phaseolina. In the field, P. chlororaphis SRB127 emerged as an effective biocontrol agent of charcoal rot of sorghum. The bacterium, when applied as seed treatment, reduced the charcoal rot incidence by >40%, crop-lodging by >20%, and increased grain mass. P. chlororaphis SRB127, when grown in a gnotobiotic sand system, effectively colonized the sorghum root and formed microcolony-like cell-aggregates in some parts of the root. Under glasshouse conditions the bacterium survived in the sorghum rhizosphere without a significant reduction in population. We conclude that the use of a selection of effective strains of bacteria can be a useful component of integrated management of charcoal rot in sorghum.
Keywords: Sorghum; Biocontrol; Charcoal rot; Macrophomina; Fluorescent pseudomonads

Sandeep Kumar, U.N. Joshi, Nitrogen metabolism as affected by hexavalent chromium in sorghum (Sorghum bicolor L.), Environmental and Experimental Botany, Volume 64, Issue 2, November 2008, Pages 135-144, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2008.02.005.
(http://www.sciencedirect.com/science/article/B6T66-4S0JN1F-1/2/31fba62496e7ae763747345a711096b5)
Abstract:
A pot experiment was conducted to determine the effects of varying Cr (VI) levels (0-4 ppm in the form of potassium dichromate) on the key enzymes of nitrogen metabolism in sorghum. Total as well as specific enzyme activity of nitrate reductase, nitrite reductase, glutamine synthetase, glutamate dehydrogenase (GDH) and urease in various plant organs at different growth stages decreased with an increase in Cr (VI) levels from 0 to 4.0 ppm. In general, the enzyme activitiy increased with advancement of growth to reach maximum at 50% flowering stage (70 DAS) and thereafter decreased at grain filling stage (90 DAS). However, nitrite reductase activity in shoot

increased continuously till grain filling stage. It is concluded that Cr (VI) at higher doses adversely affects the key enzymes of nitrogen metabolism in forage sorghum (Sorghum bicolor L.).
Keywords: Sorghum bicolor L.; Chromium (VI); Nitrate reductase; Nitrite reductase; Glutamine synthetase; Glutamate dehydrogenase; Urease

Sangita Bansal, Avinash Mishra, Akash Tomar, Shailendra Sharma, Vijay Kumar Khanna, Govind Krishan Garg, Isolation and temporal endospermal expression of [gamma]-kafirin gene of grain sorghum (Sorghum bicolor L. moench) var. M 35-1 for introgression analysis of transgene, Journal of Cereal Science, Volume 48, Issue 3, November 2008, Pages 808-815, ISSN 0733-5210, DOI: 10.1016/j.jcs.2008.06.004.
(http://www.sciencedirect.com/science/article/B6WHK-4T3DCTJ-1/2/b49a16c97be31b5c0ee1f6dc91a4c881)
Abstract:
A gamma-kafirin gene of Sorghum bicolor L var. M35-1 was isolated using a PCR based approach by designing specific primers. The primers gave highly reproducible amplification. The amplicons were then cloned and sequenced. Nucleotide sequences were subjected to the homology search and a comparative analysis was done with other prolamins. Amplified [gamma]-kafirin gene (accession no. AY566298 and AY566299) showed 99% homology with a [gamma]-kafirin gene of Sorghum vulgare. Compared to Sorghum vulgare, only 3 extra bases were present in Sorghum bicolor at position 40 nucleotide bases downstream of transcription initiation site. These sequences were related with prolamins of other genera, i.e. coix and maize with 84% sequence homology. The deduced protein sequence of [gamma]-kafirin gene of S. bicolor (accession no. AAS73290) gave significant similarity of 99%, 79% and 77% with gamma-kafirin protein of S. vulgare, [gamma]-zein and [gamma]-coixin proteins, respectively. All cysteine residues of [gamma]-kafirin were highly conserved. Probable secondary structure of gamma-kafirin protein was predicted using the online PSIPRED server. Study of temporal expression of the [gamma]-kafirin gene is needed for analysing the expression pattern of introgressed gene(s) driven by its promoter. Temporal expression of gamma-kafirin gene in endosperm studied by semi quantitative RT-PCR with specifically designed primers showed that [gamma]-kafirin expression started at 7 DAP (days after pollination). There was statistically a non-significant increase in expression up to 14 DAP, thereafter expression increased significantly (at the 5% level) and reached a maximum at 21 DAP. Expression of [gamma]-kafirin started decreasing after 21 DAP and a very low expression was detected at 28 DAP.
Keywords: Sorghum; Kafirin; Seed storage protein; Gene isolation; Temporal expression; Semi-quantitative RT-PCR

Markus Piotrowski, Primary or secondary? Versatile nitrilases in plant metabolism, Phytochemistry, Volume 69, Issue 15, November 2008, Pages 2655-2667, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2008.08.020.
(http://www.sciencedirect.com/science/article/B6TH7-4TM6M1T-1/2/562907e1842e756c557416cd6bce6fd7)
Abstract:
The potential of plant nitrilases to convert indole-3-acetonitrile into the plant growth hormone indole-3-acetic acid has earned them the interim title of 'key enzyme in auxin biosynthesis'. Although not widely recognized, this view has changed considerably in the last few years. Recent work on plant nitrilases has shown them to be involved in the process of cyanide detoxification, in the catabolism of cyanogenic glycosides and presumably in the catabolism of glucosinolates. All plants possess at least one nitrilase that is homologous to the nitrilase 4 isoform of Arabidopsis thaliana. The general function of these nitrilases lies in the process of cyanide detoxification, in which they convert the intermediate detoxification product [beta]-cyanoalanine into asparagine, aspartic acid and ammonia. Cyanide is a metabolic by-product in biosynthesis of the plant

hormone ethylene, but it may also be released from cyanogenic glycosides, which are present in a large number of plants. In Sorghum bicolor, an additional nitrilase isoform has been identified, which can directly use a catabolic intermediate of the cyanogenic glycoside dhurrin, thus enabling the plant to metabolize its cyanogenic glycoside without releasing cyanide. In the Brassicaceae, a family of nitrilases has evolved, the members of which are able to hydrolyze catabolic products of glucosinolates, the predominant secondary metabolites of these plants. Thus, the general theme of nitrilase function in plants is detoxification and nitrogen recycling, since the valuable nitrogen of the nitrile group is recovered in the useful metabolites asparagine or ammonia. Taken together, a picture emerges in which plant nitrilases have versatile functions in plant metabolism, whereas their importance for auxin biosynthesis seems to be minor.
Keywords: Nitrilase; Cyanide detoxification; Cyanogenic glycosides; Glucosinolates; Auxin biosynthesis; Arabidopsis thaliana; Sorghum bicolor; Zea mays

Ashok Mishra, James W. Hansen, Michael Dingkuhn, Christian Baron, Seydou B. Traore, Ousmane Ndiaye, M. Neil Ward, Sorghum yield prediction from seasonal rainfall forecasts in Burkina Faso, Agricultural and Forest Meteorology, Volume 148, Issue 11, October 2008, Pages 1798-1814, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2008.06.007.
(http://www.sciencedirect.com/science/article/B6V8W-4T53HFN-2/2/81b765fbdfdf8127cc9af85ba05ca44a)
Abstract:
The high variability of rainfall, from interannual to multi-decadal time scales, has serious impacts on food security in the West African Sahel. At five locations in Burkina Faso, we explore the potential to improve model-based prediction of sorghum yields at a range of lead-times by incorporating seasonal rainfall forecasts. Analyses considered empirical and dynamic rainfall forecasts, two methods (regression and stochastic disaggregation) for linking rainfall forecasts with crop simulation, three levels of production technology and four forecast dates (15 May, June, July and August) based on predictors observed from the preceding month, for the period of available data (1957-1998). Accuracy of yield forecasts generally decreased with lead-time. Relative to forecasts based solely on monitored weather and historic climatology, incorporating rainfall forecasts resulted in modest improvements to yield forecasts made in May or June. The benefit from seasonal rainfall forecasts tended to increase with northern latitude. Statistical and dynamic rainfall forecast systems captured much of the multi-decadal variation apparent in historic rainfall and in yields simulated with observed rainfall. This multi-decadal component of rainfall variability accounts for a portion of the apparent predictability of sorghum yields. Correlation between point-scale crop yield simulations and district-scale production statistics (1984-1998) was weakly positive late in the season, and suggest that a dynamic crop model (SARRA-H) has potential to contribute to regional yield prediction beyond what the best linear regression can provide from seasonal rainfall or its predictors. We discuss avenues for further improving crop yield forecasts during the growing season.
Keywords: Yield forecasting; Seasonal climate prediction; Multi-decadal variability; Crop modeling; Sahel

Edgar Vladimir Gutierrez-Castorena, C.A. Ortiz-Solorio, M.C. Gutierrez-Castorena, L. Cajuste-Bontemps, M. Rocha-Aguilar, Technical, economical and social actions of farmers to mitigate water deficit in Tamaulipas, Mexico, Agriculture, Ecosystems & Environment, Volume 128, Issues 1-2, October 2008, Pages 77-85, ISSN 0167-8809, DOI: 10.1016/j.agee.2008.05.009.
(http://www.sciencedirect.com/science/article/B6T3Y-4SV6P9K-1/2/2e59987bbfff1dd5440721b4c01548c7)
Abstract:
The present study was carried out in the Third Unit of Technical Assistance (TUTA) of the Irrigation District 026, in Tamaulipas, Mexico. Since the beginning of the construction and

operation of the dam 'El Cuchillo-Solidaridad' in Nuevo Leon in 1994, the decrease in available water resources was manifested in the study area; besides, there was a prolonged drought (1995-2003), an increase of input prices, and a low market price for maize. Nonetheless, the district was able to maintain the totality of its cultivated surface. The objectives were to study the actions farmers carried out to mitigate the impacts of water deficit and abandonment of land, and to determine the level of communication and organization among farmers. A total of 90,500 pieces of information (plot number, irrigated surface, crop sown, crop surface, and crop yield) were collected by the TUTA from 1994 to 2006, and were organized into a GIS environment. The farmers mitigated water deficit impact by modifying the crop pattern in a drastic way, from maize to sorghum because the latter requires less irrigation to maintain its productivity, and distributing the water in equal form. Therefore, they were able to avoid migration, and abandonment of the land. Under favorable water availability and international market prices for maize, a new shift in crop cultivation was done, from sorghum to maize. The drastic shifts in crop cultivation were possible because of the equal representation that each farmer has within their organization, and because of the close communication among themselves. This level of organization enabled farmers to make immediate decisions and to adapt quickly to environmental and economic restrictions within each agricultural cycle. These findings represent a new alternative to face agricultural drought in other countries with similar conditions.
Keywords: Irrigation District; Crop patterns; Maize; Sorghum; GIS; Land use change; Environmental adaptation

Lieselot Van der Veken, Pa Pa Win, Annemie Elsen, Rony Swennen, Dirk De Waele, Susceptibility of banana intercrops for rhizobacteria, arbuscular mycorrhizal fungi and the burrowing nematode Radopholus similis, Applied Soil Ecology, Volume 40, Issue 2, October 2008, Pages 283-290, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2008.05.003.
(http://www.sciencedirect.com/science/article/B6T4B-4SVM0YB-1/2/9428151e9db67a4891be9fce2ac762d2)
Abstract:
The susceptibility of 7 non-leguminous and 7 leguminous banana intercrops (and rotation crops) for rhizobacteria, mycorrhizal fungi and the burrowing nematode Radopholus similis was investigated and compared with the host response of banana cv. Grande Naine (Musa AAA group). In 50% of the tested combinations, the bacteria elicited nodules but these nodules were effective in fixing nitrogen only in about 11% of the tested combinations. Of the non-leguminous intercrops tested, wormseed, sweet potato cv. Tapato and cotton showed a poor mycorrhizal compatibility, based on the frequency (F%) and intensity (I%) of mycorrhizal colonisation. Of the leguminous intercrops tested, soybean, Grant's rattlebox, common bean, pigeon pea and sunn hemp showed a moderate mycorrhizal compatibility. Overall, F% and I% were higher in the leguminous intercrops compared with the non-leguminous intercrops. The susceptibility for R. similis differed among the intercrops tested. In the non-leguminous intercrops, marigold, sweet potato cv. Tapato, cotton and sesame were non-hosts, sweet potato cv. Inzovu, sorghum were intermediate hosts and sorgho-sudangrass was a good host. In the leguminous intercrops, hairy indigo was a non-host, Grant's rattlebox, soybean and sunn hemp were poor hosts and cowpea, common bean and pigeon pea were intermediate hosts.
Keywords: AMF; Bradyrhizobium; Host response; Intercropping; Musa; Plant-parasitic nematodes; Rhizobium

S.V. Lincy, R. Latha, A. Chandrashekar, H.K. Manonmani, Detection of toxigenic fungi and quantification of type A trichothecene levels in some food and feed materials from India, Food Control, Volume 19, Issue 10, October 2008, Pages 962-966, ISSN 0956-7135, DOI: 10.1016/j.foodcont.2007.10.002.

(http://www.sciencedirect.com/science/article/B6T6S-4PWF0J6-2/2/ffcfb18de503cd020780e00062ef81d1)
Abstract:
In this study, the direct detection of toxigenic fungi and the quantification of trichothecene levels in food and feed materials from India were investigated. A total of 40 different food and feed materials were subjected to PCR for the detection of toxigenic Fusarium spp. PCR indicated the presence of tri5 gene in seven samples (six sorghum samples and one poultry feed). Results indicated the presence of T-2 toxin and diacetoxyscirpenol (DAS) in all the six sorghum samples whereas only T-2 content was noticed in poultry feed. Levels of T-2 and DAS varied from 0.012 (+/-0.004) to 0.13 (+/-0.03) mg/kg and 0.014 (+/-0.004) to 0.084 (+/-0.004) mg/kg, respectively. The levels of these toxins were falling within the range detected previously in India and in other parts of the world.
Keywords: Fusarium; Trichothecenes; Food and feed

M.A. Mgonja, S. Chandra, A.B. Obilana, E.S. Monyo, S. Kudita, M. Chisi, H.M. Saadan, E. Chinhema, Stratification of sorghum hybrid testing sites in southern Africa based on grain yield, Field Crops Research, Volume 108, Issue 3, 23 September 2008, Pages 193-197, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.05.002.
(http://www.sciencedirect.com/science/article/B6T6M-4SW85D6-1/2/a374ac0bbb30e711e0f17f0f0a1db388)
Abstract:
Sequential retrospective (SeqRet) pattern analysis technique was applied to classify sorghum hybrid testing sites in accordance with their similarity for yield differentiation among genotypes. Historical grain yield data from 150 multi-environment trials (METs) conducted at 23 sites in the Southern Africa Development Community (SADC) region during 1987/1988-1992/1993 was used. The sites were clustered into six major environment groups in the SADC region with a model fit of R2 = 68%. Analysis of these 6 years' data together with additional data from 1999/2000 stratified the 23 sites in the same six major groups (R2 = 69%), the additional five sites in 1999/2000 classified with appropriate site groups. These results suggest that future sorghum hybrid testing could be cost-effectively conducted in a few representative sites selected from within each of the six identified site groups.
Keywords: Sorghum; Site stratification; Sequential retrospective pattern analysis

E.J. van Oosterom, G.L. Hammer, Determination of grain number in sorghum, Field Crops Research, Volume 108, Issue 3, 23 September 2008, Pages 259-268, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.06.001.
(http://www.sciencedirect.com/science/article/B6T6M-4T24FR7-1/2/686170867b7b3e9c00409b6c3a69bfcd)
Abstract:
Grain number is an important component of grain yield in sorghum. Research in wheat and maize has indicated a dependency of grain number on the crop or panicle growth rate around anthesis (CGRa and PGRa respectively), but little quantitative information is available for sorghum. The aim of this paper was firstly to quantify the effect of CGRa and PGRa on grain number and secondly, to identify other parameters that could be used as substitutes for PGRa. Analyses included data from a number of experiments, covering a range in nitrogen and drought treatments and including both tall (single dwarf) and short (triple dwarf) hybrids. CGRa and SGRa (stem growth rate) were calculated from the derivative of a curvilinear function fitted to experimental data, and PGRa was obtained by subtraction of SGRa from CGRa. Results indicated a linear relationship between grain number and CGRa, but the slope differed for tall and short hybrids. This was due to a difference in the proportion of dry matter allocated to the reproductive organs around anthesis (Pr), as PGRa was closely related to grain number, irrespective of crop height. Since panicle dry mass at maturity

(excluding grain) was closely correlated with reproductive biomass shortly after anthesis, this indicator represents an integration of panicle growth during the critical period for yield determination in sorghum (i.e. flag leaf until start of grain filling). Panicle biomass at maturity (excluding grain) was thus also linearly related to grain number, and the relationship was independent of crop height and of the timing, severity, or type of stress. Our results indicate that panicle mass at maturity could provide an alternative to PGRa for the estimation of grain number.
Keywords: Drought; Nitrogen stress; Panicle growth rate; Partitioning; Resource competition; Single dwarf hybrid; Triple dwarf hybrid

Trent W. Biggs, Prasanta K. Mishra, Hugh Turral, Evapotranspiration and regional probabilities of soil moisture stress in rainfed crops, southern India, Agricultural and Forest Meteorology, Volume 148, Issue 10, 3 September 2008, Pages 1585-1597, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2008.05.012.
(http://www.sciencedirect.com/science/article/B6V8W-4SY5WTK-1/2/6a106c985e4663a3c1b09c82e4c4ed90)
Abstract:
The long-term probability of soil moisture stress in rainfed crops was mapped at 0.5[degree sign] resolution over the Krishna River basin in southern India (258,948 km2). Measurements of actual evapotranspiration (Ea) from 90 lysimeter experiments at four locations in the basin were used to calibrate a non-linear regression model that predicted the combined crop coefficient (KcKs) as a function of the ratio of seasonal precipitation (P) to potential evapotranspiration (Ep). Crops included sorghum, pulses (mung bean, chickpea, soybean, pigeonpea) and oilseeds (safflower and sunflower). Ep was calculated with the Penman-Monteith equation using net radiation derived from two methods: (1) a surface radiation budget calculated from satellite imagery (EpSRB) and (2) empirical equations that use data from meteorological stations (EpGBE). The model of Ks as a function P/Ep was combined with a gridded time series of precipitation (0.5[degree sign] resolution, 1901-2000) and maps of EpSRB to define the probability distributions of P, P/Ep and Ks for sorghum at each 0.5[degree sign] cell over the basin. Sorghum, a C4 crop, had higher Ea and Ks values than the C3 plants (oilseeds, pulses) when precipitation was low (P < 1 mm d-1) but lower maximum Ea rates (3.3-4.5 mm d-1) compared with C3 crops (oilseeds and pulses, 4.3-4.9 mm d-1). The crop coefficient under adequate soil moisture (Kc) was higher than the FAO-56 crop coefficients by up to 56% for oilseeds and pulses. The seasonal soil moisture coefficient (Ks) for sorghum ranged from 1.0 under high rainfall (July-October) to 0.45 in dry seasons (November-March), showing strong soil moisture controls on Ea. EpSRB calculated at the lysimeter stations was 4-20% lower than EpGBE, with the largest difference in the dry season. Kc derived from EpSRB was only slightly (2-4%) higher than Kc derived from EpSRB, because the maximum Ea occurred during the monsoon when the differences between EpSRB and EpGBE were small. Approximately 20% of the basin area was expected to experience mild or greater soil moisture stress (Ks < 0.80) during the monsoon cropping season 1 year in every 2 years, while 70% of the basin experienced mild or greater stress 1 year in 10. The maps of soil moisture stress provide the basis for estimating the probability of drought and the benefits of supplemental irrigation.
Keywords: Crop water use; Evapotranspiration; Soil moisture; Semi-arid tropics; India; Satellite methods; Regional

Jens B. Aune, Andre Bationo, Agricultural intensification in the Sahel - The ladder approach, Agricultural Systems, Volume 98, Issue 2, September 2008, Pages 119-125, ISSN 0308-521X, DOI: 10.1016/j.agsy.2008.05.002.
(http://www.sciencedirect.com/science/article/B6T3W-4SYDB11-1/2/fffb2e78db58539eb66d02e68565d7ba)
Abstract:

Agricultural intensification in the Sahel can be described as climbing a ladder. The capital, labour, management and institutional requirements increase when farmers climb the ladder, but the potential gains are also higher. The first step on this ladder are agricultural practices without any financial outlay but with increasing labour demand, such as organic fertilizer use, seed priming, water harvesting and harvesting grains at physiological maturity to improve fodder quality. The next step on the ladder is the use of micro-fertilising, popularly known as microdose, at the rate of 0.3 g NPK fertilizer per pocket in sorghum and millet. The following step is the development of improved crop/livestock systems characterized by use of higher rates of mineral fertilisers and manure, increasing cowpea density and improved animal fattening. The last step presented on the ladder is the development of more commercially orientated agriculture characterized by development of cash crops, milk production and/or agroforestry systems. Evidences from the field support the observation that farmers intensify their production in a sequential manner similar to the way described in this paper. The technologies presented can facilitate agricultural intensification by reducing the risks and minimising the cost in agricultural production.
Keywords: Pearl millet; Sorghum; Seed priming; Cowpea; Microfertilisation; Agricultural intensification

James K. Mitchell, Carla N. Yerkes, Scott R. Racine, Elizabeth H. Lewis, The interaction of two potential fungal bioherbicides and a sub-lethal rate of glyphosate for the control of shattercane, Biological Control, Volume 46, Issue 3, September 2008, Pages 391-399, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2008.02.009.
(http://www.sciencedirect.com/science/article/B6WBP-4S01WKB-3/2/da193c5a3beaba372df240562aa88c35)
Abstract:
Greenhouse and laboratory experiments were conducted with the potential bioherbicides Colletotrichum graminicola (Cg) and Gloeocercospora sorghi (Gs) for control of shattercane weed. Single-spray tank mixture applications containing different ratios of the two fungi resulted in additive percent weed biomass losses. Intraspecific (Cg + Cg or Gs + Gs) and interspecific (Cg + Gs or Gs + Cg) sequential applications 1- or 7-days apart indicated antagonistic interactions in percent biomass loss. Application of either fungus with, or 1-3 days prior to, a sub-lethal concentration of glyphosate resulted in an antagonistic percent biomass loss; while application of glyphosate prior to either potential bioherbicide resulted in a synergistic weed disease response. Conidia germination studies conducted both in vitro on agar plates and with leaf impression peels suggest that antagonistic interactions observed in weed disease severity are probably due to the host-pathogen response following infection.
Keywords: Colletotrichum graminicola; Gloeocercospora sorghi; Pathogen mixture; Sorghum spp.; Colby's equation; Antagonistic; Additive; Synergistic; Integrated weed management

Federico Antonio Gutierrez-Miceli, Roberto Carlos Garcia-Gomez, Reiner Rincon Rosales, Miguel Abud-Archila, Oliva Llaven Maria Angela, Marcos Joaquin Guillen Cruz, Luc Dendooven, Formulation of a liquid fertilizer for sorghum (Sorghum bicolor (L.) Moench) using vermicompost leachate, Bioresource Technology, Volume 99, Issue 14, September 2008, Pages 6174-6180, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.12.043.
(http://www.sciencedirect.com/science/article/B6V24-4S02T7Y-1/2/fdd5c898ccd04eb3c19c76419c193e5e)
Abstract:
Leachate from vermicomposting contains large amounts of plant nutrients and can be used as liquid fertilizer, but normally diluted to avoid plant damage. The amount of nutrients applied is thus reduced so that an additional fertilizer is required. We investigated how dilution of vermicompost leachate combined with different concentrations of NPK triple 17 fertilizer, and polyoxyethylene tridecyl alcohol as dispersant and polyethylene nonylphenol as adherent to increase efficiency of

fertilizer uptake, affected sorghum plant development. The vermicomposting leachate with pH 7.8 and electrolytic conductivity 2.6 dS m-1, contained 834 mg K+ l-1, 247 mg l-1 and 168 mg l-1, was free of pathogens and resulted in a 65 % germination index. Vermicompost leachate can be used as liquid fertilizer for the cultivation of sorghum without dilution and mixed with 140-170 g l-1 of NPK triple 17 fertilizer and 2-3 ml-1 of dispersant and 0-1 ml l-1 adherent. It was found that vermicompost leachate stimulated plant development, but fertilization with NPK was required for maximum growth.
Keywords: Sorghum growth; NPK triple 17 fertilizer; Polyoxyethylene tridecyl alcohol dispersant; Polyethylene nonylphenol adherent; Vermicompost leachate

R. Ghali, K. Hmaissia-khlifa, H. Ghorbel, K. Maaroufi, A. Hedili, Incidence of aflatoxins, ochratoxin A and zearalenone in tunisian foods, Food Control, Volume 19, Issue 9, September 2008, Pages 921-924, ISSN 0956-7135, DOI: 10.1016/j.foodcont.2007.09.003.
(http://www.sciencedirect.com/science/article/B6T6S-4PPW70J-1/2/005f4f6f7912c08654acfacabc9b114c)
Abstract:
A total of 209 samples of different groups of foods widely consumed by the Tunisian population were collected during 2004-2005 years. Samples were analyzed for contamination with aflatoxins, ochratoxin A and zearalenone, using competitive enzyme-linked immunosorbent assay (ELISA). The predominant mycotoxin was ochratoxin A with a mean level of 3.5 +/- 5.3 ng g-1 in 59.8% of studied samples. Furthermore, Aflatoxins were detected in all analyzed commodities with a contamination frequency of 50.5%. In addition, aflatoxin B1 was found in 37% of the samples. The zearalenone was detected around 15% with a mean level of 10.4 +/- 11.8 ng g-1. Species, dried fruits and sorghum were the most contaminated samples by aflatoxin and ochratoxin mycotoxins, whereas Rice was the least contaminated commodity. The most frequent mycotoxins co-occurrence included aflatoxins and ochratoxin A, which have been detected in 33.8% of analyzed samples. Furthermore, the simultaneous contamination by aflatoxins, ochratoxin A and zearalenone was observed in 7.2% of studied samples.
Keywords: Aflatoxins; ELISA; Ochratoxin A; Zearalenone

Min Wang, Yuan Hu, Zhiliang Tan, Shaoxun Tang, Zhihong Sun, Xuefeng Han, In situ ruminal phosphorus degradation of selected three classes of feedstuffs in goats, Livestock Science, Volume 117, Issues 2-3, September 2008, Pages 233-237, ISSN 1871-1413, DOI: 10.1016/j.livsci.2007.12.016.
(http://www.sciencedirect.com/science/article/B7XNX-4RJ4KW1-1/2/ce965cdeb24f7c8072b815d75491a542)
Abstract:
Three 4-month-old growing wether goats were used to determine the ruminal P degradability of three classes of feedstuffs with in situ nylon bag technique. Three classes of feedstuffs were cereal (maize, wheat, barley, buckwheat, rice, millet, and sorghum), legume (horsebean, soybean, pea, mungbean, and jequirity) and tuber (potato, sweat potato, and cassava). The experiment consisted of 15 periods. During each period, the ruminal P disappearance of each one of these feedstuffs was measured at 0, 2, 4, 8, 12, 24 and 36 h, respectively. The exponential model of Orskov and McDonald was employed to estimate degradation kinetics. Results showed that the degradability of feed P ranged from 805 to 986 g/kg P. Effective degradability of P generally exceeded 830 g/kg P, except for rice and millet. This updates the feed database of in situ P degradability in China, which would play an important role in improving biological P efficiency for modern ruminant production system.
Keywords: Feedstuffs; In situ ruminal degradability; Phosphorus; Goat

Sajid Mehmood, Ilkay Orhan, Zaheer Ahsan, Sinem Aslan, Muhammad Gulfraz, Fatty acid composition of seed oil of different Sorghum bicolor varieties, Food Chemistry, Volume 109, Issue 4, 15 August 2008, Pages 855-859, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.01.014.
(http://www.sciencedirect.com/science/article/B6T6R-4RMNYM1-8/2/fe35f1c6cbbd91857b2e5df0905e1f24)
Abstract:
In order to find out new sources of premium quality edible oil in the country, seeds of ten varieties of Sorghum bicolor were initially analyzed for their total oil contents. The seed oil was later fractionated into eight fatty acids including two new saturated fatty acids. The oil contents were determined by Soxhlet method and compared with the results obtained by NMR analysis. The total oil contents in the seeds of sorghum ranged from 5.0 to 8.2 % (w/w), indicating non significant difference obtained by two different techniques. The results revealed that oleic acid (31.12-48.99%), Palmitoleic acid (0.43-0.56%), linoleic acids (27.59-50.73%), linolenic acid (1.71-3.89%), stearic acid (1.09-2.59%) and palmitic acid (11.73-20.18%) was present in the seed oil of different sorghum varieties when analyzed by GC-MS. It was observed that in most of the varieties polyunsaturated fatty acids (PUFA) were higher than monounsaturated fatty acids (MUFA). The two atypical SFAs, octanedioic (C8:0) and azelaic acid (C9:0) were found in some varieties. These results suggest that these S. bicolor varieties could be additional sources of edible oil due to presence of clinically important saturated and high concentration of unsaturated fatty acids. A large scale production of the seed oil after refining process can contribute towards alleviation of edible oil shortage in the country with increased use of premium quality oil.
Keywords: Sorghum bicolor; Fatty acid; Gas chromatography (GC); Nuclear magnetic resonance (NMR)

D.R. Miller, R. Elliott, B.W. Norton, Effects of an exogenous enzyme, Roxazyme(R) G2, on intake, digestion and utilisation of sorghum and barley grain-based diets by beef steers, Animal Feed Science and Technology, Volume 145, Issues 1-4, Enzymes, Direct Fed Microbials and Plant Extracts in Ruminant Nutrition, 14 August 2008, Pages 159-181, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.05.045.
(http://www.sciencedirect.com/science/article/B6T42-4PHSFD0-3/2/28be12a0ccf2305801f24b410845fa97)
Abstract:
A series of experiments were undertaken to determine effects of a mixed xylanase and endoglucanase exogenous enzyme (EE) product, Roxazyme(R) G2, on nutrient intake, digestion and feed conversion in beef steers fed sorghum or barley grain-based diets. Sixteen Bos indicus crossbred steers (314.2 +/- 26.07 kg) were allocated within stratified liveweight (LW) blocks to four treatments consisting of dry-rolled, sorghum or barley based (~0.60) diets treated with concentrate applied EE at 0 or 4.43 ml/kg diet dry matter (DM). The EE supplementation occurred for 7 weeks with digestibility measurements 2 and 6 weeks after commencement. The EE treatment resulted in increased daily voluntary DM intakes ($P<0.05$) for steers fed the sorghum diet, but not for steers fed the barley diet. Daily LW gain increased numerically on both diets (920 g/d versus 740 g/d, $P=0.138$) with no changes in feed efficiency. The EE treatment had no effect on total tract OM or fibre digestibility, but interacted with diet ($P<0.05$) whereby sorghum starch digestibility at 6 weeks was reduced by EE treatment (0.68 versus 0.81 control) without change in barley starch digestion (0.96). The EE supplements also increased ($P<0.05$) urinary N excretion. In a second 4 x 4 Latin Square experiment with 24 d periods, ruminally cannulated B. indicus crossbred steers (364.3 +/- 21.98 kg, n = 4) were fed sorghum grain diets, either as in the first experiment or at reduced grain levels (0.35 of diet DM), and untreated or treated with EE (4.18 ml/kg diet DM) as previously. Under these conditions, EE treatment had no effects on feed intake, total tract digestibility or ruminal fermentation measurements. A marker dilution technique indicated that EE treatment reduced ($P<0.05$) the fractional passage rate of a grain-associated marker when applied to the

high grain diet, while increasing it on the low grain diet, but EE did not affect fluid or fibre marker flows from the rumen. Ruminal in sacco incubations of 3 mm ground pangola grass (Digitaria decumbens) or sorghum grain revealed a reduction (P<0.01) in the insoluble potentially degradable fraction of the grass with EE supplementation, likely due to reduced (P=0.058) anaerobic fungi colonisation, and a tendency (P=0.082) for increased extent of grain DM disappearance. A 70 d feedlot experiment used 96 Santa Gertrudis steers (351 +/- 25.3 kg) allocated in balanced groups to one of four replicates of four levels of EE supplementation (i.e., 0, 1.08, 2.16, 4.33 l/tonne DM total ration) applied to a high quality, dry-rolled sorghum (0.72 of DM) finishing ration. The EE had no effect on DM intake (120 g/kg LW0.75), LW gain (1.92 kg/d), feed efficiency (5.72 kg DM/kg LW gain) or carcase attributes. A mixed activity EE product fed to beef cattle had dietary dependant (both type and composition) effects on feed intake, starch and N digestion, microbial efficiency, grain marker flow rates and the extent of in sacco degradation of a grass forage. However, production performance and carcase measures were not effected by adding the EE to a high quality feedlot diet fed to growing steers.
Keywords: Enzymes; Grain; Digestion; Feed intake; Weight gain; Efficiency

D.R. Miller, B.C. Granzin, R. Elliott, B.W. Norton, Effects of an exogenous enzyme, Roxazyme(R) G2 Liquid, on milk production in pasture fed dairy cows, Animal Feed Science and Technology, Volume 145, Issues 1-4, Enzymes, Direct Fed Microbials and Plant Extracts in Ruminant Nutrition, 14 August 2008, Pages 194-208, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.05.049.
(http://www.sciencedirect.com/science/article/B6T42-4PHSFD0-4/2/28808db1f07032a27ba26eabea5cda5d)
Abstract:
A study was conducted to determine effects of a predominantly xylanase and endoglucanase exogenous enzyme (EE) product, Roxazyme(R) G2 Liquid, on milk production of early lactation (80 +/- 18.2 days in milk) dairy cows grazing pastures in a subtropical environment. Holstein Friesian cows (n = 72) were allocated to one of six treatments in a 2 x 3 factorial design comprising either dry-rolled barley or sorghum grain supplements (6.7 kg dry matter (DM)/day) treated with one of three levels of applied EE (i.e., 0, 2.15 or 4.30 ml/kg DM, Control, Low and High levels, respectively) diluted with water to 20 ml/kg DM concentrate. Cows (549 +/- 47.9 kg live weight (LW)) grazed irrigated prairie grass (Bromus willdenowii cv. Matua) and biennial ryegrass (Lolium multiflorum cv. Concord) pastures during the 75-day treatment period, with individual feeding of supplement occurring at the morning (4.0 kg DM) and evening (2.7 kg DM) milkings. Rumen fluid samples were collected 2 and 6 weeks after supplementation commenced prior to (05:00-06:45 h) and 6 h after (10:40-13:00 h) the morning feeding. The EE application caused a linear decline (P<0.05) in LW gain of cows fed the sorghum supplement, but not in cows fed the barley supplement. There were no effects of EE supplements on body condition score changes. Milk yield (28.6 l/day) and composition were unaffected by grain type or EE supplementation, although milk fat yields were numerically (P=0.112) lower for cows on the High EE supplementation level versus unsupplemented cows (960 g/day versus 1010 g/day, respectively). EE treatment had no effect on supplement intake or estimated pasture intake. Despite some grain-specific effects on rumen fermentation, including NH3-N and VFA concentration changes, we conclude that there are no beneficial effects of supplementing dairy cows grazing C3 dominant pastures with the fibrolytic enzyme Roxazyme(R) G2 Liquid.
Keywords: Enzymes; Barley; Sorghum; Supplementation; Milk production

R.E. Larrain, D.M. Schaefer, M.P. Richards, J.D. Reed, Finishing steers with diets based on corn, high-tannin sorghum or a mix of both: Color and lipid oxidation in beef, Meat Science, Volume 79, Issue 4, August 2008, Pages 656-665, ISSN 0309-1740, DOI: 10.1016/j.meatsci.2007.10.032.
(http://www.sciencedirect.com/science/article/B6T9G-4R2H937-1/2/0389591459382a01292ab77dbba1f3fc)

Abstract:
We tested the hypothesis that feeding high-tannin sorghum (HTS) to steers would produce beef more resistant to oxidative deterioration. We observed lower thiobarbituric acid-reactive substances (TBARS) in Gluteus medius of steers fed HTS before it was displayed (P = 0.028), which could be explained by a reduced response to stress in these animals. While steers finished with corn and corn + HTS had elevated plasma cortisol at the end of the feeding period (P = 0.047 and 0.093, respectively), animals fed HTS and corn + vitamin E did not. However, feeding HTS increased the rate of discoloration and TBARS accumulation after aerobic display of Longissimus lumborum and Gluteus medius. Diet did not affect the activity of oxidation-related enzymes and fatty acid composition of muscle. The accelerated rate of lipid oxidation during display of beef could be partially explained by a numerically lower concentration of tocopherols in the tissue.
Keywords: Beef color; Cortisol; Oxidation; Sorghum; Corn; Antioxidant

Nicholas C. Carpita, Maureen C. McCann, Maize and sorghum: genetic resources for bioenergy grasses, Trends in Plant Science, Volume 13, Issue 8, August 2008, Pages 415-420, ISSN 1360-1385, DOI: 10.1016/j.tplants.2008.06.002.
(http://www.sciencedirect.com/science/article/B6TD1-4T1W488-2/2/d25942fcdaaa33970dd55b68e6947cda)
Abstract:
The highly photosynthetic-efficient C4 grasses, such as switchgrass (Panicum virgatum), Miscanthus (Miscanthus x giganteus), sorghum (Sorghum bicolor) and maize (Zea mays), are expected to provide abundant and sustainable resources of lignocellulosic biomass for the production of biofuels. A deeper understanding of the synthesis, deposition and hydrolysis of the distinctive cell walls of grasses is crucial to gain genetic control of traits that contribute to biomass yield and quality. With a century of genetic investigations and breeding success, recently completed genome sequences, well-characterized cell wall compositions, and a close evolutionary relationship with future bioenergy perennial grasses, we propose that maize and sorghum are key model systems for gene discovery relating to biomass yield and quality in the bioenergy grasses.

T.P. Lanyasunya, Hongrong Wang, S.T. Kariuki, E.A. Mukisira, S.A. Abdulrazak, N.K. Kibitok, J.O. Ondiek, The potential of Commelina benghalensis as a forage for ruminants, Animal Feed Science and Technology, Volume 144, Issues 3-4, 15 July 2008, Pages 185-195, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.10.009.
(http://www.sciencedirect.com/science/article/B6T42-4RB5GHX-1/2/3ddd981da9092b9fd74b06999cc2aecc)
Abstract:
To evaluate the potential of Commelina benghalensis as a forage for ruminants, effects of plant maturity on chemical composition, rumen degradability as well as its increased dietary inclusion level on intake, digestibility and N balance in sheep fed Sorghum almum were investigated with forage obtained from the wild, re-established and harvested at 6, 10 and 14 weeks of growth. Composite herbage samples were analyzed for dry matter (DM), chemical components, total extractable phenolics (TEP) and amino acid content. In sacco rumen degradability measurements used six individually confined wethers (8 +/- 0.5 months of age; 21 +/- 2.6 kg live-weight (LW)) fitted with rumen cannulae and fed a ration of 3:1 fresh S. almum and Medicago sativa hay (about 1:2 on a DM basis). In sacco bags containing 5 g each of dry herbage were inserted into the rumen and withdrawn sequentially after 0, 12, 24, 36 and 48 h. Metabolizable energy (ME) was estimated from 24 h in vitro gas production. In the digestibility study, 12 wethers fitted with rumen canula were housed in metabolic crates and allotted to four treatment diets (i. e., D0, D10, D20 and D30) constituted from fresh S. almum and pre-wilted C. benghalensis in a randomized complete block design. The control diet (D0) was 3 kg fresh S. almum ([approximate]535.5 g DM/wether/d about 30 g/kg LW), whereas D10, D20 and D30 were D0 +300, 600 or 900 g of

wilted C. benghalensis ([approximate]34, 68 or about 102 g DM/wether/d), respectively. The study lasted for 21 d. Dry matter, fibre and TEP content increased (P<0.001) with maturity of the forage, whereas those of CP and EE decreased (P<0.0001) over the same period. Amino acids (AA) also declined with maturity (P<0.05). Rumen degradability of DM and OM were unaffected, but DM intake increased linearly (P<0.0001) at a decreasing rate (Q: P<0.05) and DM digestibility (DMD) and N intake increased linearly (P<0.01 and P<0.0001, respectively) as level of C. benghalensis in the diet increased. Results indicate that advancing maturity affected chemical composition, but not rumen degradability, of C. benghalensis and also demonstrated that inclusion of C. benghalensis in S. almum diet improved intake, digestibility and N intake, suggesting its potential use as a feed supplement.
Keywords: Digestibility; Sheep; N balance; Sorghum almum; Rumen; Phenolics; Degradability

G. Animut, R. Puchala, A.L. Goetsch, A.K. Patra, T. Sahlu, V.H. Varel, J. Wells, Methane emission by goats consuming diets with different levels of condensed tannins from lespedeza, Animal Feed Science and Technology, Volume 144, Issues 3-4, 15 July 2008, Pages 212-227, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.10.014.
(http://www.sciencedirect.com/science/article/B6T42-4RB5BJ3-1/2/8420ed050c710766d7eddbe47e50009b)
Abstract:
Twenty-four yearling Boer x Spanish wethers (7/8 Boer; initial body weight (BW) of 34.1 +/- 1.02 kg) were used to determine effects on methane (CH4) emission of dietary levels of a condensed tannin (CT)-containing forage, Kobe lespedeza (Lespedeza striata; K), and a forage very low in CT, sorghum-sudangrass (Sorghum bicolor; G). Treatments were dietary K levels (dry matter (DM) basis) of 1.00, 0.67, 0.33, and 0 (100, 67, 33, and 0 K, respectively). Forages were harvested daily and fed at approximately 1.3 times maintenance metabolizable energy requirement. The experiment lasted 21 days, with most measures on the last 8 days. The CT concentration was 0.3 and 151 g/kg DM in G and K, respectively. DM intake was similar among treatments (i.e., 682, 675, 654, and 648 g/day; S.E. = 30.0) and gross energy (GE) digestibility increased linearly (P<0.05) with decreasing K (0.472, 0.522, 0.606, and 0.666 for 100, 67, 33, and 0 K, respectively). CH4 emission changed quadratically (P<0.05) with decreasing K (10.9, 13.8, 17.6, and 26.2 l/day; 32, 42, 57, and 88 kJ/MJ GE; 69, 81, 94, and 133 kJ/MJ digestible energy for 100, 67, 33, and 0 K, respectively). In vitro CH4 emission by incubation of ruminal fluid for 3 weeks with a medium for methanogenic bacteria and other conditions promoting activity by methanogens also was affected quadratically (P<0.05) by K level (7.0, 8.1, 9.2, and 16.1 ml for 100, 67, 33, and 0 K, respectively). The total bacterial count of ruminal samples was similar among K levels, but the number of total protozoa increased linearly (P<0.05) as K declined (8.3, 11.8, 15.6, and 27.1 x 105 ml-1 for 100, 67, 33, and 0 K, respectively). The CT-containing forage K decreased CH4 emission by goats regardless of its feeding level, although the effect per unit of K increased with decreasing K. Forage type (i.e., legume versus grass) may have contributed to the effect of K on CH4 emission, but most of the change appeared attributable to CT, which appeared to directly impact activity of methanogenic bacteria, although alterations of protozoal activity could have been involved. These findings suggest that relatively low dietary levels of CT could be employed to lessen CH4 emission without a marked detrimental effect on other conditions such as total tract protein digestion.
Keywords: Goats; Methane; Condensed tannins

Ghulam Habib, Muzamilla Raza, Mohammad Saleem, Effect of tree leaves with or without urea as a feed supplement on nutrient digestion and nitrogen balance in sheep, Animal Feed Science and Technology, Volume 144, Issues 3-4, 15 July 2008, Pages 335-343, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.11.002.
(http://www.sciencedirect.com/science/article/B6T42-4RFKKJT-2/2/7145c31423255a0f6bf9c28880c72a8f)

Abstract:
Two nitrogen balance experiments in a 4 x 4 Latin square design were conducted to compare leaves of Grewia oppositifolia and Ziziphus mauritiana containing condensed tannins (CT) 0.08 g and 34.7 g per kg DM, respectively as supplement on feed intake, nutrients digestibility and nitrogen (N) retention in adult wethers and to examine the benefits of adding urea to Z. mauritiana leaves containing higher level of CT on N utilization in the animals. In experiment 1, the basal diet of oat hay was fed to sheep either un-supplemented or supplemented with 320 g dried leaves of Z. mauritiana or 320 g dried leaves of G. oppositifolia or 160 g dried leaves each of Z. mauritiana and G. oppositifolia. In vivo dry matter (DM) digestibility was not different among the four diets while N digestibility remained significantly lower ($P<0.05$) in Z. mauritiana supplemented diets. Daily intake of oat hay reduced ($P<0.05$) and that of total diet DM increased ($P<0.001$) with feeding of the leave supplements. Mean N retention on control diet was 4.39 g/d and increased to 7.51 g/d with inclusion of G. oppositifolia leaves but did not change with the other two supplements. In experiment 2, a basal diet of sorghum hay was fed ad libitum without any supplement (control diet) and the other three diets were supplemented with 320 g dried leaves of Z. mauritiana with no urea, 5 g urea/d or 10 g urea/d. Daily intake (g/d) of sorghum hay or total DM intake did not respond to inclusion of urea in the diets. Supplementation of Z. mauritiana with or without urea did not affect digestibility of DM, organic matter and acid detergent fiber. Nitrogen retention increased ($P<0.05$) from 0.57 g/d on control diet to 3.72 g/d with supplementation of Z. mauritiana leaves. Addition of urea 5 g/d did not further increase the N retention (4.78 g/d) but was significantly increased to 7.16 g/d in response to 10 g urea/d in the diet. It was concluded that response to urea feeding in the presence of tannin rich Z. mauritiana leaves was dose-dependant and that feeding 10 g urea/d increased the capacity of sheep to consume more feed and retain more N in the body.
Keywords: Tree leaves; Tannins; Urea supplementation; Nitrogen balance; Nutrient digestibility; Sheep

S. Garrigues, N.V. Shabanov, K. Swanson, J.T. Morisette, F. Baret, R.B. Myneni, Intercomparison and sensitivity analysis of Leaf Area Index retrievals from LAI-2000, AccuPAR, and digital hemispherical photography over croplands, Agricultural and Forest Meteorology, Volume 148, Issues 8-9, 4 July 2008, Pages 1193-1209, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2008.02.014.
(http://www.sciencedirect.com/science/article/B6V8W-4SJ9G4J-1/2/28a909b6a9f48e317a4bbd949ee2158f)
Abstract:
Validation of Leaf Area Index (LAI) derived from moderate resolution remote sensing observations generally involves optical technique to measure ground LAI. As the current validation datasets are derived using multiple optical retrieval techniques, assessment of the consistency between these techniques is required. In this study the effective Plant Area Index (PAIeff) retrievals by three major optical instruments, LAI-2000, AccuPAR, and Digital Hemispherical Photographs (DHPs), were analyzed over 10 crops (soybean, corn, alfalfa, sorghum, peanut and pasture) at Manfredi site in Cordoba province, Argentina. The focus of research was on quantifying PAIeff sensitivity to the type of instrument, retrieval parameters and gap fraction inversion methods as well as environmental conditions (canopy heterogeneity, senescent vegetation, illumination conditions). Results indicate that sensitivity of DHP method to illumination conditions is low (14% compared to 28% and 86% for LAI-2000 and AccuPAR, respectively). The intercomparison of PAIeff retrievals indicates large discrepancies between optical techniques for short canopy over which downward-pointing DHP technique performs better than LAI-2000 and AccuPAR. Better agreement was found for tall canopy without senescent vegetation and low spatial heterogeneity. Overall, discrepancies in PAIeff between instruments are mainly explained by differences in spatial sampling of transmittance between instruments (over short and heterogeneous canopies) caused by variations in instrument footprint, azimuthal range, and zenith angle spatial resolution (coarser

for LAI-2000 than DHP). Our results indicate that DHP is the most robust technique in terms of low sensitivity to illumination conditions, accurate spatial sampling of transmittance, ability to capture gap fraction over short canopy using downward-looking photographs, independence from canopy optical ancillary information, and potential to derive clumping index. It can thus be applied to a large range of canopy structures, and environmental conditions as required by validation protocols.
Keywords: Effective Plant Area Index; Gap fraction; Optical techniques; LAI-2000; AccuPAR; Digital Hemispherical Photograph; LAI validation

D.C. Kalyani, P.S. Patil, J.P. Jadhav, S.P. Govindwar, Biodegradation of reactive textile dye Red BLI by an isolated bacterium Pseudomonas sp. SUK1, Bioresource Technology, Volume 99, Issue 11, Exploring Horizons in Biotechnology: A Global Venture, July 2008, Pages 4635-4641, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.06.058.
(http://www.sciencedirect.com/science/article/B6V24-4PJD9KV-6/2/622cd898c4d79d48dd2a4b9cfaa9ec1e)
Abstract:
A novel bacterial strain capable of decolorizing reactive textile dye Red BLI is isolated from the soil sample collected from contaminated sites of textile industry from Solapur, India. The bacterial isolate was identified as Pseudomonas sp. SUK1 on the basis of 16S rDNA analysis. The Pseudomonas sp. SUK1 decolorized Red BLI (50 mg l-1) 99.28% within 1 h under static anoxic condition at pH range from 6.5 to 7.0 and 30 [degree sign]C. This strain has ability to decolorize various reactive textile dyes. UV-Vis spectroscopy, FTIR and TLC analysis of samples before and after dye decolorization in culture medium confirmed decolorization of Red BLI. A significant increase in the activities of aminopyrine N-demethylase and NADH-DCIP reductase in cells obtained after decolorization indicates involvement of these enzymes in the decolorization process. Phytotoxicity testing with the seeds of Sorghum vulgare and Phaseolus mungo, showed more sensitivity towards the dye, while the products obtained after dye decolorization does not have any inhibitory effects.
Keywords: Isolation; Red BLI; Dye decolorization; Reactive textile dyes; Phytotoxicity

G. Tegegne, J.C. Pretorius, W.J. Swart, Antifungal properties of Agapanthus africanus L. extracts against plant pathogens, Crop Protection, Volume 27, Issue 7, July 2008, Pages 1052-1060, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.12.007.
(http://www.sciencedirect.com/science/article/B6T5T-4RR20V9-2/2/d797e27e694b5b05c55e3b1826efa88e)
Abstract:
Crude extracts of various Agapanthus africanus plant parts were screened in vitro against eight economically important plant pathogenic fungi. Radial mycelial growth was inhibited significantly ($P<0.05$) in five test organisms, while Pythium ultimum, and to a lesser extent Fusarium oxysporum and Alternaria alternata, showed a degree of tolerance. Subsequently, these crude extracts were tested in vivo in the greenhouse against Mycosphaerella pinodes, the cause of black spot or Ascochyta blight in peas. Fourth internode leaves were removed from 4-week-old pea plants, placed on moist filter paper in Petri dishes and inoculated with a M. pinodes spore suspension 30 min before and after treatment with the extracts. The control of Ascochyta blight by different concentrations of the crude extracts was measured in terms of lesion size over a 6-d period at 20 [degree sign]C in a growth cabinet. All crude extracts significantly reduced lesion development caused by M. pinodes when leaves were inoculated with spores both before and after treatment with the extracts. Neither of the extracts showed any phytotoxic reaction on the leaves, even at the highest concentration applied. A combined aerial part crude extract of A. africanus was additionally evaluated against sorghum covered (Sporisorium sorghi) and loose (Sporisorium cruentum) kernel smuts under field conditions over two seasons. The extract and a standard fungicide, Thiram that served as a positive control, were applied as seed treatments 1 h

after artificially inoculating separate sets of sorghum seed with smut spores. Inoculated, but untreated seeds served as a negative control. The extract reduced the incidence of both loose and covered kernel smuts significantly ($P<0.05$) and compared favourably with the prescribed fungicide, Thiram. Both treatments resulted in significant yield increases compared to the untreated control. From these results it was concluded that the aerial part crude extract of A. africanus possesses sufficient in vivo antifungal activity to warrant a further investigation.
Keywords: In vitro; In vivo; Antifungal activity; Agapanthus africanus; Crude extracts; Plant pathogens

Stefano Renzetti, Fabio Dal Bello, Elke K. Arendt, Microstructure, fundamental rheology and baking characteristics of batters and breads from different gluten-free flours treated with a microbial transglutaminase, Journal of Cereal Science, Volume 48, Issue 1, July 2008, Pages 33-45, ISSN 0733-5210, DOI: 10.1016/j.jcs.2007.07.011.
(http://www.sciencedirect.com/science/article/B6WHK-4PCXGFW-1/2/417866929eb3742ccba7e77598f90016)
Abstract:
Gluten is a fundamental component for the overall quality and structure of breads. The replacement of the gluten network in the development of gluten-free cereal products is a challenging task for the cereal technologist. The functionality of proteins from gluten-free flours could be modified in order to improve their baking characteristics by promoting protein networks. Transglutaminase (TGase) has been successfully used in food systems to promote protein cross-linking. In this study, TGase was investigated for network forming potential on flours from six different gluten-free cereals (brown rice, buckwheat, corn, oat, sorghum and teff) used in breadmaking. TGase was added at 0, 1 or 10 U/g of proteins present in the recipe. The effect of TGase on batters and breads was evaluated by fundamental rheological tests, Texture Profile Analysis and standard baking tests. Three-dimensional elaborations of Confocal Laser Scanning Microscopy (CLSM) images were performed on both batters and breads to evaluate the influence of TGase on microstructure. Fundamental rheological tests showed a significant increase in the pseudoplastic behaviour of buckwheat and brown rice batters when 10 U of TGase were used. The resulting buckwheat and brown rice breads showed improved baking characteristics as well as overall macroscopic appearance. Three-dimensional CLSM image elaborations confirmed the formation of protein complexes by TGase action. On the other side, TGase showed negative effects on corn flour as its application was detrimental for the elastic properties of the batters. Nevertheless, the resulting breads showed significant improvements in terms of increased specific volume and decreased crumb hardness and chewiness. Under the conditions of this study, no effects of TGase could be observed on breads from oat, sorghum or teff. Overall, the results of this study show that TGase can be successfully applied to gluten-free flours to improve their breadmaking potentials by promoting network formation. However, the protein source is a key element determining the impact of the enzyme.
Keywords: Transglutaminase; Gluten-free; Microstructure; Rheology; Bread

Kurt Gebruers, Hind Mokrane, Boubekeur Nadjemi, Johnny Beaugrand, Katleen Fierens, Paul Proost, Christophe M. Courtin, Jan A. Delcour, Sorghum (Sorghum bicolor L. Moench) contains a XIP-type xylanase inhibitor but none of the TAXI- and TLXI-types, Journal of Cereal Science, Volume 48, Issue 1, July 2008, Pages 203-212, ISSN 0733-5210, DOI: 10.1016/j.jcs.2007.09.005.
(http://www.sciencedirect.com/science/article/B6WHK-4PPF67D-1/2/fd7b085c844dc760f395befb5459187c)
Abstract:
A xylanase inhibitor of the xylanase-inhibiting protein (XIP) type was detected in sorghum (Sorghum bicolor L. Moench) whole meal using Western blot and immunoprobing with polyclonal anti-XIP antibodies. No detectable levels of Triticum aestivum xylanase inhibitor (TAXI) and

thaumatin-like xylanase inhibitor (TLXI) type xylanase inhibitors were present. Trichoderma longibrachiatum xylanase affinity chromatography (AC) was used for the purification of sorghum XIP. Biochemical characteristics and protein sequence data show that sorghum XIP strongly corresponds to wheat (T. aestivum L.) XIP-I. Like wheat XIP-I, it inhibits both glycoside hydrolase family (GH) 10 and 11 xylanases, indicating that the XIP-I active site residues are well conserved in sorghum XIP. However, in contrast to wheat XIP-I, the inhibitor is unable to affect Aspergillus niger GH 11 xylanase activity. Its specific inhibition activities towards the other xylanases tested are comparable to those of wheat XIP-I. Based on the available sorghum expressed sequence tag (EST) database, XIP is expressed in sorghum in different tissues and developmental stages. Also expression in the presence of several plant hormones and under biotic as well as abiotic stress conditions is suggested.
Keywords: Sorghum bicolor; Xylanase inhibitor; XIP; Xylanase

Carl L. Rosier, Jeffrey S. Piotrowski, Andrew T. Hoye, Matthias C. Rillig, Intraradical protein and glomalin as a tool for quantifying arbuscular mycorrhizal root colonization, Pedobiologia, Volume 52, Issue 1, 30 June 2008, Pages 41-50, ISSN 0031-4056, DOI: 10.1016/j.pedobi.2008.02.002.
(http://www.sciencedirect.com/science/article/B7CW5-4RYW0HB-2/2/c8cee96ef5d55cf5e98434d2c0d54f50)
Abstract: Summary
Assessment of root colonization by arbuscular mycorrhizal fungi (AMF) is largely dependent upon traditional microscopic techniques as no consistent biochemical marker for AMF is available outside of DNA based methods. Glomalin is an AMF produced protein that has potential to serve as a specific biomarker for rapid detection of AMF. We tested whether AMF-colonized roots contained greater concentrations of two glomalin-related protein fractions, Bradford-root protein (BRP) and MAb32B11-immunoreactive-root protein (IRP), compared to non-colonized controls. Additionally, we tested if these protein fractions were correlated with AMF colonization rate. AMF colonization significantly increased IRP within roots of Bromus inermis colonized by several different AMF isolates. BRP and IRP were also increased in Daucus carota (grown under sterile in vitro conditions), and Plantago lanceolata and Sorghum bicolor (grown in the greenhouse). The relationships between intraradical concentrations of both BRP and IRP and AMF root colonization were approximated by both linear and non-linear models in all plants (r2 from 0.50 to 0.94). Clearly, this method could be useful at least in assessing presence/absence of AMF colonization, for example in large-scale screening situations (e.g., testing for mycorrhizal mutants, verifying colonization in the horticultural/restoration industry). While the MAb32B11-ELISA assay was also useful in detecting AMF colonization, it did not consistently offer greater resolution/precision. This analysis method is more involved and hence not as practical, and we also could not conclusively attribute the antibody reaction to cross-reactivity or a true glomalin signal in roots.
Keywords: Glomalin; Arbuscular mycorrhizal fungi; Root colonization; Detection

Z. Xin, C. Franks, P. Payton, J.J. Burke, A simple method to determine transpiration efficiency in sorghum, Field Crops Research, Volume 107, Issue 2, 10 May 2008, Pages 180-183, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.02.006.
(http://www.sciencedirect.com/science/article/B6T6M-4S6Y5DF-2/2/41798ddc1062c65d191c2a66906591e0)
Abstract:
Sorghum [Sorghum bicolor (L.) Moench] is a C4 cereal grain crop grown primarily in arid and semi-arid regions in the world with limited or no irrigation. Sorghum production fluctuates and largely depends on the amount and distribution of rainfall. Transpiration efficiency (TE), the biomass produced per unit water transpired, could be a potential trait to improve sorghum yield in areas where irrigation is limited. We have developed a mini-lysimetric method that directly measures whole plant TE in sorghum during an early vegetative stage under greenhouse conditions. The

method was evaluated with 11 inbred lines and three hybrids under two greenhouse environments. In general, TE determined with the gravimetric method was higher under lower vapor pressure deficit conditions; however, similar rankings in TE were obtained across the experiments. The method described in this report offers a simple, high-throughput, and affordable way to determine the integrated TE in sorghum at an early vegetative stage.
Keywords: Transpiration efficiency; Sorghum; Genetic variation

Zeyaur R. Khan, David G. James, Charles A.O. Midega, John A. Pickett, Chemical ecology and conservation biological control, Biological Control, Volume 45, Issue 2, Conservation Biological Control, May 2008, Pages 210-224, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2007.11.009.
(http://www.sciencedirect.com/science/article/B6WBP-4R9JTVN-1/2/c2096d07706668ad3e3afcf8b3c10f5f)
Abstract:
Elucidating the chemical ecology of natural enemies, herbivores and host plants is important in the development of effective and successful integrated pest management (IPM) strategies where abundance and distribution of natural enemies could be manipulated by semiochemicals for improved conservation biological control (CBC). In response to attack by herbivores, plants produce semiochemicals called Herbivore-Induced Plant Volatiles (HIPVs) which act to repel pests and attract their natural enemies. Damaged, and in some cases, intact plants may also produce volatile signals that warn other plants of impending attack. Some of these intact plants are used as intercrops in `push-pull' strategies; cropping systems based on stimulo-deterrent principle, where the target crop is intercropped with herbivore repellent plants (push) while attractant plants (pull) are planted around this intercrop. The intercrop, in addition to repelling the herbivores, attracts and conserves natural enemies thereby ensuring continued suppression of the pests. This natural delivery of semiochemicals for CBC is currently being exploited by smallholder farmers in eastern Africa in the management of cereal stemborers in maize and sorghum. Synthetic HIPVs also have the potential to effectively recruit natural enemies, thereby improving CBC as has been demonstrated in a series of field experiments in vineyards and hop yards in the Pacific Northwest of the United States. Potentially, plants could be `turned on' by synthetic HIPV signals, and therefore become sources of natural enemy-recruiting volatiles. With the rapid development of plant molecular biology, modification of secondary plant metabolism is also possible which could allow appropriate semiochemicals to be generated by plants at certain growth stages. By identifying the promoter sequences associated with external plant signals that induce biochemical pathways, plant defense genes could be `switched on' prior to insect attack. We review recent research on `push-pull' strategies and synthetic HIPVs in recruitment of beneficial arthropods and warding off pest attack.
Keywords: Chemical ecology; Semiochemicals; Herbivore-Induced Plant Volatiles; `Push-pull' strategy; Natural enemies; Conservation biological control

Hong Li, William A. Payne, Gerald J. Michels, Charles M. Rush, Reducing plant abiotic and biotic stress: Drought and attacks of greenbugs, corn leaf aphids and virus disease in dryland sorghum, Environmental and Experimental Botany, Volume 63, Issues 1-3, May 2008, Pages 305-316, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2007.11.014.
(http://www.sciencedirect.com/science/article/B6T66-4R68NDC-1/2/7271871424458ce07bc75f5db19c050e)
Abstract:
Multi-year spatial overlay patterns of plants, insects and soil water may yield insights for management for reducing biotic and abiotic stresses in dryland crops. A study of non-irrigated grain sorghum (Sorghum bicolor (L.) Moench) was conducted in a Pullman clay loam on the semi-arid High Plain of Texas during 2002-2005. The objectives of the 4-year study were to understand the mechanisms of plant spatial and temporal responses to stress from drought, infestations of

greenbug, corn leaf aphid (CLA) and maize dwarf mosaic virus (MDMV) disease and soil water content (SWC) heterogeneity, and to reduce plant biotic and abiotic stress using their underlying relationships in space and time. Infrared IRt/c sensed-canopy temperature was measured at 18 or 54 sites along transects in a 6 m x 6 m grid across the years. Greenbugs, CLA, MDMV, SWC and hyperstectral reflectance were determined at each IRt/c site. Natural infestations of greenbugs and CLA on sorghum occurred in early July and insect populations peaked in late July or early August. Insect attacks resulted in plant water stress and sorghum yield loss except a late replanting in early July in 2004. Sorghum grain yield was negatively correlated with canopy temperature, greenbug and CLA ($-0.38 < r < -0.75$, $P < 0.05$), and positively correlated with SWC and plant near infrared reflectance ($0.25 < r < 0.67$, $P < 0.05$). The IRt/c temperature decreased with SWC but increased with greenbugs and CLA ($0.26 < R2 < 0.64$). Crosscorrelation analysis showed that these insect, crop, and soil variables were correlated in space within 48-54 m. Late planting in July or spray control in late July or early August would be options to reduce dryland sorghum water stress and yield loss from drought and insect attacks.
Keywords: Canopy infrared temperature; Insect outbreak; Plant-insect relations; Plant water stress; Drought management

Mika Zagrobelny, Soren Bak, Birger Lindberg Moller, Cyanogenesis in plants and arthropods, Phytochemistry, Volume 69, Issue 7, May 2008, Pages 1457-1468, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2008.02.019.
(http://www.sciencedirect.com/science/article/B6TH7-4S32DK2-3/2/224ce9dee985865d4e5419fa59393108)
Abstract:
Cyanogenic glucosides are phytoanticipins known to be present in more than 2500 plant species. They are regarded as having an important role in plant defense against herbivores due to bitter taste and release of toxic hydrogen cyanide upon tissue disruption, but recent investigations demonstrate additional roles as storage compounds of reduced nitrogen and sugar that may be mobilized when demanded for use in primary metabolism. Some specialized herbivores, especially insects, preferentially feed on cyanogenic plants. Such herbivores have acquired the ability to metabolize cyanogenic glucosides or to sequester them for use in their own defense against predators. A few species of arthropods (within diplopods, chilopods and insects) are able to de novo biosynthesize cyanogenic glucosides and some are able to sequester cyanogenic glucosides from their food plant as well. This applies to larvae of Zygaena (Zygaenidae). The ratio and content of cyanogenic glucosides is tightly regulated in Zygaena filipendulae, and these compounds play several important roles in addition to defense in the life cycle of Zygaena. The transfer of a nuptial gift of cyanogenic glucosides during mating of Zygaena has been demonstrated as well as the involvement of hydrogen cyanide in male attraction and nitrogen metabolism. As more plant and arthropod species are examined, it is likely that cyanogenic glucosides are found to be more widespread than formerly thought and that cyanogenic glucosides are intricately involved in many key processes in the life cycle of plants and arthropods.
Keywords: Cyanogenic glucosides; Sorghum; Almond; Arthropods; Burnet moth; Zygaena; Cytochrome P450; UDPG-glucosyltransferase; [beta]-glucosidase; [beta]-cyanoalanine synthase; Nitrilase

D.L. Pawelek, J.P. Muir, B.D. Lambert, R.D. Wittie, In sacco rumen disappearance of condensed tannins, fiber, and nitrogen from herbaceous native Texas legumes in goats, Animal Feed Science and Technology, Volume 142, Issues 1-2, 15 April 2008, Pages 1-16, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.02.014.
(http://www.sciencedirect.com/science/article/B6T42-4NB38D4-1/2/ae2ee5050090a8683f2b1e18bcb15644)
Abstract:

Condensed tannins (CT) can play a role in rumen protein and fiber degradability, especially in legumes high in CT. In order to better understand their potential role in ruminant nutrition, three legume species native to Texas, Acacia angustissima var. hirta (prairie acacia) (288.0 g/kg neutral detergent fiber (NDFom), 40.9 g/kg N), Desmodium paniculatum (panicled tick-clover) (479.7 g/kg NDFom, 24.8 g/kg N), and Lespedeza procumbens (trailing bush-clover) (401.0 g/kg NDFom, 21.7 g/kg N) were studied to determine in sacco disappearance rates of key nutritional components compared to that of Medicago sativa (alfalfa) (226.8 g/kg NDFom, 34.6 g/kg N). Herbage was incubated in rumen-cannulated goats fed a basal diet of Sorghum bicolorxS. sudanense (sorghum-Sudan) hay, with disappearance measured at 0, 4, 8, 16, 28, 48 and 96 h. Among the native legumes, the highest CT concentrations were measured in prairie acacia (263 g CT/kg DM foliage) and the lowest (120 g CT/kg DM) in trailing bush-clover. The lowest concentrations of acid detergent fiber (ADFom), NDFom, and sulfuric acid lignin (lignin(sa)) were measured in prairie acacia, the first two fractions being comparable to alfalfa. Proportion remaining was calculated for CT, ADFom, lignin(sa), NDFom, and N for 0, 24 and 48 h of rumen incubation. Disappearance parameters were measured for ADFom, lignin(sa), NDFom and N for the three native legumes and compared to alfalfa. Alfalfa had the highest disappearance of all degradable fractions except lignin(sa). Potential disappearance (PD) fraction for ADFom, lignin(sa) and N were lower for the native legumes versus alfalfa. No differences in N proportion remaining at 24 and 48 h occurred in the native legumes despite differences in protein-bound CT proportion remaining at those same times. Of the native legumes studied, prairie acacia shows the greatest potential for contributing rumen-escape protein, suggesting it may be a candidate for further development as a pasture and rangeland renovation legume.
Keywords: Condensed tannins; Plant polyphenolics; Native legumes; Goats; In sacco rumen disappearance

A. Castro-Gonzalez, J.A. Alayon-Gamboa, A. Ayala-Burgos, L. Ramirez-Aviles, Effects of Brosimum alicastrum and Lysiloma latisiliquum mixtures on voluntary intake, nutrient digestibility and nitrogen balance in sheep fed tropical pastures, Animal Feed Science and Technology, Volume 141, Issues 3-4, 1 April 2008, Pages 246-258, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.06.033.
(http://www.sciencedirect.com/science/article/B6T42-4P9T9DR-6/2/8bee86af811cdefccc551578da0572f4)
Abstract:
Effects of supplementing tree foliage mixtures on voluntary intake, apparent digestibility and N balance was evaluated using Pelibuey sheep fed low quality diets. Five treatments were examined in a 5 x 5 Latin square design, which consisted of a basal diet of grass (Sorghum halepense) hay supplemented with Brosimum alicastrum (B) and Lysiloma latisiliquum (L) at the following rates (g DM/kg diet): B264, L0; B198, L66; B132, L132; B66, L198 and B0, L264. Additionally, an in situ degradability evaluation was completed with two ruminally cannulated cows. Neutral detergent fibre (NDF), acid detergent insoluble N (ADIN), lignin(sa) and total phenols (TP) were higher ($P<0.01$) in L. latisiliquum versus B. alicastrum. Daily intake (g/kg LW0.75/day) of DM (from 98 to 73) and OM (from 88 to 66) decreased quadratically ($P<0.01$), whereas CP (from 8.0 to 5.6) and ME (from 7.7 to 5.2, MJ/sheep/day) reduced linearly ($P<0.01$), as L. latisiliquum increased in the diet. Apparent digestibility of DM (from 0.486 to 0.445), OM (from 0.511 to 0.458) and CP (from 0.417 to 0.198) decreased linearly ($P<0.01$) and was associated with a low ruminal in situ CP degradability of L. latisiliquum. The decrease in N intake and digestibility induced lower ($P<0.01$) N retention (from 2.7 to 0.1 g/sheep/day). Although the incremental substitution of B. alicastrum with L. latisiliquum negatively affected intake, rumen degradation, digestibility and N balance, results indicate that this foliage mixture, but with no more than 132 g DM/kg diet of L. latisiliquum, could be used as a supplementation strategy to sheep fed low quality forage without negative effects on voluntary intake.

Keywords: Digestibility; Foliage mixture; Intake; Polyphenols; Sheep

Meshack Obonyo, Fritz Schulthess, Juma Gerald, Onesmus Wanyama, Bruno Le Ru, Paul-Andre Calatayud, Location, acceptance and suitability of lepidopteran stemborers feeding on a cultivated and wild host-plant to the endoparasitoid Cotesia flavipes Cameron (Hymenoptera: Braconidae), Biological Control, Volume 45, Issue 1, April 2008, Pages 36-47, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2007.11.010.
(http://www.sciencedirect.com/science/article/B6WBP-4R9JTVN-2/2/9d1fff5d9b4a0b49e662ee3b6019b23b)
Abstract:
Maize fields in Africa are usually surrounded by land occupied by wild plants many of which harbor lepidopteran stemborer species not found on crops. It is not known if the exotic braconid parasitoid Cotesia flavipes, which was released in Kenya in 1993 against the invasive crambid Chilo partellus, searches for and attacks these borers in their natural habitats and whether they are suitable for parasitoid development. The objective of this study was to assess the relationship between acceptance and suitability of six stemborer species attacking cultivated sorghum (C. partellus, Busseola fusca, Sesamia calamistis, and S. nonagrioides) or Napier grass (Busseola phaia and Sciomesa piscator) to C. flavipes. Although all stemborer species were equally accepted for ovipositor probing by C. flavipes, only C. partellus and S. calamistis were suitable and produced parasitoids. In olfactometric bioassays, C. flavipes females were more attracted to stemborer-infested than uninfested plants. Analyses of the volatile compounds showed that they produced richer volatile profiles, mainly comprising C5-C6 alcohols, terpenoids, aromatic and aliphatic compounds, than uninfested plants. It can be concluded that stemborer species, that were accepted for oviposition but were unsuitable for parasitoid development, form a reproductive sink and that the exotic parasitoid would not establish in areas where these are the predominant species.
Keywords: Sesamia nonagrioides; Sesamia calamistis; Chilo partellus; Busseola fusca; Busseola phaia; Sciomesa piscator; Sorghum bicolor; Pennisetum purpureum; Plant volatiles; Y-tube olfactometer; GC analyses

H. Ahmed Idris, N. Labuschagne, L. Korsten, Suppression of Pythium ultimum root rot of sorghum by rhizobacterial isolates from Ethiopia and South Africa, Biological Control, Volume 45, Issue 1, April 2008, Pages 72-84, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2007.11.004.
(http://www.sciencedirect.com/science/article/B6WBP-4R68NCT-1/2/9cf3a931b7094e7a8b61ed3696a49c44)
Abstract:
Bacteria isolated from the rhizosphere of sorghum in Ethiopia and from different grass species within the Nylsvlei Nature Reserve in South Africa were evaluated for their in-vitro and in-vivo antagonistic activity against Pythium ultimum that causes root rot in sorghum. Root rot caused by this pathogen in sorghum is characterized by blackened discolorations with white mycelial growth on the surface of the roots. Statistically significant disease suppression was achieved by 15 isolates from sorghum rhizosphere in Ethiopia ([greater-or-equal, slanted]50% disease suppression), whereas eight isolates from the rhizosphere of grasses at Nylsvlei Nature Reserve in South Africa resulted in [greater-or-equal, slanted]80% disease suppression. The isolates maintained themselves at a level [greater-or-equal, slanted]105 cfu/g indicating that they are also highly competent in sorghum rhizosphere. Isolates which showed the best overall performance in-vitro and in-vivo were identified by means of the API system and sequencing of the bacterial 16S rDNA genes. The majority of these isolates were identified as members of the genus Bacillus, 56% of which were B. cereus. Three other isolates were identified as Brevibacterium laterosporus, Pseudomonas fluorescens and Serratia marcescens. Selected modes of action studies indicated that production of antibiotic substances and siderophores as well as induction of systemic

resistance in sorghum were exhibited by some of the most effective isolates. The results of this study offer a significant impetus to the application of plant growth promoting rhizobacteria for use as biological control agents against P. ultimum in sorghum.
Keywords: Biocontrol; Plant growth promoting rhizobacteria; Root colonization; Bacillus cereus; Bacillus subtilis; Bacillus pumilus; Pseudomonas fluorescens; Serratia marcescens

G.V.S. Bhanu Prakash, V. Padmaja, R.R. Siva Kiran, Statistical optimization of process variables for the large-scale production of Metarhizium anisopliae conidiospores in solid-state fermentation, Bioresource Technology, Volume 99, Issue 6, April 2008, Pages 1530-1537, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.04.031.
(http://www.sciencedirect.com/science/article/B6V24-4P18B5P-1/2/baa3f87e1baf2e1df5934e1316410385)
Abstract:
Optimization of conidial production was achieved by response surface methodology (RSM), a powerful mathematical approach widely applied in the optimization of fermentation process, using the three substrates; rice, barley and sorghum at variable pH, moisture content and yeast extract concentrations. These three factors were found to be important, affecting Metarhizium anisopliae spore production. A 23 full factorial central composite design and RSM were applied to determine the optimal concentration of each variable. A second-order polynomial was determined by the multiple regression analysis of the experimental data. Moisture content of 75.68% for sorghum, 73.21% for barley and 22.34% for rice produced optimal results. Maximal conidial yield was recorded for rice at a pH of 7.01; at 7.06 for sorghum and at 6.76 for barley.
Keywords: Solid-state fermentation; Response surface methodology; Metarhizium anisopliae; Conidiospores

Julie D Scholes, Malcolm C Press, Striga infestation of cereal crops - an unsolved problem in resource limited agriculture, Current Opinion in Plant Biology, Volume 11, Issue 2, Genome studies and Molecular Genetics, edited by Juliette de Meaux and Maarten Koornneef / Plant Biotechnology, edited by Andy Greenland and Jan Leach, April 2008, Pages 180-186, ISSN 1369-5266, DOI: 10.1016/j.pbi.2008.02.004.
(http://www.sciencedirect.com/science/article/B6VS4-4S1JK7D-1/2/23bda147aeb4c85d4f091a54c99b4828)
Abstract:
The parasitic weed Striga causes devastating losses in cereal yields in sub-Saharan Africa. The parasite lifecycle is intimately linked with its host via a complex interchange of signals. Understanding the molecular basis of these interactions and of host resistance to Striga is essential for the identification of genes for improving crop yield via biotechnological or marker assisted breeding strategies. Cloning and sequencing of ESTs from the `model' parasite Triphysaria versicolor is facilitating the identification of parasitism genes. The identification of resistance to Striga in sorghum and rice germplasm is allowing molecular dissection of these traits using genomic platforms and quantitative trait loci (QTL) analysis. QTL underlying different resistance phenotypes have been identified and the use of advanced backcross populations is allowing the exploitation of sources of resistance in wild relatives of cereals.

M. Kouressy, M. Dingkuhn, M. Vaksmann, A. Clement-Vidal, J. Chantereau, Potential contribution of dwarf and leaf longevity traits to yield improvement in photoperiod sensitive sorghum, European Journal of Agronomy, Volume 28, Issue 3, April 2008, Pages 195-209, ISSN 1161-0301, DOI: 10.1016/j.eja.2007.07.008.
(http://www.sciencedirect.com/science/article/B6T67-4PMT5XN-1/2/c433c3368def442247cfe8222f0aaf7f)
Abstract:

Sorghum breeders in West Africa seek to combine photoperiod-sensitivity with short-stature, stay-green and high-yield potential. A field study explored physiological interactions among these traits. Three genotypes were compared by growth analysis, V1 (tall, traditional, photoperiod-sensitive), V2 (dwarfed, photoperiod-sensitive descendant of V1) and V3 (photoperiod-insensitive, stay-green, dwarf hybrid). Seed was sown in fields near Bamako (Mali) with supplemental irrigation in 2004 and 2005 on three dates (D1, 22 June; D2, 16 July; D3, 15 September). Measurements included phenology (leaf number and life span; reproductive development), leaf length/width and internode length distribution on main stems, leaf area index (LAI), fertile tiller number, dry wt of green and senescent aboveground organs, and yield. Crop growth rate (CGR) was calculated from dry wt dynamics. Stem sugar reserves were analyzed on stems at flowering and maturity.
Photoperiod-sensitive V1 and V2 showed variable crop duration among dates but not years, whereas V3 had nearly constant duration. Dwarfing of V2 was due to shorter internodes but did not affect leaf length, width and specific leaf area. V3 had higher LAI than V1 and V2 after flowering due to greater leaf longevity. Leaf senescence was substantial even before flowering in V1 and V2, causing reduced CGR at flowering. Grain yield of V1, up to 3.7 m tall, was 1.0 t ha-1 and varied little whereas stem dry wt varied between 4 and 14 t ha-1. V2 attained only half the height of V1 and had smaller stem dry wt, but 2-3-fold greater yields. Yield of V3, which had the same height as V2, averaged 4.5 t ha-1. Only V2 showed a positive yield response to crop duration (sowing date) due to variable panicle number plant-1 and yield panicle-1, which were correlated ($P < 0.001$). In all cultivars, large stem sucrose reserves remained constant from flowering to maturity, indicating that sugars were not mobilized and did not limit grain filling.
It is concluded that the dwarf habit of V2, compared to V1, reduced competition for assimilates among sinks during stem elongation and thus enabled survival of more productive tillers and development of larger panicles. Dwarfing and compensatory tillering thus benefited yield potential. Introduction of stay-green to increase assimilates for grain filling would theoretically not improve yield because yield was sink limited. Expression of stay-green before flowering, however, might alleviate source restrictions to sink capacity development.
Keywords: Plant type; Phenology; Phyllochron; Stem elongation; Carbohydrate reserve; Senescence; Stay green

M.S. Madruga, R.G. Costa, A.M. Silva, A.V.M.S. Marques, R.N. Cavalcanti, N. Narain, C.L.C. Albuquerque, G.E. Lira Filho, Effect of silk flower hay (Calotropis procera Sw) feeding on the physical and chemical quality of Longissimus dorsi muscle of Santa Inez lambs, Meat Science, Volume 78, Issue 4, April 2008, Pages 469-474, ISSN 0309-1740, DOI: 10.1016/j.meatsci.2007.07.016.
(http://www.sciencedirect.com/science/article/B6T9G-4P7R8D5-1/2/91ac8e4a996cfcec433161469b86846e)
Abstract:
The effect of different levels of silk flower hay (Calotropis procera Sw) in the diet of confined lambs by the substitution of the commonly used foraging broom corn hay (Sorghum bicolor L) was investigated to evaluate its possible effects on the growth and quality of the lamb meat. Twenty-four male Santa Inez lambs were divided in equal numbers into four treatment groups and fed diets containing 0%, 16.7%, 33.3% and 50% of silk flower hay (SFH). Growth rate, feed intake and meat quality were investigated. Mean daily gains of lambs were 170 g for control, 180.5 g for 16.7% SFH, 96.8 g for 33.3% SFH and 22.9 g for 50% SFH. The use of silk flower hay in the diet of Santa Inez lambs affected health of the animals and meat pH when the substitution of the forage was high, up to 50%; however, the general meat quality was not affected. Meat from animals fed with levels up to 50% SFH had physical (Aw, a*, b* and L*) and chemical (moisture, ash, lipid, phosphorus, iron, phospholipid and fatty-acid profile) parameters comparable to the control group (0% SFH). Among the various levels of substitution (16.7%, 33.3% and 50%) of silk

flower hay in the diet tried in this work, the use of 16.7% was found to be an attractive and technically viable option for the Northeast region of Brazil.
Keywords: Silk flower hay; Lamb; Meat quality

A. RASHID, R.U. KHAN, H. ULLAH, Influence of Nitrogen Levels and Application Methods on Yield and Quality of Sorghum, Pedosphere, Volume 18, Issue 2, April 2008, Pages 236-241, ISSN 1002-0160, DOI: 10.1016/S1002-0160(08)60012-0.
(http://www.sciencedirect.com/science/article/B82XV-4RXTDD6-D/2/60c87f169eafa6a8314290682fdf04d1)
Abstract:
A field study was conducted for two years at the Arid Zone Research Institute, Dera Ismail Khan, Pakistan, to determine the optimum level of nitrogen and efficient application method in the production of sorghum (Sorghum bicolor L.). Using four levels of nitrogen, i.e., 0, 60, 90, and 120 kg ha-1, and two different application methods (soil application and foliar spray), the experiment was laid out in a split-plot design, where the main plots were used to determine the effective method of application and the subplots were used to detect the influence of N levels on the grain yield. The average data obtained after two years of study indicated an increase in the grain yields with an increase in N levels irrespective of the method used of N application. The grain yield increased from 2.92 to 5.61 t ha-1 in the plots that were treated with 90 kg N ha-1 compared with the control plots. Quadratic regression analysis showed that the increase in the yield was higher at the lower levels of N compared with the succeeding higher levels. The soil application method, producing an average grain yield of 4.79 t ha-1, was found to be superior to the foliar spray method with an average grain yieldof4.56tha-1. The protein content of the grain showed a linear increase with N application, attaining the maximum at 120 kg N ha-1 in both the methods of N application. In addition, compared with the method of soil application, higher crude protein contents were observed using the method of foliar spray at all N levels.
Keywords: foliar spray; grain yield; N level; protein content; soil application

Sandrine Pivard, Damjan Demsar, Jane Lecomte, Marko Debeljak, Saso Dzeroski, Characterizing the presence of oilseed rape feral populations on field margins using machine learning, Ecological Modelling, Volume 212, Issues 1-2, Selected papers from the Fifth European Conference on Ecological Modelling, 19-23 September 2005, Pushchino, Russia, 24 March 2008, Pages 147-154, ISSN 0304-3800, DOI: 10.1016/j.ecolmodel.2007.10.012.
(http://www.sciencedirect.com/science/article/B6VBS-4RTFJ60-4/2/ca8832763900c85b83553395ce7a0018)
Abstract:
Many cultivated species, such as oilseed rape, sunflower, wheat or sorghum can escape from crops, and colonize field margins as feral populations. The general processes leading to the escape and persistence of cultivated species on field margins are still poorly investigated. An exhaustive 4-year survey was conducted in the centre of France at a landscape level to study the origin of feral oilseed rape populations. We present here results obtained with machine learning methods, which are increasingly popular techniques for analysing large ecological datasets. As expected, the dynamics of feral populations relies on large seed immigration from fields and transport. However, the seed bank was shown to be the keystone of their persistence rather than local recruitment.
Keywords: Oilseed rape; Feral population; Risk assessment; Data mining; Attribute ranking; Classification tree

Mamoutou Kouressy, Michael Dingkuhn, Michel Vaksmann, Alexandre Bryan Heinemann, Adaptation to diverse semi-arid environments of sorghum genotypes having different plant type

and sensitivity to photoperiod, Agricultural and Forest Meteorology, Volume 148, Issue 3, 13 March 2008, Pages 357-371, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2007.09.009.
(http://www.sciencedirect.com/science/article/B6V8W-4R2GWPM-2/2/4022a90354bdb00f527534e75fa337dc)
Abstract:
Climatologists, breeders and agronomists need tools to translate variable climatic conditions in semi-arid environments into probable performance, and to translate genotype characteristics into agro-ecological fit of cultivars. Although geographic adaptation of West African sorghum cultivars is largely related to local characteristics of the wet season, they require, in addition to drought tolerance, effective phenological mechanisms for temporal escape from drought and excessive humidity that would favour pests and diseases during sensitive development stages. A simulation experiment was conducted to predict the potential and attainable (water limited) growth and yield of three sorghum genotypes differing in plant type and response to photoperiod for combinations of five sowing dates and three sites on the N-S climatic gradient in Mali, for the period from 1971 to 2004. The models used were SARRA-H equipped with the phenological model Impatience. Onset and end dates of the rainy season were estimated with the simple soil water balance model BIP. The resulting scenarios were evaluated on the basis of (i) escape from drought, (ii) escape of grain development phases from periods of high pest and disease pressure and (iii) the resulting 'safe' periods for sowing. The latter took into account the agronomic advantage associated with early sowing, observed by farmers to minimize weed competition and decreasing soil fertility during the wet season. The results indicated that potentially high yielding and photoperiod insensitive 'modern' cultivars display an advantage only in the north where the rainy season is short. Sensitive response of flowering to photoperiod was essential for more humid environments having a long wet season, resulting in appropriate seasonal timing of flowering and greater flexibility of crop calendars. The methodology is discussed with respect to its suitability for applications in crop breeding, geographic targeting of existing cultivars and studies on the agricultural impact of climate variability and change.
Keywords: Crop simulation modelling; Drought; Attainable yield; Phenology; Temporal escape; West African monsoon

Surindra Suthar, Bioconversion of post harvest crop residues and cattle shed manure into value-added products using earthworm Eudrilus eugeniae Kinberg, Ecological Engineering, Volume 32, Issue 3, 3 March 2008, Pages 206-214, ISSN 0925-8574, DOI: 10.1016/j.ecoleng.2007.11.002.
(http://www.sciencedirect.com/science/article/B6VFB-4RDBYXB-3/2/40403090c98f6945132c642a2e462a65)
Abstract:
The post-harvest residues of some local crops, e.g. wheat (Triticum aestivum), millets (Penniseum typhoides and Sorghum vulgare), and a pulse (Vigna radiata) were subjected to recycle through vermicomposting by using the epigeic earthworm Eudrilus eugeniae Kinberg, under laboratory conditions. The crop residues were amended with animal dung; and three types of vermibeds were prepared: (i) millet straw (S. vulgare + Pennisenum typhoides in equal quantity) + sheep manure (1:2 ratio) (MS), (ii) pulse bran (Vigna radiata) + wheat straw (Triticum aestivum) + cow dung (1:1:2 ratio) (PWC), and (iii) mixed crop residues (mixing of all types crop residues, used in this study) + cow dung in 1:1 ratio (MCR + CD). The fourth treatment was cattle shed manure (CSM). At the end, ready vermicompost showed lower organic C content and higher concentrations of other important plant nutrients. Organic C content decreased in the order: MCR + CD (27.6%) > PWC (22.8%) > CMS (22.6%) > MS (19.4%). The ready vermicompost obtained from MCR + CD vermibed showed the maximum increase (% of initial level) in content of total N (143.4%), available P (111.1%) and exchangeable K (100.0%). The end product showed reduction in C:N ration between the ranges of 60.7% (CSM) and 70.3% (MCR + CD), at the end. The composting earthworm E. eugeniae exhibited the highest values of biological parameters: maximum mean

individual biomass (1261.25 +/- 7.0 mg), biomass gain (955.84 +/- 11.03 mg), growth rate (10.62 +/- 0.10 mg wt. worm-1 day-1), cocoon numbers (87.67 +/- 6.51), and reproduction rate (0.66 +/- 0.01 cocoons worm-1 day-1) in CSM container, while MS vermibeds showed the lowest values of these parameters. During experimentation, the maximum mortality for E. eugeniae was recorded in MS (16.67 +/- 7.63%) followed by CSM > PWC > MCR + CD. Results indicated that the C:N ratio of the substrate drastically influenced the growth parameters of E. eugeniae, and it showed the close relations with maximum individual biomass gain (R2 = 0.96), individual growth rate (R2 = 0.82), and reproduction rate (cocoon worm-1 day-1) (R2 = 0.72), in different treatments. This study clearly indicates that vermicomposting of crop residues and cattle shed wastes can not only produce a value-added product (vermicomposting) but at the same time acts as best culture medium for large-scale production of earthworms.
Keywords: Crop residues; Cattle shed wastes; Earthworm; Vermicomposting; Eudrilus eugeniae; Cocoon; Vermicompost; C:N ratio

David Connor, Jordi Comas, Helena-Gomez Macpherson, Luciano Mateos, Impact of small-holder irrigation on the agricultural production, food supply and economic prosperity of a representative village beside the Senegal River, Mauritania, Agricultural Systems, Volume 96, Issues 1-3, March 2008, Pages 1-15, ISSN 0308-521X, DOI: 10.1016/j.agsy.2007.04.001.
(http://www.sciencedirect.com/science/article/B6T3W-4NYJS5K-2/2/d7806c0e6ef447dbd30a8d5779dabff6)
Abstract:
A considerable effort to rehabilitate and extend degraded irrigation schemes is taking place along the Mauritanian side in the Senegal River Valley. To increase understanding of the effects of these activities on the population, a model was used to analyse how the irrigated agriculture production interacts with other production systems, human food supply, and economic prosperity in a representative village in the Middle Valley. The activities in the village comprise grazing of mostly goats and sheep on shrubland, rain fed cropping, partly on saturated soil as river or plain floods recede, and an irrigation area of 32 ha soon to be enlarged to 90 ha. The production environment is characterized by a long dry winter, small, highly variable summer rainfall, and high temperatures and evaporative conditions. River flooding is variable and dependant on rainfall at great distance from the village. Using a generated weather series, the model evaluates the fodder supply for livestock on the shrubland, the productivity of grain and stubble for human and animal consumption, respectively, together with the human labour, and fertilizer and fuel requirements to maintain optional production scenarios. A financial sector calculates cash balance. Established cropping practice uses cowpea, sorghum, millet and rice, the latter on irrigated land. All families have equal access to grazing on the shrubland but different access to rain fed, flood land, and irrigation cropping. The model evaluates the impact of production scenarios on identified family types with distinct resources, extending current practice to a more diverse use of irrigated land by introducing alternative summer (sorghum) and new winter (cowpea) crops. The analysis of the current scenarios reveals the small and variable productivity of the shrubland, the precarious situation facing a family with access to rain-fed cropping only, and the stabilizing, although still inadequate, impact of the initial irrigation project. Expansion of the irrigation area, and more diversified cropping, will provide more families with access to irrigation but the small area available to each family (0.50 ha) will not produce sufficient grain or straw unless cropping is intensified to include a second winter crop. With that, additional benefits will flow indirectly to villagers without access to irrigation, through increased requirement for labour and sale of grain and fodder. The expanded irrigation area increases the stock carrying capacity of the village, raising concerns for the sustainable management of the shrubland.
Keywords: Animal production; Biophysical model; Cropping system; Financial analysis; Grazing; Rural village; Senegal river; Sustainable development

Shawn J. McGuire, Path-dependency in plant breeding: Challenges facing participatory reforms in the Ethiopian Sorghum Improvement Program, Agricultural Systems, Volume 96, Issues 1-3, March 2008, Pages 139-149, ISSN 0308-521X, DOI: 10.1016/j.agsy.2007.07.003.
(http://www.sciencedirect.com/science/article/B6T3W-4PJ6BX2-1/2/101ff79d92ba10580432d90283b17ebb)
Abstract:
Participatory plant breeding (PPB) seeks to involve farmers more closely in crop improvement in order to improve breeding impact. While PPB aims to reform breeding practice, there has been little analysis of the current practice breeding institutions. Such an analysis is necessary, both to understand why a breeding programme works the way it does, and to assess the possibilities of for reforms. This paper develops theories of path-dependency, social construction of technology, and actor-networks to analyse the historical development of the Ethiopian Sorghum Improvement Program (ESIP), a long-running and sophisticated public-sector effort whose outputs have had limited adoption. This analysis explores choices in technology development, the social networks influencing them, and the possibility that established choices become stabilized in a pathway that resists changes to different lines of research and technology development. Applying this analysis to ESIP helps to understand the path-dependency of sorghum breeding, showing how early choices around agroecological classifications, germplasm use, and F1 hybrid development became `locked-in', consequently resisting change. Technical constraints, breeding routines, and actor networks all reinforce particular choices from the past, as does the centralized organization of the ESIP team. Most PPB efforts assume that poor breeder awareness of the traits farmers desire is the main reason for low impact, and thus concentrate on addressing this gap. This study points to more fundamental reasons for poor impact, and indicates that institutional change in breeding is unlikely to emerge from a PPB intervention focusing on selection criteria alone. In order to be lasting, reforms need to recognise technical pathways, strengthen the voice of farmers or other beneficiary groups, and engage with dominant policy narratives. This highlights the value of analysing breeding institutions before designing breeding reforms, and the utility of path-dependency for such an analysis.
Keywords: Plant breeding; Agricultural research institutions; Path-dependency; Social construction of technology; Participation

Hector Santana-Delgado, Ernesto Avila, Angela Sotelo, Preparation of silage from Spanish mackerel (Scomberomorus maculatus) and its evaluation in broiler diets, Animal Feed Science and Technology, Volume 141, Issues 1-2, 1 March 2008, Pages 129-140, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.05.023.
(http://www.sciencedirect.com/science/article/B6T42-4NXGSC3-2/2/af758336ffb16289005680729539058f)
Abstract:
The aim of the present study was to prepare silage from whole Spanish mackerel, which is one of the cheapest commercial fish, and an under-utilized species found on both the Pacific and Gulf of Mexico coasts. Chemical and biochemical changes during the silage process: pH, total nitrogen (TN), non-protein nitrogen (NPN), lipid oxidation, and trimethylamine (TMA) generated were monitored. The effect of ter-butylhydroquinone (TBHQ) as antioxidant under mechanical stirring and stabilized temperature was also observed. The liquid silage obtained was mixed with sorghum (1:2 w/w), and dried in the sun. This silage-sorghum flour was used to prepare five diets with different silage-sorghum mix inclusions, and evaluated in a 21 d feeding trial with broilers. During the silage process the NPN increased significantly by 85% from the original total nitrogen at 96 h. The protein content in the dried silage and in the silage-sorghum mix was 653 and 169 g kg-1 on a dry matter basis, respectively. Minerals were found in high concentration in both fishmeal and silage, since the whole fish with bones and scales was used to prepare the silage, being Ca and P, which were at a higher concentration. Trp was the AA most affected by the silage process. Its

concentration in the silage was decreased by 54% compared to that of fishmeal. However, the addition of sorghum supplemented the deficiency of this amino acid in silage. Most of the fatty acids were protected by the antioxidant and the ratio PUFA (poly unsaturated fatty acid) n-3/n-6 in fishmeal and silage was 4.7 and 4.9, respectively. In the feeding trial, no differences were found between the weight gain and feed conversion of the control diet and the four diets prepared with increasing amounts of silage-sorghum mix ($P<0.05$). It can be concluded that silage-sorghum mix is a good alternative to use as fish wastes or undesirable marine species in poultry feeding. The process does not require sophisticated equipment and the environment is protected.
Keywords: Silage; Spanish mackerel; Scomberomorus maculatus; Broiler feed; Nutritional evaluation

Ives C.S. Bueno, Dorinha M.S.S. Vitti, Helder Louvandini, Adibe L. Abdalla, A new approach for in vitro bioassay to measure tannin biological effects based on a gas production technique, Animal Feed Science and Technology, Volume 141, Issues 1-2, 1 March 2008, Pages 153-170, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.04.011.
(http://www.sciencedirect.com/science/article/B6T42-4NVSWWH-2/2/0eb5ae107ffc410c68c093872db31120)
Abstract:
The aim of this paper was to study a method based on gas production technique to measure the biological effects of tannins on rumen fermentation. Six feeds were used as fermentation substrates in a semi-automated gas method: feed A - aroeira (Astronium urundeuva); feed B - jurema preta (Mimosa hostilis), feed C - sorghum grains (Sorghum bicolor); feed D - Tifton-85 (Cynodon sp.); and two others prepared mixing 450 g sorghum leaves, 450 g concentrate (maize and soybean meal) and 100 g either of acacia (Acacia mearnsii) tannin extract (feed E) or quebracho (Schinopsis lorentzii) tannin extract (feed F) per kg (w:w). Three assays were carried out to standardize the bioassay for tannins. The first assay compared two binding agents (polyethylene glycol - PEG - and polyvinyl polypirrolidone - PVPP) to attenuate the tannin effects. The complex formed by PEG and tannins showed to be more stable than PVPP and tannins. Then, in the second assay, PEG was used as binding agent, and this assay was done to evaluate levels of PEG (0, 500, 750, 1000 and 1250 mg/g DM) to minimize the tannin effect. All the tested levels of PEG produced a response to evaluate tannin effects but the best response was for dose of 1000 mg/g DM. Using this dose of PEG, the final assay was carried out to test three compounds (tannic acid, quebracho extract and acacia extract) to establish a curve of biological equivalent effect of tannins. For this, five levels of each compound were added to 1 g of a standard feed (Lucerne hay). The equivalent effect showed not to be directly related to the chemical analysis for tannins. It was shown that different sources of tannins had different activities or reactivities. The curves of biological equivalence can provide information about tannin reactivity and its use seems to be important as an additional factor for chemical analysis.
Keywords: Acacia; Anti-nutritional; Gas method; Phenols; Quebracho; Tannins

Andrea Monti, Nicola Di Virgilio, Gianpietro Venturi, Mineral composition and ash content of six major energy crops, Biomass and Bioenergy, Volume 32, Issue 3, March 2008, Pages 216-223, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2007.09.012.
(http://www.sciencedirect.com/science/article/B6V22-4R05J2W-1/2/8d1d39d038cd7a61c7e1300b5ff4b6ea)
Abstract:
The chemical composition of biofuels has not received adequate attention given that it is an important aspect in the introduction of energy crops. In this study, the ash content and mineral composition (C, N, Al, Ca, Cl, Fe, K, Mg, Na, P, S, Si) of stems, leaves and reproductive organs of some promising energy crops were determined and compared with the respective recommended thresholds reported in literature. Overall, cynara exhibited the highest ash and mineral contents,

which indicate high slagging, fouling and corrosion tendencies. However, cynara also showed the lowest Si content, both in leaves (4.3 g kg-1) and in stems (0.9 g kg-1).
Sweet sorghum and giant reed exhibited the highest N content (up to 16 g kg-1), which greatly exceeded the recommended limits in leaves. Importantly, Cl always exceeded the recommended limits (up to 18 mg kg-1 in cynara), both in stems and in leaves, thus resulting in a major stumbling block for all crops. Several significant correlations among elements were found at a single plant part; conversely these correlations were generally very weak considering different plant components, with the exception of K (r=0.91**), P (r=0.94**) and ashes (r=0.64**). Generally, leaves resulted in a significant deterioration of biofuel quality when compared with stems and flower heads. Therefore, agricultural strategies aimed at reducing the leaf component (e.g. by delaying the harvest) may considerably improve the suitability of biofuels for current combustion plants.
Keywords: Miscanthus; Arundo; Sorghum; Switchgrass; Giant reed; Cynara; Ashes; Mineral; Bioenergy

Ronghou Liu, Fei Shen, Impacts of main factors on bioethanol fermentation from stalk juice of sweet sorghum by immobilized Saccharomyces cerevisiae (CICC 1308), Bioresource Technology, Volume 99, Issue 4, March 2008, Pages 847-854, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.01.009.
(http://www.sciencedirect.com/science/article/B6V24-4N7YFVP-3/2/f75cd00b069e18c79f1402a39da483a0)
Abstract:
In order to attain a higher ethanol yield and faster ethanol fermentation rate, orthogonal experiments of ethanol fermentation with immobilized yeast from stalk juice of sweet sorghum were carried out in the shaking flasks to investigate the effect of main factors, namely, fermentation temperature, agitation rate, particles stuffing rate and pH on ethanol yield and CO2 weight loss rate. The range analysis and analysis of variance (ANOVA) were applied for the results of orthogonal experiments. Results showed that the optimal condition for bioethanol fermentation should be A4B3C3D4, namely, fermentation temperature, agitation rate, particles stuffing rate and pH were 37 [degree sign]C, 200 rpm, 25% and 5.0, respectively. The verification experiments were carried out in shaking flasks and 5 L bioreactor at the corresponding parameters. The results of verification experiments in the shaking flasks showed that ethanol yield and CO2 weight loss rate were 98.07% and 1.020 g h-1, respectively. The results of ethanol fermentation in the 5 L bioreactor showed that ethanol yield and fermentation time were 93.24% and 11 h, respectively. As a result, it could be concluded that the determined optimal condition A4B3C3D4 was suitable and reasonable for the ethanol fermentation by immobilized Saccharomyces cerevisiae. The conclusion in the research would be beneficial for application of ethanol fermentation by immobilized S. cerevisiae from stalk juice of sweet sorghum.
Keywords: Suitable parameters; Sweet sorghum; Immobilized Saccharomyces cerevisiae; Bioethanol fermentation

Lijun Wang, Curtis L. Weller, Vicki L. Schlegel, Timothy P. Carr, Susan L. Cuppett, Supercritical CO2 extraction of lipids from grain sorghum dried distillers grains with solubles, Bioresource Technology, Volume 99, Issue 5, March 2008, Pages 1373-1382, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.01.055.
(http://www.sciencedirect.com/science/article/B6V24-4NB38BH-4/2/9578ec76a60e5cb855c957065dc353c8)
Abstract:
Experiments were carried out on a lab supercritical CO2 extraction system to determine the effects of extraction conditions, including mass ratio of CO2 consumed to distillers dry grain with solubles (DDGS) extracted, extraction pressure, extraction temperature and time, on yield and composition

of extracted lipids. A maximum lipid yield of 150 g/kg DDGS was achieved with a mass ratio ~45, an extraction pressure at 27.5 MPa, an extraction temperature at 70 [degree sign]C and an extraction time of 4 h. Under these extraction conditions, the contents of tocols, phytosterols, policosanols and free fatty acids were 0.44, 15.6, 31.2 and 155.3 mg/g in the extract. Experimental results indicated that shorter extraction time and higher flow rate of CO2 can achieve higher contents of tocols, phytosterols and policosanols but lower content of free fatty acids in the lipid extract. Extraction conditions had no observed effects on the composition of free fatty acids in the extract. Palmitic, oleic and linoleic acids were three main free fatty acids extracted and constituted about 94% of all free fatty acids.
Keywords: Supercritical CO2 extraction; Phytosterols; Policosanols; Nutraceuticals; DDGS

M. Kruger, J. van den Berg, H. Du Plessis, Diversity and seasonal abundance of sorghum panicle-feeding Hemiptera in South Africa, Crop Protection, Volume 27, Issues 3-5, March-May 2008, Pages 444-451, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.07.014.
(http://www.sciencedirect.com/science/article/B6T5T-4PHSF52-2/2/63ad49723f9beb09afd08df4d989d2f6)
Abstract:
During the past two decades, panicle-feeding Hemiptera (head bugs) became serious pests of sorghum in West and Central Africa. Of the more than 100 sorghum insect pests reported in Africa, 42 species are reported to be panicle-feeding pests. Prior to this study, no research had been done on the panicle-feeding Hemiptera in South Africa. The objectives of the study were to determine the abundance and diversity of panicle-feeding Hemiptera on sorghum. Surveys were conducted between November 2004 and June 2006 at 26 sites in four provinces of South Africa. Collection was done using a plastic bag method and a D-Vac. A checklist was compiled and the temporal distribution of different Hemiptera species determined during panicle development. The total number of adults and nymphs collected during this study was 23,798. Thirty-nine herbivorous Hemiptera species were collected. The most abundant family was the Miridae followed by the Lygaeidae, which made up 41% and 17%, respectively, of the total number of individuals. Eurystylus bellevoyi, Campylomma sp., Creontiades pallidus, Nysius natalensis, Nezara viridula and Sthenaridea suturalis were the most abundant species and also occurred widely in the sorghum production area. Infestation levels of these species were generally low compared with those in other parts of Africa, but comparatively high infestation levels were observed at some sites. There was no clear distinction between the different panicle development stages during which panicles were infested by different species. The general tendency was that nearly all species were present from the flowering stage onwards and that numbers declined when grain hardened.
Keywords: Campylomma sp.; Creontiades pallidus; Deraeocoris sp.; Eurystylus bellevoyi; Grain mould; Head bugs; Nysius natalensis; Orius sp.

Teddy Matama-Kauma, Fritz Schulthess, Bruno Pierre Le Ru, Jones Mueke, James Apenyo Ogwang, Charles Omambia Omwega, Abundance and diversity of lepidopteran stemborers and their parasitoids on selected wild grasses in Uganda, Crop Protection, Volume 27, Issues 3-5, March-May 2008, Pages 505-513, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.08.003.
(http://www.sciencedirect.com/science/article/B6T5T-4PPWM50-1/2/21774fd9573021aa50a684e23cc96432)
Abstract:
Surveys were conducted in four agroecological zones in Uganda to catalogue wild host plants of lepidopteran stemborers. Among those sampled, Panicum maximum, Pennisetum purpureum, Pennisetum polystachion and Sorghum arundinaceum were selected for further studies on stemborer diversity and density. Overall, stemborer incidence was low (<10.8%) with the highest infestations on S. arundinaceum. Among the 11 borer species identified, there were seven

noctuids, two crambids, one pyralid and one unidentified cossid. The economically important crambid Chilo partellus and the noctuid Busseola fusca were mostly found on S. arundinaceum and were rare on the other three grass species. Braconid larval parasitoids were commonly obtained from C. partellus on S. arundinaceum and parasitoids of Sesamia spp. were most often found on P. purpureum. We concluded that in Uganda, with the exception of S. arundinaceum, wild grasses play a minor role in the seasonal persistence of C. partellus and B. fusca.
Keywords: Stemborers; Diversity; Wild host plants; Infestation; Parasitism

Olufunmi O. Olayinka, Kayode O. Adebowale, Bamidele I. Olu-Owolabi, Effect of heat-moisture treatment on physicochemical properties of white sorghum starch, Food Hydrocolloids, Volume 22, Issue 2, March 2008, Pages 225-230, ISSN 0268-005X, DOI: 10.1016/j.foodhyd.2006.11.004.
(http://www.sciencedirect.com/science/article/B6VP9-4N1SPC7-1/2/d1f00e1ef53d4913d4dca66e4403cbd6)
Abstract:
White sorghum starch was subjected to heat-moisture treatment (HMT) at moisture levels ranging from 18% to 27%. The treatments had a great impact on the physicochemical properties as studied with a rapid visco analyzer (RVA). The increase in onset temperature of viscosity development and the decrease in the peak viscosity observed with RVA as a consequence of HMTs were also attributed to the decrease in swelling power and solubility. The swelling power and solubility increased with increasing degree of alkalinity which revealed that they were pH dependent with higher values obtained at pH 12 in both native and modified starches. Water absorption capacity, oil absorption capacity and alkaline water retention of the starches were enhanced after HMT.
Keywords: White sorghum starch; Heat moisture treatment; Physicochemical properties

W.J. Fulkerson, A. Horadagoda, J.S. Neal, I. Barchia, K.S. Nandra, Nutritive value of forage species grown in the warm temperate climate of Australia for dairy cows: Herbs and grain crops, Livestock Science, Volume 114, Issue 1, March 2008, Pages 75-83, ISSN 1871-1413, DOI: 10.1016/j.livsci.2007.04.013.
(http://www.sciencedirect.com/science/article/B7XNX-4NVK21W-2/2/96ab720f0b335063b9d9906931ac4810)
Abstract:
The objective of this study was to quantify the nutritive characteristics of 6 grain crops and 4 herb forages over 4 seasons, when all species were grown at the same site, under the same climatic and edaphic conditions, and with soil moisture and nutrient availability being non-limiting to growth. The forages grown were maize (Zea mays), sorghum (Sorghum bicolor), millet (Pennisetum americana), wheat (Triticum aestivum), triticale (Triticum x secale), oats (Avena sativa), fodder radish (Raphanu sativa), rape (Brassica rapa), chicory (Cachorium intybus) and plantain (Plantago lanceolata). The in sacco degradation characteristics of organic matter (OM) and crude protein of herbages were measured in the rumen of cannulated sheep in order to calculate the availability of effective rumen degradable protein (ERDP), rumen by pass protein, metabolisable protein (MP) and the synchrony index (Is), which describes the efficiency of utilization of degradable nitrogen (N) and OM for microbial protein synthesis (MPS) in the rumen.
In this study, all grain crops except maize had a ERDP/fermentable metabolizable energy (FME) ratio varying from 14 for millet to 23 for wheat, well above the ratio of 11 required for optimum MPS in the rumen of dairy cows. In contrast, maize had the lowest ERDP/FME ratio of 3, indicating that ERDP would be limiting MPS in the rumen. The availability of MP varied from 58 g/kg DM in maize to 153 g/kg DM in wheat and all forage species except maize were be able to meet the MP requirement of high-producing dairy cows (30 L/milk/day) provided they were able to consume 11 to13 kg DM/cow/day of the forage.

The availability of MP from herbs varied from 95 g/kg DM in fodder radish to 163 g/kg DM in plantain, which would be sufficient for high-producing cows, however, most dairy cows could not consume sufficient forage to achieve these high levels of production due to very high nitrate content in rape (mean of 11.1 g/kg DM) and fodder radish (mean of 8 g/kg DM).
Keywords: Rumen degradability; Metabolizable protein; Herbs; Grain crops

A. Horadagoda, W.J. Fulkerson, I. Barchia, R.C. Dobos, K.S. Nandra, The effect of grain species, processing and time of feeding on the efficiency of feed utilization and microbial protein synthesis in sheep, Livestock Science, Volume 114, Issue 1, March 2008, Pages 117-126, ISSN 1871-1413, DOI: 10.1016/j.livsci.2007.04.016.
(http://www.sciencedirect.com/science/article/B7XNX-4NX8RRM-1/2/4073fd274225c0edab4e59f09527157b)
Abstract:
This study investigated the effect of cereal grain species (sorghum, wheat, oats and barley), extent of processing (cracked barley, finely ground barley, and wet whole barley) and time of feeding (barley grain mixed with ryegrass hay or fed 2 h before hay was fed), on whole tract dry matter digestibility (WTDMD), and microbial protein synthesis (MPS), as a supplement to ryegrass hay when fed to rumen-cannulated sheep.
Expected dry matter digestibility (EDMD) in mixtures of cereal grain and ryegrass hay was calculated by interpolation between in vitro dry matter digestibility (DMD) of each grain and the ryegrass hay. These were compared with measured actual WTDMD to detect positive or negative associative effects. Among grain species, the percentage difference in digestibility between actual WTDMD and EDMD was negative at - 6.6% units for wheat but positive at + 2.3%, + 4.3% and + 5.7% units for sorghum, oats, cracked or finely ground barley, respectively.
As expected, the supplementation of sheep fed ryegrass hay with different sources of carbohydrates increased urinary allantoin output (as an indicator of MPS) when compared to sheep fed ryegrass hay alone. The concentration of urinary allantoin was significantly higher in sheep supplemented with sorghum (1916 mg/sheep/day) than wheat, oats or cracked barley ([mean +/- S.E.M.] 1451 +/- 24 mg/sheep/day) grain. There was a significantly higher urinary allantoin concentration in sheep fed cracked barley compared to finely ground barley or wet whole barley (1479 vs. 1095 vs. 1031 mg/sheep/day, respectively). There was no significant ($P > 0.05$) difference in urinary allantoin output, expressed as output/kg DM intake, when cracked barley was mixed and fed with the hay or fed 2 h before hay. However, in terms of total output of allantoin this was significantly higher ($P < 0.05$) (1479 vs. 1209 mg/sheep/day).
In sacco degradability characteristics of organic matter and nitrogen for sorghum, oats, wheat, barley at different levels of processing and for ryegrass hay were also measured in the rumen of cannulated sheep.
Among grain species, wheat had the highest effective organic matter degradability in the rumen (78.1%) while sorghum had the lowest. The effective degradability of protein of finely ground barley in the rumen was found to be higher than cracked barley or wet whole barley.
Wheat grain, being highly degradable in the rumen, had a negative effect on WTDMD. In contrast, sorghum grain, being more slowly degradable in the rumen, would be expected to provide a substantially increased supply of energy to microbes over time in the rumen for MPS.
Both cracked barley and finely ground barley also had a positive associative effect on WTDMD when fed with ryegrass increasing it by 5.7% units. The MPS was significantly higher ($P < 0.05$) in sheep fed cracked barley compared to finely ground barley or wet whole barley. This supports the hypothesis that slowly degrading carbohydrate sources synchronise more closely with available N from degradation of forage in the rumen.
Keywords: Cereal grains; Allantoin; Microbial protein synthesis; Rumen degradability; In vivo digestibility

Marco Thines, Markus Goker, Sabine Telle, Malcolm Ryley, Kusum Mathur, Yaladabagi D. Narayana, Otmar Spring, Ram P. Thakur, Phylogenetic relationships of graminicolous downy mildews based on cox2 sequence data, Mycological Research, Volume 112, Issue 3, March 2008, Pages 345-351, ISSN 0953-7562, DOI: 10.1016/j.mycres.2007.10.010.
(http://www.sciencedirect.com/science/article/B7XMR-4R1MF8H-2/2/bca6e372af1de85c68106897192b053a)
Abstract:
Graminicolous downy mildews (GDM) are an understudied, yet economically important, group of plant pathogens, which are one of the major constraints to poaceous crops in the tropics and subtropics. Here we present a first molecular phylogeny based on cox2 sequences comprising all genera of the GDM currently accepted, with both lasting (Graminivora, Poakatesthia, and Viennotia) and evanescent (Peronosclerospora, Sclerophthora, and Sclerospora) sporangiophores. In addition, all other downy mildew genera currently accepted, as well as a representative sample of other oomycete taxa, have been included. It was shown that all genera of the GDM have had a long, independent evolutionary history, and that the delineation between Peronosclerospora and Sclerospora is correct. Sclerophthora was found to be a particularly divergent taxon nested within a paraphyletic Phytophthora, but without support. The results confirm that the placement of Peronosclerospora and Sclerospora in the Saprolegniomycetidae is incorrect. Sclerophthora is not closely related to Pachymetra of the family Verrucalvaceae, and also does not belong to the Saprolegniomycetidae, but shows close affinities to the Peronosporaceae. In addition, all GDM are interspersed throughout the Peronosporaceae s lat., suggesting that a separate family for the Sclerosporaceae might not be justified.
Keywords: Pennisetum glaucum; Peronosporaceae phylogeny; Sarga; Sorghum bicolour; Zea mays

J.S. Piotrowski, S.L. Morford, M.C. Rillig, Inhibition of colonization by a native arbuscular mycorrhizal fungal community via Populus trichocarpa litter, litter extract, and soluble phenolic compounds, Soil Biology and Biochemistry, Volume 40, Issue 3, March 2008, Pages 709-717, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2007.10.005.
(http://www.sciencedirect.com/science/article/B6TC7-4R34CNC-1/2/4740e5f529dd7232e760d41bc58b155c)
Abstract:
Controls on the colonization and abundance of arbuscular mycorrhizal fungi (AMF) in ecosystems are little understood and may be related to host factors, the fungal community, and soil physio-chemical properties; and changes in these variables during soil development may affect succession between mycorrhizal groups. Here we investigated the effects of litter, litter leachates, and common soluble phenolic compounds on AMF colonization of roots. In previous studies, we observed a negative correlation between increases in black cottonwood (Populus trichocarpa) litter and AMF abundance and inoculum potential along a riparian chronosequence in northwest Montana. From this, we hypothesized that litter inputs negatively affect the native AMF community and may contribute to the shift between AMF and ectomycorrhizas. We tested the effects of cottonwood foliage and litter extract additions on the colonization of AMF of both cottonwood and Sudan grass (Sorghum sudanese) seedlings. Addition of 5% (v/v) dried cottonwood leaves completely inhibited AMF colonization of S. sudanese. AMF colonization of S. sudanese was significantly reduced by litter extract of P. trichocarpa foliage, and colonization was negatively correlated with litter extract concentrations. Additions of aqueous litter extract significantly reduced AMF colonization of cottonwood seedlings as well. The effect of the litter extract on AMF colonization of S. sudanese did not appear to be mediated by changes in soil pH or plant biomass. Available phosphorus was higher in soil receiving highest concentration of litter extract, but not at a level expected to be inhibitory to AMF colonization. Litter additions significantly increased total soil phenolics, but with a range similar to natural soils of the Nyack floodplain. We tested pure

soluble phenolic compounds common to Populus for their effect on AMF colonization by native fungi from the Nyack floodplain. All tested compounds significantly reduced AMF colonization but did not affect colonization by non-AMF root-colonizing fungi. This suggests secondary compounds present in cottonwood litter can affect colonization ability of a native AMF community. The potential mechanisms of inhibition and the relevance of these findings to AMF succession within both a single host and soil are discussed.
Keywords: Arbuscular mycorrhizae; Litter leachates; Soil phenolics; Mycorrhizal succession; Populus

Mukesh Jain, Prem S. Chourey, Qin-Bao Li, Daryl R. Pring, Expression of cell wall invertase and several other genes of sugar metabolism in relation to seed development in sorghum (Sorghum bicolor), Journal of Plant Physiology, Volume 165, Issue 3, 18 February 2008, Pages 331-344, ISSN 0176-1617, DOI: 10.1016/j.jplph.2006.12.003.
(http://www.sciencedirect.com/science/article/B7GJ7-4N1SJK7-2/2/081885f33ff3c810ec3c3c4dbd0ce86f)
Abstract: Summary
We report expression profiles of several genes of carbohydrate metabolism, cell wall invertase (CWI) in particular, to better understand sugar transport and its utilization in developing caryopses of grain sorghum [Sorghum bicolor (L.) Moench]. Gene expression analyses for CWI using RNA gel blot and real-time quantitative PCR approaches on developing caryopses, including the glumes (maternal tissue appended to the seeds), showed expression of SbIncw (ZmIncw2 ortholog) primarily in the basal sugar unloading zone of endosperm. The expression of ZmIncw1 ortholog was significantly less abundant and restricted to the glumes. The protein and enzyme activity data corroborated the temporal transcript expression profile that showed maximal CWI protein (INCW) expression preceding the starch-filling phase of endosperm development, i.e. 6-12 d-after-pollination (DAP). Protein gel blot analysis using polyclonal maize INCW1 antibodies showed a single polypeptide of 72 kDa. The highest level of enzyme activity was unique to the basal part of the endosperm, in particular the basal endosperm transfer cell (BETC) layer and the maternal pedicel region that were highly enriched for the INCW protein, as seen by immunolocalization. High hexose-to-sucrose ratio in 6-12 DAP seeds, and negligible starch deposition in glumes corroborated the CWI activity data. Additionally, we report transcription profiles of several other genes related to sugar-to-starch metabolism in developing sorghum endosperm. As in maize, the INCW-mediated apoplastic cleavage of sucrose in the BETC and pedicel during the early developmental stages of caryopses is essential for the normal development of filial tissues. The unique cell-specificity of the INCW protein to both proximal and distal ends of placental sac shown here for the first time is likely to greatly increase uptakes of both hexose sugars and water through turgor sensing into developing seed. This trait is unique to sorghum among cereals and may facilitate its survival in drought environment.
Keywords: Caryopsis development; Cell wall invertase; Sugar-to-starch transition; Sugar unloading

J.-H. Chung, J.-A. Han, B. Yoo, P.A. Seib, S.-T. Lim, Effects of molecular size and chain profile of waxy cereal amylopectins on paste rheology during retrogradation, Carbohydrate Polymers, Volume 71, Issue 3, 8 February 2008, Pages 365-371, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2007.05.018.
(http://www.sciencedirect.com/science/article/B6TFD-4NXHCC0-1/2/45c3525ed9c41a9c6eb36497c7efdce2)
Abstract:
Amylopectins were purified from five waxy cereal starches (corn, sorghum, barley, wheat, and rice) in amorphous state by ethanol precipitation from dimethyl-sulfoxide (DMSO) solution followed by removing any amylose complexes with butanol in water. Their molecular weights (Mw) were determined by size-exclusion chromatography in tandem with multi-angle laser light scattering and

refractive index detectors. Chain length distributions were determined by debranching followed by size-exclusion chromatography coupled with a refractive index detector. Amylopectin pastes (15% dry solids) were also analyzed using a dynamic rheometer while cooling to 4 [degree sign]C and storing for 20 days, and the relations between the structural and rheological characteristics were investigated. The weight-average molecular weights (Mw) of the waxy cereal amylopectins ranged from 204.4 x 106 to 344.4 x 106 g/mol, and the average chain length (CLw) ranged from 26.8 to 30.4. Among the tested starches, waxy rice had the largest amylopectin molecules and the longest B [greater-or-equal, slanted] 2 chains. The order of chain length of B [greater-or-equal, slanted] 2 chains among the samples were waxy rice > waxy corn = waxy sorghum > waxy barley = waxy wheat. But there were no difference in the CLw of total chains among the amylopectins. Storage (G') and loss (G'') moduli of amylopectin pastes (15% solids) significantly increased during the cooling period from 95 to 4 [degree sign]C, which was more than the increase during cold storage for 20 days at 4 [degree sign]C. Among the waxy samples, waxy rice displayed the greatest moduli increases both during the initial cooling and during the cold storage. Among the structural parameters measured, the Mw of amylopectin and CLw of B [greater-or-equal, slanted] 2 chains correlated positively with complex modulus(G*) increases.
Keywords: Amylopectin; Molecular weight; Chain profile; Rheology; Retrogradation

E. Zahran, J. Sauerborn, A.A. Abbasher, E.A. Ahmed, R.I. Mohukker, P. Karlovsky, E.A. Mohamed, D. Muller-Stover, 'Pesta' and alginate delivery systems of Fusarium spp. for biological control of Striga hermonthica (Del.) Benth. under Sudanese field conditions, Biological Control, Volume 44, Issue 2, February 2008, Pages 160-168, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2007.10.025.
(http://www.sciencedirect.com/science/article/B6WBP-4R29FK9-1/2/07197032e05ca70ae847e90dff0f8729)
Abstract:
The parasitic weed, Striga hermonthica, is one of the main biotic factors affecting cereal production in the semi-arid tropics. Field experiments were conducted at Gezira, Sudan, in two consecutive seasons (2003/2004), to study the efficacy of two Fusarium isolates originating from Sudan (Fusarium nygamai (FN) and Fusarium sp.'Abuharaz' (FA)) formulated in wheat flour-kaolin granules on Striga infestation and to determine the dose needed for effective weed control. Furthermore, an alginate formulation was tested as alternative delivery system. In the first season the highest control efficacy was achieved by applying FA in 'Pesta' granules at 1.5 g per planting hole, which reduced the total number of parasite shoots by 82% and the number of healthy Striga shoots by 88% compared to the untreated control. As a consequence, sorghum biomass and sorghum 100-seed weight were increased by 88% and 110%, respectively, compared to the untreated control. FN and the combination of the fungal isolates were slightly less efficient in controlling the parasites. During the second season all preparations applied at 1.5 g per planting hole showed a lower efficacy in reducing Striga total number compared to the first season. Nevertheless, FA formulated in 'Pesta' or alginate pellets caused disease in 74% and 80% of the Striga plants, respectively, and consequently improved sorghum performance.
Keywords: Striga hermonthica; Parasitic weeds; Fusarium mycoherbicide; Formulation

Jose E. Sanchez, Laura Mejia, Daniel J. Royse, Pangola grass colonized with Scytalidium thermophilum for production of Agaricus bisporus, Bioresource Technology, Volume 99, Issue 3, February 2008, Pages 655-662, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.11.067.
(http://www.sciencedirect.com/science/article/B6V24-4N55TFB-1/2/f2af9a926e3cbbff2993ebe279cd8f88)
Abstract:
This work had the dual objective of selecting a substrate for rapid mycelial growth of Scytalidium thermophilum and then comparing the growth and production of a brown variety of Agaricus

bisporus on substrate non-colonized and colonized with S. thermophilum. Mycelial growth of S. thermophilum at 45 [degree sign]C was significantly greater on potato dextrose yeast extract agar (0.58 mm/h) as compared to malt extract glucose agar (0.24 mm/h) and yeast extract glucose agar (0.44 mm/h). On cereal grain, S. thermophilum grew significantly faster on rice (0.31 mm/h) compared to sorghum (0.22 mm/h) and millet (0.18 mm/h). It also grew faster on Pangola grass (0.49 mm/h) compared to corncobs (0.30 mm/h) and sawdust (0.18 mm/h). Colonization of Pangola grass with S. thermophilum was influenced by the addition of calcium salts in the form of gypsum, hydrated lime and ground limestone. For production of A. bisporus, biological efficiency (BE) on pasteurized Pangola grass pre-colonized by S. thermophilum for 4 days at 45 [degree sign]C was more than twice (26.4%) that on grass non-colonized by S. thermophilum (11.0%). The addition of 2% hydrated lime to Pangola grass prior to colonization by S. thermophilum resulted in an additional doubling of BE of mushroom production (48.1%). These results show the possibility of developing a non-composted substrate method for producing A. bisporus without autoclaving the substrate.
Keywords: Portobello cultivation; Digitaria decumbens; Non composted substrate; Edible mushrooms; Mushroom production

Michael Dingkuhn, Mamoutou Kouressy, Michel Vaksmann, Benoit Clerget, Jacques Chantereau, A model of sorghum photoperiodism using the concept of threshold-lowering during prolonged appetence, European Journal of Agronomy, Volume 28, Issue 2, February 2008, Pages 74-89, ISSN 1161-0301, DOI: 10.1016/j.eja.2007.05.005.
(http://www.sciencedirect.com/science/article/B6T67-4P83D9X-1/2/e9927c60b7ca938ef5f6d180ada71aeb)
Abstract:
Effects of photoperiod (PP) on panicle initiation (PI) of West African sorghums are essential for the crop's agro-ecological adaptation, but not well understood. Conventional models based on fixed PP thresholds (qualitative response) or additive signal accumulation (qualitative response) are able to predict flowering for only a limited range of conditions. Recently, an alternative concept was proposed based on thresholds that vary with plant age. Using this concept, this study develops a generic model of PP response of sorghum called 'Impatience' because it implements decreasing day length requirements during prolonged wait states, or appetence, during the photoperiod sensitive phase (PSP).
The model was applied to experimental field data obtained from sowing date experiments in Mali, in order to validate it and evaluate the range of genotypic response that can be explained with it. It predicted accurately the observations that (1) PI does not occur at any genotype specific day length, but instead, on increasingly long days as the PSP is extended; (2) PI occurs predominantly when day length decreases, or after summer solstice; (3) the duration of PSP increases linearly (but not always proportionally) when crops are sown earlier in the year; (4), a genotype specific sowing date exists in winter (cool season) or spring (hot dry season) after which PSP suddenly increases by up to 160 days ('break point'); (5), the largest variance of PSP occurs near the break point. Most genotypic variations of this complex pattern could be simulated by fitting only one of the four model parameters while using default values for the three other parameters. However, the model tended to underestimate the duration of PSP when it fell into the cool season, which might be explained by specific thermal effects or a specific inhibitory effect of increasing day length on PI in some genotypes.
The ability of the model to discriminate among genotypes was used to devise a simple, model assisted phenotyping methodology. Genotypic parameters were determined by fitting two model parameters to measured dates of flag leaf ligule appearance for three sowing dates. Thus parameterized, the model predicted accurately the phenological patterns of contrasting materials observed in different experiments. The authors discuss the physiological probability of the model's

underlying concepts, the need for further studies to develop them into a comprehensive theory, and possible applications in crop simulation and varietal selection.
Keywords: Phenology; Panicle initiation; Flowering; Agro-ecological adaptation; Photoperiod sensitive phase (PSP); Temporal escape; Phenotyping methodology

Gilles Lemaire, Erik van Oosterom, Marie-Helene Jeuffroy, Francois Gastal, Angelo Massignam, Crop species present different qualitative types of response to N deficiency during their vegetative growth, Field Crops Research, Volume 105, Issue 3, 1 February 2008, Pages 253-265, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.10.009.
(http://www.sciencedirect.com/science/article/B6T6M-4R8KT4B-3/2/9940b3bf23269b0903bc5bf37aac6ee3)
Abstract:
Crops respond to N deficiency through a reduction in resource capture and/or resource use efficiency. The objective of this paper is to examine whether differences in this response pattern are associated with either metabolic group (C3 vs. C4) or botanical classification (mono- vs. dicotyledons). Hereto, we analysed the effect of N deficiency on the relationships between N uptake, LAI, and biomass accumulation, for maize, sorghum, wheat, canola, tall fescue, and sunflower, grown in experiments in either France or Australia. Maize and tall fescue maintained LAI per unit biomass (measure of resource capture) at the expense of N uptake per unit LAI (measure of resource use efficiency). Wheat and canola had the opposite response, whereas sunflower and sorghum were intermediate. In general, C4 species reduced N uptake per unit LAI more than C3 species. Species differences in the effect of N deficiency on resource use efficiency were associated with differences in the SLN or in the N storage capacity of the stems. For wheat, canola, and tall fescue, SLN declined with increasing LAI under high N conditions, and the minimum crop SLN under N deficiency was only marginally lower than under high N conditions. For sorghum, sunflower, and maize, crop SLN under high N changed little with increasing LAI, but the minimum crop SLN under N deficiency was considerably lower than under high N. Sorghum and maize were the only species that substantially decreased stem N uptake per unit LAI under N deficiency. Overall, our data suggest that C3 species are better able to maintain resource use efficiency under N stress than C4 species, and a survey of literature suggests this may be because in C4 species, the critical SLN for radiation use efficiency is higher than the critical SLN for leaf expansion, whereas the opposite is the case for C3 species. We hypothesise that species differences in response to N deficiency could be associated with these differences in critical SLN, which in turn could be a consequence of the lower photosynthetic nitrogen use efficiency of C3 crops.
Keywords: Critical nitrogen level; Dry mass; Leaf area index; Nitrogen deficiency; Nitrogen uptake; Resource capture; Resource use efficiency; Stress response

K.P. Yashoda, V.K. Modi, R. Jagannatha Rao, N.S. Mahendrakar, Eggs chips prepared by using different millet flours as binders and changes in product quality during storage, Food Control, Volume 19, Issue 2, February 2008, Pages 170-177, ISSN 0956-7135, DOI: 10.1016/j.foodcont.2007.03.005.
(http://www.sciencedirect.com/science/article/B6T6S-4NC4M86-2/2/fe237f95499f6b00e3aca80129d820bd)
Abstract:
Whole liquid egg was homogenized and mixed with optimized quantities of refined wheat flour, rice flour, corn starch, spices, salt and millet flour, viz., pearl millet (Pennisetum vulgare), barley (Hordeum vulgare), or sorghum (Sorghum vulgare). The dough was flattened in to 2-3 mm thick sheet, cut in to 2.5 x 3 cm strips and fried in refined sunflower oil to obtain ready-to-eat egg chips. The cooled chips were packed in metalised polyester bags, sealed with air or nitrogen-gas, and stored at ambient temperature (27 +/- 2 [degree sign]C) for 4 months. Inclusion of barley flour

caused lowest fat content (14.9%) and water activity (aw = 0.38). Decrease in pH (6.3-6.5 to 5.6-6.0), crispiness (11.3-15.4 to 7.8-13.1 N), sensory quality scores (6.8-8.8 to 5.2-7.9) and increase in aw (0.38-0.46 to 0.44-0.55), free fatty acids (FFA) (0.17-0.32 to 0.83-1.76 as % oleic), thiobarbituric acid (TBA) values (0.62-0.75 to 1.46-2.13 mg malonaldehyde/kg) were noticed in fried egg chips during storage at 27 +/- 2 [degree sign]C. Hunter colour values were marginally affected. Low standard plate counts (1.7-2.9 log cfu/g) and spore counts (1.2-1.6 log cfu/g) and absence of yeasts and moulds, colifoms, staphylococci and enterococci throughout the storage period ensured the microbiological safety of egg chips. All the products were sensorily acceptable during storage up to 4 months and barley egg chips, however, were judged superior by the panelists compared to chips containing pearl millet or sorghum flours.
Keywords: Egg chips; Millet flours; Binders; Rancidity; Microbial quality; Sensory quality

Evariste Comlan Simon Mitchikpe, Romain A.M. Dossa, Eric-Alain D. Ategbo, Joop M.A. van Raaij, Paul J.M. Hulshof, Frans J. Kok, The supply of bioavailable iron and zinc may be affected by phytate in Beninese children, Journal of Food Composition and Analysis, Volume 21, Issue 1, February 2008, Pages 17-25, ISSN 0889-1575, DOI: 10.1016/j.jfca.2007.06.006.
(http://www.sciencedirect.com/science/article/B6WJH-4P59X64-2/2/6a5cfb8c4f6527a52b0de31f9021e987)
Abstract:
Food composition data are important for estimating energy and nutrient intakes. The objectives of this study were, first, to evaluate the proximate and inorganic composition of foods eaten in northern Benin and second, to estimate the potentially inhibiting effect of phytate on iron and zinc bioavailability. Chemical analyses were performed in 23 samples of most frequently consumed foodstuffs collected from retailers in local markets. Proximate composition was analysed by routine methods. Inorganic constituents and phytate were analysed using ICP-AES and HPLC. Protein contents were in agreement with those in FAO food composition database. Fat and fibre were in general higher whereas carbohydrate and energy were lower. Differences were mainly due to analytical or calculation methods. The most important sources of iron and zinc in children's diets were maize, sorghum and millet. In these cereals, iron and zinc ranged from 2.6 to 8.4 and 2.2 to 3.4 mg/100 g, respectively. Phytate ranged from 104 to 503 mg/100 g. Phytate/iron and phytate/zinc molar ratios ranged from 1 to 11 and 3 to 22, respectively. They suggest poor iron and zinc bioavailability. Reducing phytate and polyphenol contents in order to improve iron and zinc bioavailability from the most frequently consumed cereal food needs to be studied.
Keywords: Proximate composition; Inorganic constituents; Phytate; Iron and zinc bioavailability; Benin

Christine K.Y. Yu, Chun-Hat Shih, Ivan K. Chu, Clive Lo, Accumulation of trans-piceid in sorghum seedlings infected with Colletotrichum sublineolum, Phytochemistry, Volume 69, Issue 3, February 2008, Pages 700-706, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2007.09.012.
(http://www.sciencedirect.com/science/article/B6TH7-4R05JBK-1/2/93e1983a180308b425a02b11641acf12)
Abstract:
Sorghum SbSTS1, a pathogen inducible gene, was previously demonstrated to encode an enzyme with stilbene synthase activity. In this study, we attempt to identify the stilbene derivatives that accumulate in infected sorghum seedlings after inoculation with the anthracnose pathogen Colletotrichum sublineolum. Scanning for precursor ions that produced the common stilbene aglycones as diagnostic ions was performed in a triple quadrupole mass spectrometer. It was found that infected sorghum seedlings accumulated trans-piceid as the major stilbene metabolite together with an unknown resveratrol derivative. Time-course accumulation of trans-piceid was examined in two sorghum cultivars, DK18 and DK77, which are resistant and susceptible to C. sublineolum, respectively. In both cultivars, trans-piceid was not detected until 48 h after

inoculation, consistent with the late induction of SbSTS1 reported previously in infected sorghum plants. The levels of trans-piceid detected in DK77 seedlings were approximately three times the levels detected in DK18 seedlings at 120 h after inoculation. In vitro assays demonstrated that trans-piceid did not exhibit significant toxicity on conidial germination and mycelial growth of C. sublineolum. Hence trans-piceid alone may not represent an important defense component against the anthracnose pathogen in sorghum seedlings.
Keywords: Anthracnose; Colletotrichum sublineolum; Sorghum bicolor; Poaceae; Precursor ion scan; Stilbene glycosides; Stilbene synthase; trans-Piceid

Edilegnaw Wale, A study on financial opportunity costs of growing local varieties of sorghum in Ethiopia: Implications for on-farm conservation policy, Ecological Economics, Volume 64, Issue 3, 15 January 2008, Pages 603-610, ISSN 0921-8009, DOI: 10.1016/j.ecolecon.2007.04.005.
(http://www.sciencedirect.com/science/article/B6VDY-4NP9KG3-1/2/3630d1620dfcba8d2408603eb2600d09)
Abstract:
The increasing interest in on-farm conservation is driven by its diverse attractive features -- its participatory nature and its flexible and dynamic features; its capacity to maintain not only crop diversity but the knowledge that evolves with it; and the chance it offers to link conservation with utilization and farmers' livelihoods. To implement this strategy on a sustainable basis, policy incentives are crucial. This paper argues that opportunity costs farmers face have a role to play to design sound policy incentives. Taking sorghum as an example, opportunity costs have been examined in this paper using data collected from 198 farmers in Eastern Ethiopia. The average opportunity costs suggest the size of the required policy incentives and they are the basis to estimate the national conservation costs for on-farm conservation. The regression analysis shows that opportunity costs increase with access to output markets and extension, output price, access to input supply, experience in growing improved varieties, and the relative importance of the crop. On the contrary, plot quality, input price, and oxen ownership are reducing the opportunity costs. The paper then concludes outlining the policy implications of the empirical findings to incentive design for on-farm conservation.
Keywords: On-farm conservation; Opportunity costs; Incentive design; Crop genetic resources; Ethiopia

W.W. Immerzeel, A. Gaur, S.J. Zwart, Integrating remote sensing and a process-based hydrological model to evaluate water use and productivity in a south Indian catchment, Agricultural Water Management, Volume 95, Issue 1, January 2008, Pages 11-24, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.08.006.
(http://www.sciencedirect.com/science/article/B6T3X-4R1NNFK-1/2/29e86a270b35e73227dbb7f848db1e6a)
Abstract:
The combined use of remote sensing and a distributed hydrological model have demonstrated the improved understanding of the entire water balance in an area where data are scarcely available. Water use and crop water productivity were assessed in the Upper Bhima catchment in southern India using an innovative integration of remotely sensed evapotranspiration and a process-based hydrological model. The remote sensing based Surface Energy Balance Algorithm for Land (SEBAL) was used to derive an 8 month time series of observed actual evapotranspiration from October 2004 to May 2005. This dataset was then used in the calibration of the Soil and Water Assessment Tool (SWAT). This hydrological model was calibrated by changing 34 parameters to minimize the difference between simulated and observed actual evapotranspiration. The calibration efficiency was assessed with four different performance indicators. The calibrated model was used to derive a monthly basin water balance and to assess crop water productivity and crop water use for the irrigation year 2004-2005. It was found that evapotranspiration is the

largest water loss in the catchment and total evaporative depletion was 38,172 Mm3 (835 mm). Of the total evaporative depletion 42% can be considered as non-beneficial and could be diverted to other beneficial utilization. Simulated crop water productivities for sugarcane, sorghum and winter wheat are relatively high at 2.9 kg/m3, 1.3 kg/m3 and 1.3 kg/m3, respectively. The frequency distributions of crop water productivity are characterised by low coefficient of variation, yielding limited scope for improvement in the agricultural areas under the current cropping systems. Further improvements in water productivity may however be achieved by shifting the crop base from sugarcane to a dual crop and introducing a fallow period from March to May or by converting non-productive rangelands to bio fuel production or other agricultural land uses.
Keywords: SWAT; SEBAL; Calibration; Crop water productivity; Evapotranspiration; Water balance

D.R. Miller, R. Elliott, B.W. Norton, Effects of an exogenous enzyme, Roxazyme(R) G2 Liquid, on digestion and utilisation of barley and sorghum grain-based diets by ewe lambs, Animal Feed Science and Technology, Volume 140, Issues 1-2, 1 January 2008, Pages 90-109, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.02.008.
(http://www.sciencedirect.com/science/article/B6T42-4NDDT0S-1/2/865184e6b517b9a9ba95f5e50a0fa81c)
Abstract:
A study was conducted to determine effects of a predominantly xylanase/endoglucanase exogenous enzyme (EE) product on digestion and production characteristics of growing lambs (25.3 kg) fed barley or sorghum grain-based diets. Dorset cross ewe lambs were allocated within four liveweight (LW) block groups to one of eight treatments (2 x 4 factorial design) comprising either whole barley or cracked sorghum grain diets (630 g/kg, DM basis) treated with one of four levels of a concentrate applied EE (0, 1.22, 4.88 and 9.76 ml/kg ration DM). Dietary digestibility was determined 4 and 8 weeks after EE treatments commenced and the lambs were fed for 84 d (until average LW > 40 kg). Compared with lambs fed barley-based diets, the lambs fed sorghum-based diets had superior ($P<0.05$) feed conversion to LW (7.13 and 5.80 kg as fed/kg, respectively) and daily wool growth, although average daily LW gain (172 g) was not affected by diet. Supplementing lambs with EE did not change voluntary feed intakes or total tract digestibility of NDF and starch compared to the lambs fed EE untreated diets. Lambs fed the sorghum diet exhibited a linear increase in total tract ADF digestibility with increasing rate of EE treatment and N balance also increased linearly, potentially due to improved ruminal protein availability. However EE supplementation did not improve lamb performance in terms of LW gain, feed conversion efficiency or wool growth.
Keywords: Enzymes; Digestibility; Barley; Sorghum; Lambs; Growth

Georgia Antonopoulou, Hariklia N. Gavala, Ioannis V. Skiadas, K. Angelopoulos, Gerasimos Lyberatos, Biofuels generation from sweet sorghum: Fermentative hydrogen production and anaerobic digestion of the remaining biomass, Bioresource Technology, Volume 99, Issue 1, January 2008, Pages 110-119, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.11.048.
(http://www.sciencedirect.com/science/article/B6V24-4MWXT6W-3/2/f6b729932dfece7cf8d6e7087c6b636c)
Abstract:
The present study focuses on the exploitation of sweet sorghum biomass as a source for hydrogen and methane. Fermentative hydrogen production from the sugars of sweet sorghum extract was investigated at different hydraulic retention times (HRT). The subsequent methane production from the effluent of the hydrogenogenic process and the methane potential of the remaining solids after the extraction process were assessed as well. The highest hydrogen production rate (2550 ml H2/d) was obtained at the HRT of 6 h while the highest yield of hydrogen produced per kg of sorghum biomass was achieved at the HRT of 12 h (10.4 l H2/kg sweet sorghum). It has been proved that the effluent from the hydrogenogenic reactor is an ideal substrate for methane

production with approximately 29 l CH4/kg of sweet sorghum. Anaerobic digestion of the solid residues after the extraction process yielded 78 l CH4/kg of sweet sorghum. This work demonstrated that biohydrogen production can be very efficiently coupled with a subsequent step of methane production and that sweet sorghum could be an ideal substrate for a combined gaseous biofuels production.
Keywords: Biofuels; Fermentation; Hydrogen; Methane; Sweet sorghum

T.E. Stathers, W. Riwa, B.M. Mvumi, R. Mosha, L. Kitandu, K. Mngara, B. Kaoneka, M. Morris, Do diatomaceous earths have potential as grain protectants for small-holder farmers in sub-Saharan Africa? The case of Tanzania, Crop Protection, Volume 27, Issue 1, January 2008, Pages 44-70, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.04.020.
(http://www.sciencedirect.com/science/article/B6T5T-4P5RKJM-1/2/8911c1e60d43e694b13ef2feaa4528cf)
Abstract:
Participatory on-farm field trials were set up over three storage seasons, from 2002 to 2005, in different agroecological zones of Tanzania to compare the efficacy of the enhanced diatomaceous earths (DEs) Protect-It(R) and Dryacide(R) alone or combined with the pyrethroid permethrin. Other treatments included three commercially available synthetic chemical dilute dusts, containing 1.6% pirimiphos-methyl and 0.3% permethrin (Actellic Super and Stocal Super from different manufacturers) and 1% fenitrothion and 0.13% deltamethrin (Shumba Super); traditional protectants; and a locally available DE collected from Kagera in north-west Tanzania. Treatments were applied to maize and sorghum grain and dried beans. Insect pests are the main threat during storage, which in Tanzania includes the devastating larger grain borer, Prostephanus truncatus. All the grain protectants, except the traditional ones, kept damage incidence well below that of the untreated controls, and usually below 10% for periods of 40 weeks of storage. Exceptions occurred when grain was badly infested prior to treatment, in which case Actellic Super dust was more effective than the DEs. Very little difference in damage was observed between the DE treatments until 40 weeks of storage. In addition to the commercially available synthetic grain protectants, Protect-It(R) 0.25% w/w or Protect-It(R) 0.1% w/w plus permethrin at 2 mg/kg can be recommended to protect dry un-infested, winnowed maize and sorghum grain that is to be stored on-farm in sacks or woven granary baskets for periods of 4 months or more in Tanzania. Beans can be protected with lower application rates of Protect-It(R) 0.05% w/w or Dryacide(R) 0.1% w/w. The study also demonstrated that Actellic Super dust obtained from an approved source and applied according to the manufacturer's recommendations is effective in protecting stored maize, sorghum and beans for periods of at least 40 weeks--contrary to many of the suggestions that this product is no longer effective in Tanzania.
Keywords: Diatomaceous earths; Food security; Pest management; Post-harvest; Rural livelihoods; Maize; Sorghum; Beans; Prostephanus truncatus; African diatomaceous earths; Combinations

Joseph M. Awika, Behavior of 3-deoxyanthocyanidins in the presence of phenolic copigments, Food Research International, Volume 41, Issue 5, 2008, Pages 532-538, ISSN 0963-9969, DOI: 10.1016/j.foodres.2008.03.002.
(http://www.sciencedirect.com/science/article/B6T6V-4S1C2N9-2/2/55e9ce7376a3ff77bc26302caf19b091)
Abstract:
Anthocyanin stability and color intensity are generally improved in the presence of copigments in moderately acidic environments. The 3-deoxyanthocyanins on the other hand are fairly stable to color loss due to change in pH. It is unknown, therefore, how they behave in the presence of copigments. We studied the effects of common phenolic copigments, tannic, ferulic, and O-coumaric acids, and rutin on behavior and stability of six 3-deoxyanthocyandins over 4.5 months.

Tannic and ferulic acid produced the most significant bathochromic shift, whereas rutin had no bathochromic effect. None of the copigments produced a significant hyperchromic shift with the pigments, implying colored species of the pigments were predominant under conditions used. Ferulic and tannic acids were the most effective at improving color stability of 5-hydroxylated pigments, whereas tannic acid and rutin improved the stability of 5-methoxylated pigments the most. Substitution at C-5 was key to overall behavior of the 3-deoxyanthocyanidins.
Keywords: Anthocyanin stability; 3-Deoxyanthocyanin structure; Copigmentation; Phenolic compounds; Sorghum

Marisol T. Berti, Burton L. Johnson, Seed germination response of cuphea to temperature, Industrial Crops and Products, Volume 27, Issue 1, January 2008, Pages 17-21, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2007.05.004.
(http://www.sciencedirect.com/science/article/B6T77-4P77G55-1/2/70a97e17ae71af4e0b36ae480af71326)
Abstract:
Cuphea (Cuphea viscosissima Jacq. x C. lanceolata W.T. Aiton; PSR23) is a potential new oilseed crop. Its oil is high in medium-chain fatty acids that are suitable for detergent/cleaner applications and also for cosmetics. The objective of this study was to determine the critical temperatures for cuphea seed germination. To determine the base, maximum, and optimum temperatures for seed germination, mature cuphea seeds were harvested from plants grown at Prosper, ND, in 2004, 2005, and 2006. Seeds were germinated on a temperature-gradient bar varying between 5 and 35 [degree sign]C. Cumulative germination was calculated for each temperature treatment. Base temperature (Tb) and optimum temperature (To) were estimated from the third-order polynomial temperature-response functions for each year. In addition, germination rate per day was used in a linear model to estimate the base temperature below which germination rate was equal to zero (Tb), and the maximum temperature above which germination was equal to zero (Tm). The optimum temperature (To) was calculated as the intercept of sub-optimal and supra-optimal temperature-response functions. Through the third-order polynomial temperature-response functions and the sub-optimal/super-optimal intercept approaches, we were able to generate six estimates for each critical value. Estimates of the base temperature for cuphea seed germination ranged between 3.3 and 11 [degree sign]C, with the most reliable estimates between 6 and 10 [degree sign]C, similar to many warm-season crops such as corn (Zea mays L.) and sorghum (Sorghum bicolor L.). The optimum temperature for cuphea seed germination ranged between 18.5 and 24 [degree sign]C with a mean value of 21 [degree sign]C. The maximum temperature for seed germination ranged 33-38 [degree sign]C. On this basis, a cuphea planting date after 20 May is recommended for east-central North Dakota.
Keywords: Medium-chain-length fatty acids; Cardinal temperatures; Germination rate

Seok-Ho Park, Frank H. Arthur, Scott R. Bean, Tilman J. Schober, Impact of differing population levels of Rhyzopertha dominica (F.) on milling and physicochemical properties of sorghum kernel and flour, Journal of Stored Products Research, Volume 44, Issue 4, 2008, Pages 322-327, ISSN 0022-474X, DOI: 10.1016/j.jspr.2008.02.008.
(http://www.sciencedirect.com/science/article/B6T8Y-4SV12RP-1/2/02c859c92955f383a7d7661b11b06190)
Abstract:
The effects of different population levels of Rhyzopertha dominica (F.), the lesser grain borer, on physiochemical properties of sorghum kernels and flour, were investigated through a laboratory study at 27 and 32 [degree sign]C, and 57% relative humidity. Initial population level and temperature, and their interaction, were significant for the number of F1 progeny and feeding damage ($P<0.01$). A strong positive correlation was also found between initial population size, number of F1 progeny, percentage of insect-damaged kernels (IDKs) and feeding damage. The

impact of R. dominica on the milling quality of sorghum was seen through a reduction in abrasive hardness, milling yield, and kafirin content. Initial population and temperature affected most pasting properties, and overall pasting viscosity increased with initial population, number of F1 progeny, and percentage of IDK at 32 [degree sign]C. Results show that R. dominica can potentially impact the milling quality of sorghum and also alter the physicochemical properties of sorghum flour.
Keywords: Sorghum; Rhyzopertha dominica; Susceptibility; Kafirin content; Pasting property; Milling property

Noureddin Bouayad, Kacem Rharrabe, Naima Ghailani, Fouad Sayah, Effects of different food commodities on larval development and [alpha]-amylase activity of Plodia interpunctella (Hubner) (Lepidoptera: Pyralidae), Journal of Stored Products Research, Volume 44, Issue 4, 2008, Pages 373-378, ISSN 0022-474X, DOI: 10.1016/j.jspr.2008.02.012.
(http://www.sciencedirect.com/science/article/B6T8Y-4T5JPD2-1/2/1374533374a23d0abecf6f767781e669)
Abstract:
The present work was undertaken to study the influence of four commodities (wheat flour, dates, sorghum and barley) on Plodia interpunctella post-embryonic development. Larval weight, larval mortality, pupation and adult emergence were recorded. The study also aimed to find out the effect of these commodities on protein and glycogen production as well as on [alpha]-amylase activity. Results indicated that the weight of fourth instar larvae placed on dates increased gradually. Percentage mortality was low. Pupation and adult emergence were delayed. In contrast, the weight of larvae placed on wheat flour, sorghum or barley remained low. Pupation and adult emergence occurred sooner than among those placed on dates and the percentage mortality was highest for larvae placed on barley. Results also showed that protein content and [alpha]-amylase activity were lower for larvae placed on dates than for those placed on other commodities. The biochemical composition of different commodities showed that dates are a rich source of glucose, while their protein and starch contents were very low as compared to the other commodities. In contrast, wheat flour, sorghum and barley contained large amounts of starch and protein and low amounts of glucose. Thus, the reduction in [alpha]-amylase activity was probably due to the high levels of glucose in dates.
Keywords: Plodia interpunctella; Post-embryonic development; Dates; Wheat flour; Sorghum; Barley; Starch; Glucose; [alpha]-amylase

Kirsten Annette Nielsen, David B. Tattersall, Patrik Raymond Jones, Birger Lindberg Moller, Metabolon formation in dhurrin biosynthesis, Phytochemistry, Volume 69, Issue 1, January 2008, Pages 88-98, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2007.06.033.
(http://www.sciencedirect.com/science/article/B6TH7-4PF0XDC-2/2/6336a76e6f928b8d75544ce6bec1fda8)
Abstract:
Synthesis of the tyrosine derived cyanogenic glucoside dhurrin in Sorghum bicolor is catalyzed by two multifunctional, membrane bound cytochromes P450, CYP79A1 and CYP71E1, and a soluble UDPG-glucosyltransferase, UGT85B1 (Tattersall, D.B., Bak, S., Jones, P.R., Olsen, C.E., Nielsen, J.K., Hansen, M.L., Hoj, P.B., Moller, B.L., 2001. Resistance to an herbivore through engineered cyanogenic glucoside synthesis. Science 293, 1826-1828). All three enzymes retained enzymatic activity when expressed as fluorescent fusion proteins in planta. Transgenic Arabidopsis thaliana plants that produced dhurrin were obtained by co-expression of CYP79A1/CYP71E1-CFP/UGT85B1-YFP and of CYP79A1/CYP71E1/UGT85B1-YFP but not by co-expression of CYP79A1-YFP/CYP71E-CFP/UGT85B1. The lack of dhurrin formation upon co-expression of the two cytochromes P450 as fusion proteins indicated that tight interaction was necessary for efficient substrate channelling. Transient expression in S. bicolor epidermal cells as monitored by confocal

laser scanning microscopy showed that UGT85B1-YFP accumulated in the cytoplasm in the absence of CYP79A1 or CYP71E1. In the presence of CYP79A1 and CYP71E1, the localization of UGT85B1 shifted towards the surface of the ER membrane in the periphery of biosynthetic active cells, demonstrating in planta dhurrin metabolon formation.
Keywords: Cytochrome P450; Glucosyltransferases; Multienzyme complexes; Green fluorescent protein; Dhurrin; Cyanogenic glucosides; CYP79A1; CYP71E1; UGT85B1

Q.W. Zhan, T.Z. Zhang, B.H. Wang, J.Q. Li, Diversity comparison and phylogenetic relationships of S. bicolor and S. sudanense as revealed by SSR markers, Plant Science, Volume 174, Issue 1, January 2008, Pages 9-16, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2007.09.007.
(http://www.sciencedirect.com/science/article/B6TBH-4PRYFRY-1/2/17d0e990eab7227bc51fcad9a2d00032)
Abstract:
Phylogenetic relationships among 48 accessions of sorghum (Sorghum bicolor), sudangrass (S. sudanense) and their relatives (S. propinquum, S. halepense, Zea mexicana, Z. mays) were investigated using SSR markers. The 91 SSR primer pairs generated a total of 723 polymorphic alleles, with an average of 7.945 alleles per locus, and a range of 2-19 alleles. The average genetic diversity, as measured by the polymorphic information content (PIC), was 0.783. The average polymorphic rates were 84.530% and 78.483% within sorghum and sudangrass, respectively. The PIC values were 0.774 and 0.770, respectively, and there was no significant difference ($P > 0.05$) between sorghum and sudangrass. Additionally, the genetic distance (GDsor-su) between sorghum and sudangrass was only 0.035, suggesting a high degree of genetic homogeneity. Genetic similarity (GS) values between all varieties ranged from 0.217 to 0.975 and were used to produce a dendrogram. The 48 accessions were clustered into five groups (GS = 0.766), specifically, group I (consisting of sorghum, sudangrass and sorghum-sudangrass hybrids), group II (S. propinquum), group III (S. halepense), group IV (Z. mexicana) and group V (Z. mays). Results of our analyses suggest the sudangrass/sorghum relationship is sufficiently close to place them both within the same species - sorghum (S. bicolor).
Keywords: Sorghum [Sorghum bicolor (L.) Moench]; Sudangrass [Sorghum sudanense (Piper) Stapf]; SSR; Genetic diversity; Phylogenetic relationship

Joshua Miron, Ephraim Zuckerman, Gabriel Adin, Ran Solomon, Ezra Shoshani, Moshe Nikbachat, Edith Yosef, Abraham Zenou, Zwi Gershon Weinberg, Yahira Chen, Ilan Halachmi, Daniel Ben-Ghedalia, Comparison of two forage sorghum varieties with corn and the effect of feeding their silages on eating behavior and lactation performance of dairy cows, Animal Feed Science and Technology, Volume 139, Issues 1-2, 3 December 2007, Pages 23-39, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2007.01.011.
(http://www.sciencedirect.com/science/article/B6T42-4N1SP8Y-1/2/95c2a102e37d58bb14eaa5389eb3c535)
Abstract:
This study examined the biomass yield and nutritive value for lactating cows of two sorghum silages, a new brown mid-rib BMR-101 variety (BMR) and the commercial hybrid FS-5 widely used in Israel, in comparison with the corn Oropesa silage. Forages were grown in a Mediterranean climate in five replicate plots, harvested by a combine harvester at the soft dough stage and ensiled in bunker silos. The BMR plants had high degree of lodging, and the yield of forage dry matter (DM) was highest for corn, intermediate for FS-5 and lowest for BMR. Ensiling resulted in moderate DM losses for corn and FS-5 and higher losses for BMR, but all silages were stable after exposure to air. The in vitro DM digestibility (IVDMD) of BMR and corn silages were similar and higher than that of the FS-5 silage. Forty-two milking cows were assigned into three groups of 14 cows each, that were similar in their initial performance and DM intake, and fed three total mixed rations (TMR) containing either BMR, FS-5 or corn silages as the basal forage, in a 3 x 3 Latin

square design. Each period consisted of 2 adaptation weeks to the TMR plus 5 data collection weeks. There were no differences in DM intake among cows fed the three silage-based TMR, but the number of voluntary daily meals per cow was higher for the FS-5-fed group versus the BMR and corn groups. In contrast, DM intake per meal and average meal duration were higher for the cows fed the corn and BMR-based TMR. Rate of feed consumption and daily eating duration were similar in the three treatments. Milk yield of the cows fed the corn-based TMR was higher than that of the FS-5 group, while that of BMR group was intermediate (42.1 vs. 40.7 and 41.4 kg /d, respectively). The two groups fed the sorghum TMR had higher milk fat production, while the group fed corn silage TMR had higher milk and milk protein production and moderate milk fat yield and content, as well as the lowest loss of body weight (BW). However, silage yield per hectare, digestibility of the silage, and availability of water for irrigation are the dominant parameters when deciding which forage varieties to grow.
Keywords: FS-5 and BMR-101 sorghum silage; Corn Oropesa silage; Eating behavior; Milk performance; Dairy cows

Louis K. Prom, Ndiaga Cisse, Ousmane Ndoye, Assessing the vulnerability of selected sorghum lines from the United States of America to long smut (Sporisorium ehrenbergii Vanky) disease, Crop Protection, Volume 26, Issue 12, December 2007, Pages 1771-1776, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.03.011.
(http://www.sciencedirect.com/science/article/B6T5T-4NKJ172-1/2/7f316994e591709a975ce992e273ce99)
Abstract:
Long smut is a limiting factor in sorghum productivity in some countries and therefore, a threat to food security. Long smut (Sporisorium ehrenbergii Vanky) disease response was assessed in experiments on 51 sorghum accessions including 31 commercial hybrids and 20 cultivars from the United States of America (USA) in 2004 and 2005 at the Agronomic Research Stations in Bambey and Nioro, Senegal, West Africa. The highest disease incidence of 44.33% in 2004 and 16.47% in 2005 was observed in hybrid A425, and no infection was noted in hybrids 3552 and A571 in 2005 at both locations. Hybrids 730, 837, P84552, TR438, TR65G, and Wac660 exhibited low levels of infection. Among the cultivars and parental lines, SRN39 recorded the highest disease incidence of 48.0% followed by B.Tx623 with 45.8%, whereas B.9612 and R.9645 consistently recorded low levels of infection. These two cultivars B.9612 and R.9645 may possess genes for long smut resistance. All other promising sorghum cultivars and parental lines to be released/registered in the USA exhibited varied levels of susceptibility. In order to establish the sources of long smut resistance, it is of paramount importance to conduct additional screenings of aforesaid hybrids/lines in a wide spectrum of selections that would be carried out under varied environmental conditions.
Keywords: Sorghum; Long smut; Sporisorium ehrenbergii; Tolyposporium ehrenbergii

Esayas Mendesil, Chemeda Abdeta, Abush Tesfaye, Zekarias Shumeta, Habte Jifar, Farmers' perceptions and management practices of insect pests on stored sorghum in southwestern Ethiopia, Crop Protection, Volume 26, Issue 12, December 2007, Pages 1817-1825, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.03.018.
(http://www.sciencedirect.com/science/article/B6T5T-4NRMCYT-1/2/45acc2ed135c36c43ed7c5cd9f6d95b2)
Abstract:
Surveys were undertaken in six districts of southwestern Ethiopia from July to October 2003 to investigate farmers' perceptions and management practices of insect pests on traditionally stored sorghum. The survey involved 138 randomly selected farmers who were interviewed using a semi-structured questionnaire. Storage insect pests were perceived as the major insect pests of sorghum. The majority of the farmers estimated sorghum yield losses of up to 50% due to insect

damage during storage. High temperature and lack of storage hygiene were cited as the major factors resulting in insect infestation of stored sorghum. Infestations of stored sorghum insect pests were common on different forms of sorghum, which stored in various types of farm storage. Farmers classified sorghum varieties according to the level of resistance to stored sorghum insect pests. Only about 32% of the farmers had access to chemical insecticides for the control of stored sorghum insect pests, while the majority of them used cultural practices and locally available plant materials as storage protectants.
Keywords: Ethiopia; Farm-store; Farmers' perceptions; Storage pest; Sorghum

I. Barikmo, F. Ouattara, A. Oshaug, Differences in micronutrients content found in cereals from various parts of Mali, Journal of Food Composition and Analysis, Volume 20, Issue 8, 6th International Food Data Conference, December 2007, Pages 681-687, ISSN 0889-1575, DOI: 10.1016/j.jfca.2007.04.002.
(http://www.sciencedirect.com/science/article/B6WJH-4NJ209J-1/2/d26f0f28b01750d580e22f50d7221e03)
Abstract:
Food samples were collected from four different regions (Mopti, Segou, Timbuktu and Bamako) in Mali. The cereals, analyzed for iron, zinc, thiamine, riboflavin and niacin, were millet (Pennisetum glaucum), sorghum (Sorghum bicolor), rice (Oryza sativa), wheat (Triticum aestivum) and fonio (Digitaria exilis). For millet the lowest coefficient of variation (CV %) between the regions was found in thiamine (15%) and the highest variation in niacin (126%). For sorghum it was the same nutrients that gave the lowest and highest CV, 34% in thiamine and 98% in niacin. For rice, however, the main variations were for zinc (lowest, CV 20%) and iron (highest, 141%). For wheat the lowest CV was in thiamine (47%) and highest in iron (115%), while for fonio the lowest CV was in zinc (9%) and highest in iron (61%). Even though the variation was very high for all nutrients except zinc in fonio, it was thiamine and zinc that differed the least and iron and niacin that differed the most. The use of different methods and laboratories could not explain the variation between different regions. The variation between ecological zones seems rather important. This raises the question of whether we can defend borrowing data on food composition from one country or area to another, with different ecological and climatic conditions. The globalization process impacting all countries actualize this question even more than before. Finally this has consequences for the design and use of the food composition table for Mali, which contain one main table giving average values, and separated tables from each region giving regional data when they are available.
Keywords: Food composition data; Mali; Cereal; Micronutrient content; Ecological zones

Z. Andrianjaka, R. Bally, M. Lepage, J. Thioulouse, G. Comte, M. Kisa, R. Duponnois, Biological control of Striga hermonthica by Cubitermes termite mound powder amendment in sorghum culture, Applied Soil Ecology, Volume 37, Issue 3, November 2007, Pages 175-183, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2007.03.001.
(http://www.sciencedirect.com/science/article/B6T4B-4PMJ9TR-1/2/e7e8646e23e5cca140a6580648bff91d)
Abstract:
Striga hermonthica (Del.) Benth is an obligate root hemi-parasite of several cereals. Its effect on cereal crops is the main constraint for food production in sub-Saharan Africa. Various control methods have been already proposed, but the infestation by these parasitic plants persists. An appropriated method for Striga management adapted for the African farmer is very much needed. In this study, amendment of soil infested by this phytoparasite with Cubitermes mound powder is proposed as chemical amendment and natural microbial inoculum, to promote plant growth and reduce damage by S. hermonthica on sorghum (Sorghum bicolor L.). The influence of Cubitermes mound powder on the development of several microbial groups (arbuscular mycorrhizal fungi, actinomycetes, saprophytic fungi) was investigated in a pot experiment with sorghum cultured in a

sandy soil infested by S. hermonthica. In the amended soil, sorghum growth and mycorrhizal colonization of sorghum plants were significantly greater than in the control treatment. Mycorrhizal colonization was negatively correlated with the number of emerged Striga plants per pot and positively correlated with sorghum growth. The relationship with substrate-induced respiration (SIR) responses showed that amended soil was characterized by its response to hydroxybutyric acid (catabolic marker of mycorrhizal colonization) and non-amended soil by its response to phenylalanine. We noted that the number of emerged Striga plants in amended pots was significantly decreased. Since Cubitermes mound suspensions did not affect Striga seed germination under axenic conditions, it suggests that the amendment with Cubitermes powder reduces S. hermonthica infestation indirectly, i.e. via its effect on the indigenous soil microflora. Overall, it appears that management of Cubitermes mounds is a promising strategy to consider for effective protection of sorghum from Striga infestation.
Keywords: Termite; Arbuscular mycorrhiza; Striga; Sorghum; Plant protection

G. Ganjyal, Q. Fang, M.A. Hanna, Freezing points and small-scale deicing tests for salts of levulinic acid made from grain sorghum, Bioresource Technology, Volume 98, Issue 15, November 2007, Pages 2814-2818, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.07.042.
(http://www.sciencedirect.com/science/article/B6V24-4NFR5J6-1/2/4e967430f5612a344a9708cbab538143)
Abstract:
Deicers from renewable resources are needed to overcome the disadvantages of using traditional deicers. Salts made from levulinic acid produced using grain sorghum as raw material were tested as road deicing agents. Freezing points of these salts viz., sodium levulinate, magnesium levulinate and calcium levulinate along with rock salt (sodium chloride) were determined according to American Society for Testing and Materials (ASTM) D 1177-94 standard at concentrations of 10, 20, 30 and 40 % w/w. There were significant differences among the freezing points of the salts. Freezing points for rock salt, sodium levulinate, calcium levulinate and magnesium levulinate, for different concentrations, were in the ranges of -6.6 to -20.5, -2.9 to -15.0, -2.1 to -7.8 and -1.5 to -6.5 [degree sign]C, respectively. Deicing effectiveness of the salts of levulinic acid were investigated by conducting small-scale deicing tests with aqueous solutions of various salt concentrations (2%, 5% and 10%) in a laboratory freezer and by spraying the deicer on a graveled surface covered by ice and snow with the average temperature during the testing at -2.7 [degree sign]C. Deicing capabilities of the three salts of levulinic acid differed. At -2.7 [degree sign]C, all three salts caused melting of the ice. Among the different levulinates studied sodium levulinate was the most effective deicing agent. These salts of levulinates could be a viable replacement for traditional deicers and could help in reducing the disadvantages of traditional deicers.
Keywords: Deicers; Sorghum; Levulinates; Freezing point

Manuel Vazquez, Martha Oliva, Simon J. Tellez-Luis, Jose A. Ramirez, Hydrolysis of sorghum straw using phosphoric acid: Evaluation of furfural production, Bioresource Technology, Volume 98, Issue 16, November 2007, Pages 3053-3060, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.10.017.
(http://www.sciencedirect.com/science/article/B6V24-4MGVT2S-1/2/d1ce01d4b036df91bfd0096e818d43ab)
Abstract:
Sorghum straw is a waste that has been studied scarcely. The main application is its use as raw material for xylose production. Xylose is a hemicellulosic sugar mainly used for its bioconversion toward xylitol. An alternative use could be its conversion toward furfural. The objective of this work was to study the furfural production by hydrolysis of sorghum straw with phosphoric acid at 134 [degree sign]C. Several concentrations of H3PO4 in the range 2-6% and reaction time (range 0-300 min) were evaluated. Kinetic parameters of mathematical models for predicting the

concentration of xylose, glucose, arabinose, acetic acid and furfural in the hydrolysates were found. Optimal conditions for furfural production by acid hydrolysis were 6% H3PO4 at 134 [degree sign]C for 300 min, which yielded a solution with 13.7 g furfural/L, 4.0 g xylose/L, 2.9 g glucose/L, 1.1 g arabinose/L and 1.2 g acetic acid/L. The furfural yield of the process was 0.1336 g furfural/g initial dry matter was obtained. The results confirmed that sorghum straw can be used for furfural production when it is hydrolyzed using phosphoric acid.
Keywords: Furfural; Sorghum; Straw; Modelling; Acid hydrolysis

Leila Medraoui, Mohammed Ater, Ouafae Benlhabib, Driss Msikine, Abdelkarim Filali-Maltouf, Evaluation of genetic variability of sorghum (Sorghum bicolor L. Moench) in northwestern Morocco by ISSR and RAPD markers, Comptes Rendus Biologies, Volume 330, Issue 11, November 2007, Pages 789-797, ISSN 1631-0691, DOI: 10.1016/j.crvi.2007.08.005.
(http://www.sciencedirect.com/science/article/B6X1F-4PNF2RF-1/2/1752e52880ad229bcf1246973b07d94a)
Abstract:
The study of the genetic variability of the Moroccan landraces of sorghum constitutes a necessary step that can be exploited in the programs of improvement and valorisation of this marginalized species. The aim of this investigation is to evaluate the variability of sorghum populations and to establish their phylogenetic relations using RAPD and ISSR markers. Sampling was taken in 33 fields of northern regions where this species is most cultivated. Individual plants (398) were collected in 13, 11, 5, and 4 fields of Larache, Tangier, Chefchaouen, and Tetouan, respectively. Thirty-eight RAPD primers and four ISSR primers were used. The percentage of polymorphic fragments revealed with ISSR (98%) is higher than the one revealed with RAPD (85%). The level of the variability obtained through the two techniques is very high. Nevertheless, ISSR markers revealed more diversity than RAPD (0.995+/-0.006 against 0.946+/-0.031). The classification based on Jaccard's similarity index distinguished the totality of fields. Data analysis revealed a genetic structure that is closely related to the micro-geographical repartition of the different fields. To cite this article: L. Medraoui et al., C. R. Biologies 330 (2007).
Keywords: Sorghum bicolor L. Moench; Moroccan landraces; Genetic variability; RAPD; ISSR; Sorghum bicolor L. Moench; Varietes-populations; Variabilite genetique; RAPD; ISSR

D.B. Ishaya, S.A. Dadari, J.A.Y. Shebayan, Evaluation of herbicides for weed control in sorghum (Sorghum bicolour) in Nigeria, Crop Protection, Volume 26, Issue 11, November 2007, Pages 1697-1701, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.02.013.
(http://www.sciencedirect.com/science/article/B6T5T-4NY4RH3-1/2/6aad067db9e96228981d796f0c111e96)
Abstract:
Weed infestation is one of the major threats to cereal production in the Nigerian Savanna. Two trials were conducted in 2002 and 2003 to evaluate different types of herbicides for weed control in sorghum. Among the herbicides tested, pretilachlor+dimethametryne at 2.5 kg a.i./ha, cinosulfuron at 0.05 kg a.i./ha and piperophos+cinosulfuron at 1.5 kg a.i./ha performed best as they effectively controlled weeds, increased crop vigour, plant height, reduced crop injury and produced higher grain yield of sorghum.
Keywords: Herbicides; Sorghum; Weed; Control hoe-weeding

G. Fellet, L. Marchiol, D. Perosa, G. Zerbi, The application of phytoremediation technology in a soil contaminated by pyrite cinders, Ecological Engineering, Volume 31, Issue 3, IUFRO World Congress (Forest Rehab after Disturbance), 1 November 2007, Pages 207-214, ISSN 0925-8574, DOI: 10.1016/j.ecoleng.2007.06.011.
(http://www.sciencedirect.com/science/article/B6VFB-4PGH4C6-1/2/f8faa91fd6f7f6278b5a4d0de327bfdd)

Abstract:
A research project dealing with the phytoremediation of a soil polluted by pyrite cinders is currently running. The case study is represented by a polluted area located in an industrial site; since 2001, the site has been listed in the clean-up national priority list. Before the beginning of the in situ trials, two experiments in controlled conditions were carried out. The first pot experiments were performed growing Glycine max, Sorghum bicolor, Zea mays and Helianthus annuus on substrates polluted by different levels of pyrite cinders, containing As, Cd, Cu, Pb and Zn. In a second experiment, the possible influence of fertilization on the uptake of As and heavy metals by S. bicolor and H. annuus was observed.
The potential of phytoextraction of crops was evaluated considering the plant biomass, the concentration of As and heavy metals in the plant tissues and also the bioconcentration factor (BCF) and the translocation factor (TF).
In the most polluted substrate, S. bicolor appeared more efficient than H. annuus in the uptake of metals; the transport of the metals from roots towards stems and leaves was less efficient in S. bicolor.
Keywords: Pollution; Pyrite cinders; Heavy metals; Soil clean up; Phytoremediation

Vinay B. Raghavendra, S. Lokesh, M. Govindappa, T. VasanthKumar, Dravya--As an organic agent for the management of seed-borne fungi of sorghum and its role in the induction of defense enzymes, Pesticide Biochemistry and Physiology, Volume 89, Issue 3, November 2007, Pages 190-197, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2007.06.004.
(http://www.sciencedirect.com/science/article/B6WP8-4P1G9HF-2/2/3750cc9d47de639df0fbd67592ad0155)
Abstract:
A commercially developed cytokinin and seaweed extract formulation 'Dravya' was used at 0.3% concentration for soaking of sorghum seeds for 12 h to test its effect on germination, vigour index, chlorophyll content and defense enzyme activity against seed mycoflora of sorghum. Among the treatments, Dravya (0.3%) with Dithane M-45 (0.1%) and GLSTIN (0.1%) or separately or in combination resulted is maximum percentage of seed germination, seedling vigour and reduced the incidence of seed mycoflora besides defense enzymes enhancement was noticed. In this study, Dravya was used for seed soaking, foliar spray, separately as well as in combination with GLSTIN and Mancozeb M-45 to test its efficacy in the enhancement of seedling vigour, chlorophyll content and defence enzyme activities. Hence, it is inferred that Dravya is a good growth promoter and improves natural resistance to disease in sorghum.
Keywords: Sorghum; Fungicides; Dravya; Seed-borne fungi; Management; Defense enzymes

Oloro V. McHugh, Tammo S. Steenhuis, Berihun Abebe, Erick C.M. Fernandes, Performance of in situ rainwater conservation tillage techniques on dry spell mitigation and erosion control in the drought-prone North Wello zone of the Ethiopian highlands, Soil and Tillage Research, Volume 97, Issue 1, November 2007, Pages 19-36, ISSN 0167-1987, DOI: 10.1016/j.still.2007.08.002.
(http://www.sciencedirect.com/science/article/B6TC6-4R00F9F-1/2/6bfdb66c1ef902ac1172df88f7979f97)
Abstract:
Grain production shortfalls in northern Ethiopia are commonly associated with occurrence of intra-seasonal dry spells or droughts and rapid land degradation which adversely impact crop yields. Suitable practices that use available rainwater more efficiently to mitigate impact of dry spells on crops and that protect soil are needed to stabilize and improve grain yields in the predominately rainfed agriculture. During three cropping seasons on-farm experiments tested conservation tillage techniques implemented with oxen-drawn plows on clay loam soil. Tested tillage techniques are subsoiling, open and tied ridges, no till, and conventional tillage with the local maresha plow (the control). Effectiveness in improving root zone soil moisture, limiting soil erosion, and improving

sorghum (Sorghum bicolor (L.) Moench.) and chickpea (Cicer arietinum L.) grain yield were determined. Results demonstrate that performance of the tillage techniques varied with seasonal rainfall distribution and intensity and land slope gradient. Tied and open ridge increased seasonal root zone soil moisture 15-24%. Subsoiling slightly (3%) increased and no till slightly decreased soil moisture but were not statistically different from conventional tillage. Tied ridge and no till significantly reduced seasonal soil loss by up to 11 Mg ha-1 during seasons with moderate intensity storms, but during a season with high intensity storms tied ridge on over 9% slope gradient increased soil loss (up to 35 Mg ha-1). The increased soil disturbance of subsoiling led to higher soil loss rates (up to 32 Mg ha-1) than conventional tillage during all seasons. Grain yield decreased and runoff and erosion rates increased rapidly with increasing land slope gradient. During a season with moderate intensity rainfall open and tied ridge increased sorghum yield by 67-73% over the control (730 kg ha-1) while no till decreased yield by 25%. During a season when high intensity rainfall events damaged the ridges, subsoiling had the best sorghum yield with 42% increase over the control (1430 kg ha-1). Poor early season rainfall and fungus attacks resulted in low chickpea yields (200-320 kg ha-1) and statistically insignificant differences between tillage methods. Overall results of the study suggest that on slopes below 8% gradient oxen-drawn ridge tillage and subsoiling, to a lesser degree, can effectively improve conditions that mitigate impact of short dry spells especially during seasons with less intense rainfall events.
Keywords: Ridge tillage; Subsoiling; Soil moisture; Soil erosion; Drought mitigation; On-farm trial

Robert M. Auge, Heather D. Toler, Jennifer L. Moore, Keunho Cho, Arnold M. Saxton, Comparing contributions of soil versus root colonization to variations in stomatal behavior and soil drying in mycorrhizal Sorghum bicolor and Cucurbita pepo, Journal of Plant Physiology, Volume 164, Issue 10, 19 October 2007, Pages 1289-1299, ISSN 0176-1617, DOI: 10.1016/j.jplph.2006.08.005.
(http://www.sciencedirect.com/science/article/B7GJ7-4MNJ2R5-1/2/bfb13abb2734f97fc1b0f2f438849cc5)
Abstract: Summary
In prior studies we learned that colonization of soil can be as important as colonization of roots in determining mycorrhizal influence on the water relations of host plants. Here we use a path analysis modeling approach to test (a) whether quantity of hyphae in soil contributes to variations in stomatal behavior and soil drying, and (b) whether soil colonization or root colonization has a stronger influence on these stomatal and soil drying responses. Experiments were performed on Sorghum bicolor and Cucurbita pepo, with soils and roots colonized by a mixture of Glomus intraradices and Gigaspora margarita. Soil colonization generally made more significant contributions to stomatal conductance than did root colonization. Soil colonization did not make significant direct contributions to soil water potential measures (soil water potential at stomatal closure or soil drying rate), whereas root colonization did contribute a potentially important path to each. The findings further support a role for mycorrhization of the soil itself in contributing to the regulation of stomatal behavior of host plants.
Keywords: Drought; Mycorrhiza; Path analysis; Soil water potential; Stomatal conductance

A.J. Franzluebbers, H.H. Schomberg, D.M. Endale, Surface-soil responses to paraplowing of long-term no-tillage cropland in the Southern Piedmont USA, Soil and Tillage Research, Volume 96, Issues 1-2, October 2007, Pages 303-315, ISSN 0167-1987, DOI: 10.1016/j.still.2007.07.001.
(http://www.sciencedirect.com/science/article/B6TC6-4PFFCXR-1/2/a8dc1e1a913ef0217497486462620254)
Abstract:
The type of conservation-tillage management employed could impact surface-soil properties, which could subsequently affect relationships between soil and water quality, as well as with soil C sequestration and greenhouse gas emissions. We determined soil bulk density, organic C and N fractions, plant-available N, and extractable P on Typic Kanhapludults throughout a 7-year period,

in which four long-term (>10 years), no-tillage (NT) water catchments (1.3-2.7 ha each) were divided into two treatments: (1) continuation of NT and (2) paraplowing (PP) in autumn (a form of non-inversion deep ripping) with NT planting. Both summer [cotton (Gossypium hirsutum L.), maize (Zea mays L.), sorghum (Sorghum bicolor L. Moench), soybean (Glycine max L. Merr.)] and winter [wheat (Triticum aestivum L.), barley (Hordeum vulgare L.), rye (Secale cereale L.), crimson clover (Trifolium incarnatum L.)] crops were NT planted throughout the study under each management system. Soil bulk density was reduced with PP compared with NT by as much as 0.15 Mg m-3, but the extent of reduction was inversely related to the time lag between PP operation and sampling event. Soil organic C became significantly enriched with time during this study under NT (0.49 Mg C ha-1 year-1), but not under PP, in which poultry litter was applied equivalent to 5.7 Mg ha-1 year-1 to all water catchments. Soil maintained a highly stratified depth distribution of organic C and N fractions and extractable P under both NT and PP. Inability to perform the PP operation in the last year of this study resulted in rapid convergence of soil bulk density between tillage systems, suggesting that PP had <1-year effectiveness on soil loosening. The high energy cost of PP (ca. 30 kW shank-1) and the lack of sustained improvement in surface-soil properties put into question the value of PP for improving upon long-term NT management in sandy loam and sandy clay loam Ultisols of the Southern Piedmont USA, unless large effects on crop yield, water quality, or other ecosystem processes warrant its use.
Keywords: Bulk density; Conservation tillage; Organic carbon; Soil nitrogen; Soil quality

Armen R. Kemanian, Claudio O. Stockle, David R. Huggins, Luis M. Viega, A simple method to estimate harvest index in grain crops, Field Crops Research, Volume 103, Issue 3, 13 September 2007, Pages 208-216, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.06.007.
(http://www.sciencedirect.com/science/article/B6T6M-4PBG1GD-1/2/7eeccb812c6824d71a662309afbd9924)
Abstract:
Several methods have been proposed to simulate yield in crop simulation models. In this work, we present a simple method to estimate harvest index (HI) of grain crops based on fractional post-anthesis phase growth (fG = fraction of biomass accumulation that occurred in the post-anthesis phase). We propose that HI increases in a linear or curvilinear fashion in response to fG. The linear model has two parameters, the intercept (HIo) and the slope (s). The curvilinear model was assumed to be monotonic: HI = HIx - (HIx - HIo) [middle dot] exp(-k[middle dot]fG); where HIx is the asymptote, HIo is the intercept and k is a constant modulating the rate of HI increase. The models were tested for barley (Pullman, WA and Uruguay), wheat (Pullman, WA) and sorghum (Australia). A positive relationship between HI and fG was in general evident. For barley, the linear model appropriately represented the response of HI to fG, with both HIo and s in the vicinity of 0.3. For wheat HIo and s were 0.34 and 0.21, respectively, but the curvilinear model yielded a slightly better fitting than the linear model. For sorghum, both linear and linear-plateau models fitted data reasonably well. It is shown that the models work well in crops source-limited or source-sink co-limited during grain filling, but in sink-limited conditions the magnitude of the limitation needs to be characterized to compute HI. A major advantage of this method is that the parameters of the linear or curvilinear model are readily calibrated from yield data and biomass measurements at anthesis and harvest.
Keywords: Simulating harvest index; Source-sink limitation; Sterility; Reserves utilization

E. Acikgoz, M. Sincik, M. Oz, S. Albayrak, G. Wietgrefe, Z.M. Turan, A.T. Goksoy, U. Bilgili, A. Karasu, O. Tongel, O. Canbolat, Forage soybean performance in mediterranean environments, Field Crops Research, Volume 103, Issue 3, 13 September 2007, Pages 239-247, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.06.006.
(http://www.sciencedirect.com/science/article/B6T6M-4P5YK4H-4/2/e89ef26b4be6add5d8a80e00f7c0fc41)

Abstract:
Livestock producers are interested in growing forage soybean [Glycine max (L.) Merr.] in summer and ensiling alone or in mixtures with corn or sorghum. Four row spacings (20, 40, 60, and 80 cm), four seeding rates (50, 100, 150, and 200 kg seeds per hectare) and four harvesting stages for forage production (V5, R2, R4, and R6) were evaluated under irrigated conditions in a randomized split-split plot design with three replications in three different locations in Turkey with Mediterranean-type climate in 2004 and 2005. Dry matter (DM) yield was significantly reduced with increased row spacings in all locations. There was no significant difference between 20, 40, or 60 cm row spacings while 80 cm provided the lowest yield. Increased seeding rates (50, 100, 150, and 200 kg seeds per hectare) generally increased DM yield, although the most suitable row spacing varied by location. DM yield was significantly affected by harvest maturity increasing with advancing maturity in all locations. DM constituent plant components were generally unaffected by row spacing and seeding rate but harvest maturity did significantly affect DM partitioning. As expected, leaf blade fractions decreased continually as plant maturity increased, while stem and flower plus pod fraction increased from V5 to R6. In general, row spacing and seeding rate did not significantly affect crude protein, degradable protein, and in vitro dry matter digestibility of soybean forage, but all decreased significantly with advancing maturity. These studies demonstrated soybeans managed for forage in a Mediterranean-type environment can average of 9.3 and 11.3 t ha-1 dry matter yield at R4 and R6 stages, respectively, while averaging 13.3% crude protein, 8.2% degradable protein, and 60.6% in vitro dry matter digestibility.
Keywords: Glycine max (L.) Merr.; Crude protein; Degradable protein; In vitro dry matter digestibility

M. Dehghan-banadaky, R. Corbett, M. Oba, Effects of barley grain processing on productivity of cattle, Animal Feed Science and Technology, Volume 137, Issues 1-2, 1 September 2007, Pages 1-24, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2006.11.021.
(http://www.sciencedirect.com/science/article/B6T42-4MJS039-1/2/f422703751dfc2ecce4f7f086b1fdfee)
Abstract:
Barley grain is one of the most common feed grains used in diets for dairy and beef cattle. Because the endosperm of the barley kernel is surrounded by the pericarp, which is extremely resistant to microbial degradation in the rumen, dry barley grain needs to be processed to improve its utilization by beef and dairy cattle. Dry rolling is a common processing method, and increases ruminal digestibility of grain and productivity of animals, but the grain kernels often shatter during processing, producing many fine particles, which has been associated with inconsistent animal performance. Steam rolling and temper rolling can reduce production of fine particles during rolling, allowing more uniform particle size distribution. Steam flaking uses moisture, heat and pressure to gelatinize starch granules, but positive effects of starch gelatinization on animal performance may be less for barley grain versus corn or sorghum because barley starch, once exposed to microbial organisms in the rumen, is readily degradable even without being gelatinized. Treatment of grains with NaOH may increase its ruminal starch digestibility without increasing ruminal rate of starch release. Roasting and aldehyde treatment decrease the rate of crude protein degradation and optimize organic matter degradation in the rumen, while application of ammonia or fibrolytic enzymes can increase degradation of the hull. Consistency in processed grain quality (e.g., particle size) and predictability in animal performance should be considered as an important quality parameter of processing. In addition, initial grain quality, extent of processing, processing method, and their interactions, determine the feeding value of barley grain and affect the productivity of cattle. Further research is warranted to develop a common quality parameter accounting for variations in physical, chemical and biochemical properties for processed barley grain.
Keywords: Barley grain; Processing; Dairy cows; Beef cattle; Productivity

L. Cheng, S.W. Leavitt, B.A. Kimball, P.J. Pinter Jr., M.J. Ottman, A. Matthias, G.W. Wall, T. Brooks, D.G. Williams, T.L. Thompson, Dynamics of labile and recalcitrant soil carbon pools in a sorghum free-air CO2 enrichment (FACE) agroecosystem, Soil Biology and Biochemistry, Volume 39, Issue 9, September 2007, Pages 2250-2263, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2007.03.031.
(http://www.sciencedirect.com/science/article/B6TC7-4NNPB72-1/2/2e7348880ffad1420f6d89016ac91296)
Abstract:
Experimentation with dynamics of soil carbon pools as affected by elevated CO2 can better define the ability of terrestrial ecosystems to sequester global carbon. In the present study, 6 N HCl hydrolysis and stable-carbon isotopic analysis ([delta]13C) were used to investigate labile and recalcitrant soil carbon pools and the translocation among these pools of sorghum residues isotopically labeled in the 1998-1999 Arizona Maricopa free air CO2 enrichment (FACE) experiment, in which elevated CO2 (FACE: 560 [mu]mol mol-1) and ambient CO2 (Control: 360 [mu]mol mol-1) interact with water-adequate (wet) and water-deficient (dry) treatments. We found that on average 53% of the final soil organic carbon (SOC) in the FACE plot was in the recalcitrant carbon pool and 47% in the labile pool, whereas in the Control plot 46% and 54% of carbon were in recalcitrant and labile pools, respectively, indicating that elevated CO2 transferred more SOC into the slow-decay carbon pool. Also, isotopic mixing models revealed that increased new sorghum residue input to the recalcitrant pool mainly accounts for this change, especially for the upper soil horizon (0-30 cm) where new carbon in recalcitrant soil pools of FACE wet and dry treatments was 1.7 and 2.8 times as large as that in respective Control recalcitrant pools. Similarly, old C in the recalcitrant pool under elevated CO2 was higher than that under ambient CO2, indicating that elevated CO2 reduces the decay of the old C in recalcitrant pool. Mean residence time (MRT) of bulk soil carbon at the depth of 0-30 cm was significantly longer in FACE plot than Control plot by the averages of 12 and 13 yr under the dry and wet conditions, respectively. The MRT was positively correlated to the ratio of carbon content in the recalcitrant pool to total SOC and negatively correlated to the ratio of carbon content in the labile pool to total SOC. Influence of water alone on the bulk SOC or the labile and recalcitrant pools was not significant. However, water stress interacting with CO2 enhanced the shift of the carbon from labile pool to recalcitrant pool. Our results imply that terrestrial agroecosystems may play a critical role in sequestrating atmospheric CO2 and mitigating harmful CO2 under future atmospheric conditions.
Keywords: Elevated CO2; [delta]13C; Soil recalcitrant and labile carbon pools; SOC dynamics; Mean residence time; Sorghum FACE

Joshua Miron, Efraim Zuckerman, Gabriel Adin, Moshe Nikbachat, Edith Yosef, Abraham Zenou, Zwi G. Weinberg, Ran Solomon, Daniel Ben-Ghedalia, Field yield, ensiling properties and digestibility by sheep of silages from two forage sorghum varieties, Animal Feed Science and Technology, Volume 136, Issues 3-4, 1 August 2007, Pages 203-215, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2006.09.001.
(http://www.sciencedirect.com/science/article/B6T42-4KYY3SV-1/2/d44472d7b95361d9b2a6a509092bdb6f)
Abstract:
This study examines the yield, composition, digestibility and ensiling properties of the new sorghum brown-midrib hybrid BMR-101. The commercial forage sorghum FS-5 was used as a reference variety. Forages were grown in a typical Mediterranean climate in five replicate plots, irrigated with 250 mm water, combine harvested at the soft dough stage and ensiled under both laboratory and commercial conditions. Both varieties were tall (>2.0 m). The dry matter (DM) content at harvest of FS-5 was higher than that of BMR-101 (296 g/kg forage versus 255 g/kg forage, $P<0.05$). BMR-101 plants suffered from higher lodging than FS-5 plants (60% versus

16.7%, P<0.05). Dry matter (DM) yield of the green forage was higher for FS-5 than BMR-101 (12.1 t/ha versus 9.89 t/ha, P<0.05). The distribution of DM among plant organs was similar for the two varieties, which contained also similar levels of neutral detergent fiber (aNDFom, 560-563 g/kg DM). BMR-101 raw plants had higher content of crude protein (CP) and hemicellulose and lower content of water-soluble carbohydrate (WSC), cellulose and lignin than FS-5 plants. Ensiling of the two varieties in glass silos resulted in moderate DM losses (<0.08 of yield) mostly as volatile gases, solubilisation of 0.04-0.12 hemicellulose, and high conversion of WSC mostly into lactate, ethanol and acetate. Ensiling in large scale bunker silos resulted in more extensive fermentation of WSC and lactate into acetate and ethanol, but in similar low pH (<4). In vitro DM digestibility of the two silages was similar, but in vitro NDF digestibility was higher for BMR-101 silage than FS-5 silage (P<0.05). Eight Assaff rams were assigned randomly into two dietary groups of four rams each and fed the two silages in a 2 x 2 crossover design. Intake and digestibility by sheep of silage DM and CP were similar for both varieties. Digestibility of silage NDF, cellulose and hemicellulose was higher for sheep fed BMR-101 as compared with FS-5 (P<0.05). The production of digestible silage DM was calculated to be higher for FS-5 than BMR-101 (7.14 t/ha versus 6.13 t/ha, P<0.05). These data highlight the advantages of commercial FS-5 relative to the new BMR-101 variety: its better resistance to lodging and higher production of silage DM and digestible DM per ha.
Keywords: BMR sorghum; Ensiling; Digestibility by sheep; Sorghum composition

C. Lanzas, D.G. Fox, A.N. Pell, Digestion kinetics of dried cereal grains, Animal Feed Science and Technology, Volume 136, Issues 3-4, 1 August 2007, Pages 265-280, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2006.09.004.
(http://www.sciencedirect.com/science/article/B6T42-4M1TSY6-2/2/e213c4b0bac96dec047efa865b3b648b)
Abstract:
Grain fermentability largely determines the feed value of grains for ruminants. Our objective was to evaluate the variation in kinetics of gas production of cereal grains and the relationship among gas production, chemical composition and feed value. Eighteen barley, 99 corn, 23 sorghum, and 57 wheat samples were fermented in vitro for 48 h. Gas production was measured with a computerized system and an exponential model was fitted to the data. The impact of the variation in composition and kinetics on the feed value of grains in feedlot rations was assessed with the Cornell Net Carbohydrate and Protein System (CNCPS). Fractional gas rates were significantly different between grains (P<0.001), with a mean and S.D. of 0.24 (0.029) h-1 for barley (n = 20), 0.15 (0.026) h-1 for corn (n = 98), 0.06 (0.016) h-1 for sorghum (n = 23) and 0.26 (0.039) h-1 for wheat (n = 57). Fermentation rates were more variable than the chemical components. Fractional rates were poorly correlated with chemical composition within grain with the highest correlations for acid detergent insoluble crude protein (ADICP) (r = -0.31, P<0.01) and ADF (r = -0.27, P<0.01) for corn and neutral detergent insoluble crude protein (NDICP) (r = 0.35, P<0.05) for wheat. The impact of the variation in composition and kinetics on the feed value of grains in feedlot rations was assessed. The CNCPS predicted a maximal variation of <2.1 MJ/day and <60 g/day in metabolizable energy (ME) and metabolizable protein (MP) supply from grains, respectively. For sorghum, the fermentation rate was predicted to be a major determinant of the site of starch fermentation. A detailed evaluation of feed values for grains needs to include information on rates of fermentation.
Keywords: Fermentation rates; Cereal grains; Gas production; Feed variation; CNCPS

L. Hubbell, D. Goodwin, L. Samuel, K.P. Navder, Effect of Soy Protein Isolate on the Textural and Physical Attributes of Gluten-Free Muffins Made from Sorghum Flour, Journal of the American Dietetic Association, Volume 107, Issue 8, Supplement 1, ADA FNCE 2007 Food & Nutrition

Conference & Expo, ADA FNCE 2007 Food & Nutrition Conference & Expo, August 2007, Page A76, ISSN 0002-8223, DOI: 10.1016/j.jada.2007.05.194.
(http://www.sciencedirect.com/science/article/B758G-4P8G9Y7-90/2/9bf0740732b28c7978cda37f7964f55c)

Jose Antonio Monreal, Ana Belen Feria, Jose Maria Vinardell, Jean Vidal, Cristina Echevarria, Sofia Garcia-Maurino, ABA modulates the degradation of phosphoenolpyruvate carboxylase kinase in sorghum leaves, FEBS Letters, Volume 581, Issue 18, 24 July 2007, Pages 3468-3472, ISSN 0014-5793, DOI: 10.1016/j.febslet.2007.06.055.
(http://www.sciencedirect.com/science/article/B6T36-4P300C3-3/2/3ee657d7e5021fb38d69959c462c9c53)
Abstract:
Salt stresses strongly enhance the phosphoenolpyruvate carboxylase kinase (PEPC-k) activity of sorghum leaves. This work shows that (1) abscisic acid (ABA) increased the rise in kinase activity in illuminated leaf disks of the non-stressed plant, (2) ABA decreased the disappearance of PEPC-k activity in the dark, (3) two PEPC-k genes expressed in sorghum leaves, PPCK1 and PPCK2, were not up-regulated by the phytohormone and, (4) ABA effects were mimicked by MG132, a powerful inhibitor of the ubiquitin-proteasome pathway. Collectively these data support a role for the ubiquitin-proteasome pathway in the rapid turnover of PEPC-k. The negative control by ABA on this pathway might account for the increase of kinase activity observed in salt-treated plants.
Keywords: Abscisic acid; Phosphoenolpyruvate carboxylase; Phosphoenolpyruvate carboxylase kinase; Ubiquitin-proteasome

Dirk Philipp, Kenneth J. Moore, Jeffrey F. Pedersen, Richard J. Grant, Daren D. Redfearn, Robert B. Mitchell, Ensilage performance of sorghum hybrids varying in extractable sugars, Biomass and Bioenergy, Volume 31, Issue 7, July 2007, Pages 492-496, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2007.02.001.
(http://www.sciencedirect.com/science/article/B6V22-4N9MYHH-1/2/a5d988be06bacad839f8b280ec1b003a)
Abstract:
Renewable feedstock resources require novel storage technologies to optimize industrial use. Solid state fermentation of biomass feedstock may provide organic chemicals and fibers while reducing the risk of current dry-storage procedures. Here, we compare the chemical composition and fermentation of six sorghum hybrids (Sorghum bicolor L. Moench) following 1, 7, and 21 days of storage. Ensilage of 7 days resulted in a pH of 3.8 and declined further to 3.75 at day 21. Lactate increased during ensilage from 2.0 to 3.9 g 100 g-1. Acetic acid increased between 1 and 7 days of ensiling but did not change until the end of the ensiling period. Total organic acids averaged 2.5 g 100 g-1 after day 1 and increased to 4.2 and 4.7 g `100 g-1 after days 7 and 21, respectively. Neutral detergent fiber ranged from 38 to 50 g 100 g-1 among hybrids and total non-structural carbohydrates varied from 18 to 32 g 100 g-1. Hemicellulose and cellulose ranged from 13 to 19 g 100 g-1 and 20 and 28 g 100 g-1, respectively. Genotypic variation in sorghum may offer designing dual-purpose hybrids for production of biomass and economically valuable byproducts.
Keywords: Sorghum bicolor (L.); Solid state fermentation; Chemical composition

Janet Taylor, Scott R. Bean, Brian P. Ioerger, John R.N. Taylor, Preferential binding of sorghum tannins with [gamma]-kafirin and the influence of tannin binding on kafirin digestibility and biodegradation, Journal of Cereal Science, Volume 46, Issue 1, July 2007, Pages 22-31, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.11.001.
(http://www.sciencedirect.com/science/article/B6WHK-4N0XNHB-1/2/8c39921dc066dc3a6b7c0caafffd8610)

Abstract:
Kafirins, sorghum prolamins bind with sorghum condensed tannins (CTs). The binding of different kafirin species with sorghum CTs was investigated. Analysis by chemical assay and by sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE), reversed-phase high-performance liquid chromatography (RP-HPLC), and free zone capillary electrophoresis (FZCE), showed that [gamma]-kafirin bound more CTs than the other kafirin species. SDS-PAGE suggested that the [gamma]-kafirin-bound tannins were in the form of aggregates of molecular size >200k. RP-HPLC and FZCE revealed that sample preparation and drying the kafirins prior to the binding assays had a significant impact on [gamma]-kafirin solubility. The effect of tannin binding on kafirin and kafirin film digestibility and film biodegradation was determined. Kafirins bound to tannins had lower digestibilities than unbound kafirins. Films made from tannin-bound kafirin had much lower digestibility and were less biodegradable than films made from unbound kafirin. The increase in kafirin film life by tannin modification appears to be due to a decrease in protein digestibility caused by kafirin-tannin binding. These findings suggest that [gamma]-kafirin content in sorghum may be manipulated to either reduce or increase tannin binding in order to change the functionality of the kafirin in food, feed or film applications.
Keywords: Sorghum; Tannin; Binding; Kafirin

Paul M. White, Charles W. Rice, Jeff A. Baldock, Mitch R. Tuinstra, Soil biological properties following additions of bmr mutant grain sorghum, Soil Biology and Biochemistry, Volume 39, Issue 7, July 2007, Pages 1518-1532, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2006.12.032.
(http://www.sciencedirect.com/science/article/B6TC7-4N0XM50-5/2/23764d0ad8135b08cf7018bfcac38f08)
Abstract:
Soil carbon (C) sequestration may be a viable technology to reduce increases in greenhouse gas emissions until cleaner fuel technology is available. Crop plants with increased lignin levels may lead to increased soil C sequestration. Grain sorghum (Sorghum bicolor) exhibiting lower lignin due to the naturally occurring brown midrib mutation (bmr) may allow an assessment of the potential of biotechnology to affect soil C sequestration by manipulating plant lignin levels. A 194-d laboratory microcosm experiment was conducted to investigate the mineralization of bmr and normal plant residue from four sorghum hybrids. Cross-polarization magic angle spinning 13C-nuclear magnetic resonance of the residue agreed with chemical analysis that the bmr residue contained altered lignin and less lignin per mass weight. Ground bmr or normal grain sorghum residue was added to soil, with or without an inorganic nitrogen (N) amendment. Initial C mineralization from microcosms receiving bmr residue was higher than from microcosms receiving normal residue, but the differences were not maintained through the 194-d experiment. Total residue C mineralization was not different between bmr or normal isolines, and accounted for only 26% of the originally added residue C. Greater variability was observed between sorghum lines than between bmr or normal isolines. The addition of N to soil resulted in increased soil C mineralization. With no added N, however, microcosm C mineralization was most strongly correlated with the lignin/N ratio. With added N, microcosm C mineralization was most strongly correlated with hemicellulose content. The soil microbial community, as assessed by phospholipid and neutral-lipid fatty acid analysis, was not affected by bmr or normal genotype, but the addition of N resulted in significant changes to the soil microbial community, most notably changes to the soil fungi. Results indicate that potential does exist to modify plant residue chemistry to increase soil C sequestration, but soil fertility and microbial community dynamics are important considerations and may further enhance C sequestration potential.
Keywords: Carbon sequestration; bmr mutant grain sorghum; Microbial ecology; Lignin

M. Sakellariou-Makrantonaki, D. Papalexis, N. Nakos, I.K. Kalavrouziotis, Effect of modern irrigation methods on growth and energy production of sweet sorghum (var. Keller) on a dry year in

Central Greece, Agricultural Water Management, Volume 90, Issue 3, 16 June 2007, Pages 181-189, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.03.004.
(http://www.sciencedirect.com/science/article/B6T3X-4NMKVFW-1/2/6b33904a6dac28ebe809418165bf2f4e)
Abstract:
The subject of this project is to estimate the growth and productivity of sweet sorghum [Sorghum bicolor (L.)] var. Keller, under two different irrigation methods - the conventional surface drip method (two treatments) and the subsurface drip method - in a dry year in Central Greece, as an energy crop for the production of bio-ethanol. A field experiment was carried out on the experimental farm of the University of Thessaly during 2005, comprising of a completely randomized block design with four treatments in four blocks, including control (non-irrigated). In the treatments of surface drip method the evapotranspiration needs were satisfied by using full (100% ETm) and supplement (80% ETm) irrigation doses, while in the treatments of subsurface drip method only supplement irrigation water was used (80% ETm) with the aim of more efficient water conservation. Irrigation was fully automated, and application depths were determined, using a class A open evaporation pan for matching the evapotranspiration needs. The growth of the crop was measured by means of plant height and leaf area index, which were determined periodically throughout the growing period. Fresh and dry biomass productions were measured over six harvests covering the entire growth and production process of cultivation. The results of the first year demonstrated a clear superiority of the subsurface drip method on plant heights, leaf area index and total fresh and dry biomass production compared with the surface drip method for equal values of irrigation water. Maximum yield was attained by mid-September, before crop maturation, something which should be taken into consideration when choosing the best harvesting time of the crop. After late September, large negative growth rates were recorded, resulting in an appreciable drop in the final fresh and dry matter yield.
Keywords: Bio-ethanol; Drip irrigation; Growth and production analysis; Subsurface irrigation; Sweet sorghum; Water use efficiency

Simone Gisele de Oliveira, Telma Teresinha Berchielli, Marcio dos Santos Pedreira, Odo Primavesi, Rosa Frighetto, Magda Aparecida Lima, Effect of tannin levels in sorghum silage and concentrate supplementation on apparent digestibility and methane emission in beef cattle, Animal Feed Science and Technology, Volume 135, Issues 3-4, 15 June 2007, Pages 236-248, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2006.07.012.
(http://www.sciencedirect.com/science/article/B6T42-4KPP48T-2/2/e7bf234c984d9a2b5938fbdc9968a991)
Abstract:
This study evaluated the effect of diets containing sorghum silages with higher (HT) and lower-tannin (LT) concentrations supplemented with concentrate or urea on intake, digestibility, ruminal digestibility, methane emission and rumen parameters in beef cattle. Four treatments were distributed according to a 2 x 2 factorial arrangement in a duplicate 4 x 4 Latin square: LT sorghum silage + urea, LT sorghum silage + concentrate, HT sorghum silage + urea, and HT sorghum silage + concentrate. Total digestibility of the organic matter was higher when concentrate was included in the diet (0.749 and 0.753 in the LT and HT treatments, respectively). It was observed lower ruminal apparent digested matter of neutral detergent fiber in HT diets. There was no effect of tannin levels on digestibility and methane emission. The supplementation with concentrate in the LT diet decreased gas losses as a function of gross energy intake in comparison to the supplementation of the diet with urea. These results suggest the potential of concentrate supplementation to minimize energy loss as methane emission by ruminants and increase the efficiency of energy utilization.
Keywords: Global greenhouse gases; Nutritive value; Ruminal fermentation; Polyphenols

Taiichiro Hattori, Kaori Sonobe, Shinobu Inanaga, Ping An, Wataru Tsuji, Hideki Araki, Anthony Egrinya Eneji, Shigenori Morita, Short term stomatal responses to light intensity changes and osmotic stress in sorghum seedlings raised with and without silicon, Environmental and Experimental Botany, Volume 60, Issue 2, June 2007, Pages 177-182, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2006.10.004.
(http://www.sciencedirect.com/science/article/B6T66-4M7VB5J-1/2/cac4d2c03395673e26885630f1908f57)
Abstract:
Effects of silicon application on stomatal conductance in sorghum were investigated. Sorghum seedlings were grown in culture solution containing 0 or 1.67 mM silicon. On ninth day after giving silicon treatment, when there were no differences in shoot and root growth between the silicon-supplied and silicon-deficient treatments, seedlings were exposed to gradually increasing light intensity, combination of sudden increase and decrease in light intensity, and water stress induced by mixing sorbitol with the culture solution. There was increased stomatal conductance with increasing light intensity and no significant difference was observed between the two silicon treatments. Under water stress, the stomatal conductance of silicon-supplied seedlings was higher than that of silicon-deficient seedlings. The higher stomatal conductance in silicon-supplied seedlings under water stress was attributed to increased leaf water potential due to silicon-induced enhancement of hydraulic conductance. The results indicated that silicon application could affect stomatal conductance in sorghum seedlings through the modification of plant water relations.
Keywords: Silicon; Stomatal conductance; Water potential; Osmotic stress

A.P.P. Kayode, J.D. Hounhouigan, M.J.R. Nout, Impact of brewing process operations on phytate, phenolic compounds and in vitro solubility of iron and zinc in opaque sorghum beer, LWT - Food Science and Technology, Volume 40, Issue 5, June 2007, Pages 834-841, ISSN 0023-6438, DOI: 10.1016/j.lwt.2006.04.001.
(http://www.sciencedirect.com/science/article/B6WMV-4K1HF1V-1/2/8bf3a9ba57f0be549eb6f95e4bf5f508)
Abstract:
Opaque sorghum beer is a significant component of the diet of millions of poor people in rural Africa. This study reports the effect of traditional brewing operations on its level of micronutrients, especially iron and zinc. The example of a West African sorghum beer, tchoukoutou, in Northern Benin was studied. The beer was characterized and the impact of process unit operations on phytate, phenolic compounds, and Zn and Fe in vitro solubility was evaluated. The major microorganisms involved in the beer fermentation were Saccharomyces cerevisiae and heterofermentative lactobacilli. The manufacturing process reduces the phytate content by nearly 95%, particularly during germination, mashing-boiling and fermentation. The level of reactive phenolic groups increased as a result of germination and fermentation as well as from a shift in dry matter composition. Simultaneously with these modifications, an increase of Fe solubility was observed, and a correlation between phytate and Fe solubility ($R2=0.85$) was established. No clear correlation could be established between the Zn solubility and the phytate content of the products. During beer manufacturing, significant losses of minerals occur particularly during soaking and mashing/filtration; thus the quantity of minerals available to consumers is restricted. Improvements aiming to minimize such losses are highly desirable.
Keywords: Sorghum; Brewing; Tchoukoutou; Solubility; Iron; Zinc

Fugen Dou, Alan L. Wright, Frank M. Hons, Depth distribution of soil organic C and N after long-term soybean cropping in Texas, Soil and Tillage Research, Volume 94, Issue 2, June 2007, Pages 530-536, ISSN 0167-1987, DOI: 10.1016/j.still.2006.10.001.
(http://www.sciencedirect.com/science/article/B6TC6-4MBCB8N-2/2/731a6886b817dc31d96acdb1db0ce8b0)

Abstract:
Crop management practices have potential to enhance subsoil C and N sequestration in the southern U.S., but effects may vary with tillage regime and cropping sequence. The objective of this study was to determine the impacts of tillage and soybean cropping sequence on the depth distribution of soil organic C (SOC), dissolved organic C (DOC), and total N after 20 years of treatment imposition for a silty clay loam soil in central Texas. A continuous soybean monoculture, a wheat-soybean doublecrop, and a sorghum-wheat-soybean rotation were established under both conventional (CT) and no tillage (NT). Soil was sampled after soybean harvest and sectioned into 0-5, 5-15, 15-30, 30-55, 55-80, and 80-105 cm depth intervals. Both tillage and cropping intensity influenced C and N dynamics in surface and subsurface soils. No tillage increased SOC, DOC, and total N compared to CT to a 30 cm depth for continuous soybean, but to 55 cm depths for the more intensive sorghum-wheat-soybean rotation and wheat-soybean doublecrop. Averaged from 0 to 105 cm, NT increased SOC, DOC, and total N by 32, 22, and 34%, respectively, compared to CT. Intensive cropping increased SOC and total N at depths to 55 cm compared to continuous soybean, regardless of tillage regime. Continuous soybean had significantly lower SOC (5.3 g kg-1) than sorghum-wheat-soybean (6.4 g kg-1) and wheat-soybean (6.1 g kg-1), and 19% lower total N than other cropping sequences. Dissolved organic C was also significantly higher for sorghum-wheat-soybean (139 mg C kg-1) than wheat-soybean (92 mg C kg-1) and continuous soybean (100 mg C kg-1). The depth distribution of SOC, DOC, and total N indicated treatment effects below the maximum tillage depth (25 cm), suggesting that roots, or translocation of dissolved organic matter from surface soils, contributed to higher soil organic matter levels under NT than CT in subsurface soils. High-intensity cropping sequences, coupled with NT, resulted in the highest soil organic matter levels, demonstrating potential for C and N sequestration for subsurface soils in the southern U.S.
Keywords: Carbon sequestration; Dissolved organic C; Soil organic matter; Tillage

C. Martinez Ortiz de Montellano, J.J. Vargas-Magana, A.J. Aguilar-Caballero, C.A. Sandoval-Castro, L. Cob-Galera, M. May-Martinez, R. Miranda-Soberanis, H. Hoste, R. Camara Sarmiento, J.F.J. Torres-Acosta, Combining the effects of supplementary feeding and copper oxide needles for the control of gastrointestinal nematodes in browsing goats, Veterinary Parasitology, Volume 146, Issues 1-2, 15 May 2007, Pages 66-76, ISSN 0304-4017, DOI: 10.1016/j.vetpar.2007.02.012.
(http://www.sciencedirect.com/science/article/B6TD7-4ND71DX-1/2/dff95f989cd03df79e7a1497512f03d3)
Abstract:
The aim was to assess the benefits obtained from combining supplementary feeding and copper needles (COWP), compared to the use of both approaches independently, for the control of gastrointestinal nematode (GIN) infections in browsing kids. Forty-four nematode free Criollo kids were exposed to natural parasite infection. The kids were divided into six experimental groups: not treated, supplemented (NT-S), not treated, not supplemented (NT-NS), moxidectin treated, supplemented (M-S), moxidectin treated not supplemented (M-NS), copper treated, supplemented (COWP-S) and copper treated, non-supplemented (COWP-NS). Copper treated groups received Copinox(R) (2 g capsules) on day 0 and on day 60 of the trial. Moxidectin treated groups received Cydectin(R) (0.2 mg/kg of body weight sc) every 28 days. Three of the groups received individual supplementation (100 g of feed/day fresh basis; 74% sorghum: 26% soybean meal; NT-S, M-S and COWP-S) and the other three groups were not supplemented (NT-NS, M-NS and COWP-NS). Animals browsed native vegetation (6.5 h/day) during the wet season (154 days). Kids were weighed every 14 days to determine live weight gain (LWG) and blood and faecal samples were obtained to determine packed cell volume (PCV), haemoglobin (Hb), peripheral eosinophil counts (PEC) and faecal egg counts (FEC). At the end of the trial, four kids of each group were euthanatized (six kids in each COWP treated group). Worm burdens, female worm lengths and prolificacy were determined. Liver samples were used to determine copper concentration and were

stained with haematoxylin-eosin to determine microscopic lesions. Animals receiving the combination of supplementary feeding and COWP improved their LWG, PCV and Hb to similar levels of animals with suppressive AH treatment. This was not the case when COWP was used without supplementation. Liver copper concentration in COWP treated groups increased significantly especially in the COWP-NS kids but this was not associated with liver lesions or clinical signs. Post-mortem Haemonchus contortus and Trichostrongylus colubriformis worm counts had a tendency to be reduced in the different groups (66-35% reduction) compared to NT-NS group at the end of the trial (P > 0.05). Also, COWP treatment and/or supplementation reduced female worm length of T. colubriformis and prolificacy of H. contortus and T. colubriformis. This study, confirmed the value of nutritional supplementation in the control of GIN in growing kids. The use of COWP in addition to supplementation had a limited contribution on the kids' resilience against GIN. This may be due to the reduced infection of H. contortus during this trial.
Keywords: Supplementary feeding; Copper needles; Helminth; Browsing; Goats; Resilience

Surendra Suthar, Nutrient changes and biodynamics of epigeic earthworm Perionyx excavatus (Perrier) during recycling of some agriculture wastes, Bioresource Technology, Volume 98, Issue 8, May 2007, Pages 1608-1614, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.06.001.
(http://www.sciencedirect.com/science/article/B6V24-4KKWVMY-1/2/1b34ac5ba62eeceb098c75d1930f4ca0)
Abstract:
Potential of an oriental composting earthworm: Perionyx excavatus (Perrier) to decompose waste resources generated from agricultural practices (crop residues, farm yard manure, and cattle dung) was studied for 150 days under laboratory conditions. At the end of experiment, all vermibeds showed significant decrease in their organic C content (~21-29%), while increase in total N (~91-144%), available P (~63-105%), and exchangeable K (~45-90%). P. excavatus showed maximum individual live weight (662.05 mg) after 120 days in MIXED (mixed crop residues + cow dung in 1:1) substrate. The maximum growth rate (mg worm-1 day-1) was between 3.79 +/- 0.08 and 2.35 +/- 0.16 on different substrates. The mean number of cocoon production was between 394.3 +/- 23.2 and 690.7 +/- 23.2 for different experimental beddings. MIXED bedding showed maximum reproduction rate (0.23 +/- 0.004 cocoons worm-1 day-1), whereas farmyard manure bedding (FYM) showed least value (0.15 +/- 0.002 cocoons worm-1 day-1). During vermicomposting, the total mortality in worms' population was recorded between 0% (in MIXED) and 21.7% (in Jowar straw (Sorghum vulgare) + millet straw (Pennisenum typhoides) + sheep manure in 1:1:2 ratio (JMS)). The waste decomposition and earthworm production was associated strongly with the quality of the substrate, especially with their chemical as well as biological composition.
Keywords: Agriculture waste; Vermicomposting; Perionyx excavatus; Crop residues; Fym; Cocoon; Biomass production; Cow dung; Sheep manure; C:N ratio

O.O. Atanda, I. Akpan, F. Oluwafemi, The potential of some spice essential oils in the control of A. parasiticus CFR 223 and aflatoxin production, Food Control, Volume 18, Issue 5, May 2007, Pages 601-607, ISSN 0956-7135, DOI: 10.1016/j.foodcont.2006.02.007.
(http://www.sciencedirect.com/science/article/B6T6S-4KGX855-1/2/9b50df7179bcb5ac5d9e79c4ad31b307)
Abstract:
Essential oils of sweet basil (Ocimum basilicum), cassia (Cinnamomum cassia), coriander (Coriandrum sativum) and bay leaf (Laurus nobilis) at 1-5% (v/v) concentration in palm kernel broth inoculated with spore suspension (106/ml) of Aspergillus parasiticus CFR 223 were evaluated for their potential in the control of aflatoxigenic fungus A. parasiticus CFR 223 and aflatoxin production. Healthy sorghum grains (120/treatment) immersed in the oils and distributed in three petri dishes with wet cotton wool were also inoculated with spore suspension (106/ml) of

A. parasiticus CFR 223 and assayed for grain protection. Sweet basil oil at optimal protective dosage of 5% (v/v) was fungistatic on A. parasiticus CFR 223 and aflatoxins produced in vitro and on fungal development on sorghum grains (P [less-than-or-equals, slant] 0.05) with a residual effect that lasted for 32 days. In contrast, oils of cassia and bay leaf stimulated the mycelia growth of the fungus in vitro but reduced the aflatoxin concentration (B1 + G1) of the fungus by 97.92% and 55.21% respectively, while coriander oil did not have any effect on both the mycelia growth and aflatoxin content of the fungus. The combination of cassia and sweet basil oils at half their optimal protective dosages (2.5% v/v) completely inhibited the growth of the fungus. The feasibility of implementing the results of this study to control aflatoxins was examined by the addition of whole and ground dry basil leaves at 5% and 10% (w/w), respectively, to 10 g sorghum, groundnut, maize and melon seed after 35 days storage period. It was found that the addition of whole and ground basil leaves markedly reduced aflatoxin contamination; however, 10% (w/w) of whole leaves was more effective as the reduction in aflatoxin was between 89.05% and 91%.
The findings showed that aflatoxins can be controlled by co-storing whole sweet basil leaves with aflatoxin infected foods. The economic value of the study lies in the simplified technique for control of aflatoxin contamination in agricultural products and the benefits derivable from the use of local resources.
Keywords: Aflatoxigenic fungus; Essential oils; Protection assay and sorghum grains

D. Sola-Oriol, E. Roura, D. Torrallardona, Pig preference for cereal based diets, relationship with their digestibility and physical properties, Livestock Science, Volume 108, Issues 1-3, 10th International Symposium on Digestive Physiology in Pigs, Denmark 2006, Part 1, 1 May 2007, Pages 190-193, ISSN 1871-1413, DOI: 10.1016/j.livsci.2007.01.052.
(http://www.sciencedirect.com/science/article/B7XNX-4N0GJN4-H/2/f0c78c66ef269f40d3b271556625d5bc)
Abstract:
One of the most important challenges in pig farming is to overcome the initial anorexia of the pig at weaning. Since the use of palatable ingredients should facilitate the initiation of feeding at weaning, we have previously conducted a series of trials to measure the preference of pigs for different cereals. Preference is driven by odour and taste, but the physical and post-ingestive properties of the cereals could also have an effect. The present trial aims to study the relationship between the preferences for diets with 60% of rice, barley, sorghum or oats and their digestibility and physical properties. We measured the ileal and faecal digestibilities of dry matter, organic matter, and crude protein, and the proximal GIT emptying (from the flow of digesta through the ileal cannula) for 12 h after feeding. Particle size profile, viscosity, swelling and water retention capacity and texture (hardness, fragility, chewing effort and stickiness) of the four diets, were also measured. Pearson's correlation coefficients with feed preference were statistically significant ($P < 0.05$) for particle size profile and texture of the feeds. They tended to be significant ($P < 0.1$) for ileal digesta viscosity, faecal dry matter digestibility and proximal GIT emptying rate. Additional studies of palatability for cereals should consider these parameters in order to confirm this.
Keywords: Cereal; Palatability; Texture; Digestibility; Pigs

L. Marchiol, G. Fellet, D. Perosa, G. Zerbi, Removal of trace metals by Sorghum bicolor and Helianthus annuus in a site polluted by industrial wastes: A field experience, Plant Physiology and Biochemistry, Volume 45, Issue 5, Iron nutrition and Interactions in Plants, XIII International Symposium on Iron Nutrition and Interactions in Plants (ISINIP), May 2007, Pages 379-387, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2007.03.018.
(http://www.sciencedirect.com/science/article/B6VRD-4N8BMVM-5/2/26e4a25a786e1685e35fd8b7876be849)
Abstract:

Using the perspective of full scale application of phytoremediation techniques, research is focusing on the optimization of agronomic practices. Two annual high biomass yield crops, Sorghum bicolor and Helianthus annuus, were grown in a polymetallic soil. The experimental site, polluted by pyrite cinders, is located in an industrial site that has been listed in the clean-up national priority list since 2001. Specific aims of this work were to observe the concentration of metals in plants during the crop cycle and to establish the amount of metal removed by the crops. The field trial, arranged in a randomized block design, started in 2005. The concentrations of heavy metals in the soil were: As 309, Cd 4.29, Co 50.9, Cu 1527 and Zn 980 mg kg-1. The crops grown on the polluted soil received mineral fertilization (Fert) and organic amendment (Org), while plants in control soil (Ctrl) did not receive anything. The plots were watered during the crop cycle during two drought periods, using a sprinkler irrigation system. The phytoextraction potential of crops was estimated during the whole growth cycle and the plant biomass that was collected in each sampling date was ICP-analyzed. Plant-biomass growth curves were obtained. The concentrations of the metals in the shoots and in the total plant biomass were recorded. Finally, the metal removal was calculated for the harvestable parts of the crops. The amelioration of the nutritive status of the substrate that resulted, was highly effective for the biomass yield. However, fertilization and soil amendment did not heighten the concentration of metals in the harvestable tissue of the plants during the crop cycle. In some cases, organic matter appeared to bind the elements making them less available for the plants. The evaluation of the potential of phytoremediation of our plants compared to other crops in terms of metal removal was positive. Our results of metal removal are consistent with the results from other in situ experiments. The Zn removal by S. bicolor and H. annuus reached about 2000 g ha-1 and 1000 g ha-1, respectively.
Keywords: Soil pollution; Pyrite; Heavy metals; Phytoextraction; Fertilization; Field trial

Elisee Ouedraogo, Abdoulaye Mando, Lijbert Brussaard, Leo Stroosnijder, Tillage and fertility management effects on soil organic matter and sorghum yield in semi-arid West Africa, Soil and Tillage Research, Volume 94, Issue 1, May 2007, Pages 64-74, ISSN 0167-1987, DOI: 10.1016/j.still.2006.07.001.
(http://www.sciencedirect.com/science/article/B6TC6-4KNM9VW-1/2/292aaf2a6d8894df4d23f652151eb07f)
Abstract:
Whether it is traditional, modern or 'sustainable' agriculture, soil organic matter plays a key role in sustaining crop production and in preventing land degradation. A field experiment was conducted on a Ferric Lixisol at Gampela (Burkina Faso) in 2000 and 2001 to carried out the effects of tillage, fertilisation and their interaction on soil organic carbon (SOC) (0-10 cm), crop performance and microbial activities. Maize straw or sheep dung were applied separately or combined with urea in a till or no-till systems and compared with urea only and a control treatment. Sampling was done each year at 2 months after sowing and at harvest. SOC was increased in the tillage treatments in 2000 by 35% but only with 18% in 2001 suggesting reduced carbon accumulation in the absence of organic and mineral restitution. Ploughing in maize straw under conditions of N deficiency led to a drastic decrease in SOC due microbial priming effect that, was not observed when ploughing in sheep dung. In no-till system, losses, organic amendment N concentration and the soil N status determined the impact on SOC and crop productivity. The negative effect on SOC in the tillage treatment with maize straw (4.1 g kg-1) was less when maize straw was combined with urea (6.2 g kg-1). It is concluded that in semi-arid West Africa, without both organic resource and N inputs, soil organic matter 'pays' for crop N nutrition. Increasing SOC accumulation while improving crop yield may be conflicting under low-input agricultural systems in semi-arid West Africa. Therefore, optimum soil organic carbon and crop performance results from a judicious combination of organic resources and inorganic N mediated by microbial activity.
Keywords: Crop performance; Fertiliser; Organic amendments; Soil carbon; Tillage

P.C. Doraiswamy, G.W. McCarty, E.R. Hunt Jr., R.S. Yost, M. Doumbia, A.J. Franzluebbers, Modeling soil carbon sequestration in agricultural lands of Mali, Agricultural Systems, Volume 94, Issue 1, Making Carbon Sequestration Work for Africa's Rural Poor - Opportunities and Constraints, April 2007, Pages 63-74, ISSN 0308-521X, DOI: 10.1016/j.agsy.2005.09.011.
(http://www.sciencedirect.com/science/article/B6T3W-4MG1P8D-1/2/8c670905f473053ddd72c600b4c13592)
Abstract:
Agriculture in sub-Saharan Africa is a low-input low-output system primarily for subsistence. Some of these areas are becoming less able to feed the people because of land degradation and erosion. The aim of this study is to characterize the potential for increasing levels of soil carbon for improving soil quality and carbon sequestration. A combination of high- and low-resolution imagery was used to develop a land use classification for an area of 64 km2 near Omarobougou, Mali. Field sizes were generally small (10-50 ha), and the primary cultivation systems are conventional tillage and ridge tillage, where tillage is performed by a combination of hand tools and animal-drawn plows. Based on land use classification, climate variables, soil texture, in situ soil carbon concentrations, and crop growth characteristics, the EPIC-Century model was used to project the amounts of soil carbon sequestered for the region. Under the usual management practices in Mali, mean crop yield reported (1985-2000) for maize is 1.53 T ha-1, cotton is 1.2 T ha-1, millet is 0.95 T ha-1, and for sorghum is 0.95 T ha-1. Year-to-year variations can be attributed to primarily rainfall, the amount of plant available water, and the amount of fertilizer applied. Under continuous conventional cultivation, with minimal fertilization and no residue management, the soil top layer was continuously lost due to erosion, losing between 1.1 and 1.7 Mg C ha-1 over 25 years. The model projections suggest that soil erosion is controlled and that soil carbon sequestration is enhanced with a ridge tillage system, because of increased water infiltration. The combination of modeling with the land use classification was used to calculate that about 54 kg C ha-1 year-1 may be sequestered for the study area with ridge tillage, increased application of fertilizers, and residue management. This is about one-third the proposed rate used in large-scale estimates of carbon sequestration potential in West Africa, because of the mixture of land use practices.
Keywords: Crop yields; Soil erosion; Land use classification; EPIC-Century model; Ridge tillage

V. Nallathambi Gunaseelan, Regression models of ultimate methane yields of fruits and vegetable solid wastes, sorghum and napiergrass on chemical composition, Bioresource Technology, Volume 98, Issue 6, April 2007, Pages 1270-1277, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.05.014.
(http://www.sciencedirect.com/science/article/B6V24-4KCRS9F-3/2/b2d03790bc8399d83b879d7b244af490)
Abstract:
Several fractions of fruits and vegetable solid wastes (FVSW), sorghum and napiergrass were analyzed for total solids (TS), volatile solids (VS), total organic carbon, total kjeldahl nitrogen, total soluble carbohydrate, extractable protein, acid-detergent fiber (ADF), lignin, cellulose and ash contents. Their ultimate methane yields (Bo) were determined using the biochemical methane potential (BMP) assay. A series of simple and multiple regression models relating the Bo to the various substrate constituents were generated and evaluated using computer statistical software, Statistical Package for Social Sciences (SPSS). The results of simple regression analyses revealed that, only weak relationship existed between the individual components such as carbohydrate, protein, ADF, lignin and cellulose versus Bo. A regression of Bo versus combination of two variables as a single independent variable such as carbohydrate/ADF and carbohydrate + protein/ADF also showed that the relationship is not strong. Thus it does not appear possible to relate the Bo of FVSW, sorghum and napiergrass with single compositional characteristics. The results of multiple regression analyses showed promise and the relationship appeared to be good. When ADF and lignin/ADF were used as independent variables, the percentage of variation

accounted for by the model is low for FVSW (r2 = 0.665) and sorghum and napiergrass (r2 = 0.746). Addition of nitrogen, ash and total soluble carbohydrate data to the model had a significantly higher effect on prediction of Bo of these wastes with the r2 values ranging from 0.9 to 0.99. More than 90% of variation in Bo of FVSW could be accounted for by the models when the variables carbohydrate, lignin, lignin/ADF, nitrogen and ash (r2 = 0.904), carbohydrate, ADF, lignin/ADF, nitrogen and ash (r2 = 0.90) and carbohydrate/ADF, lignin/ADF, lignin and ash (r2 = 0.901) were used. All the models have low standard error values, which indicate the amount of spread is less. Thus, considering only the higher r2 values, six models are proposed for predicting the Bo based on FVSW data and sorghum and napiergrass data. It would be more convenient if Bo could be predicted by analyzing the chemical composition of the substrate rather than performing the long-term batch fermentation. To test the validity of the regression models, chemical constituents of FVSW that were not included in the regression analyses were determined and their experimental Bo were determined by BMP assay. All the six models were used to predict the Bo from the chemical constituents of these FVSW. It was found that most of the predicted values were within 20% of the experimental Bo in models 1, 3 and 6. Since models 3 and 6 used the same variables namely, total soluble carbohydrate, ADF, lignin/ADF, nitrogen and ash, Bo can be predicted from these five chemical constituents which accounts for more than 90% of the variation in Bo (r2 > 90).

Keywords: Fruit wastes; Vegetable wastes; Sorghum; Napiergrass; Standard biomass; Biochemical methane potential assay; Multiple regression models; Ultimate methane yield; Predicting Bo

S. Audilakshmi, C. Aruna, R.B. Solunke, M.Y. Kamatar, H.G. Kandalkar, P. Gaikwad, K. Ganesh Murthy, K. Jayaraj, C.V. Ratnavathi, N. Kannababu, S. Indira, N. Seetharama, Approaches to grain quality improvement in rainy season sorghum in India, Crop Protection, Volume 26, Issue 4, April 2007, Pages 630-641, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.05.015.
(http://www.sciencedirect.com/science/article/B6T5T-4KMYFM0-2/2/e9d771d75e46a3793c54d21f1a07aebd)

Abstract:
In India, the area and production of sorghum during rainy season has been stagnant for the last 9 years. The main reason for this is the poor quality of the grain produced during the rainy season. Heavy rains at the time of crop maturity cause severe damage to the grain quality. The deterioration is caused by infection from a complex of fungi (resulting in moulded grain) and discolouration of the grain due to leaching out of colour from glume. We explored five approaches to manage the mould problem in 18 farmers' fields each in the districts of Parbhani, Akola (Maharashtra), Mahabubnagar (Andhra Pradesh), Indore (Madhya Pradesh), Coimbatore (Tamil Nadu) and Dharwad (Karnataka) of India:
(i) Identification of cultivars for superior grain quality among the released cultivars.
(ii) Effect of anti-heating chemicals and fungicides on grain quality in relation to moulds.
(iii) Pearling of grain to improve the deteriorated grain.
(iv) Identification of grain mould tolerant variety, and
(v) Solarization to improve storability of rainy season grain.
Among the released cultivars, CSH 16 was identified for its good quality mould tolerant grain. Its bold, round and lustrous grain fetched up to 21% increased market price than those of other cultivars. Acetic acid treatment was most effective among the anti-heating chemicals. The wet produce treated with acetic acid gave a reduced grain mould score. The market price was improved when normal deteriorated grain was pearled. The high yielding variety SVD 9601 was superior in grain mould tolerance during all the three years when tested under epiphytotic conditions. The technology of solarization of harvested produce and storing in metal bins helped in reducing the insect infestation by about 40%. These technologies can be practiced either independently or in combination. Cultivating good quality high yielding varieties followed by

harvesting the produce at physiological maturity with artificial drying and storing the solarized produce in metal bins would be the best package of technology for improving the grain quality of the rainy season produce.
Keywords: Sorghum bicolor; Pearling; Acetic acid; Solarization; Grain moulds; Storage

N.R. Hulugalle, T.B. Weaver, L.A. Finlay, J. Hare, P.C. Entwistle, Soil properties and crop yields in a dryland Vertisol sown with cotton-based crop rotations, Soil and Tillage Research, Volume 93, Issue 2, April 2007, Pages 356-369, ISSN 0167-1987, DOI: 10.1016/j.still.2006.05.008.
(http://www.sciencedirect.com/science/article/B6TC6-4K8S5GN-2/2/d2be2a62545e002a6c70d2dc23dff2b4)
Abstract:
Information on the effects of growing cotton (Gossypium hirsutum L.)-based crop rotations on soil quality of dryland Vertisols is sparse. The objective of this study was to quantify the effects of growing cereal and leguminous crops in rotation with dryland cotton on physical and chemical properties of a grey Vertisol near Warra, SE Queensland, Australia. The experimental treatments, selected after consultations with local cotton growers, were continuous cotton (T1), cotton-sorghum (Sorghum bicolor (L.) Moench.) (T2), cotton-wheat (Triticum aestivum L.) double cropped (T3), cotton-chickpea (Cicer arietinum L.) double cropped followed by wheat (T4) and cotton-wheat (T5). From 1993 to 1996 land preparation was by chisel ploughing to about 0.2 m followed by two to four cultivations with a Gyral tyne cultivator. Thereafter all crops were sown with zero tillage except for cultivation with a chisel plough to about 0.07-0.1 m after cotton picking to control heliothis moth pupae. Soil was sampled from 1996 to 2004 and physical (air-filled porosity of oven-dried soil, an indicator of soil compaction; plastic limit; linear shrinkage; dispersion index) and chemical (pH in 0.01 M CaCl2, organic carbon, exchangeable Ca, Mg, K and Na contents) properties measured. Crop rotation affected soil properties only with respect to exchangeable Na content and air-filled porosity. In the surface 0.15 m during 2000 and 2001 lowest air-filled porosity occurred with T1 (average of 34.6 m3/100 m3) and the highest with T3 (average of 38.9 m3/100 m3). Air-filled porosity decreased in the same depth between 1997 and 1998 from 45.0 to 36.1 m3/100 m3, presumably due to smearing and compaction caused by shallow cultivation in wet soil. In the subsoil, T1 and T2 frequently had lower air-filled porosity values in comparison with T3, T4 and T5, particularly during the early stages of the experiment, although values under T1 increased subsequently. In general, compaction was less under rotations which included a wheat crop (T3, T4, T5). For example, average air-filled porosity (in m3/100 m3) in the 0.15-0.30 m depth from 1996 to 1999 was 19.8 with both T1 and T2, and 21.2 with T3, 21.1 with T4 and 21.5 with T5. From 2000 to 2004, average air-filled porosity (in m3/100 m3) in the same depth was 21.3 with T1, 19.0 with T2, 19.8 with T3, 20.0 with T4 and 20.5 with T5. The rotation which included chickpea (T4) resulted in the lowest exchangeable Na content, although differences among rotations were small. Where only a cereal crop with a fibrous root system was sown in rotation with cotton (T2, T3, T5) linear shrinkage in the 0.45-0.60 m depth was lower than in rotations, which included tap-rooted crops such as chickpea (T4) or continuous cotton (T1). Dispersion index and organic carbon decreased, and plastic limit increased with time. Soil organic carbon stocks decreased at a rate of 1.2 Mg/ha/year. Lowest average cotton lint yield occurred with T2 (0.54 Mg/ha) and highest wheat yield with T3 (2.8 Mg/ha). Rotations which include a wheat crop are more likely to result in better soil structure and cotton lint yield than cotton-sorghum or continuous cotton.
Keywords: Farming system; Cropping system; Soil quality; Clay; Dryland; Wheat; Sorghum; Chickpea; Halpustert; Compaction

B.A. Ould Ahmed, T. Yamamoto, V. Rasiah, M. Inoue, H. Anyoji, The impact of saline water irrigation management options in a dune sand on available soil water and its salinity, Agricultural Water Management, Volume 88, Issues 1-3, 16 March 2007, Pages 63-72, ISSN 0378-3774, DOI: 10.1016/j.agwat.2006.10.001.

(http://www.sciencedirect.com/science/article/B6T3X-4M9H3P8-1/2/6f7d67821a455771a28065d5d80019d2)
Abstract:
In this study the effect of two levels of irrigation input, each at two frequencies, were assessed on sorghum (Sorghum bicolor (L.) Moench) grain yield as impacted by available soil water after irrigation and the electrical conductivity of soil water (ECsw) in a dune sand, in a greenhouse experiment. Saline water (7.32 dS m-1) at input amounts equivalent to 50% or 100% of pan evaporation was applied daily or every second day. Using time domain reflectometry technique, soil water content and ECsw were monitored simultaneously just before and 1-2 h after irrigation. The cumulative recharge by irrigation in the top 25 cm of the profile ranged from 309 to 662 mm and it depended on irrigation input amounts, which ranged from 382 to 765 mm, and frequency. The potential cumulative evapotranspiration (ETc) was 578 mm. The daily recharge matched against the corresponding ETc indicated that grain yield might have been impacted by water stress in the 50% irrigation input, regardless of the frequency, but not in the 100% input treatment. The daily ECsw in the root-zone matched against the FAO threshold (13.6 dS m-1) indicated the possibility of salinity stress during the late maturity stage in the 50% input treatment, regardless of the irrigation frequency, but no stress in the 100% input treatment. Though there was no water or salinity stress in the every second day irrigated 100% input treatment, the significant relative yield reduction, compared with the daily 100% input, is attributed to inherent limited available soil water capacity and rapid percolation losses between irrigations in this sand. The results indicate daily irrigation at 100% input is the most appropriate saline water irrigation management option for this dune sand.
Keywords: Saline water irrigation; Available soil water; Soil water salinity; Sorghum; Sustainability

P.R. Westerman, A. van Ast, T.J. Stomph, W. van der Werf, Long-term management of the parasitic weed Striga hermonthica: Strategy evaluation with a population model, Crop Protection, Volume 26, Issue 3, Weed Science in Time of Transition, March 2007, Pages 219-227, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.01.017.
(http://www.sciencedirect.com/science/article/B6T5T-4M3RNVW-2/2/8e97129d10e1a0f20c385bdb8e10d6b0)
Abstract:
To increase sorghum yields in areas in Africa that are heavily infested with the root parasite Striga hermonthica, crop varieties are being bred whose roots emit fewer exudates that stimulate S. hermonthica seeds to germinate. Because S. hermonthica has a persistent seedbank, it is important to anticipate the long-term effects of such breeding efforts on the seedbank dynamics. This study reports the results of analyses conducted with a population model for S. hermonthica based on existing and earlier published models and data. The essential innovation is an explicit modelling of density-dependent feedback, which was included at different points in the life cycle. Sensitivity analyses showed that density-dependence reduced the impact on the equilibrium seedbank density of life cycle parameters at stages preceding the density-dependent process. The implication is that intervention early in the parasite life cycle through, for instance, breeding for low exudate emission of the cereal host, carries the risks of maintaining or increasing S. hermonthica seedbanks, and selection for S. hermonthica populations responsive to the new varieties. Only crop varieties with very low production of germination-stimulant will be effective in the long run. The best breeding strategy is to select for crop varieties that inhibit S. hermonthica development or growth at stages later in the life cycle or that affect the parasite at multiple stages simultaneously. The most effective management strategy is to use control measures that cause a reduction in seed production, viability of newly produced seed, or seed survival in the soil, or to use a combination of measures that affect the parasites at multiple stages. Despite considerable knowledge gaps regarding the basic demography of S. hermonthica, the model proved useful in identifying points in the S. hermonthica life cycle that are of particular interest for designing

intervention strategies. In-depth studies on the demography of S. hermonthica and on the location(s) of density-dependence in the parasite's life cycle are needed.
Keywords: Density-dependent feedback; Long-term effects; Striga hermonthica; Seedbank; Resistance

RM. Kathiresan, Integration of elements of a farming system for sustainable weed and pest management in the tropics, Crop Protection, Volume 26, Issue 3, Weed Science in Time of Transition, March 2007, Pages 424-429, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.11.015.
(http://www.sciencedirect.com/science/article/B6T5T-4M93NY3-1/2/3d82812598544c7d2de489f65d95af5f)
Abstract:
Diversification of agricultural activities that links farm-based enterprises with cultivation of field crops helps the resource-poor farmers in tropics to generate additional income, gainful employment and improve their dietary standards. A farming system approach has been found to be a resource management strategy for achieving economic and sustainable agricultural production, catering to the diverse needs of tropical farm household while preserving the resource base and ensuring high environmental quality. A judicious combination of any one or more of the farming enterprises like poultry rearing, duckery, fish culture, cattle rearing, green manuring and culture of bio-fertilizers contribute significantly for weed and pest management in field crops. Cropping system strategies like rotation of crops in sequence, intercropping and mulching do influence the weed-pest complex of crops. All these elements alter the weed flora in cropped fields through their feeding habits, allelopathic or allelomediatory principles in their excreta, suppression through physical interference like shading and altered ecology. Some of these elements also supplement pest management directly by virtue of their predatory behaviour or indirectly through suppression of weeds that serve as alternate hosts and by inducing fast and robust crop growth. Field experiments in Faculty of Agriculture, Annamalai University, India have revealed such beneficial interactions among component elements of different farming systems, viz., rice+fish+poultry, rice+azolla+fish, greenmanure-rice, rice-pulse, goat rearing+sorghum and cotton intercropped with pulse. All these approaches along with similar strategies involving other farming elements are discussed here.
Keywords: Farm components; Animal; Agro-forestry; Integrated weed and pest management

Dalton Henrique Pereira, Odilon Gomes Pereira, Bruno Ceolin da Silva, Maria Ignez Leao, Sebastiao de Campos Valadares Filho, Fernanda Helena Martins Chizzotti, Rasmo Garcia, Intake and total and partial digestibility of nutrients, ruminal pH and ammonia concentration and microbial efficiency in beef cattle fed with diets containing sorghum (Sorghum bicolor (L.) Moench) silage and concentrate in different ratios, Livestock Science, Volume 107, Issue 1, March 2007, Pages 53-61, ISSN 1871-1413, DOI: 10.1016/j.livsci.2006.09.002.
(http://www.sciencedirect.com/science/article/B7XNX-4M3BGYV-2/2/ad86332da72f6d6fe9ec0fc96b4ba6b3)
Abstract:
The intake and total apparent and partial digestibility of nutrients, ruminal pH and ammonia concentrations and efficiency of microbial synthesis were evaluated in beef cattle fed diets containing sorghum silage and concentrate in the following ratios: 800:200, 650:350, 500:500 and 350:650 g/kg, in a total dry matter basis. Four crossbred Holstein x Zebu rumen and abomasum fistulated steers, 224 +/- 23 kg-average initial live weight, were assigned to a 4 x 4 Latin square design. Chromic oxide was used as marker to estimate fecal and abomasal dry matter flows, and microbial efficiency was determined from purine basis. The intakes and total apparent digestibilities of DM, OM, CP and NFC and TDN intakes increased linearly ($P < 0.01$) with the increase of concentrate in the diet. NDF intake and total apparent digestibility decreased linearly ($P < 0.05$). The apparent ruminal and intestinal digestibilities of DM, OM, CP, NDF and NFC were

not influenced (P > 0.05) by increasing the concentrate in the diet, and the mean values were 619 and 381 (g/kg); 656 and 349; 391 and 498; 902 and 79 and 600 and 399 (g/kg DM), respectively. There was a quadratic effect of collection time (P < 0.01) on the concentration of ruminal NH3-N and pH, considering maximum and minimum values of 14.89 mg/dL and 6.16 at 2.39 and 4.28 h after feeding, respectively. The efficiency of microbial synthesis, expressed in different ways was not influenced (P > 0.05) by treatments, with 11.39 g CPmic/100 gTDN on average. Although increasing concentrate levels in the diets resulted in higher intakes of almost all nutrients, this did not result in alterations in the ruminal variables evaluated.
Keywords: Chromic oxide; Crude protein; Ruminal parameters; Roughage

W. McNair Bostick, Vincent B. Bado, Andre Bationo, Cecilia Tojo Soler, Gerrit Hoogenboom, James W. Jones, Soil carbon dynamics and crop residue yields of cropping systems in the Northern Guinea Savanna of Burkina Faso, Soil and Tillage Research, Volume 93, Issue 1, March 2007, Pages 138-151, ISSN 0167-1987, DOI: 10.1016/j.still.2006.03.020.
(http://www.sciencedirect.com/science/article/B6TC6-4JW7WMB-1/2/3eef4647d5393dca7d035cd3fba4e411)
Abstract:
Concerns about effects of increasing atmospheric concentration of carbon dioxide (CO2) on climate has given rise to the possibility of emission credits for soil organic carbon (SOC) sequestration. The goal of this study was to analyze SOC sequestration options in cropping systems of the Northern Guinea Savanna of West Africa. An 11-year experiment from the region, which consisted of 56 cropping system treatments that combined various crop rotation sequences with various input levels and an additional treatment of native grass fallow, was analyzed. Rotations included one or more of: sorghum (Sorghum bicolor (L.) Moench), cotton (Gossypium hirsutum L.), groundnut (Arachis hypogaea L.), maize (Zea mays L.) and native grass fallow. Inputs were defined by whether or not the plots were plowed and the addition of soil amendments (N, nitrogen; P, phosphorous; K, potassium; D, dolomite; CR, crop residues; CP, compost and ME, manure). Plots were moldboard plowed before seeding, except fallows, which were not plowed. Soil organic carbon in select treatments and residue yields from all cropped treatments were analyzed. The slope parameters from the regression analysis of SOC in the continuous fallow treatment were not significantly different from zero (P > 0.05), suggesting SOC (0.53% after 11 years) was at steady state in this treatment. Rotation and input significantly affected SOC (P < 0.05), but interaction effects were not significant. After 11 years, the cropped rotation with the greatest SOC was sorghum-fallow (0.46%), which was significantly greater (P < 0.05) than SOC in other the rotations measured: continuous cotton (0.36%), continuous sorghum (0.35%), and cotton-maize-sorghum (0.33%). For the input levels, addition of P, K, and ME gave the greatest SOC (0.44%) after 11 years of cropping, which was significantly greater (P < 0.05) than SOC from the N, P, K and D (0.37%), no input (0.32%) and N, P and K (0.34%) treatments. In addition, SOC with inputs of N, P, K and D (0.37%) was significantly greater than SOC with no input (0.32%). Three management practices, which had significantly greater SOC than others and were among the best for yields, were identified as sequestering management options for the region. These were rotating sorghum and fallow, and amending the soil with mineral P, K, and ME or N, P, K and D. However, potential drawbacks, such as a risk of reduced production with increased fallows, must be identified and addressed if the options are to be adopted.
Keywords: Burkina Faso; Soil carbon; Soil carbon model; West Africa; Crop residue

Uttam Kumar Mandal, U.S. Victor, N.N. Srivastava, K.L. Sharma, V. Ramesh, M. Vanaja, G.R. Korwar, Y.S. Ramakrishna, Estimating yield of sorghum using root zone water balance model and spectral characteristics of crop in a dryland Alfisol, Agricultural Water Management, Volume 87, Issue 3, 16 February 2007, Pages 315-327, ISSN 0378-3774, DOI: 10.1016/j.agwat.2006.08.002.

(http://www.sciencedirect.com/science/article/B6T3X-4KWK12B-1/2/7238bb3437cbbcc8960e5abd83ae94ef)
Abstract:
This study investigated the relationship between sorghum grain yield for a range of soil depths, with the seasonal crop water stress index based on relative evapotranspiration deficits and spectral vegetation indices. A root zone water balance model was used to evaluate seasonal soil water fluctuations and actual evapotranspiration within a toposequence; soil depth varied between 30 and 75 cm and available water capacity ranged from 6.9 to 12.6% (v/v, %). An empirical model was used to determine root growth. Runoff was estimated from rainfall data using the curve number techniques of the Soil Conservation Services, combined with a soil water-accounting procedure. The high r2 values between modeled and observed values of soil water in the root zone (r2 > 0.70, significant at P < 0.001) and runoff (r2 = 0.95, significant at P < 0.001) indicated good agreement between the model output and observed values. Canopy reflectance was measured during the entire crop growth period and the following spectral indices were calculated: simple ratio, normalized difference vegetation index (NDVI), green NDVI, perpendicular vegetation index, soil adjusted vegetation index (SAVI) and modified SAVI (MSAVI). All the vegetation indices, except for the perpendicular vegetation index, measured from booting to anthesis stage, were positively correlated with leaf area index (LAI) and yield. The correlation coefficient for spectral indices with dry biomass was relatively less than for LAI and yield. Modified SAVI recorded from booting to milk-grain stage gave the highest average correlation coefficient with grain yield. Additive and multiplicative forms of water-production functions, as well as water stress index calculated from water budget model, were used to predict crop yield. A multiple regression was carried out with yield, for the years 2001-2003, as the dependent variable and MSAVI, from the booting to the milk-grain stage of crop and relative yield values, calculated using both additive and multiplicative water production functions as well as water stress index, as the independent variables. The multiplicative model and MSAVI, recorded during the heading stage of crop growth, gave the highest coefficient of determination (r2 = 0.682, significant at P < 0.001). The multiple regression equation was tested for yield data recorded during 2004; the deviation between observed and estimated yields varied from -6.2 to 9.4%. The water budget model, along with spectral vegetation indices, gave satisfactory estimates of sorghum grain yields and appears to be a useful tool to estimate yield as a function of soil depth and available water.
Keywords: Toposequence; Vegetation indices; Water production function; Water stress index

J.L. Foster, J.P. Muir, B.D. Lambert, D. Pawelek, In situ and in vitro degradation of native Texas warm-season legumes and alfalfa in goats and steers fed a sorghum-sudan basal diet, Animal Feed Science and Technology, Volume 133, Issues 3-4, 15 February 2007, Pages 228-239, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2006.04.005.
(http://www.sciencedirect.com/science/article/B6T42-4K0FMPJ-1/2/1386317bbb8be7000895368f71509c76)
Abstract:
The objective was to determine in situ degradation (ISD) rates of herbaceous native Texas legumes when incubated in ruminally fistulated goats and cattle fed a basal diet of sorghum-sudan hay (643.7 +/- 75.1 g/kg neutral detergent fiber (NDFom), 77.3 +/- 20.5 g/kg crude protein (CP)). Velvet bundle flower (Desmanthus velutinus) (414.7 +/- 14.9 g/kg NDFom, 184.9 +/- 11.2 g/kg CP), prairie acacia (Acacia angustissima var. hirta) (340.9 +/- 36.5 g/kg NDFom, 186.5 +/- 46.7 g/kg CP), tropical neptunia (Neptunia pubescens) (387.3 +/- 3.0 g/kg NDFom, 169.8 +/- 12.2 g/kg CP) and alfalfa (Medicago sativa) (498.0 +/- 8.0 g/kg NDFom, 197.9 +/- 2.8 g/kg CP) were incubated in situ for 0, 4, 8, 16, 24, 48 and 96 h. There was no interaction between animal species and forage for dry matter (DM) or organic matter (OM) ISD. Because animal species did not affect most ISD parameters, data was pooled between species. The greatest rate of ISD was in alfalfa and, among the native legumes, A. angustissima var. hirta and N. pubescens contained a greater

amount of soluble and slowly degraded DM and OM than D. velutinus indicating that they possess greater potential nutritive value under these conditions.
Keywords: Warm-season forage; Native legumes; Goats; Steers; In situ degradation; In vitro digestibility

Lisa J. Bird, Raymond J. Akhurst, Effects of host plant species on fitness costs of Bt resistance in Helicoverpa armigera (Lepidoptera: Noctuidae), Biological Control, Volume 40, Issue 2, February 2007, Pages 196-203, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2006.11.004.
(http://www.sciencedirect.com/science/article/B6WBP-4MD2TBF-1/2/11452d0887c276ab77de6d1a13ba9a3f)
Abstract:
Increases in the magnitude and dominance of fitness costs associated with resistance have been implicated as key factors in delaying or preventing increases in resistance allele frequency in insect populations. We tested the hypotheses that the magnitude and dominance of fitness costs can be affected by the crop used in the refuge. The performance of Helicoverpa armigera (Hubner) on three refuge plant species (sorghum, cotton, and pigeon pea) was compared for a susceptible laboratory strain, a near-isogenic strain selected in the laboratory against the Cry1Ac endotoxin of Bacillus thuringiensis, and the F1 progeny of these two strains. Survival on each plant species was lower in resistant individuals compared with their susceptible counterparts. Compared with the susceptible strain, larval development of the resistant strain was delayed on cotton (by 4.7 days) and on sorghum (by 1.5 days), with no delay on pigeon pea. These results indicate that a fitness cost is associated with Cry1Ac resistance and that, for some traits, the magnitude of the cost depends on plant species. Generally, life history traits were similar for susceptible and F1 insects that developed on pigeon pea. However, on cotton, development was slower in F1 insects compared with susceptible insects, while on sorghum pupal weight and fecundity were reduced in F1 insects compared with susceptible insects. These results suggest that an understanding of the interaction between host refuge plant and fitness costs associated with Cry1A resistance in H. armigera could be advantageous for maximizing the benefits of refuges used in resistance management of bioinsecticides, whether microbial or transgenic plants. Although further data on overall fitness are required to provide a definitive position, the data indicate that cotton may be the most effective refuge when B. thuringiensis or its toxins are used for controlling H. armigera on cotton.
Keywords: Refuges; Bt cotton; Helicoverpa armigera; Fitness cost; Resistance; Dominance

M.B.T. Munyuli, G.C. Luther, S. Kyamanywa, Effects of cowpea cropping systems and insecticides on arthropod predators in Uganda and Democratic Republic of the Congo, Crop Protection, Volume 26, Issue 2, February 2007, Pages 114-126, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.04.010.
(http://www.sciencedirect.com/science/article/B6T5T-4K6CPG4-1/2/d2658302c50325465bfefc72a321050e)
Abstract:
Knowledge of the distribution, abundance, species diversity and effectiveness of indigenous natural enemies of cowpea pests in Uganda and the Democratic Republic of the Congo (DRC) is poor. Similarly, effects of insecticides commonly used by cowpea farmers on arthropod predators are not well documented in these countries, so effects of insecticides on these natural enemies were monitored in field trials with cowpea grown solely and in association with sorghum or greengram. The abundance of predators (Coccinellidae, Staphylinidae, Syrphidae, Anthocoridae, Mantidae, Dermaptera, ground beetle, predatory mite, lygaeid bugs, Anthocoridae, dragonflies and spiders) were considerably affected by insecticides and the cropping system. Polyculture had a higher index of diversity than monocultures. In terms of species diversity supported, there was no significant difference between cowpea/greengram and cowpea/sorghum. There was a seasonal

variation in similarity (MS=0.71, long rains; MS=0.77, short rains) of the predator community supported by the cowpea cropping system, between Mulungu (DRC) and Kumi (Uganda) habitats. Lower pests pressure on cowpea crop, higher abundance of predators and higher cowpea yields were observed to be associated with cowpea/greengram cropping systems. Therefore cowpea/greengram should be promoted among other biological control conservation strategies, aiming at enhancing natural enemies in cowpea systems, through habitat manipulation. This study indicated that generalist predators, through their activities might be important natural enemies of cowpea pests in Uganda and in DRC.
Keywords: Predators; Cowpea pests; Cropping systems; Insecticides; Uganda; D R Congo; Cowpea yield; Habitat manipulation; Biological control conservation and enhancement

B. Colomb, P. Debaeke, C. Jouany, J.M. Nolot, Phosphorus management in low input stockless cropping systems: Crop and soil responses to contrasting P regimes in a 36-year experiment in southern France, European Journal of Agronomy, Volume 26, Issue 2, February 2007, Pages 154-165, ISSN 1161-0301, DOI: 10.1016/j.eja.2006.09.004.
(http://www.sciencedirect.com/science/article/B6T67-4M6S059-1/2/26f0cd2d301698236c84dfa8666152f8)
Abstract:
Fertiliser recommendation systems should aim at a finer tuning of non-renewable P inputs for agronomic, environmental and economic reasons. Modern decision support systems should take into account the relevant soil characteristics, the P recycling capabilities of the cropping system, and crop requirements for attainable production in a range of soil/weather conditions. Unfortunately, information is still lacking for low input cropping systems in south-western France. In 1968 INRA Toulouse set up a P experiment, which has been going on for 36 years, on a deep alluvial silty-clay/clay soil with varying CaCO3. Four P regimes (P0, P1, P2, P4) were arranged in four blocks with periodic changes in the fertiliser dressings. Wheat, maize, sunflower, sorghum and soybean were tested for grain yield (GY) and grain P concentration (GPC) response to soil Olsen P concentration. The highest GY were observed in both P2 and P4, although P1 yields were significantly lower in only 4 years out of 36. P0 resulted 32 times in lower yields than P2-P4 and 27 times in lower yields than P1. Wheat was the crop most sensitive to the absence of P fertilization (GYP0/GYPmax = 0.72); maize and sorghum were intermediate (0.77) and sunflower was the less sensitive on average (0.83). As the highest GPC values were observed in the P4 treatments, P removal was maximum for P4 (21.9 kg P ha-1 year-1) and minimal in P0 (11.7 kg P ha-1 year-1). The critical soil Olsen P values for yield responses were determined using the Cate-Nelson and Mitscherlich approaches. Although the thresholds differ for the two methods (3.3-7.2 mg P kg-1 with Cate-Nelson; 4.4-11.2 mg P kg-1 with Mitscherlich), crops ranked similarly with both methods. Critical soil P values were lowest for maize and highest for sunflower, while wheat, soybean and sorghum had intermediate values. Because of low-input management and frequent water stress, critical values fall within the lower range of published values. Only in the P4 treatment were P-Olsen values potentially hazardous for the environment (>20 mg P kg-1) 8-10 years after the beginning of the experiment. Annual P dressings of 17.5 kg P ha-1 year-1 (P1) were sufficient to achieve good yields but P dressings of 35 kg P ha-1 year-1 (P2) were necessary to stabilize soil P around the critical level in the calcareous part of the experiment.
Keywords: Phosphorus; Long-term experiment; Low input cropping system; Soil-test phosphorus; Olsen-P critical value; P removal; Grain phosphorus concentration; Triticum aestivum L.; Zea mais L.; Helianthus annuus L.; Sorghum bicolor L.; Glycine max. L

Brenda L. Gambin, Lucas Borras, Plasticity of sorghum kernel weight to increased assimilate availability, Field Crops Research, Volume 100, Issues 2-3, 1 February 2007, Pages 272-284, ISSN 0378-4290, DOI: 10.1016/j.fcr.2006.08.002.

(http://www.sciencedirect.com/science/article/B6T6M-4KV8TD7-3/2/78cc7a13737f116d8c0118739dbf94a1)
Abstract:
Understanding source or sink limitations on crop yield is critical for the rational design of agricultural practices as well as breeding strategies. In the present article, we studied sorghum [Sorghum bicolor (L.) Moench] source-sink yield limitations during grain filling, and tested the hypothesis that the time in which kernel maximum water content is reached during grain filling defines a temporal limit for the crop to profit from source increases. Earlier studies have never tested increasing assimilate availability per kernel in different developmental stages. We conducted a field experiment increasing assimilate availability per kernel at anthesis and 15 days after anthesis in commercial hybrids. The anthesis treatment was aimed to increase assimilates per kernel from early grain filling, and the 15 days after anthesis treatment from the stage kernel maximum water content was achieved. Both treatments removed 50% of the kernels from one side of the panicle. Kernel dry weight (KW), kernel water content and kernel volume were measured in apical and basal positions of the panicle throughout grain filling. Increased assimilate availability always yielded a higher KW (~34% increase). This KW increase was consistent across the two kernel developmental stages when the treatment was imposed, the panicle position and hybrid. Achieving maximum water content did not prevent kernels from increasing their weight when assimilates were subsequently increased. Final KW was closely related to maximum kernel volume ($r2 = 0.72$; $n = 42$; $p < 0.0001$). Increased assimilate availability per kernel promoted changes in both kernel growth rate and duration of grain filling.
We applied a quantitative approach for determining the magnitude of sorghum KW changes in response to assimilate availability changes during grain filling. This allowed us to compare our data to previously published articles, and to determine any general response pattern across environments. The analysis supported our observation that sorghum KW is highly responsive to increased assimilates, and indicated that increased assimilate availability during filling always increased sorghum KW. As such, growth of sorghum kernels is predominately source limited; breeding and management practices aimed to increase assimilate availability per kernel will be likely to enhance sorghum yield. Results show that the crop has the capacity to profit from source increases even after the initial grain-filling stages have occurred.
Keywords: Sorghum bicolor L. Moench; Source-sink relations; Kernel water relations; Kernel volume; Kernel desiccation

Benedicte Lebouteiller, Aurelie Gousset-Dupont, Jean-Noel Pierre, Jean Bleton, Alain Tchapla, Mickael Maucourt, Annick Moing, Dominique Rolin, Jean Vidal, Physiological impacts of modulating phosphoenolpyruvate carboxylase levels in leaves and seeds of Arabidopsis thaliana, Plant Science, Volume 172, Issue 2, February 2007, Pages 265-272, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2006.09.008.
(http://www.sciencedirect.com/science/article/B6TBH-4M4CTJP-1/2/2ab103e8bb9fc2425fd66c4b5c49e2a4)
Abstract:
Arabidopsis thaliana was transformed with a Sorghum C4 PEPC cDNA under the control of the 35S promoter. Primary transformants were isolated and classified on a seed PEPC activity basis: A lines (two-fold increase) and B lines (four-fold increase). Primary transformants also expressed the C4 PEPC in leaves (up to a 10-fold increase in activity). In seeds, ectopically expressed PEPC impacted on dry weight and total protein content that were increased by up to 30%. In the stable progeny of A and B lines, the increase in PEPC activity was amplified in seeds; however, a decrease in PEPC content and activity (inversely proportional to seed levels) was observed in maternal tissues (leaves and siliques). This was due to the absence of the exogenous C4 PEPC and a partial decrease in the endogenous C3 PEPC forms (mRNA, protein and activity). There was no apparent compensation by a PEPC hyperphosphorylation. In these plants, the anaplerotic

pathway flux was altered (notably, a decrease in organic acids and glutamine levels) as judged by 1H NMR metabolite profiling. Whereas in the corresponding seeds (four- to eight-fold increase in PEPC activity) there was no increase in protein and seed mass, but a moderate decrease in lipid content was observed (compared to control plants). Under normal culture conditions, the transformants (primary and progeny) did not show any apparent growth phenotype or modification in seed production per plant. However, the A and B lines exhibited severe growth defects when salt stressed by LiCl.
Keywords: Anaplerotic pathway; Arabidopsis thaliana; Carbon metabolism; Phosphoenolpyruvate carboxylase; Transgenic plants

E.Y. Raddad, O. Luukkanen, The influence of different Acacia senegal agroforestry systems on soil water and crop yields in clay soils of the Blue Nile region, Sudan, Agricultural Water Management, Volume 87, Issue 1, 10 January 2007, Pages 61-72, ISSN 0378-3774, DOI: 10.1016/j.agwat.2006.06.001.
(http://www.sciencedirect.com/science/article/B6T3X-4KF7875-2/2/d2deef1d4103f560ee60e4fb704e274a)
Abstract:
The purpose of this study was to test the hypotheses that (1) the tree Acacia senegal competes for water with associated agricultural crops, and the soil water content would vary spatially with tree density and type of management; (2) the microclimate created by trees would favourably affect the soil water content and improve the growth of associated agricultural crops. Trees were grown at 5 m x 5 m or 10 m x 10 m spacing alone or in mixture with sorghum or sesame. Soil water content was measured using a neutron probe at three depths, 0-25, 25-50 and 50-75 cm; and at different stages of crop development (early, mid, and late). Crop growth and yield and the overall system performance were investigated over a 4-year period (1999-2002). Results showed no significant variation in the soil water content under different agroforestry systems. Intercropping also resulted in a higher land equivalent ratio. No significant variation was found between yields of sorghum and sesame when these crops were grown with or without trees. The averages crop yields were1.54 and 1.54 t ha-1 for sorghum; and 0.36 and 0.42 t ha-1for sesame in intercropping and pure cultivation, respectively. This suggests that at an early stage of agroforestry system management, A. senegal has no detrimental effect on agricultural crop yield. However, the pattern of resource capture by trees and crops can change as the system matures. There was little competition between trees and crops for water suggesting that in A. senegal agroforestry systems with 4-year-old trees the clay soil has enough water to support the crop growth over a whole growing season up to maturation and harvest.
Keywords: Acacia senegal; Intercropping; Land equivalent ratio; Precipitation use efficiency; Sorghum bicolor; Sesamum indicum

H. Ahmed Idris, N. Labuschagne, L. Korsten, Screening rhizobacteria for biological control of Fusarium root and crown rot of sorghum in Ethiopia, Biological Control, Volume 40, Issue 1, January 2007, Pages 97-106, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2006.07.017.
(http://www.sciencedirect.com/science/article/B6WBP-4KPNVT1-1/2/fc338e31be3279a2f8c60a86df4d2a02)
Abstract:
Fusarium oxysporum Schlectend causes root and crown rot in several crops including sorghum that results in low grain yield in Ethiopia and other East African countries. Seventy-eight bacterial isolates were obtained and subsequently tested both in vitro and in the greenhouse. Of the 78 isolates tested, 23 displayed between 30 and 66.3% inhibition of in vitro mycelial growth of F. oxysporum and also showed significant root colonization ability on sorghum seedlings. These isolates were further tested for their biocontrol ability against F. oxysporum in the greenhouse. Four isolates viz. KBE5-7, KBE5-1, KBE2-5 and NAE5-5 resulted in 100% disease suppression

and no symptoms of root and crown rot were observed compared to the control. The complete suppression of F. oxysporum by these isolates was also confirmed by root plating on Fusarium-selective medium. The most effective isolates were identified by means of the API system as members of the Genus Bacillus including B. cereus, B. subtilis, B. circulans, B. licheniformis and B. stearothermophilus. Two other isolates, which colonized the sorghum rhizosphere and resulted in more than 70% disease suppression, have been identified as Chromobacterium violaceum. The study demonstrated effective biological control by the rhizobacterial isolates tested, thereby indicating the possibility of application of rhizobacteria for control of soilborne diseases of sorghum in Ethiopia and other countries.
Keywords: Plant growth promoting rhizobacteria; Fusarium oxysporum; Bacillus cereus; B. subtilis; B. circulans; B. licheniformis; B. stearothermophilus; Chromobacterium violaceum; Biocontrol; Sorghum; Root colonization; Fusarium root and crown rot

T.R. Fasola, J.S. Gbolagade, I.O. Fasidi, Nutritional requirements of Volvariella speciosa (Fr. Ex. Fr.) Singer, a Nigerian edible mushroom, Food Chemistry, Volume 100, Issue 3, 2007, Pages 904-908, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2005.10.061.
(http://www.sciencedirect.com/science/article/B6T6R-4HYV0BT-2/2/d8ccfc68cf35bdc832c8d8348506f23c)
Abstract:
Nutritional requirement studies were carried out on synthetic and semi-synthetic media, as well as different agro-industrial wastes, to evaluate vegetative growth of Volvariella speciosa (Fr. Ex. Fr.) Singer, a Nigerian edible mushroom. The optimum temperature that supported the best growth of this fungus was 30 [degree sign]C while the optimum pH was 6.0. The moisture contents were observed to vary with different substrates. The best vegetative growth was obtained at 40% moisture content, on sawdust, while it was 80% on Andropogon gianus straw. Among the different media used, the best mycelial extension (92.0 mm) was observed on semi-synthetic, potato dextrose agar while the least growth (74.0 mm) was recorded on laboratory formulated sorghum agar. Maize and A. gianus straw stimulated the best mycelial extension (92.0 mm) while fresh and fermented horse dung supported moderate growths of 70.0 and 67.0 mm, respectively. The least growth (36.0 mm) was observed on fresh cow dung. These findings are discussed in relation to the cultivation of V. speciosa in Nigeria.
Keywords: Nutritional requirements; Volvariella speciosa; Mycelial growth; Media; Agricultural substrates

Stefano Comai, Antonella Bertazzo, Lucia Bailoni, Mirella Zancato, Carlo V.L. Costa, Graziella Allegri, The content of proteic and nonproteic (free and protein-bound) tryptophan in quinoa and cereal flours, Food Chemistry, Volume 100, Issue 4, 2007, Pages 1350-1355, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2005.10.072.
(http://www.sciencedirect.com/science/article/B6T6R-4J556BJ-2/2/8a92cf0b4b182bb127bb3cb109d9d492)
Abstract:
The content of proteic and nonproteic (free and protein-bound) tryptophan and of proteins in quinoa, wheat, rice, maize, barley, oat, rye, spelt, sorghum and millet flours was determined. Protein content and proteic tryptophan of quinoa were similar to that of wheat and spelt, but higher than in other cereals. Free tryptophan in quinoa flour showed values similar to those of wheat, oat and sorghum Kalblank, lower than those of barley, spelt and pearl millet, but higher than in rice, maize, rye, sorghum DK 34 - Alabama hybrid. In addition, nonproteic tryptophan appears bound both to water soluble proteins and to proteins soluble at pH 8.9. The results are discussed regarding the importance of the nonprotein tryptophan fraction, the only one able to enter the brain, that is more easily absorbed, so guarantees a greater amount available for uptake by the central nervous system.

Keywords: Quinoa; Cereals; Proteic tryptophan; Free tryptophan; Protein-bound tryptophan

Nomusa R. Dlamini, John R.N. Taylor, Lloyd W. Rooney, The effect of sorghum type and processing on the antioxidant properties of African sorghum-based foods, Food Chemistry, Volume 105, Issue 4, 2007, Pages 1412-1419, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2007.05.017.
(http://www.sciencedirect.com/science/article/B6T6R-4NSMMW2-4/2/13cd906dedcdcffe7a94717be2ab3f81)
Abstract:
This work determined the effect of sorghum type and different processing technologies of traditional African sorghum foods on total phenols, tannin content and antioxidant activity. The products were prepared by fermentation, conventional and extrusion cooking of whole and decorticated ground grain. The tannin sorghum types, had higher ABTS and DPPH antioxidant activities, compared to the types without tannins. Antioxidant activity was significantly correlated with total phenols and tannins ($r > 0.95$). Decortication, reduced antioxidant activity of both tannin and non-tannin sorghum by 82-83% due to the removal of the pericarp and the testa, which decreased phenols. Processing, generally decreased antioxidant activity, however, conventionally cooked porridges had higher antioxidant activity than the extrusion cooked products. The retention of antioxidant activity, particularly in fermented and unfermented porridges, means that whole tannin sorghum can be processed into foods with potential health benefits.
Keywords: Sorghum-based foods; Antioxidant activity; Tannins; ABTS; DPPH; Total phenols

Youngmin Choi, Heon-Sang Jeong, Junsoo Lee, Antioxidant activity of methanolic extracts from some grains consumed in Korea, Food Chemistry, Volume 103, Issue 1, 2007, Pages 130-138, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2006.08.004.
(http://www.sciencedirect.com/science/article/B6T6R-4M1DB79-7/2/03baa7ba7d276eb0ea3ca40294faec94)
Abstract:
The objectives of this study were to determine antioxidant activity of the methanolic extracts from some grains and to investigate relationships between antioxidant activities and antioxidant contents in the extracts. 1,1-Diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activities, 2,2-azino-bis-(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) radical cation scavenging activities, inhibitory effect on lipid peroxidation, chelating activity and reducing power have been used to investigate the relative antioxidant activities of the extracts from grains. The concentrations of total polyphenolics and carotenoids in the extracts were measured by spectrophotometric methods and vitamin E analysis was carried out by HPLC. The methanolic extracts prepared from red sorghum and black rice showed significantly higher antioxidant activities and contained higher polyphenolic contents than other grains such as white rice, brown rice, mungbean, foxtail millet, prosomillet, barley, and adlay. Polyphenolic compounds were the major naturally occurring antioxidants in grains. The correlation coefficient between total polyphenolic content and ABTS radical cation scavenging activity in the extracts was >0.99. However, no relationship was found between antioxidant activities and carotenoids and vitamin E derivatives.
Keywords: Grains; Antioxidant activity; Polyphenolics; Antioxidant components

Vasudeva Kamath, Sajeeda Niketh, Arun Chandrashekar, P.S. Rajini, Chymotryptic hydrolysates of [alpha]-kafirin, the storage protein of sorghum (Sorghum bicolor) exhibited angiotensin converting enzyme inhibitory activity, Food Chemistry, Volume 100, Issue 1, 2007, Pages 306-311, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2005.10.004.
(http://www.sciencedirect.com/science/article/B6T6R-4HKD04V-2/2/e78c5d85be25d02c8a5d66db557980b7)
Abstract:

Kafirin is the main storage protein (prolamin) in sorghum grains. [alpha]-Kafirin, the alcohol soluble fraction, was isolated from sorghum flour. Treatment of [alpha]-kafirin with chymotrypsin yielded a hydrolysate which on fractionation, using Sephadex G-25 column, yielded four fractions with significant angiotensin converting enzyme (ACE) inhibitory activity in vitro. The IC50 values of these fractions ranged from 1.3 to 24.3 [mu]g/ml. Two of the fractions were found to be competitively inhibiting the enzyme, while two other fractions were non-competitive inhibitors. These results demonstrate that chymotryptic hydrolysates of sorghum prolamin could serve as a good source of peptides with angiotensin I converting enzyme inhibitory activity.
Keywords: Sorghum flour; Angiotensin converting enzyme; Kafirin; Chymotryptic hydrolysate; IC50; Lineweaver-Burk plots

Sreeramaiah Hemalatha, Kalpana Platel, Krishnapura Srinivasan, Zinc and iron contents and their bioaccessibility in cereals and pulses consumed in India, Food Chemistry, Volume 102, Issue 4, 2007, Pages 1328-1336, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2006.07.015.
(http://www.sciencedirect.com/science/article/B6T6R-4M0BHRV-8/2/97d501dd5aa87206d8f00ce77bee8604)
Abstract:
Several cereals and pulses commonly consumed in India were screened for zinc and iron contents and their bioaccessibility in the same was determined by equilibrium dialysis employing an in vitro simulated digestion procedure. Zinc content of cereals ranged from 1.08 mg/100 g in rice to 2.24 mg/100 g in sorghum. Zinc content of pulses was between 2.03 mg/100 g (whole chickpea) and 2.68 mg/ 100 g (decorticated chickpea). Iron content of cereals ranged from 1.32 mg% in rice to 6.51 mg% in sorghum, while that of pulses ranged from 3.85 mg% in decorticated green gram to 6.46 mg% in black gram. Dialyzability of zinc from pulses (27-56%) was generally higher than that from cereals (5.5-21.4%). Dialyzabilities of iron were almost similar from both cereals and pulses examined and were 4.13-8.05% in cereals and 1.77-10.2 % in pulses. A significant negative correlation between inherent phytate content and zinc dialyzability value was inferred in the case of pulses. Phytic acid content of the cereals had a significant negative influence on iron dialyzability. Inherent calcium had a negative influence on zinc dialyzability in cereals. Tannin did not have any significant influence on zinc or iron dialyzabilities from cereals and pulses. While both insoluble and soluble fractions of the dietary fibre generally interfered with zinc dialyzability, the insoluble fraction alone had this effect on iron dialyzability. The lower collective negative influence of the inherent factors on zinc dialyzability from pulses is consistent with their higher concentrations in these grains, relative to cereals. The negative correlation of inherent phytic acid with zinc and iron dialyzabilities was supported by enhanced dialyzabilities of these minerals upon partial removal of phytate from the grains by treatment with fungal phytase.
Keywords: Zinc; Iron; Cereals; Pulses; Bioaccessibility; Inherent factors

F.E. Sikwese, K.G. Duodu, Antioxidant effect of a crude phenolic extract from sorghum bran in sunflower oil in the presence of ferric ions, Food Chemistry, Volume 104, Issue 1, 2007, Pages 324-331, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2006.11.042.
(http://www.sciencedirect.com/science/article/B6T6R-4MRND1S-6/2/e598ffa93f978931392f1df3ae95dfdf)
Abstract:
Whole grain condensed tannin sorghum, its bran and a crude phenolic extract (CPE) prepared from the bran were evaluated for total phenols (TP), condensed tannins (CT) and antioxidant activity (AA). Antioxidant effect of the CPE from the sorghum bran was evaluated in sunflower oil in the presence of ferric ions by measuring peroxide values (PVs) and anisidine values (AVs) during storage at 65 [degree sign]C, in comparison with tertiary butyl hydroquinone (TBHQ). Sorghum bran contained three times more TP and AA, and seven times more CT than the whole grain. The CPE had highest levels of TP, CT and AA. Sunflower oil with CPE had lower PVs and

AVs compared to control samples. Oil samples with TBHQ had PVs lower than, but AVs similar to samples containing CPE. In the presence of ferric ions, the CPE was less effective in reducing PVs, but was more effective than TBHQ in reducing AVs.
Keywords: Sorghum bran; Phenolic extract; Antioxidant activity; Lipid oxidation; Ferric ions; Peroxide value; Anisidine value

Yong Lin Ren, Daphne Mahon, Evaluation of 35S-residues in grains and grain fractions fumigated with 35S-labelled carbonyl sulfide, Journal of Stored Products Research, Volume 43, Issue 4, 2007, Pages 356-361, ISSN 0022-474X, DOI: 10.1016/j.jspr.2006.10.001.
(http://www.sciencedirect.com/science/article/B6T8Y-4N08X39-2/2/0d7725a4151f894d721118c14f6f2a98)
Abstract:
35S-labelled carbonyl sulfide (CO35S) was used to measure the amount of sorbed 35S residues and converted 35S residues in grains and grain fractions after fumigation with CO35S. Hard wheat, soft wheat, paddy rice, brown rice, polished rice, sorghum, maize, canola, barley, oats and peas were exposed for 4 days to 50 mg L-1 of CO35S with a total radioactivity of 20 mCi. After exposure, the samples were aired. The levels of 35S residues varied with extraction solvent, e.g. 0.003-0.02 mg (COS equivalents) kg-1 (grain) in chloroform extractions and 0.09-0.38 mg kg-1 in water extractions. More than 90% of 35S (COS equivalents) residues were in the water extractions. The total radioactivity determined by scanning radiation images (fluorescent image) of extractions and sectioned commodities ranged from 0.1 to 0.4 mg kg-1. The radiation image shows that more than 90% of 35S residues were located or distributed in the embryo, testa, pericarp and husk, and that the 35S was still slowly desorbing from grains after 2 days aeration.
Keywords: Fumigation; Cereals; Legumes; Oilseeds; Carbonyl sulfide; 35S-labelled carbonyl sulfide; 35S residue

Leia Cecilia de Lima Favaro, Welington Luiz Araujo, Edneia Aparecida de Souza-Paccola, Joao Lucio Azevedo, Luzia Doretto Paccola-Meirelles, Colletotrichum sublineolum genetic instability assessed by mutants resistant to chlorate, Mycological Research, Volume 111, Issue 1, January 2007, Pages 93-105, ISSN 0953-7562, DOI: 10.1016/j.mycres.2006.08.008.
(http://www.sciencedirect.com/science/article/B7XMR-4MHPNNH-2/2/d98a04bf9103b32e3349f75132dca53f)
Abstract:
The fungus Colletotrichum sublineolum, causal agent of sorghum anthracnose, presents high variability, genetic instability and host specialization. The aims of the present work were to investigate the mechanisms involved in the genetic instability in this species. Mutants resistant to chlorate and unable to use nitrate (Nit mutants), were obtained spontaneously, isolated and characterized for complementation pattern, reversion frequency and RAPD profile. The results showed that chlorate-resistant mutants could be divided into six phenotypic classes that probably represented mutations in the structural nitrate reductase locus (nit1), in the structural nitrite reductase locus (nit6 and niiA of Neurospora and Aspergillus, respectively), in the specific regulator locus (nit3), in the main regulator locus (nit2), in loci that codified the cofactor containing molybdenum necessary for nitrate reductase activity (NitM), and one or more genes responsible for nitrate intake (crn). In addition, the genetic control of this metabolism in C. sublineolum seems to be similar to other fungi species such as Aspergillus, Neurospora and Fusarium. The high reversion frequency (10-4 to 10-5) presented by nit1 mutants suggests that the instability in evaluated strains could be a result of transposable elements activity. The RAPD analysis enabled confirmation that the Nit mutants have a similar genetic background to original strain, and that polymorphism exists among wild-type strains, nit1 mutants and revertants of C. sublineolum. These are important aspects for the later direction of molecular analysis, where these mutants will be used as a tool to isolate the active transposable elements in the C. sublineolum genome.

Keywords: Anthracnose; Nit mutants; Plant pathology; Sorghum

Elvia Martinez Blanco, Christopher R. Little, Anita L.Davelos Baines, Variation in antibiotic inhibitory abilities among streptomycetes from south Texas agricultural soils, Soil Biology and Biochemistry, Volume 39, Issue 1, January 2007, Pages 268-275, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2006.07.015.
(http://www.sciencedirect.com/science/article/B6TC7-4KRY75S-4/2/f0fca4596a447dfa7314f67095a6e7a7)
Abstract:
Effective control of soilborne pathogens remains a challenge in agricultural systems. As part of an integrated pest management strategy, one approach to increase disease control is the active management of indigenous pathogen antagonists found in soil microbial communities. The focus of this study was the in vitro characterization of streptomycetes, bacteria commonly found in soil and known antibiotic-producers. Streptomycete isolates from watermelon and sorghum fields in south Texas were evaluated for their inhibitory activity and diversity of inhibitory phenotypes against a well characterized reference collection of streptomycetes isolated from Minnesota agricultural soils. Higher streptomycete densities, zones of inhibition and diversity of inhibitory phenotypes were found for isolates from sorghum fields compared to watermelon fields. These results suggest that increasing the density and activity of the indigenous microbes may provide additional disease control in these agricultural systems.
Keywords: Streptomycetes; Inhibition; Biocontrol; Suppressive soils; Lower Rio Grande Valley

Markus Gershater, Kate Sharples, Robert Edwards, Carboxylesterase activities toward pesticide esters in crops and weeds, Phytochemistry, Volume 67, Issue 23, December 2006, Pages 2561-2567, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2006.09.019.
(http://www.sciencedirect.com/science/article/B6TH7-4M7K9YM-4/2/59c2edec662ecab5629b8fbf83134ffa)
Abstract:
Proteins were extracted from maize, rice, sorghum, soybean, flax and lucerne; the weeds Abutilon theophrasti, Echinochloa crus-galli, Phalaris canariensis, Setaria faberii, Setaria viridis, Sorghum halepense and the model plant Arabidopsis thaliana and assayed for carboxylesterase activity toward a range of xenobiotics. These included the pro-herbicidal esters clodinafop-propargyl, fenoxaprop-ethyl, fenthioprop-ethyl, methyl-2,4-dichlorophenoxyacetic acid (2,4-d-methyl), bromoxynil-octanoate, the herbicide-safener cloquintocet-mexyl and the pyrethroid insecticide permethrin. Highest activities were recorded with [alpha]-naphthyl acetate and methylumbelliferyl acetate. Esters of p-nitrophenol were also readily hydrolysed, with turnover declining as the chain length of the acyl component increased. Activities determined with model substrates were much higher than those observed with pesticide esters and were of limited value in predicting the relative rates of hydrolysis of the crop protection agents. Substrate preferences with the herbicides were typically 2,4-d-methyl > clodinafop-propargyl > fenthioprop-ethyl, fenoxaprop-ethyl and bromoxynil-octanoate. Isoelectric focussing in conjunction with staining for esterase activity using [alpha]-naphthyl acetate as substrate confirmed the presence of multiple carboxylesterase isoenzymes in each plant, with major qualitative differences observed between species. The presence of serine hydrolases among the resolved isoenzymes was confirmed through their selective inhibition by the organophosphate insecticide paraoxon. Our studies identify potentially exploitable differences between crops and weeds in their ability to bioactivate herbicides by enzymic hydrolysis and also highlight the usefulness of Arabidopsis as a plant model to study xenobiotic biotransformation.
Keywords: Arabidopsis; Detoxification; Herbicide bioactivation; Maize (Zea mays L.); Pesticides; Rice (Oryza sativa); Sorghum (Sorghum bicolor); Soybean (Glycine max); Serine hydrolases; Weeds; Xenobiotics

Jose G. Guzman, Chad B. Godsey, Gary M. Pierzynski, David A. Whitney, Ray E. Lamond, Effects of tillage and nitrogen management on soil chemical and physical properties after 23 years of continuous sorghum, Soil and Tillage Research, Volume 91, Issues 1-2, December 2006, Pages 199-206, ISSN 0167-1987, DOI: 10.1016/j.still.2005.12.004.
(http://www.sciencedirect.com/science/article/B6TC6-4J6WNYH-1/2/cfe57f20b31425e2ec4493a8d09a0493)
Abstract:
Long-term tillage and nitrogen (N) management practices can have a profound impact on soil properties and nutrient availability. A great deal of research evaluating tillage and N applications on soil chemical properties has been conducted with continuous corn (Zea Mays L.) throughout the Midwest, but not on continuous grain sorghum (Sorghum bicolor (L.) Moench). The objective of this experiment was to examine the long-term effects of tillage and nitrogen applications on soil physical and chemical properties at different depths after 23 years of continuous sorghum under no-till (NT) and conventional till (CT) (fall chisel-field cultivation prior to planting) systems. Ammonium nitrate (AN), urea, and a slow release form of urea were surface broadcast at rates of 34, 67, and 135 kg N ha-1. Soil samples were taken to a depth of 15 cm and separated into 2.5 cm increments. As a result of lime applied to the soil surface, soil pH in the NT and CT plots decreased with depth, ranging from 6.9 to 5.7 in the NT plots and from 6.5 to 5.9 in the CT plots. Bray-1 extractable P and NH4OAc extractable K was 20 and 49 mg kg-1 higher, respectively, in the surface 2.5 cm of NT compared to CT. Extractable Ca was not greatly influenced by tillage but extractable Mg was higher for CT compared to NT below 2.5 cm. Organic carbon (OC) under NT was significantly higher in the surface 7.5 cm of soil compared to CT. Averaged across N rates, NT had 2.7 Mg ha-1 more C than CT in the surface 7.5 cm of soil. Bulk density ([Delta]b) of the CT was lower at 1.07 g cm-3 while [Delta]b of NT plots was 1.13 g cm-3. This study demonstrated the effect tillage has on the distribution and concentration of certain chemical soil properties.
Keywords: Long-term tillage; No-till; Nitrogen management; Grain sorghum

Avner Carmi, Yohav Aharoni, Menahem Edelstein, Nakdimon Umiel, Amir Hagiladi, Edith Yosef, Moses Nikbachat, Abraham Zenou, Joshua Miron, Effects of irrigation and plant density on yield, composition and in vitro digestibility of a new forage sorghum variety, Tal, at two maturity stages, Animal Feed Science and Technology, Volume 131, Issues 1-2, 15 November 2006, Pages 121-133, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2006.02.005.
(http://www.sciencedirect.com/science/article/B6T42-4JFGFBM-1/2/1adbdc93b67f8e3f1751e94682d2e4fc)
Abstract:
Most of the commercial varieties of forage sorghum belong to the tall types. Use of low types is limited, mainly due to their lower forage productivity. Recently a new low variety of forage sorghum, Tal, was developed in Israel. This study examined effects of irrigation level (IL) and plant density (PD) on Tal productivity and quality, as measured by field performance, chemical composition and in vitro digestibility. The optimal harvest stage for getting the best combination of yield amount and forage quality was explored. Irrigation included levels of 20, 100 and 180 mm, and PD consisted of 200,000, 260,000 and 330,000 plants/ha. Harvests were carried out at maturity stages of early heading (EH) and soft dough (SD). Tal resistance to lodging was high. High irrigation increased plant height and dry matter (DM) yield in both harvests, and enhanced the content of neutral detergent fiber (NDF) and lignin, at EH. In most cases, additional irrigation decreased DM content, DM ratio of leaves/stems, and in vitro DM digestibility (IVDMD). Plant density did not affect significantly plant height or DM yield at either harvest, but did affect DM digestibility at EH. Maturation from EH to SD increased considerably DM content under all irrigation levels, and DM yield only under high irrigation. Maturation increased DM allocation to the panicles and enhanced their DM digestibility. Tal has the potential to become a successful forage crop, which under sufficient irrigation attains the best digestible DM and NDF yields at SD.

Keywords: New sorghum variety--Tal; Plant density; Irrigation level; Growth stage; In vitro digestibility; Forage composition and yield

Nega Gebreselassie Wubeneh, J.H. Sanders, Farm-level adoption of sorghum technologies in Tigray, Ethiopia, Agricultural Systems, Volume 91, Issues 1-2, November 2006, Pages 122-134, ISSN 0308-521X, DOI: 10.1016/j.agsy.2006.02.002.
(http://www.sciencedirect.com/science/article/B6T3W-4JHMJTT-1/2/45eb1a2d6844609a1552e81b62bb3646)
Abstract:
Curtailing the effect of Striga weed, improving moisture availability and increasing soil fertility are essential strategies to increase the productivity of agriculture in the sorghum producing semi-arid areas of Ethiopia. The adoption of Striga resistant sorghum varieties and inorganic fertilizer on small subsistence farms in Tigray, Ethiopia was analyzed to identify the factors determining farmers' adoption decisions. Separate Tobit regression models were estimated on survey data of a random sample of 90 farm households conducted in 2001. Results indicate that access to information, soil type, and farmers' perceptions of technology characteristics and rainfall risk were the factors associated with the adoption of the new sorghum cultivars. In contrast, availability of adult family labour, farm size, manure use, and soil type were the major determinants of the adoption of inorganic fertilizers. Farm size is negatively related to fertilizer adoption as small farms are more pressured to adopt inorganic fertilizer and intensive production techniques. Instead of the over emphasis of on short cycle varieties as a means of coping with drought and Striga, breeders need to generate intermediate and longer season Striga resistant cultivars to increase productivity during moderate and good rainfall years. Varieties combining the desirable characteristics of higher grain and biomass yields of the traditional cultivars with Striga resistance are expected to be more successfully adopted.
Keywords: Ethiopia; Tigray; Adoption; Striga resistant sorghum; Inorganic fertilizer

Upendra M. Sainju, Wayne F. Whitehead, Bharat P. Singh, Shirley Wang, Tillage, cover crops, and nitrogen fertilization effects on soil nitrogen and cotton and sorghum yields, European Journal of Agronomy, Volume 25, Issue 4, November 2006, Pages 372-382, ISSN 1161-0301, DOI: 10.1016/j.eja.2006.07.005.
(http://www.sciencedirect.com/science/article/B6T67-4KSVGC0-2/2/1415c9b4f0c36c0415a3eaa1a21fe82f)
Abstract:
Sustainable soil and crop management practices that reduce soil erosion and nitrogen (N) leaching, conserve soil organic matter, and optimize cotton and sorghum yields still remain a challenge. We examined the influence of three tillage practices (no-till, strip till and chisel till), four cover crops {legume [hairy vetch (Vicia villosa Roth)], nonlegume [rye (Secaele cereale L.)], vetch/rye biculture and winter weeds or no cover crop}, and three N fertilization rates (0, 60-65 and 120-130 kg N ha-1) on soil inorganic N content at the 0-30 cm depth and yields and N uptake of cotton (Gossypium hirsutum L.) and sorghum [Sorghum bicolor (L.) Moench]. A field experiment was conducted on Dothan sandy loam (fine-loamy, siliceous, thermic, Plinthic Paleudults) from 1999 to 2002 in Georgia, USA. Nitrogen supplied by cover crops was greater with vetch and vetch/rye biculture than with rye and weeds. Soil inorganic N at the 0-10 and 10-30 cm depths increased with increasing N rate and were greater with vetch than with rye and weeds in April 2000 and 2002. Inorganic N at 0-10 cm was also greater with vetch than with rye in no-till, greater with vetch/rye than with rye and weeds in strip till, and greater with vetch than with rye and weeds in chisel till. In 2000, cotton lint yield and N uptake were greater in no-till with rye or 60 kg N ha-1 than in other treatments, but biomass (stems + leaves) yield and N uptake were greater with vetch and vetch/rye than with rye or weeds, and greater with 60 and 120 than with 0 kg N ha-1. In 2001, sorghum grain yield, biomass yield, and N uptake were greater in strip till and chisel till than in no-

till, and greater in vetch and vetch/rye with or without N than in rye and weeds with 0 or 65 kg N ha-1. In 2002, cotton lint yield and N uptake were greater in chisel till, rye and weeds with 0 or 60 kg N ha-1 than in other treatments, but biomass N uptake was greater in vetch/rye with 60 kg N ha-1 than in rye and weeds with 0 or 60 kg N ha-1. Increased N supplied by hairy vetch or 120-130 kg N ha-1 increased soil N availability, sorghum grain yield, cotton and sorghum biomass yields, and N uptake but decreased cotton lint yield and lint N uptake compared with rye, weeds or 0 kg N ha-1. Cotton and sorghum yields and N uptake can be optimized and potentials for soil erosion and N leaching can be reduced by using conservation tillage, such as no-till or strip till, with vetch/rye biculture cover crop and 60-65 kg N ha-1. The results can be applied in regions where cover crops can be grown in the winter to reduce soil erosion and N leaching and where tillage intensity and N fertilization rates can be minimized to reduce the costs of energy requirement for tillage and N fertilization while optimizing crop production.
Keywords: Tillage; Cover crop; Nitrogen fertilization; Inorganic nitrogen; Cotton yield; Sorghum yield

John Taylor, Peter Shewry, Preface to sorghum and millets reviews, Journal of Cereal Science, Volume 44, Issue 3, November 2006, Page 223, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.10.001.
(http://www.sciencedirect.com/science/article/B6WHK-4M6SBG0-2/2/094bec1b69454da597c5a7b99afcc43f)

M.M. O'Kennedy, A. Grootboom, P.R. Shewry, Harnessing sorghum and millet biotechnology for food and health, Journal of Cereal Science, Volume 44, Issue 3, November 2006, Pages 224-235, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.08.001.
(http://www.sciencedirect.com/science/article/B6WHK-4M3BC6R-1/2/d701597b4890bf1f808715542afd8f65)
Abstract:
This review highlights recombinant DNA technology as a powerful tool to enhance the gene pools of sorghum and pearl millet crops regarded as jewels of Africa. Although important advances in the improvement of these species have been made by classical breeding and modern marker assisted selection, genetic manipulation and in vitro culture allows the gene pool to be broadened beyond that normally available for improvement by allowing the transfer of genes which control well-defined traits between species. The current state of sorghum and millet transformation technology is summarised and applications in the improvement of nutritional quality and the resistance to pathogens and pests for crops grown in Africa and Asia is discussed. Regulatory aspects including gene flow and future prospects are also discussed.
Keywords: Genetic engineering; Sorghum; Pearl millet; Biolistics; Agrobacterium

Linda Dykes, Lloyd W. Rooney, Sorghum and millet phenols and antioxidants, Journal of Cereal Science, Volume 44, Issue 3, November 2006, Pages 236-251, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.06.007.
(http://www.sciencedirect.com/science/article/B6WHK-4KPP48B-1/2/5db591c9c31155fe8be227ed6944f276)
Abstract:
Sorghum is a good source of phenolic compounds with a variety of genetically dependent types and levels including phenolic acids, flavonoids, and condensed tannins. Most sorghums do not contain condensed tannins, but all contain phenolic acids. Pigmented sorghums contain unique anthocyanins that could be potential food colorants. Some sorghums have a prominent pigmented testa that contains condensed tannins composed of flavan-3-ols with variable length. Flavan-3-ols of up to 8-10 units have been separated and quantitatively analyzed. These tannin sorghums are excellent antioxidants, which slow hydrolysis in foods, produce naturally dark-colored products and increase the dietary fiber levels of food products. Sorghums have high concentration of 3-

deoxyanthocyanins (i.e. luteolinidin and apigenidin) that give stable pigments at high pH. Pigmented and tannin sorghum varieties have high antioxidant levels that are comparable to fruits and vegetables. Finger millet has tannins in some varieties that contain a red testa. There are limited data on the phenolic compounds in millets; only phenolic acids and flavones have been identified.
Keywords: Sorghum; Millet; Phenols; Phenolic acids; 3-Deoxyanthocyanins; Condensed tannins; Antioxidants; Health benefits

John R.N. Taylor, Tilman J. Schober, Scott R. Bean, Novel food and non-food uses for sorghum and millets, Journal of Cereal Science, Volume 44, Issue 3, November 2006, Pages 252-271, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.06.009.
(http://www.sciencedirect.com/science/article/B6WHK-4KTVP06-1/2/05ae5a61e1f173057b395d8c1a1523b6)
Abstract:
Sorghum and millets have considerable potential in foods and beverages. As they are gluten-free they are suitable for coeliacs. Sorghum is also a potentially important source of nutraceuticals such antioxidant phenolics and cholesterol-lowering waxes. Cakes, cookies, pasta, a parboiled rice-like product and snack foods have been successfully produced from sorghum and, in some cases, millets. Wheat-free sorghum or millet bread remains the main challenge. Additives such as native and pre-gelatinised starches, hydrocolloids, fat, egg and rye pentosans improve bread quality. However, specific volumes are lower than those for wheat bread or gluten-free breads based on pure starches, and in many cases, breads tend to stale faster. Lager and stout beers with sorghum are brewed commercially. Sorghum's high-starch gelatinisation temperature and low beta-amylase activity remain problems with regard to complete substitution of barley malt with sorghum malt . The role of the sorghum endosperm matrix protein and cell wall components in limiting extract is a research focus. Brewing with millets is still at an experimental stage. Sorghum could be important for bioethanol and other bio-industrial products. Bioethanol research has focused on improving the economics of the process through cultivar selection, method development for low-quality grain and pre-processing to recover valuable by-products. Potential by-products such as the kafirin prolamin proteins and the pericarp wax have potential as bioplastic films and coatings for foods, primarily due to their hydrophobicity.
Keywords: Sorghum; Millet; Food; Bread; Malting; Brewing; Bioethanol; Gluten-free; Kafirin; Wax

A. Chandrashekar, K.V. Satyanarayana, Disease and pest resistance in grains of sorghum and millets, Journal of Cereal Science, Volume 44, Issue 3, November 2006, Pages 287-304, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.08.010.
(http://www.sciencedirect.com/science/article/B6WHK-4M936JH-1/2/9181dbd275c8470d403e74542a61b3af)
Abstract:
In this review available information on the mechanisms of resistance to insect pests and fungal pathogens in sorghum and millets is discussed. The primary source of resistance lies in the chemical and physical make up of the grain. Phenolic compounds such as ferulic acid and tannins present in some sorghums are potent inhibitors of pests and pathogens. Grain hardness is a major deterrent to infection and infestation in low tannin grains. The prolamins, the grain storage proteins of sorghum, are organized into protein bodies and provide a physical and a nutritional barrier since they are resistant to digestion by insect and fungal proteases. A plethora of proteins that belong to the `pathogenesis related protein' group are distributed in various parts of the grain. Some of them are located in protein bodies. Notwithstanding, sorghum is still susceptible to insect pests and fungal pathogens. An understanding of the natural mechanisms of resistance in the grain is paramount for the development of durable resistance against pests and pathogens. The

pyramiding of resistance genes and the development of transgenic lines based on this understanding are two sources of hope for the future protection of sorghum and millets.
Keywords: Sorghum; Millets; PR proteins; Antifungal proteins; Insecticidal proteins; Phtyoalexins; Polyphenols; Tannins; Development of resistance; Grain hardness

Israel Salinas, Arturo Pro, Yolanda Salinas, Eliseo Sosa, Carlos Miguel Becerril, Manuel Cuca, Miguel Cervantes, Jaime Gallegos, Compositional variation amongst sorghum hybrids: Effect of kafirin concentration on metabolizable energy, Journal of Cereal Science, Volume 44, Issue 3, November 2006, Pages 342-346, ISSN 0733-5210, DOI: 10.1016/j.jcs.2006.08.008.
(http://www.sciencedirect.com/science/article/B6WHK-4M877DS-2/2/22331e4e7d1fc6bcdf82186f0fc64657)
Abstract:
Kafirins are stored proteins that negatively affect the nutritional quality of sorghum grain. Kafirin concentration and other chemical characteristics were determined in 12 sorghum hybrids and varied significantly, from 58% (HB1) to 42% (HB12) as percent total protein. Kafirin concentration correlated negatively with crude protein (CP) (-0.49), with acid detergent fiber (-0.40), apparent metabolizable energy (-0.61), and true metabolizable energy corrected for N (-0.63). HB12 was the hybrid with the lowest content of kafirins, amylose and tannins, and the highest content of apparent metabolizable energy. No differences were observed in the concentration of starch, but differences were found in apparent metabolizable energy (3325-2944 kcal kg-1) probably due to a greater availability of starch, related to differences in kafirin concentration.
Keywords: Sorghum hybrids; Kafirin; Metabolizable energy

Lian-Dong Huang, David Backhouse, Analysis of chitinase isoenzymes in sorghum seedlings inoculated with Fusarium thapsinum or F. proliferatum, Plant Science, Volume 171, Issue 5, November 2006, Pages 539-545, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2006.05.015.
(http://www.sciencedirect.com/science/article/B6TBH-4KCGHBV-1/2/181168fc03508a6dbddf2a379afa4c0d)
Abstract:
An investigation was conducted on the chitinase isoenzymes in various tissues of 1-week-old sorghum seedlings that had been inoculated with the fungal pathogens Fusarium thapsinum and Fusarium proliferatum. Electrophoresis of non-denatured extracts on SDS-PAGE gels revealed at least 11 bands of activity. Using native PAGE gels, seven acidic isoenzymes and four basic isoenzymes were identified. Two acidic chitinases were expressed constitutively and their activity did not differ between control and inoculated seedlings. The activity of the other acidic isoenzymes increased in all tissues following inoculation. The activities of both inducible and constitutive acidic chitinase isoenzymes were higher in the scutellum than in other tissues. Inducible basic chitinases increased only in the roots and shoots after infection, while the activity of basic chitinases decreased in the seed and scutellum. The pattern of chitinase isoenzymes from dormant caryopses was different from that in seed-derived tissues in the seedling. Generally, seedling tissues infected with Fusarium fungi had higher levels of acidic isoenzymes and lower levels of basic isoenzymes than dormant caryopses. The findings were consistent with hypotheses that acidic chitinases are primarily involved in active defence responses, while basic chitinases are part of pre-formed defence mechanisms.
Keywords: Sorghum seedling; Chitinase isoenzymes; Fusarium thapsinum; Fusarium proliferatum; PAGE

A. Javaid, S. Shafique, R. Bajwa, S. Shafique, Effect of aqueous extracts of allelopathic crops on germination and growth of Parthenium hysterophorus L., South African Journal of Botany, Volume 72, Issue 4, November 2006, Pages 609-612, ISSN 0254-6299, DOI: 10.1016/j.sajb.2006.04.006.

(http://www.sciencedirect.com/science/article/B7XN9-4KJ757X-1/2/2e2950a0cb93a140f93fcb5e5bada33c)
Abstract:
Herbicidal effects of aqueous root and shoot extracts of three allelopathic crops, viz. sunflower (Helianthus annuus L.), sorghum (Sorghum bicolor L.) and rice (Oryza sativa L.) were evaluated against germination and growth of the noxious alien weed Parthenium hysterophorus L. The study, carried out in petri dishes using 5, 10, 15, 20 and 25% (w/v) aqueous root and shoot extracts of fresh plant materials of the test crops, indicated insignificant effects on shoot length and seedling biomass while germination and root length were significantly reduced by extracts of all the test crops. In a foliar spray bioassay, aqueous shoot extracts of 50 and 100% w/v (on a fresh weight basis) of sunflower and sorghum were applied to 10 day old Parthenium plants. The root biomass of Parthenium plants was significantly suppressed by 50 and 100% extracts of both the test allelopathic extracts. Both concentrations of sorghum extracts significantly reduced shoot biomass, but sunflower extract was effective only at the lower concentration.

Sung-Ho Lee, Bruce R. Hamaker, Cys155 of 27 kDa maize [gamma]-zein is a key amino acid to improve its in vitro digestibility, FEBS Letters, Volume 580, Issue 25, 30 October 2006, Pages 5803-5806, ISSN 0014-5793, DOI: 10.1016/j.febslet.2006.09.033.
(http://www.sciencedirect.com/science/article/B6T36-4M0BF7X-7/2/6275f4cddb4769360bfd2fe5c02a9152)
Abstract:
Twenty-seven kilodalton [gamma]-zein is a subclass of the maize zein storage proteins and, due to its localization at the protein body periphery, is critical to digestibility characteristics of all zeins. This protein had low in vitro digestibility, presumably due to its high Cys content (7.35 mol%) that is similar to the hard-to-digest analogous sorghum protein, [gamma]-kafirin. Therefore, each of the conserved disulfide-bonded Cys' was mutated to create C144A, C148A, C155A, and C156A maize [gamma]-zein mutants. The C155A showed a remarkable increase in digestibility to proteases - pepsin, chymotrypsin, and trypsin. A high conservation of this Cys among cereal [gamma]-prolamins indicates the utility of this finding.
Keywords: Cereal; Protein; Zein; Cysteine; Digestibility

P.V. Vara Prasad, Kenneth J. Boote, L. Hartwell Allen Jr, Adverse high temperature effects on pollen viability, seed-set, seed yield and harvest index of grain-sorghum [Sorghum bicolor (L.) Moench] are more severe at elevated carbon dioxide due to higher tissue temperatures, Agricultural and Forest Meteorology, Volume 139, Issues 3-4, 12 October 2006, Pages 237-251, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2006.07.003.
(http://www.sciencedirect.com/science/article/B6V8W-4KMYKX3-1/2/e8357958d586b4bc9d0260c3ccc1aed2)
Abstract:
Global climate change, especially, increases in carbon dioxide (CO2) concentration and the associated increases in temperature will have significant impact on the crop production. Grain-sorghum [Sorghum bicolor (L.) Moench] cultivar DeKalb 28E was grown at daytime maximum/nighttime minimum temperature regimes of 32/22, 36/26, 40/30 and 44/34 [degree sign]C at ambient (350 [mu]mol CO2 mol-1) and elevated (700 [mu]mol CO2 mol-1) CO2 from emergence to maturity in controlled environments to quantify the effects of temperature and CO2 on the reproductive processes and yield. Growth temperatures of 40/30 and 44/34 [degree sign]C inhibited panicle emergence. Growth temperatures >=36/26 [degree sign]C significantly decreased pollen production, pollen viability, seed-set, seed yield and harvest index when compared to 32/22 [degree sign]C. Percentage decreases in pollen viability, seed-set, seed yield and harvest index due to elevated temperature were greater at elevated CO2 when compared with ambient CO2. Elevated CO2 increased seed yield (26%) at 32/22 [degree sign]C, but decreased seed yield

(10%) at 36/26 [degree sign]C. At high temperatures, elevated CO2 increased vegetative growth but not seed yield, thus, leading to decreased harvest index. We conclude that the adverse effects of elevated temperature on reproductive processes and yield of grain-sorghum were more severe at elevated CO2 than at ambient CO2; and the beneficial effects of elevated CO2 decreased with increasing temperature. The adverse temperature sensitivity of reproductive processes and yield at elevated CO2 was attributed to higher canopy foliage and seed temperatures.
Keywords: Sorghum; Climate change; Global warming; Carbon dioxide; Yield

Isaac Olusanjo Adewale, Edith Ngachi Agumanu, Florence Ihuoma Otih-Okoronkwo, Comparative studies on [alpha]-amylases from malted maize (Zea mays), millet (Eleusine coracana) and Sorghum (Sorghum bicolor), Carbohydrate Polymers, Volume 66, Issue 1, 5 October 2006, Pages 71-74, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2006.02.022.
(http://www.sciencedirect.com/science/article/B6TFD-4JWFGYT-1/2/e25d72ae55612611890c1b10ad5decc3)
Abstract:
Starch-digesting enzymes were extracted from unmalted, malted, malted and kilned samples of maize (Zea mays), millet (Eleusine coracana) and sorghum (Sorghum bicolor) and the specific activities were determined with soluble starch as substrate. The extract of malted and kilned samples was partially purified by using ammonium sulphate fractionation and the kinetic parameters of the [alpha]-amylases were determined using starch as substrate. The heat stability of the enzymes at different temperatures was also established. The results showed that all the malted grains expressed [alpha]-amylases in appreciable quantity. Sorghum had the lowest drop in [alpha]-amylases activity after kilning. Sorghum [alpha]-amylases also had the lowest Km for starch, and maize, the highest. Amylases from maize were least stable to heat denaturation at all temperatures investigated, while sorghum and millet [alpha]-amylases had similar sensitivity to heat inactivation, although sorghum amylases were slightly more resistant. The overall summary showed that [alpha]-amylases from maize were least stable to heat denaturation, and also had the lowest affinity for soluble starch. A combination of these factors might have influenced the choice of sorghum grains over maize and millet for commercial malt production.
Keywords: Malt; Starch-digesting enzymes; [alpha]-Amylases; Maize; Sorghum; Millet; Stability

Yun-long BIAN, Seiji Yazaki, Maiko Inoue, Hong-wei CAI, QTLs for Sugar Content of Stalk in Sweet Sorghum (Sorghum bicolor L. Moench), Agricultural Sciences in China, Volume 5, Issue 10, October 2006, Pages 736-744, ISSN 1671-2927, DOI: 10.1016/S1671-2927(06)60118-1.
(http://www.sciencedirect.com/science/article/B82XG-4M6380T-2/2/639d6d5414538ab20acbd44e9ccaa0a0)
Abstract:
High sugar content of sorghum stalk is an important factor in the sorghum silage production. To identify the genomic regions controlling sugar content and to develop molecular markers linked to sugar content in sweet sorghum, we used an F2:3 segregating population consisting of 207 individuals derived from a cross between a high sugar content inbred line, Early Folger, and a normal inbred line, N32B, for genetic linkage mapping and quantitative trait locus (QTL) analysis. We constructed a genetic linkage map spanning 983.5 cM based on a total of 327 markers comprising 31 restriction fragment length polymorphism (RFLP) markers, 254 amplified fragment length polymorphism (AFLP) markers, and 42 simple sequence repeat (SSR) markers. In the 20 linkage groups detected, 98.2% of markers aligned to the 10 linkage groups of sorghum. Variations in sugar content at different growth stages and among interaodes suggested that the sugar content of middle internodes is stable and suitable for measuring at early dough stage. The broad sense heritability (hB2) of sugar content was 0.64 and 0.62 estimated from the data of F3 families and each parent in 2003 and 2004. We identified one and two QTLs accounting for 22.2 to 25.0% of phenotypic variance using simple interval mapping method in 2003 and 2004,

respectively. These two QTLs showed a negative additive effect, and over-dominance effect. A QTL on LG-D was detected in both two years. Above results will be help us to understand the genetic mechanism of sugar content in sorghum and the QTL detected in this study might be useful in the improvement of sugar content by marker-assisted selection.
Keywords: sugar content; molecular marker; QTL; sorghum

Philippe Debaeke, Jean-Marie Nolot, Didier Raffaillac, A rule-based method for the development of crop management systems applied to grain sorghum in south-western France, Agricultural Systems, Volume 90, Issues 1-3, October 2006, Pages 180-201, ISSN 0308-521X, DOI: 10.1016/j.agsy.2006.01.001.
(http://www.sciencedirect.com/science/article/B6T3W-4J84T1G-1/2/f74c2075701089587cd5a911c5de5dea)
Abstract:
A generic approach is proposed for the development and testing of crop management systems in contrasting situations of water availability. Ecophysiological knowledge, expertise, regional references and simulation models are combined to devise management strategies adapted to production targets and constraints. The next stage consists of converting these crop management strategies into logical and consistent sets of decision rules. Each rule describes the reasoning which is used to apply a technical decision by taking account of observed or simulated environmental conditions or predicted agronomic risks.
This approach was applied to design crop management systems for grain sorghum (Sorghum bicolor L. Moench.) in south-western France. For spring-sown crops, management (sowing date, plant density, varietal choice, N fertilizer rate and timing) was based on water availability, both for economic and environmental reasons. Specific sets of decision rules were written for irrigated and rainfed conditions. The establishment of rules was based on agronomic principles (e.g. for plant density) or on the application of a simulation model (e.g. for sowing date, variety). N fertilization and irrigation were applied using combined N and water dynamic models.
A novel methodology combining crop diagnosis, analytical trials and crop simulation was developed to evaluate the management systems. An irrigated and a rainfed rule-based management system were compared near Toulouse (S.W. France) from 1995 to 2002. The profitability of rainfed low-input management was confirmed for sorghum in spite of high yields under irrigation (up to 10 t ha-1). The adaptation of sorghum management in rainfed conditions was mainly achieved through early maturing cultivars and by reducing N applications by 65%.
Keywords: Decision rule; Crop management system; Sorghum; Irrigation

Xue-Jian YE, Zheng-Yin Wang, Shi-Hua Tu, G. SULEWSKI, Nutrient Limiting Factors in Acidic Vegetable Soils, Pedosphere, Volume 16, Issue 5, October 2006, Pages 624-633, ISSN 1002-0160, DOI: 10.1016/S1002-0160(06)60096-9.
(http://www.sciencedirect.com/science/article/B82XV-4KYR9DF-B/2/7a4a4a0f95400278057c10d0845e3914)
Abstract: ABSTRACT
Nutrient limiting factors in acidic soils from vegetable fields of the Chongqing suburbs of China were assessed by employing the systematic approach developed by Agro Services International (ASI) including soil testing, nutrient adsorption study, and pot and field experiments to verify the results of soil testing, with a conventional soil test (CST) used for comparison. The ASI method found the moderately acidic soil (W01) to be N and P deficient; the strongly acidic soil (W04) to be N, K and S deficient; and the slightly acidic soil (W09) to be N, K, S, Cu, Mn, and Zn deficient. The CST method showed that W01 had P, B and Cu deficiencies; W04 had N, P and S deficiencies; and W09 had N, P, S, B, Cu, and Zn deficiencies. There were differences between the two methods. Among the two indicator plants selected, the response of sorghum on the three representative acidic soils was more closely related to the ASI results than that of sweet pepper.

Keywords: acidic vegetable soil; nutrient limiting factor; sorghum; sweet pepper; systematic approach

Abraham Mehari, Bart Schultz, Herman Depeweg, Salinity impact assessment on crop yield for Wadi Laba spate irrigation system in Eritrea, Agricultural Water Management, Volume 85, Issues 1-2, 16 September 2006, Pages 27-37, ISSN 0378-3774, DOI: 10.1016/j.agwat.2006.05.009.
(http://www.sciencedirect.com/science/article/B6T3X-4K606JT-2/2/5c539a9e59aaee8e7ab6ec14d83b5f90)
Abstract:
Spate irrigation is a floodwater harvesting and management system. In the Wadi Laba (ephemeral stream) spate irrigation system, unpredictable and potentially destructive floods are currently the only source of irrigation water used to grow sorghum (Sorghum bicolor) and maize (Zea mays) on about 2600 ha. From about 1900 to 2000, farmers harnessed floods with indigenous brushwood and earthen dams. Large floods (>100 m3/s) frequently damaged the structures. In 2000, the Government of Eritrea installed a concrete headwork. The objective was to divert large floods of up to 265 m3/s and to irrigate annually all the Wadi Laba fields thereby doubling production. This was done without considering the potential salinity problems. In 2002 and 2003, we determined the salinity of the floodwaters and found that it increased with the flood discharges. For floods that exceed 100 m3/s, the average rootzone salinities, estimated for leaching fractions ranging from 0.1 to 0.3, could result in yield reductions; particularly for maize the yield reduction ranges from 30 to 100%. The main conclusion to be drawn from the study is that the water management reforms cannot double crop production (especially of maize) unless the management and allocations of floodwaters takes into account the need to control soil salinity.
Keywords: Crop yield; Floods; Irrigation water quality; Maize; Sorghum; Soil salinity; Spate irrigation; Water management

I.Y. Dugje, A.Y. Kamara, L.O. Omoigui, Infestation of crop fields by Striga species in the savanna zones of northeast Nigeria, Agriculture, Ecosystems & Environment, Volume 116, Issues 3-4, September 2006, Pages 251-254, ISSN 0167-8809, DOI: 10.1016/j.agee.2006.02.013.
(http://www.sciencedirect.com/science/article/B6T3Y-4JN2NJN-2/2/affd930592f15603074c07adf2d82564)
Abstract:
Parasitism of crop plants by Striga species is a major constraint in the savanna zones of West Africa. Farmers ranked Striga as a leading constraint during a livelihood analysis of 30 communities in northeast Nigeria. A field survey was conducted to ascertain the extent of infestation by Striga spp. About 935 crop and fallow fields were surveyed across 30 communities in three agro-ecological zones.
Four major Striga species were identified: Striga hermonthica in sorghum or maize; Striga aspera in rice; Striga densiflora in pearl millet and fallow and Striga gesnerioides in cowpea. About 68% of all fields sampled were infested, about 75% of compound fields and 60% of bush fields. The level of infestation was 60% in southern Guinea, 68% in Sudan and 74% in northern Guinea savanna. The level of infestation of cereal fields by S. hermonthica was in the order of Sudan savanna > Northern Guinea > Southern Guinea. Infestation of cowpea with S. gesnerioides was in the order of Northern Guinea savanna > Sudan savanna > Southern Guinea savanna. Across the three ecozones, about 85% of fields planted to maize and sorghum were infested with S. hermonthica and 81% of cowpea fields with S. gesenerioides. S. aspera infested 40-59% of rice fields and S. densiflora infested 27-60% of millet fields and fallow.
Keywords: Striga hermonthica; Striga densiflora; Striga gesnerioides; Striga aspera; Savannas; Maize; Sorghum; Cowpea

J. Kanani, S.D. Lukefahr, R.L. Stanko, Evaluation of tropical forage legumes (Medicago sativa, Dolichos lablab, Leucaena leucocephala and Desmanthus bicornutus) for growing goats, Small Ruminant Research, Volume 65, Issues 1-2, September 2006, Pages 1-7, ISSN 0921-4488, DOI: 10.1016/j.smallrumres.2005.04.028.
(http://www.sciencedirect.com/science/article/B6TC5-4GDK9VV-3/2/55af7266f71e57a34db0b15b5e633275)
Abstract:
A 56-day feeding trial was conducted to evaluate forage legumes (Medicago sativa, Dolichos lablab, Leucaena leucocephala and Desmanthus bicornutus) as protein supplements to a sudangrass (Sorghum bicolor) diet based on growth and feed performance of growing goats. Twenty-four castrated kids were used in the experiment with an average initial age of 135 days and body weight of 18.7 kg. Kids were Boer x Spanish crossbreds. Four dietary treatments were composed of sudangrass (60% of diet offered) supplemented with one of four forage legumes (40% of diet offered) and corn (0.2 kg/day). A split-plot design was employed with diet as the main plot, pens as experimental units (consisting of three pens per diet as replicates) and goats as samples (two goats per pen). Fixed effects of breed type, litter size born, parity of dam and initial age of kid as a linear covariate were added to the model for growth traits. All forage legumes had over 20% crude protein (CP). Final body weight was not affected by diet ($P > 0.05$). Average daily gain (ADG) tended ($P < 0.10$) to be more rapid for goats fed leucaena compared to desmanthus (least squares means of 93.9 and 60.9 g/day, respectively). Voluntary daily feed intakes of sudangrass and alfalfa were higher by 22 and 33 g ($P < 0.01$ and <0.001) per goat for pens receiving alfalfa with sudangrass compared to combined mean intakes of pens fed experimental forage legumes. Intake of leucaena compared to desmanthus forage was higher by 97 g/day ($P < 0.001$), demonstrating relatively poorer acceptability of desmanthus. Also, goats fed leucaena had better ($P < 0.05$) gain efficiency (ADG/total feed intake) compared to goats fed desmanthus. Experimental results suggest that L. leucocephala had more potential for feeding growing goats in tropical regions compared to the other forage legumes evaluated.
Keywords: Goats; Growth; Feeding level; Tropical forages

S.L. Patil, M.N. Sheelavantar, Soil water conservation and yield of winter sorghum (Sorghum bicolor L. Moench) as influenced by tillage, organic materials and nitrogen fertilizer in semi-arid tropical India, Soil and Tillage Research, Volume 89, Issue 2, September 2006, Pages 246-257, ISSN 0167-1987, DOI: 10.1016/j.still.2005.07.013.
(http://www.sciencedirect.com/science/article/B6TC6-4HYN6NV-1/2/7b147b5c7ff0d352c1a0a3a41bd32a1a)
Abstract:
Soil water and nutrients play an important role in increasing sorghum (Sorghum bicolor L. Moench) yields in the Vertisols of semi-arid tropics during post-rainy season. The effects of tillage practices, organic materials and nitrogen fertilizer on soil properties, water conservation and yield of sorghum were evaluated during winter seasons of 1994-1995 and 1995-1996 on deep Vertisols at Bijapur in the semi-arid tropics of Karnataka State (Zone 3) of south India. Conservation and availability of water and nutrients during different stages of crop growth were increased by deeper tillage resulting in increased grain yield of winter sorghum. Medium and deep tillage increased the grain yield by 23% (1509 kg ha-1) and 57% (1919 kg ha-1) during 1994-1995 and 14% (1562 kg ha-1) and 34% (1835 kg ha-1) during 1995-1996, respectively, over shallow tillage. Water use efficiency increased from shallow (4.90 kg ha-1 mm-1) to deep tillage (7.30 kg ha-1 mm-1). Greater water use efficiency during 1994-1995 as compared to 1995-1996 was attributed to lower consumptive use of water during 1994-1995. Among organic materials, application of Leucaena loppings conserved larger amounts of water and increased winter sorghum yield and water use efficiency. Application of Leucaena loppings increased the winter sorghum grain yield by 9% (mean of 1994-1995 and 1995-1996) as compared to vermicompost. Significantly ($P < 0.05$) higher water use

efficiency of 6.32 kg ha-1 mm-1 was observed in Leucaena loppings incorporated plots compared to 5.72 kg ha-1 mm-1 from vermicompost. Grain yield increased by 245 kg ha-1 with application of 25 kg N ha-1 in 1994-1995, and a further increase in N application to 50 kg ha-1 increased the grain yield by about 349 kg ha-1 in 1995-1996. Deep tillage with application of 25 kg N ha-1 resulted in significantly higher sorghum yield (2047 kg ha-1) than control during 1994-1995. Deep tillage with integrated nutrient management (organic and inorganic N sources) conserved higher amount of soil water and resulted in increased sorghum yields especially during drought years.
Keywords: Deep tillage; Organic materials; Nitrogen; Vertisols; Crop yield; India; Semi-arid tropics; Water use efficiency; Leucaena leucocephala

Nader Katerji, Gianfranco Rana, Modelling evapotranspiration of six irrigated crops under Mediterranean climate conditions, Agricultural and Forest Meteorology, Volume 138, Issues 1-4, 29 August 2006, Pages 142-155, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2006.04.006.
(http://www.sciencedirect.com/science/article/B6V8W-4K48N70-1/2/c4e4cbc985bc713b87e79860687d843c)
Abstract:
Two models based on the Penman-Monteith equation have been used to calculate the evapotranspiration, on hourly and daily scales, for six crops (grass, tomato, soybean, sunflower, grain sorghum, sweet sorghum), grown in a Mediterranean region, in well watered conditions. These crops presented different sensitivity to the air vapour pressure deficit, due to their height ranging between 0.1 and 2.8 m. In the first model (model 1), the canopy resistance was considered variable and modelled as function of climatic variables. The experimental tests showed that this model simulated well the evapotranspiration for the six crops, both at hourly and daily scales. On the other hand, the simulations obtained by this model 1 at daily scale are clearly more accurate than those obtained by using the standard FAO 56 method. In the second model (model 2), the canopy resistance, locally determined, is considered constant. The experiments showed that the model 2 simulated acceptably the evapotranspiration only for the short crops: the grass (at hourly and daily scales) and the tomato (only at daily scale), but with lower performances than the model 1. For the other four crops (soybean, sunflower, grain sorghum and sweet sorghum) the model 2 seems to be not adapted to calculate correctly the evapotranspiration. In the conclusions we discuss the advantages linked to the use of the model 1 for the direct calculation of the evapotranspiration.
Keywords: Fixed canopy resistance; Variable canopy resistance; Height crop; Penman-Monteith formulation; Vapour pressure deficit; Aerodynamic resistance

R.H. Santos Ricalde, I.J. Lean, Digestibility of dried star grass (Cynodon nlemfuensis) and consumption of fresh star grass in primiparous pregnant sows, Animal Feed Science and Technology, Volume 129, Issues 1-2, 4 August 2006, Pages 12-22, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.11.012.
(http://www.sciencedirect.com/science/article/B6T42-4J4404H-1/2/cea41051ad93be17e8476b20acadfcd1)
Abstract:
Two experiments to evaluate the consumption and digestibility of star grass (Cynodon nlemfuensis) in pregnant sows are reported. Experiment one: Six pregnant sows were used to evaluate the effect of dried star grass (DSG) on coefficient of total tract apparent digestibility (CTTAD) of dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fibre (NDF), acid detergent fibre (ADF), gross energy (GE) and nitrogen balance (NB). The experimental diets included 0 g (0 DSG) and 250 g of DSG kg-1 (250 DSG). These diets were similar in crude protein, vitamins and minerals. The experiment was conducted in two periods: 15 days for adaptation and 7 days for total urine and faeces collection. The CTTAD of DM, OM, CP, NDF, ADF, and GE were lower ($P<0.05$) in sows fed with 250 DSG diet than in sows fed with 0

DSG diet. The digestible energy value obtained for DSG was 5.5 MJ kg-1 DM. Experiment two: Six pregnant sows were used to evaluate fresh star grass (FSG) consumption. The sows were fed three basal diets based on soya bean meal and sorghum. The diets were designed to supply 19 (L), 26 (M) and 33 (H) MJ of DE day-1. After the basal diets were consumed, the sows were offered chopped FSG ad libitum. Dry matter consumption of FSG decreased (P<0.05) as energy intake from basal diets increased (L: 231 g day-1, M: 180 g day-1 and H: 136 g day-1). However, the total DM consumption (basal diet + FSG) reduced linearly (P<0.05) as energy intake from experimental diets decreased (L: 1671 kg-1, M: 1980 kg-1 and H: 2296 kg-1). Results suggest that inclusion of DSG in sow diets reduced digestibility and FSG consumption increased as energy supply in the basal diet was reduced. However, the increased in FSG consumption did not compensate for the energy deficit in the basal diet.
Keywords: Pregnant sows; Digestibility; Consumption; Star grass

E.M.A. Smaling, J. Dixon, Adding a soil fertility dimension to the global farming systems approach, with cases from Africa, Agriculture, Ecosystems & Environment, Volume 116, Issues 1-2, Nutrient Management in Tropical Agroecosystems, August 2006, Pages 15-26, ISSN 0167-8809, DOI: 10.1016/j.agee.2006.03.010.
(http://www.sciencedirect.com/science/article/B6T3Y-4JVSV8K-1/2/b526732e226df5032fffbc3e2696d189)
Abstract:
The global farming systems (GFS) approach is extended by adding a soil fertility and nutrient management dimension for Africa's forest-based, maize mixed, cereal-root crop mixed, and agro-pastoral millet/sorghum farming systems. Use is made of sustainable livelihood concepts, translated into farmer capitals (natural, physical, financial, human, social), and the indicator-based DPSIR (driving force-pressure-state-impact-response) framework for environmental reporting. State and impact indicators show, for each GFS, levels of nutrient stocks and flows, respectively. In case of nutrient depletion, soils may (i) initially still be fertile enough to provide reasonable and stable yields, (ii) support declining yields, or (iii) support low yields at low fertility level. In the latter case, food security is generally at stake. Response indicators include the level of uptake of improved integrated nutrient management strategies at land user level, and the enforcement of new and enabling pro-agriculture and pro-environment policies. Although the extended GFS have no direct relevance for farm-level interventions, the approach can be used to frame soil fertility research priorities and policies at a regional level.
Keywords: Soil fertility; Nutrient stocks; Nutrient flows; Integrated nutrient management; Farming systems; Indicators; Sub-Saharan Africa

Gikuru Mwithiga, Mark Masika Sifuna, Effect of moisture content on the physical properties of three varieties of sorghum seeds, Journal of Food Engineering, Volume 75, Issue 4, August 2006, Pages 480-486, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2005.04.053.
(http://www.sciencedirect.com/science/article/B6T8J-4GJV9WJ-2/2/855d6df858939293851b489d9b23fa03)
Abstract:
Three sorghum varieties (Kari-mtama, Serena and Seredo) were obtained from the Kenya Agricultural Research Institute and reconditioned to moisture contents ranging from 13.64% to 21.95% db. The reconditioned grain kernels were then evaluated for dimensions, 1000 grain mass, bulk density, true density, angle of repose and hardness. The major, medium and minor diameters were found to increase with increase in moisture content for all three varieties of sorghum within the experimental moisture range. At the moisture content of 13.64% db the geometric mean diameter, sphericity, 1000 grain mass, bulk density, true density, porosity, angle of repose and kernel strength were found to be 3.94 mm, 0.737, 33.91 g, 588.4 kg/m3, 1264 kg/m3, 53.44%, 30.43[degree sign] and 87.89 N for Kari-mtama, 3.33 mm, 0.733, 20.89 g, 686.33 kg/m3, 1087

kg/m3, 36.86%, 24.41[degree sign] and 59.64 N for Serena, and 3.15 mm, 0.789, 19.66 g, 757.61 kg/m3, 1138 kg/m3, 33.31%, 20.11[degree sign] and 48.66 N for Seredo, respectively. The geometric mean diameter increased linearly with moisture content for all three sorghum varieties while sphericity remained fairly unchanged. Both the 1000 grain mass and angle of repose increased linearly with moisture content within the experimental testing range (13.64-21.95% db) while bulk density and true density decreased linearly with increase in moisture content. When the moisture content was raised from 13.64% to 21.95% db, the porosity of Kari-mtama decreased slightly but linearly with increase in moisture content while that of Serena and Seredo increased linearly with increase in moisture content. The hardness of Kari-mtama, Serena and Seredo decreased with increase in the moisture content of the grains although a linear relationship with moisture content over the entire range of 13.64-21.95% db was not observed.
Keywords: Sorghum varieties; Kari-mtama; Serena; Seredo; Moisture content; Dimensions; Density; Hardness and angle of repose

Susana L. Amigot, Cecilia L. Fulgueira, Hebe Bottai, Juan Carlos Basilico, New parameters to evaluate forage quality, Postharvest Biology and Technology, Volume 41, Issue 2, August 2006, Pages 215-224, ISSN 0925-5214, DOI: 10.1016/j.postharvbio.2006.03.009.
(http://www.sciencedirect.com/science/article/B6TBJ-4K48N9D-2/2/753175bb91217ffc1493989ee94d407e)
Abstract:
The preservation of feedstuff for animal consumption (forages) by fermentation or dehydration is a common practice to supplement pastures and achieve better yields. Currently, the quality of a forage has been evaluated only through chemico-fermentative parameters. However, animals' health can also be affected by the presence of bacteria, molds, and/or some of their metabolites, e.g. mycotoxins.
The quality of 147 forage samples (55 sorghum, 49 lucerne, and 43 maize) used for feeding dairy cattle, was evaluated using chemico-fermentative (pH, ammonial nitrogen/total nitrogen ratio) characteristics, fungal propagule counts, and the presence of Aspergillus fumigatus and mycotoxins (aflatoxins and deoxynivalenol).
Most lucerne samples (55.1%) were of bad chemico-fermentative quality (risky for consumption). In addition, a high percentage of samples (38.8% lucerne, 65.1% maize and 69.1% sorghum) presented Fairly Good (doubtful) chemico-fermentative characteristics.
Maize samples showed the highest frequency of contaminated samples by high counts (25.6%), followed by lucerne (with a lower fermentative sugar content) (18.4%), and sorghum (16.4%). The mycoflora was distributed in 59 species belonging to 26 genera. In all forages, molds were the most numerous isolates, with the greatest number of isolates being Aspergillus species (17% isolates) with numerous isolates in the section Flavi, followed by Penicillium (9.7%) in maize, Fusarium (12.3%) in lucerne, and Byssochlamys (8.5%), Fusarium and Geotrichum (6.1% each) in sorghum.
Even though the lucerne and maize samples presented a high mycotoxin incidence, and in most of them the simultaneous presence of AF and DON was detected, average values were not very high (AF: 6.78 and 6.96 [mu]g/kg, DON: 1666.67 and 717.50 [mu]g/kg, respectively for lucerne and maize). The high degree of contamination registered in the samples (81.6% lucerne, 67.4% maize and 45.5% sorghum) indicates the need for improving the technology applied during the development of crops, their harvest and the preparation and conservation of forages. It could be determined ($p < 0.05$) that AF + DON are contamination markers in lucerne and maize silages. In sorghum forages, a significant association ($p < 0.01$) was detected between risk and storage method.
Keywords: Forages quality; Aflatoxin; Deoxynivalenol; Aspergillus; Fusarium; Dairy cattle

P.S. Minhas, N. Sharma, R.K. Yadav, P.K. Joshi, Prevalence and control of pathogenic contamination in some sewage irrigated vegetable, forage and cereal grain crops, Bioresource Technology, Volume 97, Issue 10, July 2006, Pages 1174-1178, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.05.006.
(http://www.sciencedirect.com/science/article/B6V24-4GMGW7R-3/2/3b1310e6f10cad40b46d0b9f1c730ef0)
Abstract:
A total of 344 samples comprising of different vegetables, fodder and grain crops were obtained from a long-term experiment under sewage irrigation. The aerobic bacterial plate counts for vegetables, fodder and grain crops ranged between 2 x 106 and 3.5 x 107, 6 x 106 and 3 x 108, 2 x 105 and 3.8 x 1010, respectively, while the corresponding Faecal coliform ranged between <2 and 9 x 105, 9 x 102 and 2 x 105 and <2, indicating that the pathogenic loads got reduced below permissible level in the produce that was harvested after sun drying in the field itself, whereas the parts coming in direct contact were the most severely contaminated. The health hazards could be markedly lowered with adoption of some of the low cost practices such as repeated washings, exposure of the produce to sunlight and raising the crops on beds. The coliform counts in vegetables were within permissible limits by two washings with water, exposing these to sunlight for about 4 h and removing the two outmost leaves of cabbage. Also, cutting above some height from ground level (0.10 m) in sorghum reduced the pollution load in fodder crops.
Keywords: Faecal coliform; Pathogenic contamination; Wastewater; Health hazards; Management practices

Lorenzo Barbanti, Silvia Grandi, Angela Vecchi, Gianpietro Venturi, Sweet and fibre sorghum (Sorghum bicolor (L.) Moench), energy crops in the frame of environmental protection from excessive nitrogen loads, European Journal of Agronomy, Volume 25, Issue 1, July 2006, Pages 30-39, ISSN 1161-0301, DOI: 10.1016/j.eja.2006.03.001.
(http://www.sciencedirect.com/science/article/B6T67-4JRVDCD-1/2/19a55079d175314884e74d448bd9ef2a)
Abstract:
Sweet and fibre sorghum (Sorghum bicolor (L.) Moench) are multipurpose cereals of potential interest for several non-food uses. In order to assess the effects of nitrogen (N) fertilization on crop growth, yield and N budget during crop cycle, field trials were carried out in Northern Italy (44[degree sign]33'N, 11[degree sign]21'E) in the years 1997-1999. Sweet and fibre sorghum were grown in combination with three N rates (0, 60, 120 kg ha-1). Both crops depicted a sigmoidal growth-pattern, but fibre sorghum showed an earlier and steeper growth. Sweet sorghum recovered due to a longer cycle, 118 versus 105 days in the 3 years' average, and attained a similar final yield. Nitrogen fertilization did not affect growth pattern, nor yield partitioning among plant organs: the sweet type allocated more photosynthates to stems (about 75% of total dry weight) compared to the fibre one (55-60%), due to a limited partitioning to panicles. Total dry weight at harvest showed an interaction with years: fibre sorghum yielded significantly more than sweet sorghum in 1997 (23.8 versus 17.7 Mg ha-1), but the opposite happened in 1998 and 1999 (20 versus 24.2 Mg ha-1 as average), when a different sweet hybrid was grown, involving a longer season. When only the stem was considered of potential interest, such as in the case of ethanol production or fibre extraction, fibre sorghum showed a slight advantage in the 1st year (14.4 versus 12 Mg ha-1), whereas the sweet type prevailed in the following 2 years (18.7 versus 11 Mg ha-1). Fertilization did not significantly influence total yield, although interacted with sorghum type in plant N concentration and uptake: fibre sorghum rose in both parameters, due to bulkier panicles acting as a late-season sink for the nutrient, while the sweet type was not affected. Nitrogen budget at harvest was clearly influenced by applied fertilizer and plant uptake, whereas nutrient losses as ammonia volatilization and nitrate leaching and natural supplies along with precipitation played a less relevant role. The expected variations in soil reserves ranged between -

216 and +77 kg ha-1 of N, depending also on the plant portion removed from the field (whole plant or stem). A slight decrease in soil reserves, more favourable in environmental terms, is achieved when the whole biomass is removed from the field and when fertilizer rates are tight-suited to crop needs in specific growth conditions.
Keywords: Sweet sorghum; Fibre sorghum; Plant partitioning; Nitrogen dilution; Nitrogen losses; Nitrogen budget

Z.J. Liu, N.P. McMeniman, Effect of nutrition level and diets on creatinine excretion by sheep, Small Ruminant Research, Volume 63, Issue 3, June 2006, Pages 265-273, ISSN 0921-4488, DOI: 10.1016/j.smallrumres.2005.02.021.
(http://www.sciencedirect.com/science/article/B6TC5-4FY296R-1/2/b4b12cf06b52ba2735ccadd09f50da9e)
Abstract:
In this experiment, creatinine (C) excretion by sheep was measured when they were fed different diets at different levels of intake. Creatinine excretion was not affected by the level of feed intake or the addition of salt to lucerne-based diets. However, differences between individual animals were significant. Creatinine excretion was significantly affected by diets, which were formulated by combining different amounts of lucerne chaff, oaten chaff and sorghum. It was also found that there were significant diurnal changes in the ratios of purine derivatives to creatinine (PD:C) in 3 hourly urine samples when the animals were fed either once or twice daily, but the average value for the PD:C ratio of any two urine samples taken 12 h apart was close to the daily mean. The results of this experiment suggest that if separate determination of the creatinine excretion by individual animals is made and the average value of the ratio of PD:C in two spot urine samples taken 12 h apart is used to predict PD excretion by spot urine sampling, microbial nitrogen flow can be estimated more accurately than when a fixed value of creatinine excretion is used for all animals and only a single urine sample is taken.
Keywords: Creatinine excretion; Feed intake; Sheep

Imma Farre, Jose Maria Faci, Comparative response of maize (Zea mays L.) and sorghum (Sorghum bicolor L. Moench) to deficit irrigation in a Mediterranean environment, Agricultural Water Management, Volume 83, Issues 1-2, 16 May 2006, Pages 135-143, ISSN 0378-3774, DOI: 10.1016/j.agwat.2005.11.001.
(http://www.sciencedirect.com/science/article/B6T3X-4J2M6WX-1/2/e8255f56675f52be6e852be762d9a9ad)
Abstract:
Growing drought tolerant crops can save water in regions where irrigation water supply is limited. The objective of this work was to compare the responses of maize (Zea mays L.) and sorghum (Sorghum bicolor L. Moench) to deficit irrigation. A field experiment was conducted on a loam soil (Typic Xerofluvent) in Northeast Spain using the sprinkler line-source technique. This technique produces a continuous and decreasing gradient of water applied. Phenology, crop water uptake, total above-ground biomass and yield were markedly affected by the irrigation treatments in both crops. Maize yield was superior to sorghum's under well-irrigated conditions, but sorghum out yielded maize under moderate or severe water deficits. Sorghum had a greater ability to extract water from deeper soil layers. Its higher yield under irrigation deficit was achieved by a higher above-ground biomass, higher harvest index and higher water use efficiency. The results indicated that sorghum could be a good alternative to maize under limited water conditions in the semi-arid conditions of Northeast Spain.
Keywords: Sprinkler-line-source; Irrigation; Water stress; Yield; Irrigation water use efficiency (IWUE)

Joel Mutisya, Chuanxin Sun, Sara Palmqvist, Yona Baguma, Benjamin Odhiambo, Christer Jansson, Transcriptional regulation of the sbeIIb genes in sorghum (Sorghum bicolor) and barley (Hordeum vulgare): Importance of the barley sbeIIb second intron, Journal of Plant Physiology, Volume 163, Issue 7, 3 May 2006, Pages 770-780, ISSN 0176-1617, DOI: 10.1016/j.jplph.2005.04.038.
(http://www.sciencedirect.com/science/article/B7GJ7-4HDG93S-1/2/d9e15160cb18b37be6582c9be1649397)
Abstract: Summary
The transcriptional activity of the sorghum sbeIIb gene, encoding starch branching enzyme IIb, is seed specific, with expression in both the endosperm and the embryo. In comparison, expression of barley sbeIIb is confined to the endosperm, whereas that of barley sbeIIa occurs in endosperm, embryonic and vegetative tissues. It has been suggested that the second intron of barley sbeIIb may be instrumental in conferring endosperm-specific expression. Therefore, to further investigate the regulatory mechanisms of barley and sorghum sbe, we examined the tissue-specific activity of the sorghum sbe promoter in transient assays of green fluorescent protein (gfp) reporter constructs. We found that, when linked to the barley sbeIIb second intron, the sorghum sbeIIb promoter could not drive gfp transcription in sorghum or barley embryonic cells. Similar results were obtained for the barley sbeIIa promoter. Database searches showed that sequences homologous to the barley sbeIIb intron also exist in introns and flanking regions of some other grass genes. Deletion mutagenesis of the sorghum sbeIIb promoter identified the minimal promoters required for high- and low-level expression, respectively, but did not reveal any putative promoter elements crucial for expression. A sequence with similarity to the SURE element, implicated in sugar signaling, was located in the distal promoter region of sorghum sbeIIb, upstream of the minimal promoters. SURE elements are present in the proximal promoter regions of the sugar-regulated barley iso1 gene, and barley sbeIIb. In keeping in line with these observations, RNA-gel blot analyses demonstrated that expression of barley sbeIIb was sugar inducible, whereas that of sorghum sbeIIb was not.
Keywords: Barley; Intron; sbeIIb; Sorghum

X. Zhan, D. Wang, S.R. Bean, X. Mo, X.S. Sun, D. Boyle, Ethanol production from supercritical-fluid-extrusion cooked sorghum, Industrial Crops and Products, Volume 23, Issue 3, May 2006, Pages 304-310, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2005.09.001.
(http://www.sciencedirect.com/science/article/B6T77-4HDG9D8-1/2/12203aa4f32a01fad19d84e25ba53dd2)
Abstract:
Sorghum (Sorghum bicolor (L.) Moench) is a starch-rich grain similar to maize (Zea mays L.), but sorghum has been underutilized for biobased products and bioenergy. This study was designed to investigate the effects of supercritical-fluid-extrusion (SCFX) of sorghum on ethanol production. Morphology, chemical composition, and thermal properties of extruded sorghum were characterized. Analysis of extruded sorghum showed increased measurable starch content, free sugar content, and high levels of gelatinized starch. SCFX cooked and non-extruded sorghum were further liquefied, saccharified, and fermented to ethanol by using Saccharomyces cervisiae. The ethanol yield increased as sorghum concentration increased from 20 to 40% for both extruded and non-extruded sorghum. Ethanol yields from SCFX cooked sorghum were significantly greater than that from non-extruded sorghum (>5%).
Keywords: Ethanol fermentation; Sorghum; Supercritical-fluid-extrusion; Fermentation efficiency

M.L. Adriano-Anaya, M. Salvador-Figueroa, J.A. Ocampo, I. Garcia-Romera, Hydrolytic enzyme activities in maize (Zea mays) and sorghum (Sorghum bicolor) roots inoculated with Gluconacetobacter diazotrophicus and Glomus intraradices, Soil Biology and Biochemistry,

Volume 38, Issue 5, May 2006, Pages 879-886, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2005.08.004.
(http://www.sciencedirect.com/science/article/B6TC7-4H2PHVV-1/2/3ea08d9c7f63cf011ebe46c505ca08de)
Abstract:
Two strains of Gluconacetobacter diazotrophicus (Pal 5, UAP5541) and the arbuscular mycorrhizal fungus Glomus intraradices increased both the shoot and root dry weight of sorghum 45 days after inoculation, whereas they had no effect on the shoot and root dry weight of maize. Co-inoculation (Gluconacetobacter diazotrophicus plus Glomus mosseae) did not increase the shoot and root dry weight of either plant. There was a synergistic effect of Gluconacetobacter diazotrophicus on root colonization of maize by Glomus intraradices, whereas an antagonistic interaction was observed in the sorghum root where the number of Gluconacetobacter diazotrophicus and the colonization by Glomus intraradices were reduced. Plant roots inoculated with Gluconacetobacter diazotrophicus and Glomus intraradices, either separately or together, significantly increased root endoglucanase, endopolymethylgalacturonase and endoxyloglucanase activities. The increase varied according to the plant. For example, in comparison with non-inoculated plants, there were higher endoglucanase (+328%), endopolymethylgalacturonase (+180%) and endoxyloglucanase (+125%) activities in 45-day old co-inoculated maize, but not in 45-day old sorghum. The possibility is discussed that hydrolytic enzyme activities were increased as a result of inoculation with Gluconacetobacter diazotrophicus, considering this to be one of the mechanisms by which these bacteria may increase root colonization by AM fungi.
Keywords: Arbuscular mycorrhizal; Endoglucanase; Endopolymethylgalacturonase; Endoxyloglucanase; Gluconacetobacter diazotrophicus; Glomus intraradices

Sheng-Feng Kuo, Shin-Shen Ho, Chen-Wuing Liu, Estimation irrigation water requirements with derived crop coefficients for upland and paddy crops in ChiaNan Irrigation Association, Taiwan, Agricultural Water Management, Volume 82, Issue 3, 24 April 2006, Pages 433-451, ISSN 0378-3774, DOI: 10.1016/j.agwat.2005.08.002.
(http://www.sciencedirect.com/science/article/B6T3X-4H9991J-1/2/5c58f6634e3ceb688a0af2fdeddbaefe)
Abstract:
Field experiments were performed at the HsuehChia Experimental Station from 1993 to 2001 to calculate the reference and actual crop evapotranspiration, derived the crop coefficient, and collected requirements input data for the CROPWAT irrigation management model to estimate the irrigation water requirements of paddy and upland crops at the ChiaNan Irrigation Association, Taiwan. For corn, the estimated crop coefficients were 0.40, 0.78, 0.89 and 0.71 in the initial, crop development, mid-season and late-season stages, respectively. Meanwhile, the estimated crop coefficients for sorghum were 0.44, 0.71, 0.87 and 0.62 in the four stages, respectively. Finally, for soybean, the estimated crop coefficients were 0.45, 0.89, 0.92 and 0.58 in the four stages, respectively. With implementation of REF-ET model and FAO 56 Penman-Monteith method, the annual reference evapotranspiration was 1268 mm for ChiaNan Irrigation Association.
In the paddy fields, the irrigation water requirements and deep percolation are 962 and 295 mm, respectively, for the first rice crop, and 1114 and 296 mm for the second rice crop. Regarding the upland crops, the irrigation water requirements for spring and autumn corn are 358 and 273 mm, respectively, compared to 332 and 366 mm for sorghum, and 350 and 264 mm for soybean. For the irrigated scheme with single and double rice cropping patterns in the ChiaNan Irrigation Association, the CROPWAT model simulated results indicate that the annual crop water demands are 507 and 1019 mm, respectively, and the monthly water requirements peaked in October at 126 mm and in January at 192 mm, respectively.
Keywords: Irrigation water requirements; Crop coefficient; Evapotranspiration; Cropping pattern; CROPWAT model; REF-ET model

Qiong-xia GUO, Ke-hui HUANG, Yun YU, Zhen HUANG, Zhen-quan WU, Phylogenetic Relationships of Sorghum and Related Species Inferred from Sequence Analysis of the nrDNA ITS Region, Agricultural Sciences in China, Volume 5, Issue 4, April 2006, Pages 250-256, ISSN 1671-2927, DOI: 10.1016/S1671-2927(06)60046-1.
(http://www.sciencedirect.com/science/article/B82XG-4JWFR9V-2/2/4260cde7476df4f48780428bfeb547dd)
Abstract:
Analysis of phylogenetic and evolution in six species of Sorghum was based on internal transcribed spacer (ITS) sequences in nuclear ribosomal DNA. Results showed that the length of the ITS regions among the six species ranged from 588 to 589 bp and the contents of G + C in ITS (ITS1+5.8S+ITS2) regions ranged from 60.27 to 61.05%; the length of ITS1 ranged from 207 to 208 bp and the contents of G + C in the ITS1 regions ranged from 53.91 to 61.54%. The length of the 5.8S rDNA and ITS2 regions in the six species was 164 and 217 bp respectively, and the contents of G + C ranged from 56.10 to 58.54% in the 5.8S rDNA region and 66.36 to 67.28% in the ITS2 region. Among regions of ITS, ITS1, ITS2, and 5.8S, the best sequence for genetic relationship analysis in the six species was the ITS region. On the basis of the Jaccard coefficient and phylogentic tree, S. sp. was more related to S. propinguum than to other species. This was consistent with the fact that S. sp. is derived from S. propinguum. From the phylogenetic tree based on ITS1, S. halepense, silk sorghum and S. sudanense, are identical in the ITS1 sequence, whereas the phylogenetic tree based one shows that S. sudanense has a closer genetic association with S. almum rather than with S. halepense and silk sorghum.
Keywords: Sorghum; ITS; phylogenetic relationship

Seth G. Pritchard, Stephen A. Prior, Hugo H. Rogers, Micheal A. Davis, G. Brett Runion, Thomas W. Popham, Effects of elevated atmospheric CO2 on root dynamics and productivity of sorghum grown under conventional and conservation agricultural management practices, Agriculture, Ecosystems & Environment, Volume 113, Issues 1-4, April 2006, Pages 175-183, ISSN 0167-8809, DOI: 10.1016/j.agee.2005.09.010.
(http://www.sciencedirect.com/science/article/B6T3Y-4HK5SFS-4/2/6d40b7964f3751495194d7f979d2b0b8)
Abstract:
Although it is widely acknowledged that rising atmospheric CO2 concentrations will increase crop root growth, no study has considered how this response could be influenced by agricultural management practices. Therefore, we examined the influence of elevated atmospheric CO2 (ambient + 360 [mu]mol mol-1) on root dynamics of sorghum (Sorghum bicolor) produced under conventional (tillage following winter fallow) and conservation (no-till following clover (Trifolium repens) winter cover crop) agricultural management practices. Crops were grown in an outdoor soil bin facility and CO2 treatments were administered using open-top field chambers (OTC). Root dynamics were analyzed using minirhizotrons. In conventional tillage plots, CO2-enrichment increased sorghum seasonal root production and mortality by 58 and 59%, respectively. Root growth, however, was unaffected by [CO2] in conservation plots. Growth in CO2-enriched atmospheres increased residue production by 15 and 11% in conventional and conservation plots, respectively. Grain production was 6% greater in the conservation than conventional plots but was unaffected by atmospheric CO2. Neither carbon dioxide nor management practices had any impact on the proportion of roots that died by physiological maturity (i.e., root turnover). The fraction of roots that had died by physiological maturity decreased in a linear fashion from shallow to greater soil depths. Although management did not affect cumulative seasonal root production or mortality it did influence vertical root distribution; conservation management favored shallow root systems whereas conventional management favored deeper rooting. Data emphasize the importance of quantifying production and mortality as separate processes. This study suggests

that conversion from conventional to conservation management practices might diminish stimulation of rooting by rising atmospheric CO2, at least in the C4 crop sorghum.
Keywords: Elevated CO2; Agricultural management; Tillage; Root production; Root dynamics; Sorghum

Paul W. Tooley, Ranajit Bandyopadhyay, Marie M. Carras, Sylvie Pazoutova, Analysis of Claviceps africana and C. sorghi from India using AFLPs, EF-1[alpha] gene intron 4, and [beta]-tubulin gene intron 3, Mycological Research, Volume 110, Issue 4, April 2006, Pages 441-451, ISSN 0953-7562, DOI: 10.1016/j.mycres.2005.12.006.
(http://www.sciencedirect.com/science/article/B7XMR-4JJGCC5-1/2/4bcc8e73079c63a58e22e7390c4e1f94)
Abstract:
Isolates of Claviceps causing ergot on sorghum in India were analysed by AFLP analysis, and by analysis of DNA sequences of the EF-1[alpha] gene intron 4 and [beta]-tubulin gene intron 3 region. Of 89 isolates assayed from six states in India, four were determined to be C. sorghi, and the rest C. africana. A relatively low level of genetic diversity was observed within the Indian C. africana population. No evidence of genetic exchange between C. africana and C. sorghi was observed in either AFLP or DNA sequence analysis. Phylogenetic analysis was conducted using DNA sequences from 14 different Claviceps species. A multigene phylogeny based on the EF-1[alpha] gene intron 4, the [beta]-tubulin gene intron 3 region, and rDNA showed that C. sorghi grouped most closely with C. gigantea and C. africana. Although the Claviceps species we analysed were closely related, they colonize hosts that are taxonomically very distinct suggesting that there is no direct coevolution of Claviceps with its hosts.
Keywords: Clavicipitaceae; Coevolution; Ergot; Molecular phylogeny; Sorghum

Venkateshwaran Muthusubramanian, Ranajit Bandyopadhyay, Daram Rajaram Reddy, Paul W. Tooley, Cultural characteristics, morphology, and variation within Claviceps africana and C. sorghi from India, Mycological Research, Volume 110, Issue 4, April 2006, Pages 452-464, ISSN 0953-7562, DOI: 10.1016/j.mycres.2005.12.005.
(http://www.sciencedirect.com/science/article/B7XMR-4JJ86XR-1/2/4635988844d4e64eff6cc72e068882c9)
Abstract:
Sorghum ergot in India is caused by Claviceps africana and C. sorghi. The distributions of these two species in India is not known. Eighty-nine sorghum ergot isolates were cultured from young sphacelia obtained from male sterile sorghum plants artificially inoculated using inoculum collected in the field. Based on cultural characteristics, the isolates were separated into two groups which differed distinctly in the morphology of their sphacelia, conidia, and sclerotia. Marked differences also were observed in rates of secondary conidial production and disease spread between the groups. In combination with molecular evidence, our results confirm that the isolates placed in Group I represent C. africana and Group II isolates represent C. sorghi. C. africana was found to be widely distributed in all sorghum growing areas of India. The species first described as occuring in India, C. sorghi, appears to be restricted to a few locations in the states of Maharashtra, Andhra Pradesh, and Karnataka.
Keywords: Clavicipitaceae; Ergot; Population biology; Sorghum

Ramasamy Perumal, Thomas Isakeit, Monica Menz, Seriba Katile, Eun-Gyu No, Clint W. Magill, Characterization and genetic distance analysis of isolates of Peronosclerospora sorghi using AFLP fingerprinting, Mycological Research, Volume 110, Issue 4, April 2006, Pages 471-478, ISSN 0953-7562, DOI: 10.1016/j.mycres.2005.12.007.
(http://www.sciencedirect.com/science/article/B7XMR-4JHMJYS-6/2/9fea557ae4128576579a7b4154e712aa)

Abstract:
Sorghum downy mildew, caused by the obligate oomycete Peronosclerospora sorghi, has been controlled through the use of resistant cultivars and seed treatment with metalaxyl. A recent outbreak in fields planted with treated seed revealed the presence of a metalaxyl-resistant variant. Here, PCR-based methods including amplification from RAPD primers and two systems of automated AFLP analysis have been used to detect DNA-level genetic variation among 14 isolates including metalaxyl-resistant and susceptible isolates, as well as representatives of common pathotypes 1 and 3 and a new pathotype. In total, 1708 bands were detected after amplification of EcoRI/MseI fragments with 16 primer combinations. Nearly as many amplified products were observed using eight primer pairs with three-base extensions (LI-COR) as with two-base extensions (ABI-Prism genetic capillary system). Approximately 25 % of the bands were polymorphic across the 14 isolates, with the majority of differences specific to the pathotype P1 isolate. The AFLP banding patterns are consistent with metalaxyl resistance and the new pathotype having evolved from pathotype 3.
Keywords: Downy Mildews; Oomycetes; Plant pathology; Sorghum

L.O. Abdelhadi, F.J. Santini, Corn silage versus grain sorghum silage as a supplement to growing steers grazing high quality pastures: Effects on performance and ruminal fermentation, Animal Feed Science and Technology, Volume 127, Issues 1-2, 30 March 2006, Pages 33-43, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.08.010.
(http://www.sciencedirect.com/science/article/B6T42-4H8MNWR-2/2/5ba895dd1ae0b3b723da0b824a508de2)
Abstract:
Supplementation with corn silage (CS) or grain sorghum silage (SS) on average daily gain (ADG), rate of subcutaneous fat deposition (RFD) and ruminal fermentation characteristics were evaluated in 42 Angus x Hereford steers (187 +/- 26 kg) grazing high quality pastures. Steers were assigned to one of three treatments in a randomized design being; TP, fresh pasture (700 g/kg grass and 300 g/kg legumes) fed ad libitum; TCS or TSS, with restricted pasture plus CS or SS, both finely chopped and rolled at dough grain stage, representing 400 g/kg of the total diet on DM basis, respectively. Two paddocks per treatment and 7 steers per paddock were used. Average daily gain was not affected by treatments (mean = 0.939 kg/day), but RFD was lower ($P<0.03$) for TSS versus TP steers. Dry matter intake was similar among treatments (mean = 6.99 kg/day), being silage intake 2.8 kg DM/(steer day) in supplemental treatments. Ruminal pH was similar among treatments (mean = 6.7), but NH3N concentration was lower ($P<0.01$) for TSS versus TP. Total VFA concentrations, molar proportions of acetate (A), propionate (P), n-butyrate and A:P ratio were not affected by supplementation. Silage supplementation resulted in increased stocking rates, from 2.45 in TP to 4.66 (TCS and TSS) steers/ha, and live weight production from 260 for TP to 469 (TCS) and 483 (TSS) kg/ha. Grain sorghum silage can replace corn silage to supplement growing steers without detrimental effects on performance and ruminal fermentation, thus being a good alternative in marginal areas where corn production is agronomically uncertain.
Keywords: Grain sorghum silage; Corn silage; Grazing steers; Supplementation

R.O. Balogun, S.H. Bird, J.B. Rowe, Germination temperature and time affect in vitro fermentability of sorghum grain, Animal Feed Science and Technology, Volume 127, Issues 1-2, 30 March 2006, Pages 125-132, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.07.005.
(http://www.sciencedirect.com/science/article/B6T42-4H21K9D-1/2/5e03157aff72abcdc693c77f83ddbdea)
Abstract:
Two experiments were conducted to determine the effect of temperature of steeping or soaking (18 or 25 [degree sign]C) and germination time (0, 1, 3 or 5 days) (Experiment 1), and the effect of germination temperature (18, 25 or 32 [degree sign]C) and germination time (1, 3 or 5 days)

(Experiment 2) on the in vitro fermentability of sorghum. Dry rolling of grain was used as the control treatment in Experiment 1. Fermentability was evaluated by measuring the amount of starch that was fermented and the total volatile fatty acids (VFA) produced when grain was incubated in buffered rumen liquor for 5 h. Compared to dry rolling, increasing germination time to 5 days significantly increased the amount of starch fermented by 13% (P<0.01) and the total VFA production by 34% (P<0.001) (Experiment 1). Germination time had significant interaction with germination temperature (Experiment 2) but not with steeping temperature (Experiment 1). Germination time had a quadratic effect on the fermentability of germinated sorghum and the slope was different for each temperature of germination. Total VFA production was higher (P<0.05) for sorghum germinated at 25 or 32 [degree sign]C (35-46 mmol L-1) than for sorghum germinated at 18 [degree sign]C (29-40 mmol L-1). Changing the temperature during steeping did not affect (P>0.05) the amount of starch fermented (P=0.61) or the total VFA production (P=0.70). It was concluded that germination processing of sorghum grain is affected by temperature conditions during active germination and not by temperature during steeping. In practice, the response of sorghum grain to germination processing will likely depend on seasonal temperature conditions and the variety of sorghum.
Keywords: Sorghum processing; Germination temperature; Germination time; Steeping; In vitro fermentability

M.A. Mgonja, S. Chandra, E.S. Monyo, A.B. Obilana, M. Chisi, H.M. Saadan, S. Kudita, E. Chinhema, Stratification of SADC regional sorghum testing sites based on grain yield of varieties, Field Crops Research, Volume 96, Issue 1, 15 March 2006, Pages 25-30, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.05.002.
(http://www.sciencedirect.com/science/article/B6T6M-4GJKTSD-1/2/fb4a65b84999bb4daa5d2f45a0982e42)
Abstract:
We applied sequential retrospective (SeqRet) pattern analysis to stratify sorghum variety testing sites according to their similarity for yield discrimination among genotypes using historical grain yield data from 147 multi-environment trials (METs). The trials were conducted at 38 sites in 10 countries of the Southern African Development Community (SADC) region during 1987/1988-1992/1993 and 1999/2000. The analysis for the 6 years 1987/1988-1992/1993, covering 34 sites, clustered these sites into 6 major groups with a model fit of R2 = 0.75. With additional data from the year 1999/2000, the SeqRet pattern analysis delivered a very similar clustering of the 34 sites, with the additional four sites in 1999/2000 properly classified with appropriate site groups (R2 = 0.74). The results suggest that future sorghum variety testing could be restricted to a few representative sites selected from within each of the six identified site-groups.
Keywords: Sorghum; Site stratification; Sequential retrospective pattern analysis

Keunho Cho, Heather Toler, Jaehoon Lee, Bonnie Ownley, Jean C. Stutz, Jennifer L. Moore, Robert M. Auge, Mycorrhizal symbiosis and response of sorghum plants to combined drought and salinity stresses, Journal of Plant Physiology, Volume 163, Issue 5, 3 March 2006, Pages 517-528, ISSN 0176-1617, DOI: 10.1016/j.jplph.2005.05.003.
(http://www.sciencedirect.com/science/article/B7GJ7-4GSJX6X-2/2/f580bd85916d23801f6bef4b6ea7f83d)
Abstract: Summary
Arbuscular mycorrhizal (AM) symbiosis can confer increased host resistance to drought stress, although the effect is unpredictable. Since AM symbiosis also frequently increases host resistance to salinity stress, and since drought and salinity stress are often linked in drying soils, we speculated that the AM influence on plant drought response may be partially the result of AM influence on salinity stress. We tested the hypothesis that AM-induced effects on drought responses would be more pronounced when plants of comparable size are exposed to drought in

salinized soils. In two greenhouse experiments, several water relations characteristics were measured in sorghum plants colonized by Glomus intraradices (Gi), Gigaspora margarita (Gm) or a mixture of AM species, during a sustained drought following exposure to salinity treatments (NaCl stress, osmotic stress via concentrated macronutrients, or soil leaching). The presence of excess salt in soils widened the difference in drought responses between AM and nonAM plants in just two instances. Days required for plants to reach stomatal closure were similar for Gi and nonAM plants exposed to drought alone, but with exposure to combined NaCl and drought stress, stomates of Gi plants remained open 17-22% longer than in nonAM plants. Promotion of stomatal conductance by Gm occurred with exposure to NaCl/drought stress but not with drought alone or with soil leaching before drought. In other instances, however, the addition of salt tended to nullify an AM-induced change in drought response. Our findings confirm that AM fungi can alter host response to drought but do not lend much support to the idea that AM-induced salt resistance might help explain why AM plants can be more resilient to drought stress than their nonAM counterparts.
Keywords: Arbuscular mycorrhizal symbiosis; Drought stress; Lethal water potential; Salinity stress; Sorghum; Stomatal conductance

Arun Dev Sharma, Sanjay Kumar, Prabhjeet Singh, Expression analysis of a stress-modulated transcript in drought tolerant and susceptible cultivars of sorghum (Sorghum bicolor), Journal of Plant Physiology, Volume 163, Issue 5, 3 March 2006, Pages 570-576, ISSN 0176-1617, DOI: 10.1016/j.jplph.2005.06.011.
(http://www.sciencedirect.com/science/article/B7GJ7-4H392SF-3/2/e9b61e719f7cbc6df67e8f428492ed9f)
Abstract: Summary
The present study reports the cloning of a 581 bp sequence, designated as SbEST8, from the osmotically stressed germinated seeds of a drought tolerant cultivar of sorghum (Sorghum bicolor). The SbEST8, which shows no homology with the reported gene sequences, is present in multiple copies and lacks restriction fragment length polymorphism among different sorghum cultivars. The expression of SbEST8 in the germinating seeds of sorghum was modulated by different abiotic stresses. Kinetic studies revealed that imposition of osmotic stress after 8 h resulted in maximum levels of SbEST8 mRNA in the germinating seeds of cv. ICSV-272, with further stress causing a decline to undetectable levels by 16 h. However, relieving the stress after 12 h resulted in an enhancement of SbEST8 mRNA levels for at least another 4 h following which it declined. The decrease in SbEST8 mRNA levels in the leaves at 30 DAS in response to drought stress was observed only in the drought susceptible cultivar (CSV-216), whereas its expression was either increased substantially or remained unaffected in the tolerant cultivars, thus suggesting its role in water stress tolerance.
Keywords: ABA; Osmotic stress; Salt stress; Sorghum bicolor; Stress-inducible gene

Gill Tuck, Margaret J. Glendining, Pete Smith, Jo I. House, Martin Wattenbach, The potential distribution of bioenergy crops in Europe under present and future climate, Biomass and Bioenergy, Volume 30, Issue 3, March 2006, Pages 183-197, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2005.11.019.
(http://www.sciencedirect.com/science/article/B6V22-4J4HK84-1/2/fd34835bed115db6b8b9bdb8ce11ce6b)
Abstract:
We have derived maps of the potential distribution of 26 promising bioenergy crops in Europe, based on simple rules for suitable climatic conditions and elevation. Crops suitable for temperate and Mediterranean climates were selected from four groups: oilseeds (e.g. oilseed rape, sunflower), starch crops (e.g. potatoes), cereals (e.g. barley) and solid biofuel crops (e.g. sorghum, Miscanthus). The impact of climate change under different scenarios and GCMs on the

potential future distribution of these crops was determined, based on predicted future climatic conditions. Climate scenarios based on four IPCC SRES emission scenarios, A1FI, A2, B1 and B2, implemented by four global climate models, HadCM3, CSIRO2, PCM and CGCM2, were used. The potential distribution of temperate oilseeds, cereals, starch crops and solid biofuels is predicted to increase in northern Europe by the 2080s, due to increasing temperatures, and decrease in southern Europe (e.g. Spain, Portugal, southern France, Italy, and Greece) due to increased drought. Mediterranean oil and solid biofuel crops, currently restricted to southern Europe, are predicted to extend further north due to higher summer temperatures. Effects become more pronounced with time and are greatest under the A1FI scenario and for models predicting the greatest climate forcing. Different climate models produce different regional patterns. All models predict that bioenergy crop production in Spain is especially vulnerable to climate change, with many temperate crops predicted to decline dramatically by the 2080s. The choice of bioenergy crops in southern Europe will be severely reduced in future unless measures are taken to adapt to climate change.
Keywords: Bioenergy crops; Biofuel crops; Modelling; Climate change; GIS mapping; Europe

Shu-Qing An, Fen-Meng Zhu, Jiu-Hai Zhang, Xing-Long Chen, MaoSong Liu, Cheng Huang, Alternative methods for sustainably managing coastal forests as silvo-pastoral systems, Ecological Engineering, Volume 26, Issue 3, 1 March 2006, Pages 195-205, ISSN 0925-8574, DOI: 10.1016/j.ecoleng.2005.09.009.
(http://www.sciencedirect.com/science/article/B6VFB-4HNYMG8-2/2/d7914048c1406eb588eaf1c299f41f7d)
Abstract:
Integration of shelter forest and herbage into a silvo-pastoral system with sustainable management can improve the ecological and economic sustainability of shelter forest in coastal China. Sustainable management of tree density and forage grasses planting was studied by establishing five experimental treatments through selective logging of the forest. The tree density at the five treatments was 5.00, 2.50, 1.67, 1.25, and 1.00 ind./100 m2, respectively. The density of 1.25 ind./100 m2 (Treatment 4) is the best for introduced forage plants (Sorghum sudanense, Lolium multiflorum, and Medicago sativa) and mature Populus to integrate into a silvo-pastoral system, while the density of 1.00 ind./100 m2 (Treatment 5) is the best for the native grass (Setaria faberi and Arthraxon pricnode) and mature Populus. The planting experiment presented the best combination of planting practices (seed amount, planting depth, and fertilizer amount) for each introduced grass. The silvo-pastoral system has been run successfully for 3 years and has been very profitable for the local farmers. In the silvo-pastoral system, simple cultivation practices change the local dominant species of grasses. Furthermore, a new result is found about tree-grass interaction that change of tree density can alter species of forage plants under trees.
Keywords: Silvo-pastoral system; Biomass; Coastal forest; Integrating technique; Niche allocation

Sanaa Ragaee, El-Sayed M. Abdel-Aal, Pasting properties of starch and protein in selected cereals and quality of their food products, Food Chemistry, Volume 95, Issue 1, March 2006, Pages 9-18, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.12.012.
(http://www.sciencedirect.com/science/article/B6T6R-4FP1J26-1/2/63997d6ef89d00eeb4b5be8188eb10c4)
Abstract:
In an attempt to improve intake of dietary fibre and antioxidants and quality of whole grain products, whole grain meals from barley, millet, rye and sorghum were evaluated individually and in blends with wheat flour in terms of starch pasting properties and protein heat damage, during cycles of heating and cooling in RVA tests. The whole grain meals were blended with either hard or soft wheat flour and processed into bread, cake, cookie or snack products. The products were then evaluated with regard to physical properties and acceptability. Significant differences were

observed between cereals in starch peak, breakdown and setback viscosities as well as in protein peak viscosity. The results showed that RVA could be used to help formulate cereal blends with certain pasting properties. Substitution of wheat flour, with 15% of barley, rye, millet or sorghum whole grain, did not have significant detrimental effects on physical properties or acceptability of pita bread. Additionally, replacement of wheat flour with up to 30% of barley, rye, millet or sorghum whole grain meal had no significant effects on quality of cakes or cookies. A multigrain snack-like food was also developed as a healthy product and was highly acceptable in a sensory test. The developed product would help enhance consumption of whole grain foods, resulting in improved intake of fibre and health-enhancing components.
Keywords: Wheat; Barley; Millet; Rye; Sorghum; Flour; Wholemeal; Blends; RVA; Pasting properties; Pita bread; Cookie; Cake; Multigrain snack; Sensory properties

Ales Kladnik, Prem S. Chourey, Daryl R. Pring, Marina Dermastia, Development of the endosperm of Sorghum bicolor during the endoreduplication-associated growth phase, Journal of Cereal Science, Volume 43, Issue 2, March 2006, Pages 209-215, ISSN 0733-5210, DOI: 10.1016/j.jcs.2005.09.004.
(http://www.sciencedirect.com/science/article/B6WHK-4HYV05K-1/2/99f75b3b2405173d1dc1cd5605e75800)
Abstract:
Spatial occurrence of endoreduplication, a variant of the cell cycle resulting in endopolyploidy, was investigated in the developing sorghum caryopsis between 5 and 16 DAP (days after pollination). This was a period of intense mitotic and endoreduplication-associated endosperm growth. Endopolyploidy was quantitatively analyzed on median caryopsis sections using image densitometry that provided in situ cytometrical data. In the endosperm, the first endopolyploid nuclei with a nuclear DNA content of 12C (where 1C represents the nuclear DNA content of a non-replicated haploid genome) were detected at 5 DAP. In subsequent days progressively higher levels of endopolyploidy occurred, and nuclei with the highest amount of DNA (96C) were first observed at 10 DAP. The highly endopolyploid nuclei were located only in the central region of the endosperm and their occurrence coincided with the onset of starch deposition in the endosperm. Cells with non-endopolyploid nuclei (3C and 6C) were found exclusively in the peripheral layers of the endosperm. No starch was observed in the basal part of the endosperm where the highest level of endopolyploidy was 24C. The volume of endosperm nucleai and cells showed a positive correlation with the level of endopolyploidy. Endoreduplication was also prominent in the pericarp, where the highest level of endopolyploidy was 16C.
Keywords: Endoreduplication; Endosperm; Grain; Pericarp; Sorghum bicolor

N. Hatibu, K. Mutabazi, E.M. Senkondo, A.S.K. Msangi, Economics of rainwater harvesting for crop enterprises in semi-arid areas of East Africa, Agricultural Water Management, Volume 80, Issues 1-3, Special Issue on Water Scarcity: Challenges and Opportunities for Crop Science, 24 February 2006, Pages 74-86, ISSN 0378-3774, DOI: 10.1016/j.agwat.2005.07.005.
(http://www.sciencedirect.com/science/article/B6T3X-4H5MYKX-1/2/731928e3296cd970774aecac0149cde4)
Abstract:
This paper presents an analysis of economics of rainwater harvesting by poor farmers in Tanzania. A questionnaire was used to survey 120 households to obtain information on the performance of their enterprises over 6 years (1998-2003). The information was mainly based on recollection as few farmers kept detailed records. Actual monitoring and measurements of yield and inputs was done in the farmers' enterprises over 2 years during 2002/2003 and 2003/2004 production seasons. The analysis was done for four categories of rainwater harvesting systems differentiated by the size of catchments from which water is collected and the intensity of concentration and/or storage of the collected rainwater. These categories are: micro-catchments,

macro-catchments, macro-catchments linked to road drainage and micro or macro-catchments with a storage pond. Results show that rainwater harvesting for production of paddy rice paid most with returns to labor of more than 12 US$ per person-day invested. These benefits are very high due to the fact that without rainwater harvesting it is not possible to produce paddy in the study area and rainfed sorghum crop realizes a return to labor of only US$ 3.7 per person-day during above-average seasons. For the rainwater harvesting systems, those designed to collect water from macro-catchments linked to road drainage, performed best during both categories of seasons. The results also show that contrary to expectations, improving rainwater harvesting systems by adding a storage pond may not lead to increased productivity. Another finding that goes against the widely held belief is that rainwater harvesting results in more benefits during the above-average seasons compared to below-average seasons. It is therefore, concluded that there is a potential for combining rainwater harvesting with improved drainage of roads. The construction of rural roads in semi-arid areas can beneficially be integrated with efforts to increase water availability for agricultural needs.
Keywords: Economics of rainwater harvesting; Smallholders; Returns to labour; Poverty reduction; Tanzania

M. Dingkuhn, B.B. Singh, B. Clerget, J. Chantereau, B. Sultan, Past, present and future criteria to breed crops for water-limited environments in West Africa, Agricultural Water Management, Volume 80, Issues 1-3, Special Issue on Water Scarcity: Challenges and Opportunities for Crop Science, 24 February 2006, Pages 241-261, ISSN 0378-3774, DOI: 10.1016/j.agwat.2005.07.016. (http://www.sciencedirect.com/science/article/B6T3X-4GWBDX1-1/2/9b51b8a4e967948607e6ef91a29877d7)
Abstract:
Asia's Green Revolution of the 1960s and 1970s has largely bypassed West Africa, and 'modern' (high-yielding, input responsive) germplasm for staple crops has found comparatively little adoption, except for systems that are have good access to markets and sufficient water resources. It is unlikely, however, that breeding objectives conserving traditional crop characteristics as found in extensive systems would have been more successful. The authors identify systems caught in the agricultural transition from subsistence to intensified, market-oriented production as the most important target for crop improvement, and provide examples of new breeding objectives for cowpea, sorghum and upland rice. In each of these cases, breeders, with the help of physiologists, have developed innovative plant-type concepts that combine improved yield potential and input responsiveness with specific traditional crop characteristics that remain essential during the agricultural transition. In the case of cowpea, dual-purpose varieties were developed that produce a good grain yield due to an erect plant habit, then produce new leaves enabling a second harvest of green foliage. For upland rice systems that are limited by labour (mainly needed to control weeds that abound due to shortened fallow periods), a weed competitive plant type was developed from Oryza sativa x Oryza glaberrima crosses. Lastly, sorghum breeders who had previously deselected photoperiod sensitivity are now re-inserting sensitivity into plants having 'modern' architecture, in order to allow for flexible sowing dates while maintaining an agro-ecologically optimal time of flowering near the end of the wet season. The ecophysiological basis of these plant types, their place in current and future cropping systems, as well as the problem of under-funding for their realisation, are discussed.
Keywords: Selection criteria; Plant types; Sorghum; Cowpea; Upland rice; Dual-purpose varieties; Weed competition; Photoperiodism; Stay-green; Agricultural transition

Richard L. Coulter, Mikhail S. Pekour, David R. Cook, Gerard E. Klazura, Timothy J. Martin, John D. Lucas, Surface energy and carbon dioxide fluxes above different vegetation types within ABLE, Agricultural and Forest Meteorology, Volume 136, Issues 3-4, Advances in Surface-Atmosphere

Exchange - A Tribute to Marv Wesely, 1 February 2006, Pages 147-158, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2004.11.011.
(http://www.sciencedirect.com/science/article/B6V8W-4HPD3G5-1/2/af93cd0369616990b3adfd7708bf1c57)
Abstract:
Nineteen months of continuous data from two sites within the atmospheric boundary layer experiments (ABLE) facility are used to compare surface energy fluxes, carbon dioxide fluxes and controlling parameters. One site, which has been monitored continuously since 1997, is rangeland, with a mixture of C3 and C4 grasses. The other site is active cropland that was planted in sorghum for the first growing season of the observation period and in winter wheat for the second. The uptake of carbon dioxide was well-defined within the respective growing seasons, with peak uptake rates for sorghum being greater by almost a factor of 2 than those for wheat and rangeland. The longer growing season for rangeland almost countered this effect. Net production of carbon dioxide occurred at both sites at the beginning and end of the growing seasons because of root growth respiration and enhanced decay of tilled soil.
Keywords: Carbon; Carbon dioxide; Surface energy; Eddy flux

W. James Grichar, Weed control and grain sorghum tolerance to flumioxazin, Crop Protection, Volume 25, Issue 2, February 2006, Pages 174-177, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.03.015.
(http://www.sciencedirect.com/science/article/B6T5T-4G4MM8S-2/2/bd749e0aebd845922d47940880fe8c4a)
Abstract:
Field studies were conducted from 2002 to 2004 to determine weed control and sorghum tolerance to flumioxazin. Flumioxazin at 0.07 and 0.11 kg ai/ha was applied 30, 21, 14, 7, and 0 days prior to sorghum planting. Flumioxazin at either dose provided excellent control of Amaranthus tuberculatus and Parthenium hysterophorus but provided variable control of Panicum texanum. No sorghum injury was noted with flumioxazin at any application timing. Reduction in sorghum yields were noted where annual grasses and broadleaved weeds were not effectively controlled.
Keywords: Amaranthus tuberculatus; Panicum texanum; Parthenium hysterophorus; Weed efficacy

Elifatio Towo, Erika Matuschek, Ulf Svanberg, Fermentation and enzyme treatment of tannin sorghum gruels: effects on phenolic compounds, phytate and in vitro accessible iron, Food Chemistry, Volume 94, Issue 3, February 2006, Pages 369-376, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.11.027.
(http://www.sciencedirect.com/science/article/B6T6R-4GKWJ7B-1/2/bafd4b4dd522164e6fbfda0b32a50529)
Abstract:
The presence of polyphenols and phytate in cereal products has been shown to interfere with the bioavailability of minerals such as iron. In the present study, we added enzymes (wheat phytase and mushroom polyphenol oxidase) during fermentation of tannin sorghum gruels prepared from flour with or without addition of 5% flour of germinated tannin-free sorghum grains (power flour), and investigated the effects on phenolic compounds, phytate and in vitro accessible iron. Assayable phenolic compounds were significantly reduced by fermentation, with high reductions observed in gruels with added enzymes. Fermentation of the gruels with addition of enzymes reduced (on average) total phenols by 57%, catechols by 59%, galloyls by 70% and resorcinols by 73%. The phytate content was significantly reduced by fermentation (39%), with an even greater effect after addition of power flour (72%). The largest reduction of phytate (88%) was, however, obtained after addition of phytase. The in vitro accessible iron was 1.0% in the sorghum flour and it increased after fermentation with power flour and/or with enzymes. The highest in vitro

accessibility of iron (3.1%) was obtained when sorghum was fermented with addition of power flour and incubated with phytase and polyphenol oxidase after the fermentation process.
Keywords: Fermentation; Sorghum; Polyphenols; Condensed tannins; Phytate; In vitro iron accessibility; Polyphenol oxidase; Phytase

J.F.J. Torres-Acosta, D.E. Jacobs, A.J. Aguilar-Caballero, C. Sandoval-Castro, L. Cob-Galera, M. May-Martinez, Improving resilience against natural gastrointestinal nematode infections in browsing kids during the dry season in tropical Mexico, Veterinary Parasitology, Volume 135, Issue 2, 30 January 2006, Pages 163-173, ISSN 0304-4017, DOI: 10.1016/j.vetpar.2005.08.009.
(http://www.sciencedirect.com/science/article/B6TD7-4H7TD3X-1/2/134bea0e2231dff33f79e5152c3129a6)
Abstract:
The objective was to determine the effect of supplementary feeding on the resilience and resistance of Criollo kids against natural gastrointestinal nematode (GIN) infections, when browsing native vegetation during the dry season in tropical Mexico. Thirty-three two-month-old Criollo kids, raised nematode free, were included at weaning in a 20-week trial. The kids were placed into four groups. Two groups of eight kids were offered 100 g/day soybean and sorghum meal (26%:74% respectively fresh basis) (treated/supplemented (T-S) and infected/supplemented (I-S)). Two groups remained with no supplement for the duration of the trial (infected/non-supplemented (I-NS) (n = 9) and treated/non-supplemented (T-NS) (n = 8)). Kids in groups T-S and T-NS were drenched with 0.2 mg of moxidectin/kg body weight orally (Cydectin, Fort Dodge) every 28 days. Groups I-S and I-NS were naturally infected with GIN. The animals browsed native vegetation for an average of 7 h/day together with a herd of 120 naturally infected adult goats. Cumulative live weight gain (CLWG), packed cell volume (PCV), haemoglobin (Hb), total plasma protein and plasma albumin were recorded every 14 days as measurements of resilience. Resistance parameters (faecal egg counts (FEC) and peripheral eosinophil counts (PEC)) were also measured. Bulk faecal cultures were made for each group every 28 days. Every month a new pair of initially worm-free tracer kids assessed the infectivity of the vegetation browsed by the animals. Tracer kids and faecal cultures showed that kids faced low mixed infections (Haemonchus contortus, Trichostrongylus colubriformis and Oesophagostomum columbianum). Under conditions of scarce vegetation, such as those in the present study, supplemented groups (I-S and T-S) had higher growth rates compared to the non-supplemented groups independently of the control of GIN infection with anthelmintic (AH) treatment ($P < 0.001$). Supplementary feeding did not affect FEC or PEC. In the absence of supplementation, lack of AH treatment may lead to outbreaks of clinical nematodosis. The supplementary feeding was economically feasible.
Keywords: Goat; Gastrointestinal nematodes; Supplementary feeding; Resilience; Resistance

R.A.M. Al Jassim, Supplementary feeding of horses with processed sorghum grains and oats, Animal Feed Science and Technology, Volume 125, Issues 1-2, 6 January 2006, Pages 33-44, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.05.019.
(http://www.sciencedirect.com/science/article/B6T42-4GG8VWG-1/2/fd087ee4f25e90e82a247b57800e51fe)
Abstract:
Two feeding experiments and in vitro hind gut fermentation tests were carried out to study the effect of processing sorghum grain on digestion of starch and on the gastrointestinal (GI) tract environment of the horse. In experiment 1, 12 yearling Australian stock horses were blocked on the basis of sex then randomly divided into four equal groups, each containing one castrated male and two females of approximately the same age and weight. Horses were offered at 0800 and 1500 h, 3 kg medium quality liverseed grass (Urochloa panicoides) hay and 2 kg of either oats (O), dry rolled sorghum (DRS), steam-flaked sorghum (SFS) or expanded sorghum (ES). Lanthanum was used as external solid marker for the measurements of apparent total tract digestibility. Fresh

water was available ad libitum. Horses were allowed 18 days to adapt to the diets followed by a 3-day faecal collection period. Digestibility of dry matter (DM), and acid detergent fibre (ADF) were higher (P<0.01) for dry rolled and expanded sorghum diets. Digestibility of starch was similar across treatments, averaging 0.98 +/- 0.009. Faecal pH values were lower (P<0.05) for the sorghum treatments but remained slightly below neutral (>=6.42) for the steam-flaked sorghum. Sub-samples of fresh faeces were supplemented with glucose and used for in vitro measurement of potential lactate production and final pH. The 20 h in vitro pH was also lower (P<0.05) for the steam-flaked sorghum group. All horses maintained good health and completed the experiment successfully.
Results of this experiment indicate that digestibility of starch of processed sorghum is comparable to that of oats (0.97 versus 0.98), but processing sorghum grains may produce conditions favourable for lactate production and accumulation.
In experiment 2, eight Australian stock horses were used to study changes in pH and accumulation of VFA and lactate in the different parts of the gastrointestinal tract. In this experiment SFS was compared with DRS. Horses were divided into two groups on the basis of sex and body weight. Each group contained two females and two castrated males. The nutritional management of the horses was the same as for the DRS and SFS groups in experiment 1. At the end of the adaptation period horses were slaughtered at intervals of 1.5, 3.0, 4.5, and 6.0 h after morning feeding, one horse per interval per treatment. Samples were collected from the different anatomical regions, and analysed for pH, VFA, and l- and d-lactate. Fermentation in the pre-glandular stomach produced mainly lactic acid and reduced pH to 4.0-4.3 while VFA was the main product in the hind gut. Total and d-lactate were higher (P<0.01) for SFS and a similar trend was observed for total and individual VFA and l-lactate but differences lacked significance (P>0.05). It was concluded that steam flaking of sorghum exacerbates starch fermentation, which may lead to acidosis-related damage to the epithelium of the pre-glandular stomach.
Keywords: Horse feeding; Sorghum; Acidosis; Gastrointestinal tract environment

C. Tonitto, M.B. David, L.E. Drinkwater, Replacing bare fallows with cover crops in fertilizer-intensive cropping systems: A meta-analysis of crop yield and N dynamics, Agriculture, Ecosystems & Environment, Volume 112, Issue 1, January 2006, Pages 58-72, ISSN 0167-8809, DOI: 10.1016/j.agee.2005.07.003.
(http://www.sciencedirect.com/science/article/B6T3Y-4H74KW9-1/2/d09b8a7a85ae5c0a8593050431f52458)
Abstract:
The availability of Haber-Bosch nitrogen (N) has permitted agricultural intensification and increased the productive capacity of agroecosystems; however, approximately 50% of this applied fertilizer N is lost from agricultural landscapes. Extensive efforts have been devoted to improving the N use efficiency of these systems. Diversified crop rotations using cover crops to provide a variety of ecosystem functions, including biological N fixation (BNF), could maintain yields while reducing N losses. Although leguminous plants used as green manures are capable of fixing N in quantities which exceed cash crop demand, the prospect of replacing significant quantities of Haber-Bosch N with BNF is widely viewed as impractical due to yield reductions. Likewise, the practice of replacing bare fallows with non-leguminous cover crops in systems receiving Haber-Bosch N is generally deemed not economically viable. We conducted a quantitative assessment of cash crop yields and N retention in rotations that implemented these practices. We performed a meta-analysis on experiments comparing crop yield, nitrate leaching, or soil nitrate between conventional (receiving inorganic fertilizer with a winter bare fallow) and diversified systems managed using either a non-legume over-wintering cover crop (amended with inorganic fertilizer) or a legume over-wintering cover crop (no additional N fertilizer). Only studies with rotations designed to produce a cash crop every year were included in our analysis. Many yield comparisons were found in the literature, but only a limited number of nitrate leaching or soil

inorganic N studies met the criteria for inclusion in a meta-analysis. Long-term studies were also uncommon, with most data coming from experiments lasting 2-3 years. Yields under non-legume cover crop management were not significantly different from those in the conventional, bare fallow systems, while leaching was reduced by 70% on average. Relative to yields following conventional N-fertilization, the legume-fertilized crops averaged 10% lower yields. However, yields under green manure fertilization were not significantly different relative to conventional systems when legume biomass provided >=110 kg N ha-1. On average, nitrate leaching was reduced by 40% in legume-based systems relative to conventional fertilizer-based systems. Post-harvest soil nitrate status, a measure of potential N loss, was similar in conventional and green manure systems suggesting that reductions in leaching losses were largely due to avoidance of bare fallow periods. These results demonstrate the potential for diversified rotations using N- and non-N-fixing cover crops to maintain crop yields while reducing the anthropogenic contributions to reactive N fluxes.
Keywords: Legumes; Green manure; Cover crops; Meta-analysis; Reactive N; Nitrate leaching; Agroecosystems; Alternative agriculture; Corn; Sorghum; Yield

Gyanendra Singh, Estimation of a Mechanisation Index and Its Impact on Production and Economic Factors--a Case Study in India, Biosystems Engineering, Volume 93, Issue 1, January 2006, Pages 99-106, ISSN 1537-5110, DOI: 10.1016/j.biosystemseng.2005.08.003.
(http://www.sciencedirect.com/science/article/B6WXV-4HF5KK8-1/2/be247b7dd2d31b8f9ee50638b25e7a77)
Abstract:
The major factors that require higher capital investment, viz. fertiliser, irrigation and farm power were selected to assess their impact on yield through multiple linear regressions. The standardised regression coefficient has revealed that irrigation (42%) and farm power (32%) significantly contributed in increasing the yield. Both these inputs use mechanical and electrical energy extensively as a part of mechanisation. An index has been suggested based on the ratio of the cost of use of machinery to the total animate and machinery cost for the estimation of the mechanisation. State-level crop-wise secondary data have been adopted from the cost of cultivation of principal crops in India for the assessment of the mechanisation index, and to study its impact on the yield, cost of cultivation and deployment of human and animal power. The analysis has revealed that the human labour cost is still the largest component in the cost of cultivation in the wheat crop, which is the most highly mechanised crop in India. The analysis has further revealed that, although 78[middle dot]5% farm power was contributed by the mechanical sources, the mechanisation index based on cost of use of machinery was 14[middle dot]5%. In other words, the share of cost of the human and animal energy in the total operational cost was 85[middle dot]5%. The crop-wise mechanisation index varied from a lowest value of 8[middle dot]22% in sorghum and paddy to a highest value of 30% in wheat. The analysis also revealed that the states having higher mechanisation indices incurred a lower cost of cultivation of the wheat crop on quintal basis due to increased yield. As the level of mechanisation increased, the draught animal use significantly reduced annually by 6[middle dot]2%, but use of human labour reduced by -0[middle dot]18% only, from 1971-72 to 1996-97.

V. Kishore Kumar, H.C. Sharma, K. Dharma Reddy, Antibiosis mechanism of resistance to spotted stem borer, Chilo partellus in sorghum, Sorghum bioclor, Crop Protection, Volume 25, Issue 1, January 2006, Pages 66-72, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.04.001.
(http://www.sciencedirect.com/science/article/B6T5T-4G65BX3-2/2/242e04f4b57ca8d39b04fd62a2777878)
Abstract:
Spotted stem borer, Chilo partellus (Swinhoe), is the most important pest of sorghum in Asia and South and Eastern Africa, and host plant resistance is an important component for controlling this pest under subsistence farming conditions. Therefore, we studied the antibiosis mechanism of

resistance in a diverse array of 20 sorghum genotypes at the seedling stage by incorporating the freeze-dried leaf powder into artificial diet. Freeze-dried sorghum leaf powder at 12.5 g per 250 ml of the standard artificial diet or replacement of chickpea flour in the artificial diet by 50% with sorghum leaf powder can be used to quantify the extent of antibiosis mechanism of resistance to C. partellus in sorghum. There was a significant variation in larval survival, larval and pupal weights, larval and pupal periods, and percentage pupation and adult emergence in diets impregnated with freeze-dried leaf powder of different sorghum genotypes. Sorghum genotypes such as IS 1044, IS 2123, IS 1054, IS 18573, and ICSV 714 showed antibiosis to C. partellus in terms of reduced survival and development. Principal component analysis indicated that there is considerable diversity in sorghum genotypes for antibiosis to C. partellus. Genotypes placed in different groups can be used in resistance breeding programs to diversify the basis of resistance to this pest.
Keywords: Sorghum; Stem borer; Chilo partellus; Plant resistance; Resistance mechanism; Antibiosis

Sanaa Ragaee, El-Sayed M. Abdel-Aal, Maher Noaman, Antioxidant activity and nutrient composition of selected cereals for food use, Food Chemistry, Volume 98, Issue 1, 2006, Pages 32-38, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2005.04.039.
(http://www.sciencedirect.com/science/article/B6T6R-4GT7V4H-1/2/63c8eab41130d1cd0637f5f74ff32f93)
Abstract:
Whole grain products are recommended for healthy diets as being recognized sources of dietary fiber and antioxidant substances. In the present study, four cereals including barley, pearl millet, rye and sorghum which are adapted to the growing conditions in the United Arab Emirates were evaluated in terms of their composition of dietary fiber, resistant starch, minerals and total phenols and antioxidant properties. Antioxidant activity was evaluated on the basis of scavenging capacity of 2,2-diphenyl-1-picrylhydrazyl (DPPH) radicals and 2,2'-azino-di-[3-ethylbenzthiazoline sulphonate] (ABTS+ radical cations). The adapted grains exhibited better nutritional quality compared to commercial hard and soft wheat flours, the main ingredients in grain-based food products. They were significantly rich in resistant starch, soluble and insoluble dietary fibers, minerals and antioxidants. Barley had the highest levels of phosphorus, calcium, potassium, magnesium, sodium, copper, and zinc, and the second highest content of iron following millet. Sorghum was exceptionally high in antioxidant activities followed by millet and barley. The antioxidant properties of the three grains were comparable to butylated hydroxytoluene. The nutritional data suggest that the selected grains, particularly barley and sorghum, hold promise as healthy food ingredients.
Keywords: Wheat; Barley; Millet; Rye; Sorghum; Flour; Whole grain; Protein; Resistant starch; Dietary fiber; Minerals; Total phenols; Antioxidant activity; DPPH test; ABTS test

Heleen Bossuyt, Johan Six, Paul F. Hendrix, Interactive effects of functionally different earthworm species on aggregation and incorporation and decomposition of newly added residue carbon, Geoderma, Volume 130, Issues 1-2, January 2006, Pages 14-25, ISSN 0016-7061, DOI: 10.1016/j.geoderma.2005.01.005.
(http://www.sciencedirect.com/science/article/B6V67-4FJ8C5S-1/2/14d4dd6e5af902bd721b05ab7ac2c83c)
Abstract:
The interactive effects of two functionally different earthworm species (Aporrectodea caliginosa (endogeic species) and Lumbricus rubellus (epigeic species)) on the incorporation of fresh residue into large macroaggregates and formation of microaggregates within these large macroaggregates were investigated during a short-term laboratory experiment using 13C-labelled sorghum (Sorghum bicolor (L.) Moench) residues. Soil was collected from a long-term no-tillage agricultural

field, crushed through a 250-[mu]m sieve and incubated under laboratory conditions. The following earthworm treatments were applied: (i) soil+13C-labelled residue+A. caliginosa; (ii) soil+13C-labelled residue+L. rubellus; (iii) soil+13C-labelled residue+A. caliginosa+L. rubellus and; (iv) soil+13C-labelled residue. Two residue placement treatments (i.e. surface and incorporated) were superimposed on the earthworm treatments. Earthworms were added after 8 days of incubation. Aggregate size distribution and total C and 13C were measured after 22 days. Microaggregates, fine inter-microaggregate particulate organic matter (inter-POM) and intra-microaggregate POM (intra-POM) were isolated from macroaggregates. Earthworms had a greater stimulating effect on the formation of large macroaggregates (>2000 [mu]m) and microaggregates within large macroaggregates when residue was incorporated in the soil, especially in the presence of A. caliginosa. When residue was placed on the surface, residue-derived intra-POM C was highest when L. rubellus was present and significantly lower in the presence of A. caliginosa. Residue-derived inter-POM C was highest when a mix of both species was present. These results indicate that earthworm species differentially affect incorporation of fresh organic matter into stable microaggregates within macroaggregates, and that interactive effects of earthworm species might have important consequences for the incorporation and protection of C inside of microaggregates within macroaggregates especially when residues are placed on the soil surface.
Keywords: Carbon sequestration; Earthworm; Residue placement; Species interactions; Soil aggregation

Mashilla Dejene, Jonathan Yuen, Roland Sigvald, Effects of storage methods, storage time and different agro-ecological zones on chemical components of stored sorghum grain in Hararghe, Ethiopia, Journal of Stored Products Research, Volume 42, Issue 4, 2006, Pages 445-456, ISSN 0022-474X, DOI: 10.1016/j.jspr.2004.07.006.
(http://www.sciencedirect.com/science/article/B6T8Y-4JVT1S6-1/2/d07677fb5cb06bee0721b1911884804d)
Abstract:
Sorghum grain stored in traditional underground pits was sampled from seven districts of Hararghe, eastern Ethiopia, representing lowland, intermediate and highland zones, from February to August 2001, and was analysed at the International Livestock Research Institute (ILRI) for changes in chemical composition over time. Samples were also taken from a replicated aboveground bin and pit storage experiment at Alemaya University campus at 2-month intervals from March 2000 to August 2001 and analysed in a similar manner. The effect of geographic location on chemical composition was significant, but there were differences in the sorghum varieties grown. The organic matter (OM) content of grain samples from pits in the lowlands was lower than those from the highlands. The crude protein (CP) and OM contents of samples from the seven districts did not change in 7-9 storage months. The OM content decreased and the CP slightly increased over time in samples from soil pits without any lining material on Alemaya University campus. The OM content decreased from 97.8 to 91.6%; and CP increased from 10.1 to 11.2% in these samples over a 17-month period. Soluble carbohydrate (SCHO) content significantly decreased over time in samples from the districts (from 2.4 to 1.2% by 7 months) and in samples from soil pits on campus (from 2.4 to 1.9% after 7 months and to 0.97% after 17 months). There was no significant change in the organic matter, CP and SCHO contents in samples taken from the cemented aboveground bin, cement- and dung-lined pits at the Alemaya campus, all of which were lined with polythene sheeting. From these data, we conclude that the combination of storage methods, storage period, geographic location and/or sorghum variety affected grain quality. Grain storage in traditional underground pits for long periods does lead to grain deterioration. The use of improved grain storage structures maintains the grain quality and nutritional value of sorghum for a reasonably long period.
Keywords: Ash; Crude protein; Nitrogen; Organic matter; Soluble carbohydrate; Underground pit

YongLin Ren, Daphne Mahon, Fumigation trials on the application of ethyl formate to wheat, split faba beans and sorghum in small metal bins, Journal of Stored Products Research, Volume 42, Issue 3, 2006, Pages 277-289, ISSN 0022-474X, DOI: 10.1016/j.jspr.2005.04.002.
(http://www.sciencedirect.com/science/article/B6T8Y-4H80T0R-1/2/25aae6fdb7134e1f6d5818c6b64a0b62)
Abstract:
Field trials were carried out in Australia with ethyl formate for insect control in wheat (Harden, NSW), split faba beans (Vicia faba) (Two Wells, SA) and sorghum (milo) (Warwick, Qld) in unsealed metal bins normally used to store grain on farms. Liquid ethyl formate was applied as a split dose (a first dose of 85 g t-1 and after 4 h another dose of 85 g t-1) to the top of the grain through a PVC probe (4 cm i.d.x1.2 m). This method of application was chosen to maintain ethyl formate concentrations below the flammability level, reduce vaporisation, maintain an effective concentration of ethyl formate for >10 h and to avoid liquid ethyl formate accumulating at the bottom of the bin. With wheat, the concentration of ethyl formate was maintained at effective levels for about 2 days, all insects at all stages were killed rapidly, and in 5-7 days the residues were reduced to natural levels without aeration. Split faba beans sorbed ethyl formate strongly, the residues persisted longer and complete insect control was achieved. Control was high but not 100% in the sorghum trials. Residues in the sorghum at 10 [degree sign]C persisted significantly longer than at 20 [degree sign]C. During application and fumigation, the levels of ethyl formate in the working environment did not exceed a threshold limit value (TLV) of 100 ppm. The field trials have shown that ethyl formate has good potential as a fumigant in unsealed small metal bins as it kills insects rapidly. Residues decreased to natural levels even without aeration after 7 days for wheat and sorghum and 26 days for split faba beans.
Keywords: On-farm storage; Fumigant; Ethyl formate; Fumigation; Wheat; Faba beans; Sorghum; Insect; Residue

N.A. Aviara, O.O. Ajibola, O.A. Aregbesola, M.A. Adedeji, Moisture sorption isotherms of sorghum malt at 40 and 50 [degree sign]C, Journal of Stored Products Research, Volume 42, Issue 3, 2006, Pages 290-301, ISSN 0022-474X, DOI: 10.1016/j.jspr.2005.05.001.
(http://www.sciencedirect.com/science/article/B6T8Y-4H7T0RK-1/2/e000c6cf11ba9d18e15a6187798aede1)
Abstract:
The desorption and adsorption equilibrium moisture isotherms of sorghum malt at the temperatures of 40 and 50 [degree sign]C, over the water activity range of 0.1-0.9, were determined using the static gravimetric method. A non-linear regression programme was used to fit five moisture sorption isotherm models [Modified Henderson, Modified Chung-Pfost, Modified Guggenheim-Anderson-de Boer (GAB), Modified Halsey and Modified Oswin] to the experimental data. The models were compared using the standard error of estimate, mean relative percentage deviation, fraction explained variation and residual plots.
The Modified Chung-Pfost model was found to be the best for predicting the desorption equilibrium moisture content, while the adsorption equilibrium moisture content was best predicted by the Modified Oswin model. The desorption and adsorption water activities were found to be best fitted by the Modified Oswin model.
The moisture sorption isotherms were sigmoidal in shape and showed a marked effect of temperature. The span of the moisture sorption hysteresis loop formed, decreased with increase in temperature, while the size increased with increase in temperature.
Keywords: Adsorption; Desorption; Equilibrium moisture content; Modified Chung-Pfost model; Modified Oswin model; Water activity

M.A. Slingerland, K. Traore, A.P.P. Kayode, C.E.S. Mitchikpe, Fighting Fe deficiency malnutrition in West Africa: an interdisciplinary programme on a food chain approach, NJAS - Wageningen

Journal of Life Sciences, Volume 53, Issues 3-4, 2006, Pages 253-279, ISSN 1573-5214, DOI: 10.1016/S1573-5214(06)80009-6.
(http://www.sciencedirect.com/science/article/B94T2-4WFBS5M-2/2/12a09166d5fdc731ca1dbfbdbb7d6ba5)
Abstract:
About 2 billion people, mainly women and young children, suffer from iron deficiency. The supply of iron (Fe) falls short when consumed foods have a low Fe content or when absorption of Fe is inhibited by the presence of phytic acid and polyphenols in the diet. Current interventions are dietary diversification, supplementation, fortification and biofortification. In West Africa these interventions have only moderate chances of success due to low purchasing power of households, lack of elementary logistics, lack of central processing of food and the high heterogeneity in production and consumption conditions. A staple food chain approach, integrating parts of current interventions was proposed as an alternative. The research was carried out in several villages in Benin and Burkina Faso to take ecological, cultural and socio-economic diversity into account. The interdisciplinary approach aimed at elaborating interventions in soil fertility management, improvement and choice of sorghum varieties and food processing, to increase Fe and decrease the phytic acid-Fe molar ratio in sorghum-based foods. The phytic acid-Fe molar ratio was used as a proxy for Fe bioavailability in food. Synergy and trade-offs resulting from the integrated approach showed its added value. P fertilization and soil organic amendments applied to increase yield were found to also increase phytic acid content of the grain and thus to decrease its nutritional value. Amounts of Fe and phytic acid and their ratio in the grain differed among sorghum varieties, illustrating the presence of genetic variation for Fe bioavailability. The current local food preparation method for one of the main sorghum-based foods (dibou) in northern Benin did not include processing steps that remove or de-activate anti-nutritional factors reducing Fe bioavailability. The preliminary results suggest that a feasible chain solution consists of breeding for high Fe and moderate phytic acid contents and using soil organic amendments and P fertilization to increase yields but that this needs to be followed by improved food processing to remove phytic acid. Further research on timing of application of phosphate, Fe fertilizer and soil organic amendments is needed to improve phytic acid-Fe molar ratios in the grain. Research on the exact distribution of Fe, phosphate, phytic acid and tannins within the sorghum grain is needed to enable the development of more effective combinations of food processing methods aiming for more favourable phytic acid-Fe molar ratios in sorghum-based food.
Keywords: anaemia; bioavailability; nutritional quality; diet; processing; phytic acid; agronomic practices

Alfredo Campana-Torres, Luis R. Martinez-Cordova, Humberto Villarreal-Colmenares, Roberto Civera-Cerecedo, In vivo dry matter and protein digestibility of three plant-derived and four animal-derived feedstuffs and diets for juvenile Australian redclaw, Cherax quadricarinatus, Aquaculture, Volume 250, Issues 3-4, 30 December 2005, Pages 748-754, ISSN 0044-8486, DOI: 10.1016/j.aquaculture.2005.02.058.
(http://www.sciencedirect.com/science/article/B6T4D-4G3SC6V-1/2/2824a2e3dfcc3eb4ee13bb07778ad3c8)
Abstract:
Dry matter and protein digestibility of three plant-derived and four animal-derived feedstuffs and diets in which they were included were evaluated for juvenile Australian redclaw. The ingredients evaluated were: soy paste, textured wheat, sorghum meal, two sardine meals (67% and 58% crude protein), squid meal, and red crab meal. A reference diet was formulated and produced in the CIBNOR nutrition laboratory. Seven experimental diets were then made including 15% of each ingredient in the reference diet. The experiment consists of a single-factor, completely randomized design with five replicates per treatment. Digestibility was measured indirectly, using chromic oxide as a marker. Plant-derived ingredients and the corresponding diets had, in general, a higher

digestibility than animal ingredients. Soy paste and sorghum meals, and the diets in which they were included, showed an excellent dry matter (over 87%) and protein (approximately 90%) digestibility. Some of the animal ingredients such as sardine meal 67% CP and squid meal had a good dry matter digestibility (over 80%), but were significantly lower than plant-derived ingredients. The lowest dry matter and protein digestibility was recorded for sardine meal 58% CP and red crab meal. It is concluded that juvenile redclaw are omnivorous and able to efficiently consume diets containing plant- and animal-derived ingredients, but they can digest plant-derived ingredients more efficiently.
Keywords: Crustacean nutrition; Cherax quadricarinatus; Digestibility; Vegetal and animal ingredients; Diets

Deyanira Lobo, Zenaida Lozano, Fernando Delgado, Water erosion risk assessment and impact on productivity of a Venezuelan soil, CATENA, Volume 64, Issues 2-3, 25 Years of Assessment of Erosion, 30 December 2005, Pages 297-306, ISSN 0341-8162, DOI: 10.1016/j.catena.2005.08.011.
(http://www.sciencedirect.com/science/article/B6VCG-4HDGBSY-1/2/3ae0408a8d508faf1b5df268d838f397)
Abstract:
Soil losses affect the physical, chemical and biological soil properties and as a consequence reduce soil productivity. Erosion reduces or eliminates root-explorable soil depth and crop available water, selectively decreases the nutrient and organic matter content, and exposes soil layers with unsuitable characteristics for crop growth. Yield is hence assumed to be a function of root growth, which in turn is a function of the soil environment. In order to evaluate the water erosion impact on soil properties and productivity, a study was carried out on a Typic Haplustalfs soil, with sorghum (Sorghum bicolor (L) Moench), located in Chaguaramas in the Central Plains of Venezuela. Four different study locations with the same soil type, with slopes ranging from 3% to 6% and with different levels of erosion were selected: Chaguaramas I (slightly eroded), Chaguaramas II, (moderately eroded), Chaguaramas III (moderately eroded), and Chaguaramas IV (severely eroded). A sorghum-livestock farming system was introduced 30 years ago. Secondary tillage with a disc harrow (without mulch on the topsoil) was applied for seedbed preparation. Fertilizers and pesticides were applied uniformly over the entire fields. Soil samples from each horizon were analysed for particle size distribution, water retention, bulk density, pH and organic matter content. The relative production potential was estimated using the Productivity Index developed by Pierce et al. [Pierce, F.C., W.E. Larson, R.H. Dowdy and W.A. Graham. 1983. Productivity of soils: assessing long-term changes due to erosion. Journal of Soil and Water Conservation. 38 39-44.], and adapted to the methodology proposed by Delgado [Delgado F. 2003. Soil physical properties on Venezuelan steeplands: applications to conservation planning. The Abdus Salam International Centre for Theoretical Physics. College on Soil Physics. 11 pp.] for Venezuelan soil conditions. The Productivity Index (PI) could estimate the tolerable rate of soil productivity loss. A soil erosion risk was assessed by the Erosion Risk Index (ERI) taking into account the soil hydrological characteristics (infiltration-runoff ratio), rainfall aggressiveness and topography (slope). The Productivity Index (PI) and the Erosion Risk Index (ERI) were used to classify the lands for soil conservation priorities, for conservation requirements and for alternative land uses. The results showed that: (a) the Productivity Index (PI) decreased with increasing level of erosion, (b) the Productivity Index (PI) was mainly affected by changes in available water storage capacity, bulk density and pH, (c) the erosion risk (ERI) was strongly affected by slope gradient and rainfall aggressiveness, (d) the areas were classified as critical lands and super-critical lands, with high to very high soil conservation requirements, depending on the level of soil erosion.
Keywords: Erosion Risk Index; Soil Productivity Index; Sorghum; Typic Haplustalfs; Infiltration; Runoff; Venezuela

R. Rojo, G.D. Mendoza, S.S. Gonzalez, L. Landois, R. Barcena, M.M. Crosby, Effects of exogenous amylases from Bacillus licheniformis and Aspergillus niger on ruminal starch digestion and lamb performance, Animal Feed Science and Technology, Volumes 123-124, Part 2, 7 December 2005, Pages 655-665, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.04.053.
(http://www.sciencedirect.com/science/article/B6T42-4G9R1TM-3/2/e327717b4c4101a0d01a09e14e81ad34)
Abstract:
Two industrial exogenous enzymes, alpha-amylase from Bacillus licheniformis and glucoamylase from Aspergillus niger, were evaluated in vivo and in lambs fed 700 g/kg (dry matter (DM)) sorghum grain diets. Six Suffolk lambs (30 +/- 2.5 kg body weight (BW)) fitted with ruminal and duodenal cannulas were randomly allotted to two 3 x 3 Latin square experiments, to evaluate effects of alpha-amylase and glucoamylase on intake, digestibility and ruminal fermentation. The same level of protein from the two enzyme sources (0.0, 1.45 or 2.90 g enzyme/kg DM sorghum) was applied to sorghum. The enzymes were sprinkled on the sorghum 24 h before mixing the diet. The highest level of each enzyme was also fed (45 days) to 15 individually housed lambs (Suffolk crossbred, 22.5 +/- 1.4 kg BW) in a completely randomized design (i.e., control, alpha-amylase or glucoamylase) to evaluate lamb performance. The highest activity units/mg protein ($P < 0.01$) was for the alpha-amylase (4.190) followed by glucoamylase (1.952) and ruminal fluid (0.062). Dry matter, organic matter (OM) and starch intake decreased as level of dietary alpha-amylase increased (linear: $P < 0.05$), but ruminal starch digestion and total tract digestibility of DM, OM and starch increased quadratically ($P < 0.05$). Total volatile fatty acids VFA and protozoa numbers decreased linearly ($P < 0.01$), whereas lactate was quadratically ($P < 0.01$) increased with alpha-amylase. Ruminal pH, protozoa and lactate increased ($P < 0.01$) with glucoamylase. Propionate molar proportion responded quadratically ($P < 0.01$) with both enzymes. The intermediate level of glucoamylase increased intake of DM, OM and starch (quadratic: $P < 0.09$), but total tract starch digestibility decreased (linear: $P = 0.08$) as level of glucoamylase increased. Feed intake, gain and feed conversion were not affected by enzymes, but alpha-amylase improved ($P < 0.05$) partial feed efficiency. Results indicate that amylase from B. licheniformis increases ruminal starch digestion and could be used to improve ruminal starch digestion in ruminants fed diets high in grains with low digestion rates.
Keywords: Digestion; Enzymes; Sheep; Starch; Sorghum grain

Mustafa Kaplan, Sule Orman, Imre Kadar, Jozsef Koncz, Heavy metal accumulation in calcareous soil and sorghum plants after addition of sulphur-containing waste as a soil amendment in Turkey, Agriculture, Ecosystems & Environment, Volume 111, Issues 1-4, 1 December 2005, Pages 41-46, ISSN 0167-8809, DOI: 10.1016/j.agee.2005.04.023.
(http://www.sciencedirect.com/science/article/B6T3Y-4GG8VDH-4/2/dce9d313de0d16d46092eb1f02c0477b)
Abstract:
The purpose of this work was to evaluate the effect of sulphur containing industrial waste with respect to heavy metals on calcareous clay soil and sorghum (Sorghum bicolor L.) plant, as soil amendment. Pot experiment was established with a rate of 0, 20, 40, 60 t ha-1 air dry waste and 0.5, 1.0, 1.5 t ha-1 elemental sulphur and 0.5 t ha-1 sulphur + 20 t ha-1 waste. The use of waste on the soil with high CaCO3 and clay content did not create heavy metal (Ni, Cr, Co and Cd) build-up or toxicity. Even after the application of the high level of waste, it could not be seen any important toxic element accumulation in sorghum plant. Although the sulphur-rich waste, approximately up to 1 million t in the vicinity of Keciborlu Sulphur Factory Isparta/Turkey, can be considered as amendment product for reclamation of saline-sodic and calcareous soils common in Turkey and other countries, repeated waste applications would result in different heavy metal

accumulation rates. Therefore, it is needed to be examined with long term field experiments and different crops.
Keywords: Heavy metals; Industrial wastes; Soil amendment; Sulphur; Sorghum; Sorghum bicolor L.; Ni; Cr; Pb; Cd

A. van Ast, L. Bastiaans, S. Katile, Cultural control measures to diminish sorghum yield loss and parasite success under Striga hermonthica infestation, Crop Protection, Volume 24, Issue 12, December 2005, Pages 1023-1034, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.02.008.
(http://www.sciencedirect.com/science/article/B6T5T-4G94HG4-3/2/81b5c6716210544afd8efd258b7bc7f7)
Abstract:
Prospects of reducing Striga hermonthica (Del.) Benth. parasitism by means of cultural control measures were assessed. In a pot experiment, deep planting, the use of transplants and shallow soil-tillage, strongly delayed and reduced Striga infection of a sensitive and a tolerant sorghum cultivar. Application of all three measures combined resulted in a four-week delay in first emergence of the parasite, a reduced number of emerged Striga plants and a decimation of Striga dry weight. With the sensitive cultivar CK-60B a yield loss of 92% was reduced to 26%, whereas with the tolerant cultivar Tiemarifing application of the cultural control measures completely cancelled out a yield loss of 28%. Evaluation of these cultural measures under field conditions in Mali resulted in a strong reduction in Striga-infection level (85%). At the same time, the measures did not result in delayed first emergence of the parasite and had no beneficial effect on crop yield. It was argued that the presence of a natural Striga soil seed bank, with seeds throughout the tilth, might be an important reason for the reduced effectiveness of the proposed cultural control measures under field conditions.
Keywords: Striga hermonthica; Sorghum bicolor; Shallow_tillage; Deep planting; Transplanting; Avoidance

A. Roldan, J.R. Salinas-Garcia, M.M. Alguacil, E. Diaz, F. Caravaca, Soil enzyme activities suggest advantages of conservation tillage practices in sorghum cultivation under subtropical conditions, Geoderma, Volume 129, Issues 3-4, December 2005, Pages 178-185, ISSN 0016-7061, DOI: 10.1016/j.geoderma.2004.12.042.
(http://www.sciencedirect.com/science/article/B6V67-4FCSDSF-2/2/f37fcee588c45fb94f3bb584f252d27e)
Abstract:
Soil enzyme activity can be used as an indicator of soil quality for assessing the sustainability of agricultural ecosystems. The objective of this study was to determine the influence of conservation tillage practices, such as no tillage and reduced tillage (subsoil-bedding and shred-bedding), and conventional tillage practices, such as mouldboard ploughing, on physical-chemical, biochemical and physical soil quality indicators in a degraded sorghum field under warm subtropical conditions, after a period of 3 years. An adjacent soil under native vegetation was used as a standard representing local high quality soil. Conservation tillage systems, in particular no tillage, increased crop residue accumulation on the soil surface. Soil electrical conductivity and pH were not affected by the tillage practices. In the 0 to 5 cm layer, organic matter content increased with decreasing tillage intensity and was 33% greater with no tillage compared with the average of the other tillage treatments. The no tilled soil had higher values of water soluble C, dehydrogenase, urease, protease, phosphatase and [beta]-glucosidase activities and aggregate stability than tilled soils, but had lower values than the soil under native vegetation. The enzyme activity and aggregate stability showed higher sensitivity to soil management practices than did physical-chemical properties. The no tillage system was the most effective for improving soil physical and biochemical qualities.
Keywords: Aggregate stability; Crop residue; Microbial activity; No tillage; Soil enzyme activities

Marcio dos Santos Azevedo, Katia Regina dos Santos Teixeira, Gudrun Kirchhof, Anton Hartmann, Jose Ivo Baldani, Influence of soil and host plant crop on the genetic diversity of Azospirillum amazonense isolates, Pedobiologia, Volume 49, Issue 6, 30 November 2005, Pages 565-576, ISSN 0031-4056, DOI: 10.1016/j.pedobi.2005.06.008.
(http://www.sciencedirect.com/science/article/B7CW5-4GTWRWD-2/2/0496ce43cc51aa94fadbc41c9e3443f3)
Abstract: Summary
The genetic structure of Azospirillum amazonense populations isolated from the rhizosphere soil and washed and surface-sterilised roots of rice, maize and sorghum plants, cropped simultaneously in two different soils (clay loam and sandy loam) was characterised. Genetic diversity was measured by restriction fragment length polymorphism of the amplified 16S-23S rDNA intergenic spacer region (RISA-RFLP) and cluster analysis. Four genetically distinct clusters of isolates were observed with 78% similarity, suggesting that the A. amazonense population was heterogeneous at the strain level regardless of the soil type or host plant. Analysis of molecular variance (AMOVA) demonstrated that the host plant had a highly significant selective effect on the genetic structure of this species, especially on those isolates intimately associated with them, but also to a lesser extent on isolates from the rhizosphere and washed roots. The soil type also had a highly significant selective effect on A. amazonense genetic diversity, especially for those isolates from the rhizosphere soil. The selective effect of the soil type combined with that of the host plant suggests that environmental factors, such as soil texture and composition of exudates provided by C3 or C4 plants, play major roles in the overall genetic structure of A. amazonense populations associated with these cereals.
Keywords: A. amazonense genetic diversity; Nitrogen-fixing bacteria; RISA-RFLP; Soil type; Host plant; AMOVA

B. Narasimhan, R. Srinivasan, Development and evaluation of Soil Moisture Deficit Index (SMDI) and Evapotranspiration Deficit Index (ETDI) for agricultural drought monitoring, Agricultural and Forest Meteorology, Volume 133, Issues 1-4, 10 November 2005, Pages 69-88, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2005.07.012.
(http://www.sciencedirect.com/science/article/B6V8W-4HBSGNW-1/2/0e1297d4f61146bf2c020eee4ba91e57)
Abstract:
Drought is one of the major natural hazards that bring about billions of dollars in loss to the farming community around the world each year. Drought is most often caused by a departure of precipitation from the normal amount, and agriculture is often the first sector to be affected by the onset of drought due to its dependence on water resources and soil moisture reserves during various stages of crop growth. Currently used drought indices like the Palmer Drought Severity Index (PDSI) and Standardized Precipitation Index (SPI) have coarse spatial (7000-100,000 km2) and temporal resolution (monthly). Hence, the distributed hydrologic model SWAT was used to simulate soil moisture and evapotranspiration from daily weather data at a high spatial resolution (16 km2) using GIS. Using this simulated data the drought indices Soil Moisture Deficit Index (SMDI) and Evapotranspiration Deficit Index (ETDI) were developed based on weekly soil moisture deficit and evapotranspiration deficit, respectively. SMDI was computed at four different levels, using soil water available in the entire soil profile, then soil water available at the top 2 ft. (SMDI-2), 4 ft. (SMDI-4), and 6 ft. (SMDI-6). This was done because the potential of the crop to extract water from depths varies during different stages of the crop growth and also by crop type. ETDI and SMDI-2 had less auto-correlation lag, indicating that they could be used as good indicators of short-term drought. The developed drought indices showed high spatial variability (spatial standard deviation ~1.00) in the study watersheds, primarily due to high spatial variability of precipitation. The wheat and sorghum crop yields were highly correlated ($r > 0.75$) with the ETDI

and SMDI's during the weeks of critical crop growth stages, indicating that the developed drought indices can be used for monitoring agricultural drought.
Keywords: Drought index; PDSI; SPI; Soil moisture; Evapotranspiration; Crop yield

Tengyan Zhang, Walter P. Walawender, L.T. Fan, Preparation of carbon molecular sieves by carbon deposition from methane, Bioresource Technology, Volume 96, Issue 17, November 2005, Pages 1929-1935, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.01.026.
(http://www.sciencedirect.com/science/article/B6V24-4FNW4K0-1/2/fa25dcf372b3d0c834b10c3f752f8dac)
Abstract:
To prepare carbon molecular sieves (CMSs), methane was pyrolyzed in an attempt to deposit fine carbon particles on the micropore mouths of the carbon substrates being heated; the carbon substrates included grain-based activated carbons and commercial activated carbons. To explore the effects of heat treatment alone, blank experiments were conducted by heating the samples in N2. The resultant products were characterized by N2-adsorption at 77 K. Methane failed to deposit carbon at 800 [degree sign]C. The porosity of activated carbons, however, was substantially influenced by heat treatment alone. The surface areas and micropore volumes of the activated carbons from grain sorghum decreased by 39.32% and 36.84%, respectively, upon heat treatment alone; this is attributable to the destruction of pore structure by sintering. In contrast, the corresponding values of the commercial activated carbons increased by 59.86% and 62.16%, respectively, upon heat treatment alone; this can be attributable to the development of microporosity.
Keywords: Carbon deposition; Heat treatment; Methane; Carbon molecular sieves; Activated carbons; Grain

Brea Bond, Diane R. Fernandez, Dorothy J. VanderJagt, Margaret Williams, Yung-Sheng Huang, Lu-Te Chuang, Mark Millson, Ronee Andrews, Robert H. Glew, Fatty acid, amino acid and trace mineral analysis of three complementary foods from Jos, Nigeria, Journal of Food Composition and Analysis, Volume 18, Issue 7, November 2005, Pages 675-690, ISSN 0889-1575, DOI: 10.1016/j.jfca.2004.06.006.
(http://www.sciencedirect.com/science/article/B6WJH-4FFN4RJ-5/2/8d0057f644df3b50f669c28ae2b7237f)
Abstract:
Complementary foods (CF), commonly known as weaning foods, are semi-solid or solid foods that are used to transition infants from breast milk to an adult diet. Their nutritional content is important to the growth and development of children, particularly in developing countries such as Nigeria. In a previous study five CF produced in Jos, Nigeria were analyzed for their nutritional content. Based on those findings, three new CF were formulated in an effort to improve the nutritive value. The new formulations (second-generation CF) were analyzed for fatty acid (FA), amino acid, and mineral and trace element content. The results were compared to those of the most nutritious CF previously analyzed (designated Soy). The total FA content of all three second-generation CF (3.89-20.8 mg/g) was lower than the first-generation Soy mixture (105 mg/g). The content of linoleic and [alpha]-linolenic acids among the second-generation CF (1.64-10.1 and 0.084-0.63 mg/g, respectively) was also lower than the Soy CF (59.7 and 7.46 mg/g). The second-generation CF all had higher iron content than Soy (138-288 versus 98.1 [mu]g/g). The amounts of magnesium (1030-1733 versus 2255 [mu]g/g), phosphorus (2237-3830 versus 5685 [mu]g/g), and zinc (28.9-37.9 versus 54.8 [mu]g/g) in the second-generation CF were lower than in Soy. The second-generation CF also had lower protein content than Soy (66-197 versus 355 mg/g). Overall, the new second-generation CF had a lower nutritive content than the original Soy CF.
Keywords: Amino acids; Complementary food; Essential fatty acids; Infant nutrition; Nigeria; Trace minerals

Alan L. Wright, Frank M. Hons, Tillage impacts on soil aggregation and carbon and nitrogen sequestration under wheat cropping sequences, Soil and Tillage Research, Volume 84, Issue 1, November 2005, Pages 67-75, ISSN 0167-1987, DOI: 10.1016/j.still.2004.09.017.
(http://www.sciencedirect.com/science/article/B6TC6-4DX270K-1/2/dd5b467d49640777f8bf856ac8c12b74)
Abstract:
No tillage (NT) and increased cropping intensity have potential for enhanced C and N sequestration in agricultural soils. The objectives of this study were to investigate the impacts of conventional tillage (CT), NT, and multiple cropping sequences on soil organic C (SOC) and N (SON) sequestration and on distribution within aggregate-size fractions in a southcentral Texas soil at the end of 20 years of treatment imposition. Soil organic C and SON sequestration were significantly greater under NT than CT for a grain sorghum [Sorghum bicolor (L.) Moench]/wheat (Triticum aestivum L.)/soybean [Glycine max (L.) Merr.] rotation (SWS), a wheat/soybean doublecrop (WS), and a continuous wheat monoculture (CW) at 0-5 cm and for the SWS rotation at 5-15 cm. At 0-5 cm, NT increased SOC storage compared to CT by 62, 41, and 47% and SON storage by 77, 57, and 56%, respectively, for SWS, WS, and CW cropping sequences. Increased cropping intensity failed to enhance SOC or SON sequestration at either soil depth compared to the CW monoculture. No-tillage increased the proportion of macroaggregates (>2 mm) at 0-5 cm but not at 5-15 cm. The majority of SOC and SON storage under both CT and NT was observed in the largest aggregate-size fractions (>2 mm, 250 [mu]m to 2 mm). The use of NT significantly improved soil aggregation and SOC and SON sequestration in surface but not subsurface soils.
Keywords: Carbon sequestration; Conventional tillage; Cropping sequences; Nitrogen sequestration; No-tillage

S.L.S. Cabral Filho, A.L. Abdalla, I.C.S. Bueno, E.F. Nozella, J.A.S. Rodrigues, Ruminal fermentation and degradability of sorghum cultivar whole crop, and grains, using an in vitro gas production technique, Animal Feed Science and Technology, Volumes 123-124, Part 1, The in vitro Gas Production Technique: Limitations and Opportunities, 30 September 2005, Pages 329-339, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.04.036.
(http://www.sciencedirect.com/science/article/B6T42-4G7X9N6-2/2/4630d74eb7a4f625c8c0d4279cc8d854)
Abstract:
The purpose of the study was to determine fermentation and degradability of eight sorghum cultivars, being 8050-Agromen, 8118-Pioneer, 8419-Pioneer, BR306, BR700, BRS305, BRS701, Saara-Monsanto at different stages of growth, and to determine effects of condensed tannins (CT) in sorghum grain using a bio-assay. Cultivars were planted in 5 mx4.5 m plots in a randomized block design. Whole plants were harvested 30, 60, 90 and 120 days post-sowing, but grains (cobs) were harvested only at 120 days from plants other than those harvested as whole plant. Samples were analyzed for ash, acid detergent fibre and crude protein. In vitro gas production determinations of whole plant samples and grains were completed on oven dried (40 [degree sign]C for 48 h) samples ground to pass a 1 mm screen. Grain samples assayed for CT, and their interference in gas production, was determined with addition of polyethylene glycol. Differences ($P<0.05$) in chemical composition occurred among cultivars at and after 60 days. Grains of cultivars with low CT levels had higher apparent dry matter degradability (ADMD; $P<0.05$). In the bio-assay, grains had increased gas production with PEG addition, and correlations ($P<0.05$) occurred between CT content and gas increment following PEG addition as well as ADMD. Grain cultivars had as good or better fermentation parameters and ADDM when harvested at 60, 90 and 120 days post-sowing as did forage cultivars at the same maturities.
Keywords: Feed evaluation; Forages; Ruminant; Sheep; Tannins

A.B. Potgieter, G.L. Hammer, A. Doherty, P. de Voil, A simple regional-scale model for forecasting sorghum yield across North-Eastern Australia, Agricultural and Forest Meteorology, Volume 132, Issues 1-2, 20 September 2005, Pages 143-153, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2005.07.009.
(http://www.sciencedirect.com/science/article/B6V8W-4H21K1X-3/2/b9d17d8cd309fbe6426c48982a5a8a67)
Abstract:
Sorghum is the main dryland summer crop in NE Australia and a number of agricultural businesses would benefit from an ability to forecast production likelihood at regional scale. In this study we sought to develop a simple agro-climatic modelling approach for predicting shire (statistical local area) sorghum yield. Actual shire yield data, available for the period 1983-1997 from the Australian Bureau of Statistics, were used to train the model. Shire yield was related to a water stress index (SI) that was derived from the agro-climatic model. The model involved a simple fallow and crop water balance that was driven by climate data available at recording stations within each shire. Parameters defining the soil water holding capacity, maximum number of sowings (MXNS) in any year, planting rainfall requirement, and critical period for stress during the crop cycle were optimised as part of the model fitting procedure. Cross-validated correlations (CVR) ranged from 0.5 to 0.9 at shire scale. When aggregated to regional and national scales, 78-84% of the annual variation in sorghum yield was explained. The model was used to examine trends in sorghum productivity and the approach to using it in an operational forecasting system was outlined.
Keywords: Agro-climatic model; Stress index; Crop forecasting system; Technology trend

M.C. Manna, A. Swarup, R.H. Wanjari, H.N. Ravankar, B. Mishra, M.N. Saha, Y.V. Singh, D.K. Sahi, P.A. Sarap, Long-term effect of fertilizer and manure application on soil organic carbon storage, soil quality and yield sustainability under sub-humid and semi-arid tropical India, Field Crops Research, Volume 93, Issues 2-3, 14 September 2005, Pages 264-280, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.10.006.
(http://www.sciencedirect.com/science/article/B6T6M-4F4NYGW-1/2/ef9b98c664b1269551d19dcf84abfd36)
Abstract:
In south Asian countries, production fatigue has been observed as yields which have started declining or stagnating under long-term experiments in multiple cropping systems due to continuous cultivation. We examined the potential impact of continuous cultivation of crops in rotation, and fertilizer and manure application on yield trends, soil organic carbon (SOC) storage, soil quality parameters (active fractions of SOC in particular) and sustainable yield index (SYI). Crop rotations included in the study were: rice-wheat-jute, soybean-wheat and sorghum-wheat system at Barrackpore (Typic Eutrochrept), Ranchi (Typic Haplustalf) and Akola (Typic Haplustert), respectively. Field treatments included unfertilized (control), 100% N, 100% NP, 100% NPK and 100% NPK + FYM. The negative yield trend was observed in unbalanced use of inorganic N and NP application at all the three sites. The positive yield trend was observed in the NPK and NPK + FYM treatments at Ranchi and Akola. However, significantly negative-yield trends were observed in these treatments at Barrackpore under rice-based system. Results showed that the SOC in the unfertilized plot (control) decreased by 41.5, 24.5, and 15.5% compared to initial values in Barrackpore, Ranchi and Akola, respectively, wherein the treatment receiving NPK and NPK + FYM either maintained or improved it over initial SOC content in these sites. The estimated annual C input values in NPK + FYM treatments were 4392, 4159 and 3113 kg ha-1 year-1 in rice-wheat-jute, sorghum-wheat and soybean-wheat system, respectively. Active fractions of SOC, viz., water-soluble carbon and hydrolysable carbohydrates, soil microbial biomass C and N, dehydrogenase and alkaline phosphatase activity, improved significantly with the application of NPK and NPK + FYM. The content of SOC significantly ($p <= 0.05$) correlated with SYI and active

fractions of SOC, which support better sustainable productivity. Results suggest that current fertilizer recommendations of 100% recommended NPK are adequate for maintaining SOC and its active fractions as well. The causes of yield decline are mostly location specific but depletion of SOC and its active fractions seems to be a general cause.
Keywords: Carbon storage; Long-term experiments; Semi-arid; Soil organic carbon; Soil quality; Sub-humid; Sustainable yield index

B. Svihus, A.K. Uhlen, O.M. Harstad, Effect of starch granule structure, associated components and processing on nutritive value of cereal starch: A review, Animal Feed Science and Technology, Volume 122, Issues 3-4, 1 September 2005, Pages 303-320, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.02.025.
(http://www.sciencedirect.com/science/article/B6T42-4G7NF76-1/2/178baffdcd9acb777c40bb2f3cc551e4)
Abstract:
Starch is organized in concentric alternating semi-crystalline and amorphous layers in granules of various sizes within the endosperm. The amount of amylose in starch normally varies between 200 and 300 g/kg, but waxy cereals may contain negligible amounts and starch from high-amylose varieties may contain up to 700 g amylose/kg. High amylose content is associated with reduced digestibility. Fat and protein are found on the surface of starch granules, and these components may act as physical barriers to digestion. Heat treatment with sufficient water present will cause gelatinisation that will increase susceptibility for starch degradation in the digestive tract, although a linear relationship between extent of gelatinisation due to processing and digestibility has not been found. The low water content during feed processing limits the extent of gelatinisation, but gelatinisation temperature and extent of gelatinisation will be affected by properties of the starch, which in turn may affect digestibility. The effect of starch properties and feed processing on digestion in non-ruminant animals and ruminants are discussed.
Keywords: Starch digestibility; Wheat; Barley; Oats; Maize; Sorghum; Pelleting; Extrusion

J. Mushandu, M. Chimonyo, K. Dzama, S.M. Makuza, F.N. Mhlanga, Influence of sorghum inclusion level on performance of growing local Mukota, Large White and their F1 crossbred pigs in Zimbabwe, Animal Feed Science and Technology, Volume 122, Issues 3-4, 1 September 2005, Pages 321-329, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.02.033.
(http://www.sciencedirect.com/science/article/B6T42-4G9R1TM-1/2/a7b79375d0647d81d55cb51cb01ddffa)
Abstract:
A study was conducted to determine the effect of level of substitution of Red Swazi A sorghum variety (RSA) for maize on average feed intake (ADFI), average daily body weight gain (ADG) and feed conversion ratio (FCR), hot carcass mass (HCM), cold dressed mass (CDM), drip loss (DL) and backfat thickness (BF) in Large White (LW), Mukota and F1 crossbred pigs. Twelve pigs of each breed were randomly assigned to diets that contained 0, 200, 400 and 600 g/kg of RSA, and similar levels of energy and crude protein. The pigs were kept for 14 weeks. There was a linear decrease in ADG in the crossbred pigs as the sorghum level increased ($P < 0.05$). In the LW pigs, no linear or quadratic relationships existed in ADG. The ADG in the Large White and crossbred pigs was 0.69 and 0.61 kg, respectively. In Mukota pigs, however, there was a linear increase ($P < 0.05$) in ADG with sorghum inclusion level. The least square mean ADG for Mukota pigs was 0.34. The FCR increased ($P < 0.05$) in both LW and crossbred pigs as sorghum level increased, but no statistically significant change was observed in the Mukota. The least square mean FCR were 4.2, 3.3 and 3.7 for Mukota, LW and crossbred pigs, respectively. The respective DL values were 0.01, 0.02 and 0.03 for the Mukota, LW and crossbred pigs. The BF values were 8.8, 14.5 and 14.0 for Mukota, LW and crossbred pigs, respectively. These findings suggest that Mukota pigs could utilise diets containing high levels of red sorghum better than either the LW or crossbred pigs.

Mukota pigs, which are indigenous and adapted to sub-tropical environmental conditions, can therefore be recommended for use in dry areas that are suitable for sorghum production to achieve sustainable pig production.
Keywords: Mukota pigs; Sorghum; Growth performance; Carcass traits

K.G. Sonia, B.S. Chadha, H.S. Saini, Sorghum straw for xylanase hyper-production by Thermomyces lanuginosus (D2W3) under solid-state fermentation, Bioresource Technology, Volume 96, Issue 14, September 2005, Pages 1561-1569, ISSN 0960-8524, DOI: 10.1016/j.biortech.2004.12.037.
(http://www.sciencedirect.com/science/article/B6V24-4FM5CXF-2/2/ff7314a44a1f8becd05947b1fa8c4c64)
Abstract:
This paper reports the production of very high levels of cellulase free xylanase and associated hemicellulases by an indigenous thermophilic isolate of Thermomyces lanuginosus (D2W3) using solid-state fermentation. Sorghum straw, an inexpensive and abundant source of carbon supported maximal xylanase activity (11,855 units/g dry substrate). Culturing T. lanuginosus D2W3 on sorghum straw and optimizing other culture conditions (media types, particle size of carbon source, inoculum level, inoculum age and additives), yielded increased levels of xylanase (39,726 units/g dry substrate). Further optimization of enzyme production was carried out using Box-Behnken design of experiments with three independent variables (inoculum level, glycerol and ammonium sulphate concentrations) which resulted in very high levels of xylanase, 48,000 +/- 1774 units/g dry substrate, and 2.6 +/- 0.2, 13.4 +/- 0.56, 68 +/- 1.7, 1.4 +/- 0.08, 1.2 +/- 0.05 (units/g dry substrate) of [beta]-xylosidase, [alpha]-galactosidase, pectinase, [beta]-mannosidase and [alpha]-l-arabinofuranosidase, respectively.
Keywords: Cellulase free xylanase; Thermomyces lanuginosus (D2W3); Solid-state fermentation; Sorghum straw; Box-Behnken design; [beta]-xylosidase; [alpha]-galactosidase; Pectinase; [beta]-mannosidase and [alpha]-l-arabinofuranosidase

P.S. Setimela, D.J. Andrews, J. Partridge, K.M Eskridge, Screening sorghum seedlings for heat tolerance using a laboratory method, European Journal of Agronomy, Volume 23, Issue 2, September 2005, Pages 103-107, ISSN 1161-0301, DOI: 10.1016/j.eja.2004.09.008.
(http://www.sciencedirect.com/science/article/B6T67-4F53NBW-2/2/39d961d6d2a59f7e3ea3d71fcef8730f)
Abstract:
High soil temperatures at planting time can seriously reduce plant populations in the semi-arid tropics where surface temperatures can exceed 50 [degree sign]C leading to loss of crop yield. Seedling heat tolerance is critical for adequate crop establishment. Because field screening for emerging seedling heat tolerance is tedious, inconsistent, and seasonally limited, it is essential for genetic improvement to have effective and validated techniques to identify sources of tolerance and for evaluating breeding material. The objective of this research was to define a simple laboratory procedure for evaluating sorghum seedlings for their capacity to survive a controlled heat shock and resume growth, and to determine if there were significant differences for heat tolerance among the cultivars tested. Seven genotypes were grown between vertical transparent plexiglass plates in a growth chamber at 30 [degree sign]C, exposed to direct heat shock via a water bath at 50 [degree sign]C for 0, 10, 20 and 30 min and then returned to the 30 [degree sign]C growth chamber. Coleoptile growth was measured at 8, 20, 32, and 44 h after the heat treatment. Heat tolerance per se was expressed by a heat tolerance index (HTI) defined as a ratio of resumed coleoptile growth after the controlled heat shock, compared to normal growth. Ten minutes heat exposure-separated genotypes better across the time interval for coleoptile recovery compared to other exposures. Genotype x exposure interaction for HTI was significant at $P < 0.001$ and < 0.05 for 32 and 44 h intervals, respectively. The technique for heat screening at 50

[degree sign]C, 10 min of exposure and measuring coleoptile length after 32 h of recovery was the best treatment combination. This method is relatively simple and inexpensive and can be used to screen a large number of genotypes.
Keywords: Sorghum; Heat tolerance; Coleoptile length; Heat recovery; Heat shock

Fatima S. Ibrahim, Elfadil E. Babiker, Nabila E. Yousif, Abdullahi H. El Tinay, Effect of fermentation on biochemical and sensory characteristics of sorghum flour supplemented with whey protein, Food Chemistry, Volume 92, Issue 2, September 2005, Pages 285-292, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.07.024.
(http://www.sciencedirect.com/science/article/B6T6R-4DS6VB1-7/2/3967f03f5b40cb2ea2bb0ab2c53ccd56)
Abstract:
Changes in pH, titrable acidity, protein, non-protein nitrogen, total soluble solids, protein fractions and in vitro protein digestibility were investigated during fermentation and/or after supplementation of sorghum flour with whey protein. The pH of the fermenting material decreased sharply with a concomitant increase in the titrable acidity. The total soluble solids increased with progressive fermentation time. The crude protein and non-protein nitrogen both increased with fermentation time. The protein content and fractions were significantly (p [less-than-or-equals, slant] 0.05) increased after supplementation with whey protein. The albumin plus globulin fraction increased significantly (p [less-than-or-equals, slant] 0.05) during the first 8 h of fermentation after supplementation with 5% whey protein. Other fraction contents were observed to fluctuate during the fermentation time. Supplementation of the cultivar flour with 10% whey protein greatly increased the protein content as well as the albumin plus globulin fraction while other fractions were significantly decreased. The in vitro protein digestibility was significantly (p [less-than-or-equals, slant] 0.05) improved during fermentation and even after supplementation. Sensory evaluation of locally processed sorghum products (Kisra, Asida and Nasha) before and after supplementation showed no difference between the supplemented samples and the control ones as judged by trained panellists.
Keywords: Sorghum; Fermentation; Whey protein; Supplementation; Protein digestibility; Sensory evaluation

Jess D. Reed, Christian G. Krueger, Martha M. Vestling, MALDI-TOF mass spectrometry of oligomeric food polyphenols, Phytochemistry, Volume 66, Issue 18, Tannins and Related Polyphenols (Part 2), September 2005, Pages 2248-2263, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2005.05.015.
(http://www.sciencedirect.com/science/article/B6TH7-4GG2J94-2/2/d44f053f4bee862c041630430064d69b)
Abstract:
The structural heterogeneity of polyphenols from cranberries, grape seed extracts, sorghum and pomegranate was characterized by MALDI-TOF MS. Polyphenolics were isolated by liquid chromatography and subjected to MALDI-TOF MS using trans-3-indoleacrylic acid as the matrix. Spectrometric analysis gave information on degree of polymerization, monomeric substitution, and the nature of intermolecular bonds. Cranberry polyflavan-3-ols had variation in interflavan bonds (A- and B-types) and contained polyflavan-3-ols linked to anthocyanins through a CH3-CH bridge. Polygalloyl-polyflavan-3-ols in grape seed extract had large variation in the degree of galloyl substitution. Sorghum polyflavans had structural heterogeneity in glycosylation and hydroxylation. Pomegranate hydrolyzable tannins that correspond to previously described structures were detected, such as punicalagin, but others that correspond to oligomeric ellgitannins in which two to five core glucose units are cross-linked by dehydrodigalloyl and or valoneoyl units were also observed. Results demonstrate that large heterogeneity occurs in degree of polymerization,

intermolecular bonds, pattern of hydroxylation, and substitution with monosaccharides and gallic acid.
Keywords: Proanthocyanidins; Ellagitannins; Cranberry; Sorghum; Grape seed extract; Pomegranate; Tannins

Jayanand Boddu, Catherine Svabek, Farag Ibraheem, A. Daniel Jones, Surinder Chopra, Characterization of a deletion allele of a sorghum Myb gene yellow seed1 showing loss of 3-deoxyflavonoids, Plant Science, Volume 169, Issue 3, September 2005, Pages 542-552, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2005.05.007.
(http://www.sciencedirect.com/science/article/B6TBH-4G94G6Y-1/2/0af9ab4d84f52e8270a059bc557ebf56)
Abstract:
In sorghum, 3-deoxyflavonoid pigments or phlobaphenes observed in the pericarp of mature seed are derived from flavan-4-ols through the flavonoid biosynthetic pathway. We show here that phlobaphenes accumulation in pericarp, glumes and leaves is genetically linked with the functional yellow seed1 (y1) gene. Molecular and genetic analysis was performed on a loss of function allele of y1 present in the line BTx623. This sorghum line does not accumulate any detectable levels of flavan-4-ols or visible phlobaphenes in pericarp, glumes and leaves. Molecular structure of the y1[BTx623] showed a deletion of 3218 bp which removes 5' non-coding, putative promoter, exon1, intron1, exon2, and part of the intron2 sequences. The null y1 allele designated as y1-ww (white pericarp, white glume) is not transcribed and this results in a loss of Y1-regulated expression of structural genes needed for the biosynthesis of flavan-4-ols. Further LC-MS analysis of seed extracts of a functional y1 allele detected the presence of positively charged compounds known as 3-deoxyanthocyanidins. Compounds identified were apigeninidin, luteolinidin, and a methoxylated derivative of apigeninidin. These compounds were not detected in BTx623 seed extracts. Previous studies have shown that 3-deoxyanthocyanidins are induced in sorghum leaves challenged with Colletotrichum sublineolum, a fungus that causes anthracnose in sorghum. Our results now provide an evidence for a common flavonoid pathway that may lead to the biosynthesis of flavan-4-ols and 3-deoxyanthocyanidins in sorghum.
Keywords: Anthracnose; Flavan-4-ols; MYB; Phytoalexins; Sorghum; 3-Deoxyanthocyanidins

K.L. Sharma, Uttam Kumar Mandal, K. Srinivas, K.P.R. Vittal, Biswapati Mandal, J. Kusuma Grace, V. Ramesh, Long-term soil management effects on crop yields and soil quality in a dryland Alfisol, Soil and Tillage Research, Volume 83, Issue 2, September 2005, Pages 246-259, ISSN 0167-1987, DOI: 10.1016/j.still.2004.08.002.
(http://www.sciencedirect.com/science/article/B6TC6-4DTKGFH-1/2/39dd290ac22f508ad087cbd2c8513382)
Abstract:
A long-term experiment was conducted with the objective of selecting the appropriate land management treatments and to identify the key indicators of soil quality for dryland semi-arid tropical Alfisols. The experiment was conducted using a strip split-split plot design on an Alfisol (Typic Haplustalf) in southern India under sorghum (Sorghum vulgare (L))-castor (Ricinus communis (L)) bean rotation. The strip constituted two tillage treatments: conventional tillage (CT) and minimum tillage (MT); main plots were three residues treatments: sorghum stover (SS), gliricidia loppings (GL), `no' residue (NR) and sub plots were four nitrogen levels: 0 (N0), 30 (N30), 60 (N60), and 90 kg ha-1 (N90). Soil samples were collected after the sixth and seventh year of experimentation and were analyzed for physical, chemical and biological parameters. Sustainable yield index (SYI) based on long-term yield data and soil quality index (SQI) using principal component analysis (PCA) and linear scoring functions were calculated. Application of gliricidia loppings proved superior to sorghum stover and no residue treatments in maintaining higher SQI values. Further, increasing N levels also helped in maintaining higher SQI. Among the 24

treatments, the SQI ranged from 0.90 to 1.27. The highest SQI was obtained in CTGLN90 (1.27) followed by CTGLN60 (1.19) and MTSSN90 (1.18), while the lowest was under MTNRN30 (0.90) followed by MTNRN0 (0.94), indicating relatively less aggradative effects. The application of 90 kg N ha-1 under minimum tillage even without applying any residue (MTNRN90) proved quite effective in maintaining soil quality index as high as 1.10. The key indicators, which contributed considerably towards SQI, were available N, K, S, microbial biomass carbon (MBC) and hydraulic conductivity (HC). On average, the order of relative contribution of these indicators towards SQI was: available N (32%), MBC (31%), available K (17%), HC (16%), and S (4%). Among the various treatments, CTGLN90 not only had the highest SQI, but also the most promising from the viewpoint of sustainability, maintaining higher average yield levels under sorghum-castor rotation. From the view point of SYI, CT approach remained superior to MT. To maintain the yield as well as soil quality in Alfisols, primary tillage along with organic residue and nitrogen application are needed.
Keywords: Soil quality assessment; Soil quality indicators; Alfisol; Tillage; Crop residue; India

Claudivan Feitosa de Lacerda, Jose Cambraia, Marco Antonio Oliva, Hugo Alberto Ruiz, Changes in growth and in solute concentrations in sorghum leaves and roots during salt stress recovery, Environmental and Experimental Botany, Volume 54, Issue 1, August 2005, Pages 69-76, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2004.06.004.
(http://www.sciencedirect.com/science/article/B6T66-4D48X0R-2/2/5094353e0bfe03767033d9cd8a9daba3)
Abstract:
Seedlings of two sorghum genotypes [Sorghum bicolor (L.) Moench], one salt tolerant (CSF 20) and another salt sensitive (CSF 18) were exposed to 0 (control) and 100 mM NaCl (salt stress) in nutrient solution for seven days and, then, transferred to a new nutrient solution with no added NaCl for an additional period of five days (salt recovery). Plants were collected at the 7th (salt stressed) and 12th days (salt recovered) and relative growth rate (RGR) and organic and inorganic solutes in leaves and roots were determined. Salinity reduced RGR and increased Na+, Cl-, soluble carbohydrates and proline concentrations, and Na+/K+ and Na+/Ca2+ ratios, especially in the leaves of the salt sensitive genotype. During salt stress recovery, RGR of roots was lower in previously stressed seedlings, but shoot growth did not differ between these seedlings and control unstressed ones, in both genotypes. Salt recovered seedlings showed decrease in leaf Na+ plus Cl- concentrations and in Na+/Ca2+ ratio, and in root Na+/K+ ratio. The reductions in organic solutes concentrations were quite small, especially in the older leaves. A lower toxic ion accumulation during salt stress was related to salt tolerance and to seedling growth during salt recovery phase. On the contrary, higher leaf organic solute accumulation during salt stress was not related nor to salt tolerance nor to seedling recovery after salt stress relief. So, the high capacity of sorghum seedlings to recover after salt stress relief appears to be related to an adequate partition of carbon between shoots and roots and to changes in absorption, transport and re-translocation of salts.
Keywords: Inorganic solutes; Organic solutes; Salinity; Salt recovery; Sorghum bicolor

Abd Elmoneim O. Elkhalifa, B. Schiffler, R. Bernhardt, Effect of fermentation on the functional properties of sorghum flour, Food Chemistry, Volume 92, Issue 1, August 2005, Pages 1-5, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.05.058.
(http://www.sciencedirect.com/science/article/B6T6R-4FF8WMK-1/2/97d8059275e3aa121cf4e6f99dbfa34b)
Abstract:
Sorghum flour was fermented by the traditional Sudanese method of fermentation for 24 h, taking samples every 8 h, and selected functional properties were studied. Results showed that fermentation increased the protein solubility of sorghum flour in the acidic range (pH 2-4).

Fermented sorghum flour had a least gelation concentration of 6% after 16 h of fermentation, while it was 18% for unfermented sorghum. Fermentation also increased oil-binding capacity, emulsifying capacity and emulsifying stability, while it decreased the water-binding capacity. Sorghum flour, fermented or unfermented, showed no foam capacity.
Keywords: Sorghum flour; Fermentation; Functional properties

E.N. Fombang, J.R.N. Taylor, C.M.F. Mbofung, A. Minnaar, Use of [gamma]-irradiation to alleviate the poor protein digestibility of sorghum porridge, Food Chemistry, Volume 91, Issue 4, August 2005, Pages 695-703, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.06.042.
(http://www.sciencedirect.com/science/article/B6T6R-4D98JP5-B/2/e3a847fb27c745dba838c9c643e46de7)
Abstract:
One limitation to the use of sorghum as a food is that its proteins become more indigestible on wet-cooking, primarily through the formation of disulphide-linked enzymatically resistant protein polymers. Irradiation can modify bonds involved in protein secondary structure. The effects of irradiation (10 and 50 kGy) of dry and wet sorghum and maize flours on the digestibility and solubility of their proteins, when further cooked into porridge, were investigated. Irradiation of sorghum flour, followed by cooking, alleviated the adverse effect of cooking on sorghum protein digestibility. Maize porridge digestibility was unaffected by irradiation of dry flour but decreased with wet-irradiation. Increase in digestibility was not accompanied by an increase in protein solubility, suggesting that it was probably related to modification of protein structure, allowing better access to proteolytic enzymes. Maillard reactions and protein aggregation, at high doses, negatively affected digestibility. Polyphenols influenced the effects of irradiation.
Keywords: Protein digestibility; Sorghum; Maize; Porridge; Irradiation; Maillard reactions; Protein aggregation; Polyphenols

Prashant S. Hegde, T.S. Chandra, ESR spectroscopic study reveals higher free radical quenching potential in kodo millet (Paspalum scrobiculatum) compared to other millets, Food Chemistry, Volume 92, Issue 1, August 2005, Pages 177-182, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.08.002.
(http://www.sciencedirect.com/science/article/B6T6R-4DM2BYK-7/2/8244ef0bbb35afd185d8cf8205ab70e6)
Abstract:
Six different millets kodo millet (Paspalum scrobiculatum), finger millet (Eleusine coracana), little millet (Panicum miliare), foxtail millet (Setaria italica), barnyard millet (Echinochloa utilis) and great millet (Sorghum bicolor) grown in India and their white varieties were screened for free radical quenching of 1,1, Diphenyl-2-picrylhydrazyl (DPPH) by electron spin resonance (ESR). Methanol extracts of the kodo millet flour showed 70% DPPH quenching in comparison to other millet extracts which showed 15-53%. The white varieties of great millet, finger millet and foxtail millet showed lower quenching than their coloured counterparts, indicating that phenolics in the seed coat could be responsible for the antioxidant activities. However, the content of the phenols and tannin in these grains did not correlate with the antioxidant activities. Kodo millet had the highest DPPH quenching activity followed by great millet and finger millet. Cooking of kodo or finger millet by roasting or boiling reduced the activity. Fractionation of kodo millet in to husk and endosperm also decreased the activity and the phytochemicals appear to act synergistically.
Keywords: Kodo millet; Paspalum scrobiculatum; Finger millet; Eleusine coracana; Little millet; Panicum miliare; Foxtail millet; Setaria italica; Barnyard millet; Echinochloa utilis; Great millet; Sorghum bicolor; 1,1, Diphenyl-2-picrylhydrazyl; Electron spin resonance; Free radical; Antioxidant; Phenolics; Scavenging effects

G. Animut, A.L. Goetsch, G.E. Aiken, R. Puchala, G. Detweiler, C.R. Krehbiel, R.C. Merkel, T. Sahlu, L.J. Dawson, Z.B. Johnson, T.A. Gipson, Grazing behavior and energy expenditure by sheep and goats co-grazing grass/forb pastures at three stocking rates, Small Ruminant Research, Volume 59, Issues 2-3, Methodology nutrition and products quality in grazing sheep and goats, August 2005, Pages 191-201, ISSN 0921-4488, DOI: 10.1016/j.smallrumres.2005.05.014.
(http://www.sciencedirect.com/science/article/B6TC5-4GDBTFD-1/2/95cbc4e5551437eab84840c7922b779d)
Abstract:
A study was conducted to assess effects of stocking rate (SR) on grazing behavior and energy expenditure (EE) by growing sheep and goat wethers co-grazing grass/forb pastures. Grazing was for 16-week periods in 2002 and 2003. Pastures consisted of various grasses, primarily bermudagrass (Cynodon dactylon) and johnsongrass (Sorghum halepense), and forbs (e.g., ragweed; Ambrosia spp.). Sheep (Khatadin) and goats (>=75% Boer) averaged 21 +/- 0.7 and 21 +/- 0.5 kg initial BW, respectively, and were 4-5 months of age when grazing began. Stocking rates were four (SR4), six (SR6), and eight (SR8) animals per 0.4-ha pasture, with equal numbers of sheep and goats. The nine pastures (three/treatment) were divided into four paddocks that were rotationally grazed in 2-week periods. In weeks 3, 8, and 13 of both years, EE was determined on one goat and one sheep in each pasture via heart rate. In the same weeks, behavioral observations (position and activity) were made every 30 min of 13.5 h of daylight on two goats and two sheep in each pasture. Grazing behavior using IGER Grazing Behavior Monitoring System units was also measured over 24-h periods on animals used for EE measurement. Based on visual observations, grazing (52.7, 57.1, and 61.4%) and standing time (61.1, 66.3, and 69.8%) increased and idle time in daylight (24.2, 21.1, and 15.9% for SR4, SR6, and SR8, respectively) decreased linearly ($P < 0.05$) as SR increased. Species interacted ($P < 0.05$) with year in daylight time spent standing and ruminating. Grazing time during daylight was similar between species (56.1 and 58.0% for sheep and goats, respectively), although idle time was greater ($P < 0.05$) for goats (23.6% versus 17.2%; S.E. = 1.41). Time spent ruminating in daylight was similar among SR but was greater for sheep in year 2 but not year 1 (year 1, 22.3% versus 19.0%; year 2, 27.8% versus 15.1% for sheep and goats, respectively; S.E. = 1.44). Based on the IGER units, the number of steps increased linearly ($P < 0.05$) with increasing SR (2279, 2707, and 2788 for SR4, SR6, and SR8, respectively (S.E. = 96.4)), but was similar for the two species. As SR increased, time spent eating increased (7.4, 8.4, and 9.6 h) and time spent lying (11.0, 10.2, and 8.9 h), ruminating (7.9, 7.7, and 6.8 h), and idle (8.6, 8.0, and 7.6 h for SR4, SR6, and SR8, respectively) decreased ($P < 0.05$). Goats spent less time eating (1.1 h) and more time idle (0.7 h) than did sheep ($P < 0.05$). SR, species, and year interacted ($P < 0.05$) in EE of wethers (year 1, sheep: 510, 569, and 572 kJ/kg BW0.75; year 2, sheep: 572, 597, and 648 kJ/kg BW0.75; year 1, goat: 524, 524, and 640 kJ/kg BW0.75; year 2, goat: 499, 496, and 551 kJ/kg BW0.75 for SR4, SR6, and SR8, respectively; S.E. = 17.0). In summary, influences of SR on grazing time and EE can vary with grazing season. With forage conditions of this study, SR had similar effects on grazing behavior of sheep and goats when co-grazing. Effects of SR on EE may contribute to impact on ADG by small ruminants.
Keywords: Goat; Sheep; Co-grazing; Energy expenditure; Behavior; Stocking rate

G. Animut, A.L. Goetsch, G.E. Aiken, R. Puchala, G. Detweiler, C.R. Krehbiel, R.C. Merkel, T. Sahlu, L.J. Dawson, Z.B. Johnson, T.A. Gipson, Performance and forage selectivity of sheep and goats co-grazing grass/forb pastures at three stocking rates, Small Ruminant Research, Volume 59, Issues 2-3, Methodology nutrition and products quality in grazing sheep and goats, August 2005, Pages 203-215, ISSN 0921-4488, DOI: 10.1016/j.smallrumres.2005.05.015.
(http://www.sciencedirect.com/science/article/B6TC5-4GFCPXR-8/2/fb536f78161ad371a78beae059873deb)

Abstract:
Differences among ruminant species in forage selectivity offer potential for efficient utilization of pastures with diverse arrays of plant species. One common management strategy that may influence forage selectivity is stocking rate (SR). Therefore, this experiment was conducted to determine effects of SR on performance and forage selectivity of growing sheep and goat wethers co-grazing grass/forb pastures. Grazing was for 16 weeks in 2002 and 2003. Pastures consisted of various grasses, primarily bermudagrass (Cynodon dactylon) and johnsongrass (Sorghum halepense), and forbs (e.g., ragweed; Ambrosia spp.). Sheep (Khatadin) and goats (75% Boer) averaged 21 +/- 0.7 and 21 +/- 0.5 kg initial BW, respectively, and were 4-5 months of age when grazing began. Stocking rates were four (SR4), six (SR6), and eight (SR8) animals per 0.4-ha pasture, with equal numbers of sheep and goats. The nine pastures (three/treatment) were divided into four paddocks for rotational grazing in 2-week periods. Forage mass (pre- and post-grazed) and composition of grass versus forbs were determined by quadrat samples and transect analysis, respectively. BW was measured every 4 weeks and preference values for grass, forbs, and ragweed (10: highest possible preference; 0: consumption in proportion to availability; -10: no consumption) were determined from fecal microhistology and transect measures. There was a year x SR interaction ($P < 0.05$) in herbage DM mass before grazing (year 1: 2937, 3298, and 3351 kg/ha; year 2: 3033, 2928, and 2752 kg/ha for SR4, SR6, and SR8, respectively (S.E. = 174.4)). Post-grazed forage mass decreased linearly ($P < 0.05$) as SR increased (2279, 1693, and 1288 kg/ha for SR4, SR6, and SR8, respectively (S.E. = 102.6)). In vitro true DM digestibility of pre-grazed forage samples was similar among SR, but SR x year interacted ($P < 0.05$) for post-grazed samples (year 1: 57.0, 54.4, and 53.5; year 2: 56.8, 49.0, and 48.3 for SR4, SR6, and SR8, respectively (S.E. = 2.16). Year and SR interacted ($P < 0.05$) in the percentage of grass in pastures post-grazing determined by transect (year 1: 64, 69, and 74%; year 2: 50, 66, and 73% for SR4, SR6, and SR8, respectively (S.E. = 8.4)). The preference for grasses was higher and that for total forbs lower for sheep than for goats ($P < 0.05$). The preference value for ragweed, measured in year 2, was lower ($P < 0.05$) for sheep than for goats (-1.6 versus 0.2) and increased linearly with increasing SR. Average daily gain tended ($P < 0.10$) to decrease linearly as SR increased (61, 51, and 47 g/day), and total BW gain per hectare increased linearly ($P < 0.05$; 610, 759, and 933 g/day for SR4, SR6, and SR8, respectively). In conclusion, post-grazing herbage mass >1000 kg/ha at most measurement times suggests that decreasing forage availability with increasing SR may not have been primarily or solely responsible for the effect on ADG by limiting DM intake. Rather, the effect of SR on available forage mass could have limited the ability of both sheep and goats to compensate for the effect of SR on forage nutritive value.
Keywords: Goat; Sheep; Co-grazing; Stocking rate; Mixed pastures

M.A. Kahlown, M. Ashraf, Zia-ul-Haq, Effect of shallow groundwater table on crop water requirements and crop yields, Agricultural Water Management, Volume 76, Issue 1, 30 July 2005, Pages 24-35, ISSN 0378-3774, DOI: 10.1016/j.agwat.2005.01.005.
(http://www.sciencedirect.com/science/article/B6T3X-4FPX2N4-2/2/e231e959c71ea6db1db90a352beff38d)
Abstract:
Due to the increasing demand for food and fiber by its ever-increasing population, the pressure on fresh water resources of Pakistan is increasing. Optimum utilization of surface and groundwater resources has become extremely important to fill the gap between water demand and supply. At Lahore, Pakistan 18 lysimeters, each 3.05 m x 3.05 m x 6.1 m deep were constructed to investigate the effect of shallow water tables on crop water requirements. The lysimeters were connected to bottles with Marriotte siphons to maintain the water tables at the desired levels and tensiometers were installed to measure soil water potential. The crops studied included wheat, sugarcane, maize, sorghum, berseem and sunflower. The results of these studies showed that the contribution of groundwater in meeting the crop water requirements varied with the water-table

depth. With the water table at 0.5 m depth, wheat met its entire water requirement from the groundwater and sunflower absorbed more than 80% of its required water from groundwater. Maize and sorghum were found to be waterlogging sensitive crops whose yields were reduced with higher water table. However, maximum sugarcane yield was obtained with the water table at or below 2.0 m depth. Generally, the water-table depth of 1.5-2.0 m was found to be optimum for all the crops studied. In areas where the water table is shallow, the present system of irrigation supplies and water allowance needs adjustments to avoid over irrigation and in-efficient use of water.
Keywords: Groundwater contribution; Crop water requirements; Crop yield; Salinity distribution; Wheat; Sugarcane; Maize; Sorghum; Berseem; Sunflower and Pakistan

Pushpak J. Mehta, Curtis C. Wiltse, William L. Rooney, S. Delroy Collins, Richard A. Frederiksen, Dale E. Hess, Medson Chisi, David O. TeBeest, Classification and inheritance of genetic resistance to anthracnose in sorghum, Field Crops Research, Volume 93, Issue 1, 14 July 2005, Pages 1-9, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.09.001.
(http://www.sciencedirect.com/science/article/B6T6M-4DJ4CJ9-1/2/cab9acdbf8e832326bf33b035c12cbcc)
Abstract:
Anthracnose is a major disease of sorghum [Sorghum bicolor (L.) Moench]. Breeding for stable host plant resistance to this disease has been difficult due to the variable nature of the pathogen and an incomplete understanding of the host/pathogen interaction. To develop new lines with possibly more durable forms of resistance, different sources of genetic resistance must be identified and characterized. The objectives of this study were (1) to determine if different sources with anthracnose resistance possess different genes for resistance, (2) to determine the inheritance of anthracnose resistance in the groups identified in Objective 1, and (3) to identify which sources provide resistance across environments. Populations created from hybridizing resistant by resistant lines were evaluated to determine if segregation for resistance occurred within a family. The presence of segregation (susceptible plants) within a population indicated that the parents have different resistance genes. In the 11 germplasms evaluated, five different sources of resistance were identified. Segregation ratios in resistant x susceptible F2 populations were consistent with the expectations of simply inherited traits and resistance was dominant in some lines and recessive in others. Evaluation of the sources of resistance across environment indicated that one source (SC748-5) provided resistance in all evaluation environments. Methods for the use of this germplasm in anthracnose resistance breeding are recommended.
Keywords: Anthracnose; Sorghum; Genetic resistance

J. Rodenburg, L. Bastiaans, E. Weltzien, D.E. Hess, How can field selection for Striga resistance and tolerance in sorghum be improved?, Field Crops Research, Volume 93, Issue 1, 14 July 2005, Pages 34-50, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.09.004.
(http://www.sciencedirect.com/science/article/B6T6M-4DK681N-3/2/e923337db7c39e41102d7a4e8cf81479)
Abstract:
Breeding for high yielding Sorghum bicolor varieties with effective resistance and tolerance against the hemi-parasitic weed Striga hermonthica requires suitable selection measures for both characteristics. The objective of this research was to constitute a set of practical selection measures that contain independent, reliable and discriminative criteria for resistance and tolerance. Ten sorghum genotypes were grown in the field with and without Striga infestation in a split-plot design in 3 successive years (2001-2003) using different Striga infestation levels (low, high and intermediate). Resistance against Striga in the below-ground stages was determined separately in an agar-gel assay and a pot trial.

The addition of Striga-free control plots facilitated the calculation of the relative yield loss, which represents the result of resistance and tolerance combined. Correlation analysis indirectly demonstrated that both resistance and tolerance are important yield determining traits under Striga infestation. Tolerance was relatively more important under low Striga infestation levels, whereas resistance was relatively more important at high infestation levels. With respect to resistance, both the area under the Striga number progress curve (ASNPC) and maximum above-ground Striga number (NSmax) turned out to be discriminative and consistent selection measures. Both measures also corresponded well with the expression of resistance during below-ground stages of the parasite. It proved more difficult to arrive at a satisfactory measure for tolerance. Inclusion of Striga-free plots is an essential step for the determination of tolerance, but in itself not sufficient. It provides a basis for the determination of the relative yield loss, which then needs to be corrected for differences in infection level resulting from genotypic differences in resistance. A linear correction for infection level disregards the density dependency of the relative yield loss function. It is expected that clarification of the relation between Striga infection level and yield loss, provides a solid basis for the development of unambiguous tolerance measures in the field. This will enable the breeder to select for resistance and tolerance separately, which is likely to result in the optimum combination of both defence mechanisms.
Keywords: Sorghum bicolor; Striga hermonthica; Parasitic weeds; Screening methodologies

L.I. Ezeogu, K.G. Duodu, J.R.N. Taylor, Effects of endosperm texture and cooking conditions on the in vitro starch digestibility of sorghum and maize flours, Journal of Cereal Science, Volume 42, Issue 1, July 2005, Pages 33-44, ISSN 0733-5210, DOI: 10.1016/j.jcs.2005.02.002.
(http://www.sciencedirect.com/science/article/B6WHK-4G65NH4-3/2/a43aa626930032b2035084170c0a24e8)
Abstract:
The effects of endosperm vitreousness, cooking time and temperature on sorghum and maize starch digestion in vitro were studied using floury and vitreous endosperm flours. Starch digestion was significantly higher in floury sorghum endosperm than vitreous endosperm, but similar floury and vitreous endosperm of maize. Cooking with 2-mercaptoethanol increased starch digestion in both sorghum and maize, but more with sorghum, and more with vitreous endosperm flours. Increasing cooking time progressively reduced starch digestion in vitreous sorghum endosperm but improved digestibility in the other flours. Pressure-cooking increased starch digestion in all flours, but markedly more in vitreous sorghum flour; probably through physical disruption of the protein matrix enveloping the starch. Irrespective of vitreousness or cooking condition, the alpha-amylase kinetic constant (k) for both sorghum and maize flours remained similar, indicating that differences in their starch digestion were due to factors extrinsic to the starches. SDS-PAGE indicated that the higher proportion of disulphide bond-cross-linked prolamin proteins and more extensive polymerisation of the prolamins on cooking, resulting in polymers of Mr>100k, were responsible for the lower starch digestibility of the vitreous sorghum endosperm flour.
Keywords: Vitreous endosperm; Floury endosperm; Starch digestibility; Sorghum; Maize; Cooking; Kafirin; Zein

Johan Memelink, Tailoring the plant metabolome without a loose stitch, Trends in Plant Science, Volume 10, Issue 7, July 2005, Pages 305-307, ISSN 1360-1385, DOI: 10.1016/j.tplants.2005.05.006.
(http://www.sciencedirect.com/science/article/B6TD1-4GC1RR9-1/2/e4084125dc9993db59404707e8209926)
Abstract:
Metabolic engineering holds great promise as a technique for improving crop plants. However, introducing new metabolic steps can disturb normal metabolism and gene expression, affecting phenotype and quality in undesired ways. Recently, Charlotte Kristensen et al. reported that

introducing the sorghum pathway for biosynthesis of the cyanogenic glucoside dhurrin into Arabidopsis plants resulted in high dhurrin levels and only marginal side effects on the metabolome and the transcriptome.

Rossella Albrizio, Pasquale Steduto, Resource use efficiency of field-grown sunflower, sorghum, wheat and chickpea: I. Radiation use efficiency, Agricultural and Forest Meteorology, Volume 130, Issues 3-4, 30 June 2005, Pages 254-268, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2005.03.009.
(http://www.sciencedirect.com/science/article/B6V8W-4G7NSN9-1/2/29c5e8bf363ea9d8b1867ba3e168b33f)
Abstract:
Radiation use efficiency ([var epsilon]) is a crop parameter widely used in crop simulation models, derived here as the slope of the relationship linking crop carbon gain to cumulative intercepted solar radiation. Our objectives were to: (i) determine [var epsilon] of field-grown sunflower, sorghum, wheat and chickpea, at three levels of aggregation--day-time net assimilation (A), daily net carbon gain as difference between A and night-time dark respiration (R) and biomass; (ii) assess the robustness of [var epsilon] parameter in terms of ability to discriminate between C3 and C4 species, pre- and post-anthesis and impact of nitrogen status; (iii) evaluate the opportunity to normalize [var epsilon] for climate. Field experiments were conducted in 1998 and 1999 in southern Italy. All crops were well watered. Sunflower and sorghum had two nitrogen application treatments, wheat only one and chickpea had no added nitrogen. Daily intercepted solar radiation was derived from measurements of daily incident solar radiation and the percentage of mid-day light interception. Closed-system canopy chambers monitored canopy gas-exchange rates. [var epsilon], expressed in terms of A, A - R or above-ground biomass, was linear over the entire growth cycle of sorghum and wheat, and up to anthesis in sunflower and chickpea, independent of temperature, vapour pressure deficit and radiation regimes. In sunflower, deviation from linearity was observed after anthesis, due to higher carbon cost in yielding oil seeds. No conclusions could be drawn for post-anthesis chickpea due to the interruption of the experiment caused by a thunderstorm. Overall results showed a great variability in [var epsilon] values, independently of classes of species (C4 and C3), crops and nitrogen treatments. This indicates that the robustness of [var epsilon] to predict biomass productivity in crop simulation models is constrained. Attempts to normalize [var epsilon] by vapour pressure deficit (D), for reducing its variability due to climate and overlaps between crops failed.
Keywords: Crop-growth modelling; Climate normalization; Canopy gas-exchange

Pasquale Steduto, Rossella Albrizio, Resource use efficiency of field-grown sunflower, sorghum, wheat and chickpea: II. Water use efficiency and comparison with radiation use efficiency, Agricultural and Forest Meteorology, Volume 130, Issues 3-4, 30 June 2005, Pages 269-281, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2005.04.003.
(http://www.sciencedirect.com/science/article/B6V8W-4G94HJ5-1/2/615ab1cb33a2f9e1fac1b2fc52bbce71)
Abstract:
Water use efficiency (w) is a crop parameter of outstanding importance in crop simulation models, derived here as the slope of the relationship linking crop carbon gain to cumulative transpiration. This study aims at: (i) evaluating w of field-grown sunflower, sorghum, wheat and chickpea, at three levels of aggregation--day-time net assimilation (A), daily net carbon gain, as difference between A and night-time dark respiration (R), and biomass; (ii) assessing the robustness of w parameter in terms of ability to discriminate between C3 and C4 species, pre- and post-anthesis, impact of nitrogen status; (iii) investigating the opportunity to normalize w by climate, using FAO-Penman-Monteith reference evapotranspiration (Eref) or atmospheric saturation vapour pressure deficit (D); (iv) comparing w with the corresponding radiation use efficiency ([var epsilon]) results

presented in the companion paper. Field experiments were conducted in 1998 and 1999 in southern Italy. All crops were well watered. Sunflower and sorghum had two nitrogen application treatments: wheat had only one and chickpea had no added nitrogen. Closed-system canopy chambers, automated for continuous measurements, were used to monitor gas-exchanges at the canopy scale, in terms of both carbon exchange rate (CER) and evapotranspiration E, and the cuvette method to monitor gas-exchange at the leaf scale. w, expressed in terms of A, A - R, or above-ground biomass, was linear over the entire cycle of sorghum and wheat, and up to anthesis in sunflower and chickpea, independent of temperature, vapour pressure deficit and radiation regimes. In sunflower, deviation from linearity was observed after anthesis due to higher carbon cost in yielding oil seeds. No conclusions could be drawn for post-anthesis chickpea due to the destruction of the crop by a thunderstorm. The overall response patterns were common to w and [var epsilon]. Nevertheless, w proved to be more robust than [var epsilon] due to its high capacity to discriminate between species groups (C3 from C4) and its effectiveness in normalizing the values for climate, provided it is implemented through Eref rather than D. All the above confers larger extrapolative ability to w-based crop models.
Keywords: Crop-growth modelling; Climate normalization; Canopy gas-exchange

E. Gnansounou, A. Dauriat, C.E. Wyman, Refining sweet sorghum to ethanol and sugar: economic trade-offs in the context of North China, Bioresource Technology, Volume 96, Issue 9, June 2005, Pages 985-1002, ISSN 0960-8524, DOI: 10.1016/j.biortech.2004.09.015.
(http://www.sciencedirect.com/science/article/B6V24-4DWHJ1R-2/2/bbc5f02b3d22ee7bb6784be194ee160f)
Abstract:
Reducing the use of non-renewable fossil energy reserves together with improving the environment are two important reasons that drive interest in the use of bioethanol as an automotive fuel. Conversion of sugar and starch to ethanol has been proven at an industrial scale in Brazil and the United States, respectively, and this alcohol has been able to compete with conventional gasoline due to various incentives. In this paper, we examined making ethanol from the sugar extracted from the juice of sweet sorghum and/or from the hemicellulose and cellulose in the residual sorghum bagasse versus selling the sugar from the juice or burning the bagasse to make electricity in four scenarios in the context of North China. In general terms, the production of ethanol from the hemicellulose and cellulose in bagasse was more favorable than burning it to make power, but the relative merits of making ethanol or sugar from the juice was very sensitive to the price of sugar in China. This result was confirmed by both process economics and analysis of opportunity costs. Thus, a flexible plant capable of making both sugar and fuel-ethanol from the juice is recommended. Overall, ethanol production from sorghum bagasse appears very favorable, but other agricultural residues such as corn stover and rice hulls would likely provide a more attractive feedstock for making ethanol in the medium and long term due to their extensive availability in North China and their independence from other markets. Furthermore, the process for residue conversion was based on particular design assumptions, and other technologies could enhance competitiveness while considerations such as perceived risk could impede applications.
Keywords: Energy; Ethanol; Sugar; Sweet sorghum; Economics

M. Ngouajio, H. Mennan, Weed populations and pickling cucumber (Cucumis sativus) yield under summer and winter cover crop systems, Crop Protection, Volume 24, Issue 6, June 2005, Pages 521-526, ISSN 0261-2194, DOI: 10.1016/j.cropro.2004.10.004.
(http://www.sciencedirect.com/science/article/B6T5T-4DVW22S-1/2/2c4e57060792a8ae4131a7c8bc90e18f)
Abstract:
Cucumber growers are increasingly interested in integrating cover crops into their cropping systems. This study was conducted to measure the effect of summer and winter cover crops on

weed populations and cucumber yield. The experimental design was a factorial of cover crop and killing method. The cover crops were sorghum sudangrass [Sorghum bicolor (L) x S. sudanense (P) Stapf.], cereal rye (Secale cereale L.), hairy vetch (Vicia villosa Roth), and bare ground was used as a control. The cover crops were killed either by discing or with glyphosate application. Cover crop killing method had no effect on weed density, weed species composition, cucumber yield, and soil nutrient composition. Weed density was lower in all cover crop systems compared to bare ground. At 43 days after cover crop kill (DAK) in 2002, weed density was 40, 56, 65, and 372 plants m-2 in the sorghum sudangrass, cereal rye, hairy vetch, and bare ground treatments, respectively. Similar results were found at 40 DAK in 2003. Cucumber yield was the highest in sorghum sudangrass and rye systems, and lowest in the hairy vetch system. Sorghum sudangrass and rye showed potential for improvement of cucumber yield. However, fresh residue of rye in early summer may interfere with crop planting. In spite of the high weed suppression, the hairy vetch system was unacceptable because of the low cucumber yield.
Keywords: Cereal rye; Hairy vetch; Integrated crop management; Secale cereale; Sorghum bicolor; Species richness; Sustainable; Vicia villosa

Indra K. Vasil, In: N. Seetharama and I. Godwin, Editors, Sorghum Tissue Culture and Transformation, Science Publishers, Inc., Enfield, NH, USA (2004) ISBN 1-57808-218-8, p. 168 pp.., Plant Science, Volume 168, Issue 6, June 2005, Page 1645, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2005.02.012.
(http://www.sciencedirect.com/science/article/B6TBH-4FNW1HF-3/2/40a1584a55bb57d34058b42fafa4a63c)

Joshua Miron, Ephraim Zuckerman, Dganit Sadeh, Gabriel Adin, Moses Nikbachat, Edith Yosef, Daniel Ben-Ghedalia, Avner Carmi, Tal Kipnis, Ran Solomon, Yield, composition and in vitro digestibility of new forage sorghum varieties and their ensilage characteristics, Animal Feed Science and Technology, Volume 120, Issues 1-2, 9 May 2005, Pages 17-32, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.01.008.
(http://www.sciencedirect.com/science/article/B6T42-4FGX5C9-3/2/28b4e4140d057143afeee1663873ad83)
Abstract:
The objective of this study was to examine the effect of the ensilage process on yield, composition and in vitro digestibility of three new forage sorghum (Sorghum bicolor) varieties: Silobuster, Supersile 20, and the brown-midrib hybrid BMR-101. The commercial forage sorghum FS-5 was used as reference variety. Varieties were irrigated during summer with 242 mm water and harvested at their soft dough (SD) stage. All varieties were tall (>2.5 m), and their dry matter (DM) content at harvest was similar (270-280 g DM/kg green forage). FS-5 and BMR-101 contained higher proportion of heads on the account of lower proportion of leaves in FS-5, and stems in BMR-101. In all varieties the leaves tended to contain more neutral detergent fiber (aNDFom) and were characterized by lower DM digestibility as compared with the stems and heads organs. Silobuster and BMR-101 suffered from high lodging (43-65%), whereas FS-5 and Supersile 20 were characterized by moderated levels of lodging (27-30%) at harvest. Dry matter yield of the green forage was similar (15.3-16.5 t/ha) in all varieties. The ensilage of all varieties in glass silos resulted in moderated DM losses (<0.09 of yield) mostly as volatile gases, solubilization of 0.05-0.15 hemicellulose, and high conversion of water soluble carbohydrate (WSC) mostly into lactate, traces of ethanol and traces of volatile fatty acids (VFA). Consequently, similar pH (<4) was obtained in the silages of all varieties. In vitro DM digestibility of silage was similar in all varieties and ranged between 0.67 and 0.69. Silage aNDFom digestibility and yields per hectare of digestible silage DM and aNDFom were also similar. Ensilage resulted in 0.09-0.15 loss of digestible DM yield per hectare, and 0.04-0.14 loss of digestible aNDFom yield per hectare. Efficiency of water utilization for the production of digestible silage DM was high in all varieties.

This study shows advantage of commercial FS-5 over the new varieties due to its better resistance to lodging and high quality silage.
Keywords: Sorghum varieties; Ensilage effect; Composition; In vitro digestibility

C.C. Kyarisiima, M.W. Okot, B. Svihus, Use of wood ash extract and germination to improve the feeding value of Ugandan Sekedo sorghum (Sorghum bicolor) for broiler chicks, Animal Feed Science and Technology, Volume 120, Issues 1-2, 9 May 2005, Pages 67-77, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2004.10.008.
(http://www.sciencedirect.com/science/article/B6T42-4FFX9B5-1/2/c396db0a693c98eeef426320ff38ff41)
Abstract:
Three experiments were conducted to investigate the effect of treating Sekedo sorghum (SK) with wood ash extract on its feeding value for broiler chicks. Sekedo was either soaked in water and germinated for 26 h (WG), soaked in wood extract (AS), germinated after soaking in ash extract (AG) or left untreated (UT). The first experiment was a 1-week-long metabolism trial with SK constituting 980 g/kg diet. In the subsequent 4-week feeding trials (Experiments 2 and 3), the grain constituted 500 g/kg of the experimental diets, to make practical rations. Tannin content of SK was 44.9 +/- 2.5 g catechin equivalents (CE)/kg on dry matter basis. Treatment of SK with wood ash extract reduced its tannin content and greatly improved its apparent metabolizable energy (MEn) value. In Experiment 2, there was a significant improvement ($P < 0.05$) in growth rate and feed efficiency of chicks fed the AG diet. Ileal digestibility of dietary protein and fat were significantly ($P < 0.05$) higher for the AS and AG diets than for the WG and UT diets. In Experiment 3, coefficient of ileal digestibility of dry matter for the UT diet was inferior ($P < 0.05$) to that of the AS and AG diets although feed intake and body weight gain were not significantly different.
Keywords: Chicks; Sorghum; Tannins; Wood ash extract

R.O. Balogun, J.B. Rowe, S.H. Bird, Fermentability and degradability of sorghum grain following soaking, aerobic or anaerobic treatment, Animal Feed Science and Technology, Volume 120, Issues 1-2, 9 May 2005, Pages 141-150, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.01.005.
(http://www.sciencedirect.com/science/article/B6T42-4FH4V50-1/2/3bad4e8ccb32ea358fdb2ae8c39a6519)
Abstract:
This study determined the effect of soaking (steeping), aerobic (germination) and anaerobic (reconstitution) treatments on the solubility of carbohydrate and nitrogen, and on the in vitro fermentability and in sacco degradability of dry matter (DM) of sorghum grain (Sorghum bicolor cv Western Red). Samples of grain were dry rolled (DR, control), soaked (SK), stored anaerobically for 21 d (reconstitution, AS21), stored aerobically for 5 d (germination, G5) or stored aerobically for 5 d and then anaerobically for 16 d (G5AS16). Compared to the DR treatment, only G5AS16 treatment reduced ($P < 0.05$) starch content by 2% units. Free sugar and buffer-soluble nitrogen contents were higher ($P < 0.05$) in G5 and G5AS16 sorghum (21 and 54 g kg-1 DM; 241 and 375 g kg-1 total nitrogen, respectively) than in DR sorghum (8 g kg-1 DM; 142 g kg-1 total nitrogen, respectively). Free sugar and buffer-soluble nitrogen contents were similar ($P > 0.05$) for SK, AS21 and DR control sorghum. Following a 5-h incubation in buffered rumen liquor, G5 and G5AS21 treatments increased ($P < 0.05$) the in vitro fermentability of sorghum compared to the DR control treatment. This was indicated by increases in gas production (121-215%), volatile fatty acid (VFA) production (98.6-210%) and the amount of starch fermented (22-47%), following a 5-h incubation with buffered rumen liquor. In sacco degradability of DM in sorghum after 48 h of incubation was higher for G5 and G5AS16 (0.44 and 0.45, respectively) treatment than for DR, SK and AS21 treatments (0.39, 0.36 and 0.34, respectively). SK and AS21 treatments did not increase the degradability of sorghum compared to the DR treatment. It was concluded that the germination

process occurring during aerobic treatment improved the fermentability and degradability of sorghum compared to other treatments investigated in this study.
Keywords: Sorghum; Processing; Aerobic; Anaerobic; Degradability; Fermentability

G. Mariscal-Landin, J.E.L. Rodriguez, T.C. Reis de Souza, Evaluation of hulless barley as feed ingredient in growing-finishing pigs diets: amino acid ileal digestibility, Animal Feed Science and Technology, Volume 120, Issues 1-2, 9 May 2005, Pages 169-176, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2005.01.003.
(http://www.sciencedirect.com/science/article/B6T42-4FHRPRM-1/2/db0bbbf09a62e5fe4c8ba918c9a2d5fe)
Abstract:
To evaluate hulless barley in growing pigs, an experiment was conducted to measure the coefficients of apparent ileal digestibility (CAID) of amino acids and protein in sorghum (S), hulless barley (HB) and barley (B) by the difference method, using soya bean meal (SBM) as a protein source. The experiment was carried under a 4 x 4 Latin square design using four castrates of an average initial weight of 40 kg, all fitted with a simple T cannula at the terminal ileum. The experimental diets contained 160 g CP kg-1. CAID of crude protein was similar ($P > 0.05$) among raw materials (0.690); arginine, lysine, isoleucine, methionine, threonine, aspartic acid and glycine, were more digestible ($P < 0.05$) in SBM. CAID of protein and amino acids in cereals was similar ($P > 0.05$). These results suggest that HB and S had a similar nutritional value.
Keywords: Hulless barley; Sorghum; Amino acids; Ileal digestibility; Pigs

Z. Yang, M.N. Rao, N.C. Elliott, S.D. Kindler, T.W. Popham, Using ground-based multispectral radiometry to detect stress in wheat caused by greenbug (Homoptera: Aphididae) infestation, Computers and Electronics in Agriculture, Volume 47, Issue 2, May 2005, Pages 121-135, ISSN 0168-1699, DOI: 10.1016/j.compag.2004.11.018.
(http://www.sciencedirect.com/science/article/B6T5M-4FGXX7M-1/2/915951c8ed2ad9f86794ab681629f612)
Abstract:
Greenbug (Schizaphis graminum (Rondani)) outbreaks appear in the Great Plains almost every year and have had significant economic impacts on wheat and sorghum yields. Early detection of greenbug infestation becomes a critical part of integrated pest management (IPM) for wheat and sorghum production. We conducted a pilot study to determine the feasibility of using remote sensing techniques to detect stress in wheat caused by greenbug infestation. The purpose of this study was to characterize greenbug-induced stress in wheat using a hand-held radiometer. Reflectance data and derived vegetation indices from the 16 bands of the radiometer were analyzed statistically (SAS PROC MIXED). Results show that it is possible to detect greenbug-induced stress in wheat using a hand-held radiometer. The band centered at 694 nm and the vegetation indices derived from bands centered at 800 and 694 nm were identified as most sensitive to damage due to greenbug infestation. Broad Landsat TM bands and derived vegetation indices also showed potential for detecting stress in wheat caused by greenbug infestation.
Keywords: Stress; Ground-based; Radiometry; Crop stress detection; Greenbug infestation; Remote sensing

Duli Zhao, K. Raja Reddy, Vijaya Gopal Kakani, V.R. Reddy, Nitrogen deficiency effects on plant growth, leaf photosynthesis, and hyperspectral reflectance properties of sorghum, European Journal of Agronomy, Volume 22, Issue 4, May 2005, Pages 391-403, ISSN 1161-0301, DOI: 10.1016/j.eja.2004.06.005.
(http://www.sciencedirect.com/science/article/B6T67-4DBKJV4-1/2/62692db132d7a596d819b6064be953c3)
Abstract:

An experiment was conducted under outdoor pot-culture conditions to determine effects of nitrogen (N) deficiency on sorghum growth, physiology, and leaf hyperspectral reflectance properties. Sorghum (cv. DK 44C) was seeded in 360 twelve-litre pots filled with fine sand. All pots were irrigated with half-strength Hoagland's nutrient solution from emergence to 25 days after sowing (DAS). Thereafter, pots were separated into three identical groups and the following treatments were initiated: (1) the control (100% N) continued receiving the half-strength nutrient solution; (2) reduced N to 20% of the control (20% N); and (3) withheld N from the solution (0% N). Photosynthetic rate (Pn), chlorophyll (Chl) and N concentrations, and hyperspectral reflectance of the uppermost, fully expanded leaves were determined at 3- to 4-day-interval from 21 to 58 DAS during the N treatments. Plants were harvested 58 DAS to determine effects of N deficiency on leaf area (LA), biomass accumulation, and partitioning. Nitrogen deficiency significantly reduced LA, leaf Chl content and Pn, resulting in lower biomass production. Decreased leaf Pn due to N deficiency was mainly associated with lower stomatal conductance rather than carboxylation capacity of leaf chemistry. Among plant components of dry weights, leaf dry weight had the greatest and root dry weight had the smallest decrease under N deficiency. Nitrogen-deficit stress mainly increased leaf reflectance at 555 (R555) and 715 nm (R715) and caused a red-edge shift to shorter wavelength. Leaf N and Chl concentrations were linearly correlated with not only the reflectance ratios of R405/R715 (r2 = 0.68***) and R1075/R735 (r2 = 0.64***), respectively, but also the first derivatives of the reflectance (dR/d[lambda]) in red edge centered 730 or 740 nm (r2 = 0.73-0.82***). These specific reflectance ratios or dR/d[lambda] may be used for rapid and non-destructive estimation of sorghum leaf Chl and plant N status.
Keywords: Sorghum; Nitrogen deficiency; Leaf N and chlorophyll; Photosynthesis; Leaf reflectance; Reflectance ratios; Plant N monitoring

J. Taylor, J. R. N. Taylor, M. F. Dutton, S. de Kock, Identification of kafirin film casting solvents, Food Chemistry, Volume 90, Issue 3, May 2005, Pages 401-408, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.03.055.
(http://www.sciencedirect.com/science/article/B6T6R-4CMJCS9-2/2/4db706edb2bfb500c9de1d94f72d6791)
Abstract:
The sorghum prolamin protein, kafirin can be used for making edible films. Several food compatible solvents were examined to identify novel kafirin film casting solvents to replace aqueous ethanol, commonly used for prolamin film casting. Glacial acetic acid and lactic acid were identified as the best primary solvents and 55% (w/w) aqueous isopropanol as a good binary solvent. However, the low volatility of the latter two prevents their use as casting solvents. Films could be cast from glacial acetic acid at 25 [degree sign]C, a much lower temperature than the 70 [degree sign]C required with aqueous ethanol. The sensory, tensile, and water barrier properties of the films cast from glacial acetic acid at 25 [degree sign]C and aqueous ethanol at 70 [degree sign]C were almost the same. However, the use of glacial acetic acid at 25 [degree sign]C for casting kafirin films is advantageous as it gave films of more consistent quality.
Keywords: Kafirin; Solubility; Film casting; Film properties

Erika Matuschek, Ulf Svanberg, The effect of fruit extracts with polyphenol oxidase (PPO) activity on the in vitro accessibility of iron in high-tannin sorghum, Food Chemistry, Volume 90, Issue 4, May 2005, Pages 765-771, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.06.002.
(http://www.sciencedirect.com/science/article/B6T6R-4CYNNJG-2/2/f2b6b6496e848667057ce3881a761052)
Abstract:
Dephytinized high-tannin sorghum flour was incubated with crude extracts from pear, banana or avocado, respectively, followed by investigation of the effects on the phenolic content and on in vitro accessible iron. All fruits contained polyphenol oxidase (PPO) activity and incubation resulted

in significant reduction of phenolic compounds. Incubation with avocado extract resulted in the lowest levels of phenolic compounds, as well as the highest amount of in vitro accessible iron. Peroxidase activity and some organic acids in the fruit extracts might also have contributed to the positive effect on iron accessibility. Nevertheless, incubation of the sorghum flour with the fruit extracts under conditions enabling the PPO to oxidize phenolic compounds, resulted in the highest accessibility of iron. The results from this study suggest that the PPO activity in simple fruit extracts can be utilized to increase the accessibility of iron in dephytinized polyphenol-containing cereal foods.
Keywords: Oxidation; Polyphenol oxidase; PPO; Fruits; Sorghum; Tannin; Polyphenol; Iron accessibility; Bioavailability; Peroxidase; Organic acids

Isabel Correia, Alexandra Nunes, Iola F. Duarte, Antonio Barros, Ivonne Delgadillo, Sorghum fermentation followed by spectroscopic techniques, Food Chemistry, Volume 90, Issue 4, May 2005, Pages 853-859, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.05.060.
(http://www.sciencedirect.com/science/article/B6T6R-4D5P57Y-1/2/44c432e802ff404f125f00e61e7b36b3)
Abstract:
The effect of lactic bacteria fermentation on sorghum was followed by spectroscopic techniques (1H NMR and FT-IR) and chemical analysis.
Wet-cooked sorghum flour was inoculated with lactic bacteria (Lactobacillus fermentum, Lactobacillus bulgaricus, Lactobacillus lactis, Pediococcus pentosaceus and Pediococcus cerevisiae) and a mixture of Lactobacillus bulgaricus and Streptococcus thermophilus from a commercial natural yogurt. Only L. fermentum and the commercial yogurt inoculum were able to grow in sorghum.
The induced lactic bacteria fermentations were compared with a spontaneous traditional fermentation carried out with flour used for fermentation purposes.
In all fermentations, a decrease in pH was noticed and consequently an increase in titratable acidity was detected. Also observed were an increase in free amino acids and total protein content. Reducing sugars, soluble protein and starch decreased during the fermentation processes. These chemical results were confirmed by 1H NMR and FT-IR.
This study showed that spectroscopic methods are suitable and less time-consuming than chemical methods for following fermentation processes, giving the same relevant information and allowing large screening experiments.
Keywords: Sorghum bicolor (L.) Moench; Spectroscopy; Fermentation and lactic bacteria

Alis van der Aa Kuhle, Kerstin Skovgaard, Lene Jespersen, In vitro screening of probiotic properties of Saccharomyces cerevisiae var. boulardii and food-borne Saccharomyces cerevisiae strains, International Journal of Food Microbiology, Volume 101, Issue 1, 1 May 2005, Pages 29-39, ISSN 0168-1605, DOI: 10.1016/j.ijfoodmicro.2004.10.039.
(http://www.sciencedirect.com/science/article/B6T7K-4F3NY0V-3/2/c6a9a28d726fcd00c91217e0f6ce63ee)
Abstract:
The probiotic potential of 18 Saccharomyces cerevisiae strains used for production of foods or beverages or isolated from such, and eight strains of Saccharomyces cerevisiae var. boulardii, was investigated. All strains included were able to withstand pH 2.5 and 0.3% Oxgall. Adhesion to the nontumorigenic porcine jejunal epithelial cell line (IPEC-J2) was investigated by incorporation of 3H-methionine into the yeast cells and use of liquid scintillation counting. Only few of the food-borne S. cerevisiae strains exhibited noteworthy adhesiveness with the strongest levels of adhesion (13.6-16.8%) recorded for two isolates from blue veined cheeses. Merely 25% of the S. cerevisiae var. boulardii strains displayed good adhesive properties (16.2-28.0%). The expression of the proinflammatory cytokine IL-1[alpha] decreased strikingly in IPEC-J2 cells exposed to a

Shiga-like toxin 2e producing Escherichia coli strain when the cells were pre- and coincubated with S. cerevisiae var. boulardii even though this yeast strain was low adhesive (5.4%), suggesting that adhesion is not a mandatory prerequisite for such a probiotic effect. A strain of S. cerevisiae isolated from West African sorghum beer exerted similar effects hence indicating that food-borne strains of S. cerevisiae may possess probiotic properties in spite of low adhesiveness.
Keywords: Probiotics; Saccharomyces cerevisiae; Saccharomyces cerevisiae var. boulardii; Food borne; Adhesion; IPEC-J2; E. coli, IL-1[alpha]

Emmanuel B. Chamba, Nigel G. Halford, Jane Forsyth, Mark Wilkinson, Peter R. Shewry, Molecular cloning of [beta]-kafirin, a methionine-rich protein of sorghum grain, Journal of Cereal Science, Volume 41, Issue 3, May 2005, Pages 381-383, ISSN 0733-5210, DOI: 10.1016/j.jcs.2004.09.004.
(http://www.sciencedirect.com/science/article/B6WHK-4FB93TN-1/2/29f646ebd0626a4e2104682723dd611a)
Abstract:
Eight independantly amplified clones, four each from genomic DNA and cDNA, were sequenced. They encoded beta-kafirin proteins with identical amino acid sequences, the mature proteins comprising 172 amino acids including 16 methionine residues and 8 cysteine residues. The identical sequences of the clones and the results of Southern blot analysis were consistent with the presence of a single gene copy. Northern blotting showed that the transcripts were present in developing seeds between 14 and 35 days after anthesis.
Keywords: Sorghum; Kafirin; Methionine; Nutritional quality

M.N. Emmambux, M. Stading, J.R.N. Taylor, Erratum to 'Sorghum kafirin film property modification with hydrolysable and condensed tannins' [Journal of Cereal Science 2004 (40) 127-135], Journal of Cereal Science, Volume 41, Issue 3, May 2005, Page 385, ISSN 0733-5210, DOI: 10.1016/j.jcs.2005.01.001.
(http://www.sciencedirect.com/science/article/B6WHK-4FD79KC-1/2/684baf5bb9ff6f62ebb85b25eeb4cf52)

F.P. Baijukya, N. de Ridder, K.F. Masuki, K.E. Giller, Dynamics of banana-based farming systems in Bukoba district, Tanzania: changes in land use, cropping and cattle keeping, Agriculture, Ecosystems & Environment, Volume 106, Issue 4, 30 April 2005, Pages 395-406, ISSN 0167-8809, DOI: 10.1016/j.agee.2004.08.010.
(http://www.sciencedirect.com/science/article/B6T3Y-4DTKDPX-1/2/6e18d2aede60cd9faabc0bd28f28c8eb)
Abstract:
The spatial and temporal changes of land use, cropping patterns and cattle keeping were assessed for the period 1961-1999 in Kyamtwara division, Bukoba district, Tanzania. The assessment was based on interpreting aerial photographs, surveys and a review of historical statistical data. The area of grassland declined by 40% with a concomitant increase in annual crop fields and forest of 225 and 36%, respectively. The cropping pattern changed from a predominance of banana/coffee/beans to a complex mixed cropping of banana/coffee/beans/maize and root crops in the homegarden, and increased cultivation of maize and root crops in pure stands. Farmers stopped cultivating sorghum and finger millet. The population of indigenous cattle decreased by 50% and an equal percentage of dairy cattle was introduced, but cattle-owning households decreased by 85%. Nutrient balances of homegardens ranged between -27 and 17 kg N ha-1 yr-1, -1 and 7 kg P ha-1 yr-1 and -5 and 12 kg K ha-1 yr-1, with the positive balances achieved by resource-rich households. Nutrient balances of crops in pure stand ranged between -15 and -2 kg N ha-1 yr-1, -2 and -1 kg P ha-1 yr-1 and -14 and -1 kg K ha-1 yr-1, with more negative balances observed with maize, implying that soil nutrient stocks

are decreasing. Increasing population density, coupled with an unequal distribution of resources among households, land tenure, economic policies and poor crop markets were identified as major causal factors of the above changes. Reversing soil fertility decline requires external inputs of nutrients. Within the current poor economic situation of the farming community, different potential soil fertility improvement strategies, including exploitation of N2-fixing legumes are discussed.
Keywords: Land use changes; Cropping pattern; Livestock systems; Nutrient balances; Sustainability

Wenping Hu, Michael R. Murphy, Statistical evaluation of early- and mid-lactation dairy cow responses to dietary sodium bicarbonate addition, Animal Feed Science and Technology, Volume 119, Issues 1-2, 7 March 2005, Pages 43-54, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2004.12.005.
(http://www.sciencedirect.com/science/article/B6T42-4F7Y96G-1/2/e7f9ab9c0032944ff370a99ca4c55448)
Abstract:
Our objectives were to examine, using mixed model statistical analysis, effects of dietary NaHCO3 on performance of early- and mid-lactation dairy cows and to determine if there is an optimal level of dietary buffer addition. A database was developed from 27 studies published between 1980 and 1999 that included a total of 30 experiments, 73 dietary treatments and 369 cows. Dietary NaHCO3 was categorized according to amount in the diet as control (0.0 g/kg), moderate (7.0-10.0 g/kg), or high (10.5-15.0 g/kg) with NaHCO3 concentrations outside these ranges not included. Forage type in the rations was categorized as maize silage (MS), when it was the sole or main dietary forage, or as forage other than MS (NMS) when alfalfa hay, or silages based on alfalfa, barley, sorghum, triticale, or wheat were the sole or main dietary forages. The statistical model included the fixed effects of buffer concentration and forage type, and the random effect of study. Dry matter (DM) intake (DMI) did not differ among buffer treatments for cows fed NMS, but cows fed MS without NaHCO3 addition consumed 1.24 kg/d less DM ($P < 0.02$) than cows fed buffer. The DMI did not differ between moderate and high dietary NaHCO3 feeding levels in cows fed MS. Milk production, milk protein proportion, and protein yield were unaffected by buffer treatments regardless of forage type, but milk fat proportion of cows fed MS based diets was 2.7 g/kg higher ($P < 0.02$) when NaHCO3 was included. Addition of NaHCO3 at 7.0-10.0 g/kg of dietary DM was optimal for early- and mid-lactation cows fed MS based diets, but addition of NaHCO3 to NMS based diet was not supported. However, forage type was confounded with acid detergent fibre content of the diet, differences in response to buffer treatments between forage type might be partially because of variation in the fibre contents of the forage.
Keywords: Sodium bicarbonate; Mixed model statistical analysis; Performance; Dairy cows

P. Fox, J. Rockstrom, J. Barron, Risk analysis and economic viability of water harvesting for supplemental irrigation in semi-arid Burkina Faso and Kenya, Agricultural Systems, Volume 83, Issue 3, March 2005, Pages 231-250, ISSN 0308-521X, DOI: 10.1016/j.agsy.2004.04.002.
(http://www.sciencedirect.com/science/article/B6T3W-4CHHR31-1/2/0855cf8704b52bc27ab6585d194b7db8)
Abstract:
Food insecurity affects a large portion of the population in sub-Saharan Africa (SSA). To meet future food requirements current rainfed farming systems need to upgrade yield output. One way is to improve water and fertiliser management in crop production. But adaptation among farmers will depend on perceived risk reduction of harvest failure as well as economic benefit for the household. Here, we present risk analysis and economical benefit estimates of a water harvesting (WH) system for supplemental irrigation (SI). Focus of the analysis is on reducing investment risk to improve self-sufficiency in staple food production. The analysis is based on data from two on-farm experimental sites with SI for cereals in currently practised smallholder farming system in

semi-arid Burkina Faso and Kenya, respectively. The WH system enables for both SI of staple crop (sorghum and maize) and a fully irrigated off-season cash crop (tomatoes). Different investment scenarios are presented in a matrix of four reservoir sealants combined with three labour opportunity costs. It is shown that the WH system is labour intensive but risk-reducing investment at the two locations. The current cultivation practices do not attain food self-sufficiency in farm households. WH with SI resulted in a net profit of 151-626 USD year-1 ha-1 for the Burkina case and 109-477 USD year-1 ha-1 for the Kenya case depending on labour opportunity cost, compared to -83 to 15 USD year-1 ha-1 for the Burkina case and 40-130 USD year-1 ha-1 for the Kenyan case for current farming practices. Opportunity cost represents 0-66% of the investment cost in an SI system depending on type of sealant. The most economical strategy under local labour conditions was obtained using thin plastic sheeting as reservoir sealant. This resulted in a net profit of 390 and 73 USD year-1 ha-1 for the Burkina Faso and Kenyan respective site after household consumption was deducted. The analysis suggests a strong mutual dependence between investment in WH for SI and input of fertiliser. The WH system is only economically viable if combined with improved soil fertility management, but the investment in fertiliser inputs may only be viable in the long term when combined with SI.
Keywords: Water harvesting; Supplemental irrigation; Semi-arid; Labour cost; Cost-benefit

J.P. Michaud, Angela K. Grant, Suitability of pollen sources for the development and reproduction of Coleomegilla maculata (Coleoptera: Coccinellidae) under simulated drought conditions, Biological Control, Volume 32, Issue 3, March 2005, Pages 363-370, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2004.11.001.
(http://www.sciencedirect.com/science/article/B6WBP-4F4R1TW-2/2/5c8005c519002125050d4d7715d847c4)
Abstract:
Laboratory experiments compared the nutritive value of various pollen sources for the development of Coleomegilla maculata DeGeer under conditions of continuous water availability and simulated drought. When water was continuously available, larval survival was not different from 100% on diets of frozen eggs of Ephestia kuehniella Zeller, corn pollen, sorghum pollen, or pulverized bee pollen, whereas survival of larvae was significantly reduced on the latter three diets in the simulated drought treatment. Pollen of cultivated sunflower, Helianthus annus L., proved fatal to both larvae and adults; its surface structure caused clumping and accumulation on the insect cuticle that led to death from exhaustion/desiccation in petri dishes. The Ephestia egg diet yielded shorter developmental times and heavier adult weights than any pollen diet in both treatments. The drought treatment increased developmental time on all diets with a significant treatment-diet interaction. Drought reduced the adult weight of females on the sorghum pollen diet, and that of both sexes on the bee pollen diet, again with a significant treatment-diet interaction. Initial water content was highest in corn pollen (36.8%), followed by Ephestia eggs (29.2%), sorghum pollen (25.3%), sunflower pollen (8.7%), and bee pollen (4.6%), but did not appear correlated with C. maculata larval survival on pollen sources under drought conditions. Reproductive adult females that received corn or sorghum pollen as a supplement to Ephestia eggs did not differ in fecundity or fertility from those fed only Ephestia eggs.
Keywords: Coleomegilla maculata; Development; Drought; Helianthus annus; Pollen; Reproduction; Sorghum bicolor; Zea mays

G. Ramirez, R. Martinez, M. Herradora, F. Castrejon, E. Galvan, Isolation of Salmonella spp. from liquid and solid excreta prior to and following ensilage in ten swine farms located in central Mexico, Bioresource Technology, Volume 96, Issue 5, March 2005, Pages 587-595, ISSN 0960-8524, DOI: 10.1016/j.biortech.2004.06.009.
(http://www.sciencedirect.com/science/article/B6V24-4D5JVMH-1/2/d0b46c2d61189faaaa0536b07a764cac)

Abstract:
A study was carried out to define selected bacteriological characteristics of residues from 10 swine farms, 5 with or without prior clinical enteric disease (PCED) and to determine the effect of ensilage on the bacteria present in the solid fraction. At each farm, samples were taken from the sedimentation basin (SB), the solid fraction (SF), and the liquid fraction (LF). For each sample, CFU/g for enteric bacteria were quantified; Salmonella spp. were isolated and typified. Solid phase samples from each farm were used to prepare the ensilage, with a mixture of solids (80%), sorghum (12%) and molasses (8%). The quantity of enteric bacteria was significantly greater in farms without PCED ($P < 0.05$). Salmonella enterica were isolated from 8/10 of the farms with and without PCED; in 8 from SB; in 6 from LF; and in 5 from SF. Enteric bacteria were not isolated from silage, therefore, ensilage may be an alternative treatment for excreta that allows the elimination of pathogens such as Salmonella spp.
Keywords: Salmonella spp.; Swine farm residues; Ensilage

S. Audilakshmi, C. Aruna, T.B. Garud, N.Y. Nayakar, S.B. Atale, P. Veerabadhiran, B. Dayakar Rao, C.V. Ratnavathi, S. Indira, A technique to enhance the quality and market value of rainy season sorghum grain, Crop Protection, Volume 24, Issue 3, March 2005, Pages 251-258, ISSN 0261-2194, DOI: 10.1016/j.cropro.2004.07.017.
(http://www.sciencedirect.com/science/article/B6T5T-4DJBRV0-1/2/18eafe7b5ef2cda73d0a6a1de6a8f756)
Abstract:
Heavy rains at the time of maturity cause severe damage to the sorghum grain (discolouration), which affects its market price. The deterioration is mainly due to infection caused by a complex of fungi, collectively known as 'grain moulds'. The genetics of grain mould resistance is very complex, governed by major and minor genes showing significant GxE interactions and is hampering the progress in the breeding for grain mould resistance. Therefore, alternatives to breeding to improve the sorghum grain quality have been explored. Crops from the fields (one hectare each) of 18 farmers in each of the districts of Akola, Parbhani, Coimbatore and Mahabubnagar in India were selected for harvesting. One-half of the crop was harvested at physiological maturity and artificially dried (Treatment 1) to reduce the moisture content in order to prevent the mould infestation and grain deterioration; the other half was harvested at the normal maturity and sun-dried as per the normal farmers' practice (Treatment 2). Market price was ascertained for the produce from both the treatments. Significant improvement in grain quality and also the market price of the produce were observed by the use of this technology, i.e., harvesting at physiological maturity and artificial drying. On an average over the four districts, 55% increase in market price of the grain harvested at physiological maturity and artificially dried was observed over that of the produce harvested at normal maturity. A minimum of 15 ha of sorghum crop area was necessary to cover the cost of the drier in a season. The advantage of the technology is that it not only gives remunerative price to the farmer for the better grain quality but also gives extra benefits by facilitating early arrival of the sorghum produce in the market and advancement of planting of second crop of the double crop in post rainy season (to have better utilisation of residual moisture).
Keywords: Sorghum bicolor; Grain moulds; Grain quality; Physiological maturity; Artificial drying

Joseph M. Awika, Lloyd W. Rooney, Ralph D. Waniska, Anthocyanins from black sorghum and their antioxidant properties, Food Chemistry, Volume 90, Issues 1-2, March-April 2005, Pages 293-301, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.03.058.
(http://www.sciencedirect.com/science/article/B6T6R-4CNJ9FH-1/2/74e15148a9cf6a153dcfb8b47addd1ce)
Abstract:
A black, high anthocyanin sorghum variety (Tx430) grown in several environments was analyzed for anthocyanins by spectrophotometric and HPLC methods. The samples were also analyzed for

antioxidant activity using the 2,2'-azinobis (3-ethyl-benzothiaziline-6-sulfonic acid) method. Two extracting solvents, 1% HCl in methanol and 70% aqueous acetone, were compared. Sorghum brans had three to four times higher anthocyanin contents than the whole grains. The brans were a good source of anthocyanin (4.0-9.8 mg luteolinidin equivalents/g) compared to pigmented fruits and vegetables (0.2-10 mg/g), fresh weight basis. Acidified methanol extracted the anthocyanins better than aqueous acetone. Luteolinidin and apigeninidin accounted for about 50% of the anthocyanins in the black sorghums. The sorghum grains and their brans had high antioxidant activity (52-400 [mu]mol TE/g) compared to other cereals (<0.1-34 mg TE/g). Black sorghum should be useful in food and other applications, because it is a valuable source of anthocyanins with good antioxidant activity.
Keywords: Sorghum; Anthocyanins; Antioxidant activity; HPLC; ABTS

W.L. Rooney, S. Aydin, L.C. Kuhlman, Assessing the relationship between endosperm type and grain yield potential in sorghum (Sorghum bicolor L. Moench)., Field Crops Research, Volume 91, Issues 2-3, 14 February 2005, Pages 199-205, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.07.011.
(http://www.sciencedirect.com/science/article/B6T6M-4D60GBR-1/2/a7236ef1bc09a7177642cd1bd7a60504)
Abstract:
Sorghum hybrids with waxy endosperm (either homozygous or heterozygous waxy) have lower grain yield potential compared to non-waxy endosperm hybrids. The cause of this yield reduction is not known. From a genetic perspective, the yield reduction could be due to pleiotrophy or genetic linkage between the wx locus and other loci that influence grain yield. The specific cause of the relationship is important because an effective breeding program can alleviate the problem if it is due to linkage. The objective of this study was to determine whether linkage or pleiotrophy is causing the negative relationship between grain yield and waxy endosperm. From each of two F2 breeding populations segregating for waxy endosperm, between 40 and 50 inbred lines were derived, with equal numbers of waxy and non-waxy endosperm lines. No selection for yield was practiced during the development of these lines. The lines from these two populations and a set of testcross hybrids (derived from one population) were evaluated in four environments in Texas from 1998 to 2000. Across all tests and environments, the combined yield of the waxy genotypes was 17% lower than non-waxy genotypes. While yields were lower in waxy genotypes, analysis of the individual inbred lines and hybrids revealed that several waxy inbred lines were not statistically different from the best non-waxy inbreds. These results imply that selection of high yielding waxy genotypes is possible, but a significant breeding emphasis on their development is required to effectively identify those genotypes.
Keywords: Endosperm; Waxy; Amlyopectin; Breeding; Genetics

Nadir Alvarez, Eric Garine, Celestin Khasah, Edmond Dounias, Martine Hossaert-McKey, Doyle McKey, Farmers' practices, metapopulation dynamics, and conservation of agricultural biodiversity on-farm: a case study of sorghum among the Duupa in sub-sahelian Cameroon, Biological Conservation, Volume 121, Issue 4, February 2005, Pages 533-543, ISSN 0006-3207, DOI: 10.1016/j.biocon.2004.05.021.
(http://www.sciencedirect.com/science/article/B6V5X-4CYNNH9-3/2/6897314bbca9465655910cab40cc321f)
Abstract:
In many traditionally managed agroecosystems, populations of domesticated plants maintain high levels of genetic diversity. The threat of erosion of this diversity is a current conservation concern, motivating studies of how diversity can be maintained by in situ conservation measures. Precisely how the biological traits of plants and the cultural practices of farmers act on fundamental evolutionary forces - drift, migration, selection, and mutation - to create and maintain crop plant diversity has been little investigated in detail. We develop some elements of the framework

required for studying such biocultural interactions, focusing on one component of management: farmers' decisions on what to plant, and the structure of germplasm exchange among farmers. We illustrate the approach with a study of Duupa farmers in northern Cameroon. Our results suggest that sorghum populations managed by the Duupa function like source-sink metapopulations. Fields of older farmers, larger and containing a greater number of varieties, act as sources, whereas fields of younger farmers act as sinks, becoming sources as their owners mature. In each field, seeds for sowing are selected from a small number of plants. The frequent exchange of germplasm among fields may counteract the genetic bottlenecks associated with the small number of genitors within each field. Identifying key processes and key individuals should facilitate the design of in situ conservation measures to maintain crop plant diversity against the threat of genetic erosion.
Keywords: Farmers' practices; Population biology; Evolutionary forces; Sorghum; Duupa

Mamoudou Setamou, Nanqing Jiang, Fritz Schulthess, Effect of the host plant on the survivorship of parasitized Chilo partellus Swinhoe (Lepidoptera: Crambidae) larvae and performance of its larval parasitoid Cotesia flavipes Cameron (Hymenoptera: Braconidae), Biological Control, Volume 32, Issue 2, February 2005, Pages 183-190, ISSN 1049-9644, DOI: 10.1016/j.biocontrol.2004.09.008.
(http://www.sciencedirect.com/science/article/B6WBP-4DTKXHK-4/2/5b1dd7f9818a3ed34ed525eb4ce6c50d)
Abstract:
The effect of wild and cultivated gramineous hosts on the survivorship and weight of parasitized Chilo partellus larvae and on the performance of its larval parasitoid Cotesia flavipes were studied under laboratory conditions, in two experiments. In Experiment A, weight of Ch. partellus larvae offered to Co. flavipes was allowed to vary with host plant species in order to assess both the effect of weight and quality of larvae, as affected by the host plant, on the performance of the parasitoid. In Experiment B, larvae of similar weight across host plant species were selected to enable to separate the effect of weight from that of quality of the larvae. In Experiment A, the mean weight of larvae that produced cocoons varied significantly with plant species. In both experiments, the percentage of larvae producing cocoons and mean progeny size were lower and larvae died faster on wild than cultivated host plants. Immature development time of Co. flavipes tended to be higher on wild than cultivated grasses. The proportion of female progeny was highest on maize and lowest on the two sorghum species, in Experiment A, whereas in Experiment B, the sex ratio was similar between the host plant species. Similarly, egg-load of Co. flavipes offspring was highest on maize and lowest on Napier grass in Experiment A, but it did not vary significantly between host plants in Experiment B. It is suggested that in the coastal region of Kenya, perennial wild sorghum species are vital for the survival of Co. flavipes during the dry season, when superior plant hosts such as cultivated sorghum and maize are scarce.
Keywords: Cotesia flavipes, Chilo partellus; Parasitism; Host plant; Maize; Wild and cultivated sorghum; Napier grass; Tritrophic interaction

Isabelle Lestienne, Christele Icard-Verniere, Claire Mouquet, Christian Picq, Serge Treche, Effects of soaking whole cereal and legume seeds on iron, zinc and phytate contents, Food Chemistry, Volume 89, Issue 3, February 2005, Pages 421-425, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.03.040.
(http://www.sciencedirect.com/science/article/B6T6R-4CHHR3J-1/2/072b3b2e8c32c05de9984eaf8de55fe8)
Abstract:
The effects of soaking whole cereal (maize, millet, rice, sorghum) and legume seeds (mung bean, cowpea, soybean) on iron (Fe), zinc (Zn) and phytate (Phy) contents were investigated. In all the above cereals, except millet, the molar ratios of Phy/Fe were above than 14, and ratios of Phy/Zn

were above 20 while, in legumes, ratios were lower. Soaking whole seeds for 24 h led to leaching of iron and, to a lesser extent, of zinc ions into the soaking medium. Soaking led to a significant (P[less-than-or-equals, slant]0.05) reduction in the phytate content of millet, maize, rice and soybean, but did not improve the Phy/Fe molar ratio, while decreasing the Phy/Zn molar ratio only slightly. Soaking on its own was not found to be a good method for improving mineral bioavailability but the results showed that, in combination with other treatments, or with optimized soaking conditions, it could nevertheless prove useful.
Keywords: Phytate; Zinc; Iron; Molar ratios; Soaking

Leila Picolli da Silva, Maria de Lourdes Santorio Ciocca, Total, insoluble and soluble dietary fiber values measured by enzymatic-gravimetric method in cereal grains, Journal of Food Composition and Analysis, Volume 18, Issue 1, February 2005, Pages 113-120, ISSN 0889-1575, DOI: 10.1016/j.jfca.2003.12.005.
(http://www.sciencedirect.com/science/article/B6WJH-4CCNTBP-1/2/0b8cf62eb59ba96bb276f0e147bd8984)
Abstract:
Cereal grains produced in southern Brazil and collected in production trials carried out in 1996 were evaluated as to total fiber (TF), insoluble fiber (IF) and soluble fiber (SF) contents by the enzymatic-gravimetric method of (Prosky et al., J. Assoc. Anal. Chem. Int. 75 (1992) 360). Wheat (BR 23, CEP 24, EMBRAPA 16, EMBRAPA 48 and EMBRAPA 49), triticale (BR 4, EMBRAPA 17 and EMBRAPA 18), barley (BR 2, EMBRAPA 43 and PFC 9205), rye (BR 1), oats (UFRGS 14, UFRGS 15 and UFRGS 17), corn (BR 351 and BR 5202 Pampa) and sorghum (A 9904 and BR 300) cultivars were analyzed. Differences ($P<0.05$) in TF and IF were found among the species. Wheat, triticale, oats and sorghum cultivars presented significant differences in total and IF levels, and oats cultivars in IF levels. The SF levels (difference between total and IF) of wheat and sorghum cultivars were also different. Although the results may have been affected by gravimetric corrections, the total and IF values obtained suggest the possible use of different species and different cultivars of cereal grains in specific strategies for animal and human nutrition.
Keywords: Cereal cultivars; Unprocessed cereal grains; Soluble fiber values; Dietary fiber

Heleen Bossuyt, Johan Six, Paul F. Hendrix, Protection of soil carbon by microaggregates within earthworm casts, Soil Biology and Biochemistry, Volume 37, Issue 2, February 2005, Pages 251-258, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2004.07.035.
(http://www.sciencedirect.com/science/article/B6TC7-4D97G3R-1/2/844cf6b21feb2b222a09fad717b692eb)
Abstract:
Earthworms are known to play a role in aggregate formation and soil organic matter (SOM) protection. However, it is still unclear at what scale and how quickly earthworms manage to protect SOM. We investigated the effects of Aporrectodea caliginosa on aggregation and aggregate-associated C pools using 13C-labeled sorghum (Sorghum bicolor (L.) Moench) leaf residue. Two incubations were set up. The first incubation consisted of soil samples crushed <250 [mu]m to break up all macroaggregates with three treatments: (i) control soil; (ii) soil+13C-labeled residue and (iii) soil+13C-labeled residue+earthworms. Earthworms were added after 8 d and 12 d (days) later, aggregate size distribution was measured together with total C and 13C in each aggregate fraction. A second incubation was made to assay protected versus unprotected total C and13C from 21-d laboratory incubations of intact and crushed large (>2000 [mu]m) and small (250-2000 [mu]m) macroaggregates and microaggregates (53-250 [mu]m). Eight different pools of aggregate-associated C were quantified: (1) and (2) unprotected C pools in large and small macroaggregates, (3) unprotected C pools in microaggregates, (4) and (5) protected C pools in large and small macroaggregates, (6) protected C pool in microaggregates, and (7) and (8) protected C pools in microaggregates within large and small macroaggregates. In the presence of

earthworms, a higher proportion of large macroaggregates was newly formed and these aggregates contained more C and 13C compared to bulk soil. There were no significant differences between the samples with or without earthworms in the C pool-sizes protected by macroaggregates, microaggregates or microaggregates within small macroaggregates. However, in the presence of earthworms, the C protected by microaggregates within large macroaggregates was a significant pool and 22% of this C pool was newly added C. In conclusion, these results clearly indicate the direct involvement of earthworms in providing protection of soil C in microaggregates within large macroaggregates leading to a possible long-term stabilization of soil C.
Keywords: Aggregation; Microaggregates; Carbon; Earthworms; Carbon protection

Qu Sheng Li, Lyman S. Willardson, Wei Deng, Xiu Jun Li, Chang Jiang Liu, Crop water deficit estimation and irrigation scheduling in western Jilin province, Northeast China, Agricultural Water Management, Volume 71, Issue 1, 15 January 2005, Pages 47-60, ISSN 0378-3774, DOI: 10.1016/j.agwat.2004.07.003.
(http://www.sciencedirect.com/science/article/B6T3X-4DBJW4V-5/2/e44669b4743146d15f6b75c96261f74a)
Abstract:
Jilin province is one of the main dryland grain production areas in China. Recently, limited supplemental irrigation, using groundwater in the semi-arid western area of the province, has developed rapidly to improve the low grain productivity caused by rainfall variability. Research was conducted to estimate the actual crop water requirements and identify the timing and magnitude of water deficits of the main crops such as corn (Zea mays L.), soybean (Glycine max L.) and sorghum (Sorghum bicolor L.). Using the guidelines for computing crop water requirements in FAO Irrigation and Drainage paper 56 and historical rainfall distributions, the crop water requirements, ETc and the crop water deficits of corn, soybean and sorghum were calculated. Based on the water deficit analysis, a recommended average supplemental irrigation schedule was developed. Crop production was compared to full irrigation and to a rainfed control in a field experiment.
On average, compared to the rainfed control, the full irrigation and the average supplemental irrigation treatments of corn, increased yields 49.0 and 43.9%, respectively; soybean yields of those treatments increased by 41.0 and 34.7%, and sorghum yields of those treatments increased by 55.5 and 46.3%. A supplemental irrigation schedule can be used in the semi-arid western Jilin province to improve crop yields.
Keywords: Evapotranspiration; Crop water deficit; Available soil moisture; Supplemental irrigation scheduling; Crop yields

V. W. Lendzemo, Th. W. Kuyper, M. J. Kropff, A. van Ast, Field inoculation with arbuscular mycorrhizal fungi reduces Striga hermonthica performance on cereal crops and has the potential to contribute to integrated Striga management, Field Crops Research, Volume 91, Issue 1, 14 January 2005, Pages 51-61, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.05.003.
(http://www.sciencedirect.com/science/article/B6T6M-4CMHW23-3/2/a7d6b7c41b8446acd4c0a60727e085a9)
Abstract:
Maize and sorghum were grown in the field in north Cameroon, Africa, during the cropping seasons (June-October) of 2000 for maize, and 2001 and 2002 for sorghum. Both cereals were grown in fields infested with or free of seeds of the root hemiparasite Striga hermonthica, and with or without inoculation with arbuscular mycorrhizal (AM) fungi (Glomus clarum and Gigaspora margarita). Infection of maize by S. hermonthica resulted in a significant reduction in cob yield of 20%. The effects of S. hermonthica on sorghum were not significant. With AM fungal inoculation, a significant reduction (30% and more than 50% on maize and sorghum, respectively) in the number of S. hermonthica shoots was noted. Dry weight of Striga followed the same pattern (40%

reduction on maize, and 46 and 63% reduction on sorghum in 2001 and 2002, respectively) after AM fungal inoculation. There was a significant interaction effect between S. hermonthica and AM fungi on yield parameters of sorghum in the cropping season of 2002. No significant yield increase due to AM fungal inoculation was noted for maize or sorghum in 2001. The results are discussed in the context of managing mycorrhizas as a component of integrated management of S. hermonthica on cereals aimed at sustainability.
Keywords: Striga hermonthica; Maize; Sorghum; Arbuscular mycorrhiza (AM)

Gregory J. Daglish, Barry E. Wallbank, Efficacy of diflubenzuron plus methoprene against Sitophilus oryzae and Rhyzopertha dominica in stored sorghum, Journal of Stored Products Research, Volume 41, Issue 3, 2005, Pages 353-360, ISSN 0022-474X, DOI: 10.1016/j.jspr.2004.06.001.
(http://www.sciencedirect.com/science/article/B6T8Y-4DFT1DJ-5/2/0f4cd1450b5f079b08a841920e8348ff)
Abstract:
The efficacy of diflubenzuron (1 mg kg-1)+methoprene (1 mg kg-1) against Sitophilus oryzae (L.) and Rhyzopertha dominica (F.) in sorghum was evaluated in a silo-scale trial in southeast Queensland, Australia. Sorghum is normally protected from a wide range of insects by mixtures of grain protectants. The chitin synthesis inhibitor diflubenzuron was evaluated as a potential new protectant for S. oryzae in combination with the juvenile hormone analogue methoprene, which is already registered for control of R. dominica. Sorghum (ca 200 t) was treated after harvest in 2000 and assessed for treatment efficacy and residue decline during 6.5 months storage. The reproductive capacity of S. oryzae and R. dominica was greatly reduced in bioassays of treated sorghum throughout the trial, and efficacy remained relatively stable during the trial. An initial exposure of S. oryzae adults to treated sorghum for 2 weeks reduced F1 progeny production of all strains by 80.8-98.8%, but a second exposure of 4 weeks reduced F1 progeny production by 98.5-100%. In addition, the reproductive capacity of any S. oryzae progeny produced was greatly reduced. Exposure of R. dominica adults to treated sorghum for 2 weeks reduced F1 progeny production of all strains by 99.6-100%, including a methoprene-resistant strain. The results indicate that S. oryzae or R. dominica adults invading sorghum treated with diflubenzuron (1 mg kg-1)+methoprene (1 mg kg-1) would be incapable of producing sustainable populations.
Keywords: Diflubenzuron; Methoprene; Sitophilus oryzae; Rhyzopertha dominica; Stored sorghum

Rajeev K. Varshney, Ralf Sigmund, Andreas Borner, Viktor Korzun, Nils Stein, Mark E. Sorrells, Peter Langridge, Andreas Graner, Interspecific transferability and comparative mapping of barley EST-SSR markers in wheat, rye and rice, Plant Science, Volume 168, Issue 1, January 2005, Pages 195-202, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2004.08.001.
(http://www.sciencedirect.com/science/article/B6TBH-4D5X79R-1/2/5f24424ab90d462b005c293cd1e63eea)
Abstract:
Recent increase in the availability of expressed sequence tag (EST) data has facilitated the development of microsatellite or simple sequence repeat (SSR) markers in a number of plant species groups, including cereals. As these SSRs are derived from ESTs/genes (EST-SSRs), they exhibit a higher potential for transfer through cross-amplification in related species than SSR markers generated from genomic DNA libraries. In this study, a sub-set of 165 EST-SSR markers from a total of 185 assigned to the genetic map of barley was examined for transferability to wheat, rye and rice. A higher proportion, i.e., 78.2% of barley markers showed amplification in wheat followed by 75.2% in rye and 42.4% in rice. Furthermore, in silico comparison of SSR-ESTs (ESTs containing SSRs) corresponding to 185 mapped barley EST-SSR loci against 1,369,182 publicly available cereal ESTs showed significant homology with ESTs of wheat (93.5%), rye (37.3%), rice (57.3%), sorghum (51.9%) and maize (51.9%). Sequence similarity of the barley ESTs with

379,944 ESTs of the two model dicot species, Arabidopsis and Medicago suggested theoretical transferability of barley markers into dicot species although at low frequency (9.7% in Arabidopsis and 8.6% in Medicago). In silico comparative mapping (sequence comparison) of mapped barley SSR-ESTs against the mapping data of rye, wheat and rice indicated the presence of orthologues of the barley SSR-ESTs in the respective species. Furthermore, nine barley EST-SSRs were experimentally mapped to a rye genetic linkage map and all could be located in the expected orthologous region compared to their position in barley.
Keywords: EST-SSRs; SSR-ESTs; Microsatellites; Transferability; Comparative mapping; Barley

Robert Zougmore, Abdoulaye Mando, Leo Stroosnijder, Serge Guillobez, Nitrogen flows and balances as affected by water and nutrient management in a sorghum cropping system of semiarid Burkina Faso, Field Crops Research, Volume 90, Issues 2-3, 8 December 2004, Pages 235-244, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.03.006.
(http://www.sciencedirect.com/science/article/B6T6M-4CB0B0M-3/2/213261841946021385e36f6b42c94e22)
Abstract:
Efficient use of external inputs and water conservation are a prerequisite of sustainable agricultural productivity in semiarid West Africa. A field experiment was carried out during 3 years (2000-2002) at Saria in semiarid Burkina Faso (800 mm of annual rainfall, PET of 2000 mm per year) to assess the effects of stone rows or grass strips of Andropogon gayanus Kunth cv. Bisquamulatus (Hochst. Hack.) as soil and water conservation (SWC) measures, the sole application of an organic (compost-N) or mineral (urea-N) nitrogen and the combined use of SWC and compost-N or urea-N on N flows and balances. The trial was conducted on a Ferric Lixisol with 1.5% slope and comprised nine treatments in two replications. The SWC measures were put along contours lines. During the three consecutive years, all treatments induced negative annual N balances (-75 to -24 kg N ha-1). The main factors explaining these negative balances were N exports by sorghum biomass and soil erosion-induced N losses. Large amounts of N (7 kg N ha-1 per year in 2000 and 44 kg N ha-1 per year in 2002) were lost in the control treatment through runoff and eroded sediments, which corresponds respectively to about 10 and 43% of the total outflow of N. Sole stone rows and grass strips reduced erosion N losses to 8 and 12%, respectively, of the total annual loss. The combined application of SWC measures and nutrients inputs reduced erosion N losses to only 2-7% of the annual N loss. The application of urea-N or compost-N led to the lowest soil N mining over the 3 years, whereas the highest N mining was observed in plots without added N. We conclude that N mining in poor fertile soils of West Africa can be mitigated through an integration of local water and nutrient management practices.
Keywords: Nitrogen balance; Stone rows; Grass strips; Compost; Urea; Soil erosion

G. Mariscal-Landin, J.H. Avellaneda, T.C. Reis de Souza, A. Aguilera, G.A. Borbolla, B. Mar, Effect of tannins in sorghum on amino acid ileal digestibility and on trypsin (E.C.2.4.21.4) and chymotrypsin (E.C.2.4.21.1) activity of growing pigs, Animal Feed Science and Technology, Volume 117, Issues 3-4, 1 December 2004, Pages 245-264, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2004.09.001.
(http://www.sciencedirect.com/science/article/B6T42-4DJBSGR-4/2/f6822667c1216971be7c751dd5b25cdc)
Abstract:
Two experiments were conducted to evaluate the effect of tannin levels in sorghum on coefficient of apparent ileal digestibility (CAID), coefficient of standardised ileal digestibility (CSID) of amino acids, and total and specific activity (TA, SA) of trypsin and chymotrypsin of growing pigs. In the first experiment, 24 castrates (60 +/- 5 kg) were fitted with a simple T cannula to evaluate four different sorghum samples (I, II, III, and IV) with different tannin levels (1.4, 4.6, 9.8 and 10.0 g kg-1). At the end of the trial, pigs were slaughtered to obtain samples of pancreas and intestinal

digesta. Data were analysed as a randomized block design. The highest CAID ($P < 0.05$) was observed on sorghum I and the lowest on sorghum II. Leucine and glutamic acid were the most digestible amino acids in the four samples of sorghum, with glycine, lysine, threonine and cysteine being the least digestible. As tannin levels increased, proline CAID decreased ($P < 0.05$). CSID of amino acids in sorghum I was higher ($P < 0.05$) than on sorghum II, except for proline. Similarly, the CSID for isoleucine, lysine, threonine, valine, alanine and aspartic acid was similar among sorghums I, III and IV. Tannin content did not affect pancreas weight, protein content, or TA and SA of trypsin and chymotrypsin on pancreatic tissue. However, in the digesta of duodenum, trypsin TA was increased ($P < 0.05$) by 6.7% in the two treatments with the highest tannin content. In the second experiment, 32 castrates (53 +/- 7 kg) were fitted with a simple T cannula to evaluate eight different hybrids of sorghum: four Pioneer (8172, 8428, 8443, and 8641), and four Dekalb (D-45, D-65, D-68, and D-69). High-tannin sorghums (8172 and 8428) had the lowest ($P < 0.05$) CAID for arginine, glycine, and proline. Furthermore, sorghum 8428 had the lowest ($P < 0.05$) CAID for lysine (0.339). The CAID for proline was negative (-0.110) for sorghum 8428 and extremely low (0.031) in sorghum 8172. These sorghums had a low ($P < 0.05$) CSID for arginine, histidine, and proline. In sorghums with a high content of tannins the CSID for proline and glycine was very low. Lysine CSID was lower ($P < 0.05$) in sorghum 8428, when compared to the others samples of sorghums. In conclusion, tannin levels up to 1.05% are not the main depressors of the CAID and CSID of amino acids in the sorghum grain; however, tannins have a clear negative effect on CAID and CSID in sorghum with high levels (4% or more) of tannin.
Keywords: Tannins; Sorghum; Amino acids; Ileal digestibility; Pigs

Thomas G. Van Niel, Tim R. McVicar, Determining temporal windows for crop discrimination with remote sensing: a case study in south-eastern Australia, Computers and Electronics in Agriculture, Volume 45, Issues 1-3, December 2004, Pages 91-108, ISSN 0168-1699, DOI: 10.1016/j.compag.2004.06.003.
(http://www.sciencedirect.com/science/article/B6T5M-4D4PSV5-1/2/c52534c26121d0e41f162503cbefc62d)
Abstract:
The classification of crops from remote sensing has become an important part of agricultural management, and as a result, has instigated a great deal of research aimed at increasing classification accuracy through various methods and techniques. However, comparatively little research has been performed on determining the best time(s) of image acquisition for crop discrimination even though this could impact classification accuracy as much as choice of clustering algorithm or selection of training data, for example. This case study was conducted to: (1) determine temporal windows for highest overall and individual crop discrimination; and (2) compare simple methods for combining best single-date results to increase overall accuracy. Seventeen single-date classifications of four major summer crops (rice, maize, sorghum, and soybeans) were assessed for a single growing season at the Coleambally Irrigation Area, Australia using Landsat Enhanced Thematic Mapper data. Per-pixel classifications were generated using a maximum likelihood classifier and were then combined with field boundaries to produce per-field classifications, based on the majority crop type within each field. Multi-date classifications were performed by: (1) combining various numbers of bands per date into a single image stack prior to classification (2-date, and 3-date--termed standard multi-date classification); as well as (2) extracting maximum accuracy single-crop classes from different dates and combining them, post-classification (termed iterative multi-date classification). Results showed that the general time-frame for highest overall single-date classification accuracy was late February to mid March. For the individual crops, late November to early December resulted in the highest accuracy for discriminating rice, maize was best discriminated from mid-February to mid-March, the maximum sorghum separability occurred from early April till at least early May, and the soybean temporal window extended from early January to mid-March, with late-February to early March being best.

The iterative approach resulted in higher accuracy than the standard multi-date image stack of the same dates. Highest multi-date accuracy resulted from the 3-date per-field iterative classification (overall classification accuracy of 95.8%), an improvement of more than 6% over best per-field single-date results (10 March, 89.4%). Determination of temporal windows for crop discrimination and use of an iterative technique to combine multiple-date images both greatly improved overall crop classification, thus increasing the benefit of remote sensing in operational management.
Keywords: Crop classification; Remote sensing; Time-series; Satellite imagery; Multi-temporal

G. M. Sakala, D. L. Rowell, C. J. Pilbeam, Acid-base reactions between an acidic soil and plant residues, Geoderma, Volume 123, Issues 3-4, December 2004, Pages 219-232, ISSN 0016-7061, DOI: 10.1016/j.geoderma.2004.02.002.
(http://www.sciencedirect.com/science/article/B6V67-4BX7BJB-1/2/71e5c2c4ad6fb60d5824015342c6ef26)
Abstract:
The elemental composition of residues of maize (Zea mays), sorghum (S. bicolor), groundnuts (Arachis hypogea), soya beans (Glycine max), leucaena (L. leucocephala), gliricidia (G. sepium), and sesbania (S. sesban) was determined as a basis for examining their alkalinity when incorporated into an acidic Zambian Ferralsol. Potential (ash) alkalinity, available alkalinity by titration to pH 4 and soluble alkalinity (16 h water extract titrated to pH 4) were measured. Potential alkalinity ranged from 373 (maize) to 1336 (groundnuts) mmol kg-1 and was equivalent to the excess of their cation charge over inorganic anion charge. Available alkalinity was about half the potential alkalinity. Cations associated with organic anions are the source of alkalinity. About two thirds of the available alkalinity is soluble. Residue buffer curves were determined by titration with H2SO4 to pH 4. Soil buffer capacity measured by addition of NaOH was 12.9 mmol kg-1 pH-1. Soil and residue (10 g:0.25 g) were shaken in solution for 24 h and suspension pH values measured. Soil pH increased from 4.3 to between 4.6 (maize) and 5.2 (soyabean) and the amounts of acidity neutralized (calculated from the rise in pH and the soil buffer capacity) were between 3.9 and 11.5 mmol kg-1, respectively. The apparent base contributions by the residues (calculated from the buffer curves and the fall in pH) ranged between 105 and 350 mmol kg-1 of residue, equivalent to 2.6 and 8.8 mmol kg-1 of soil, respectively. Therefore, in contact with soil acidity, more alkalinity becomes available than when in contact with H2SO4 solution. Available alkalinity (to pH 4) would be more than adequate to supply that which reacts with soil but soluble alkalinity would not. It was concluded that soil Al is able to displace cations associated with organic anions in the residues which are not displaced by H+, or that residue decomposition may have begun in the soil suspension releasing some of the non-available alkalinity. Soil and four of the residues were incubated for 100 days and changes in pH, NH4+ and NO3- concentrations measured. An acidity budget equated neutralized soil acidity with residue alkalinity and base or acid produced by N transformations. Most of the potential alkalinity of soyabean and leucaena had reacted after 14 days, but this only occurred after 100 days for gliricidia, and for maize only the available alkalinity reacted. For gliricidia and leucaena, residue alkalinity was primarily used to react with acidity produced by nitrification. Thus, the ability of residues to ameliorate acidity depends not only on their available and potential alkalinity but also on their potential to release mineral N.
Keywords: Plant residues; Plant composition; Plant alkalinity; Soil acidity; Buffering; Amelioration; Zambia

T. Traore, C. Mouquet, C. Icard-Verniere, A. S. Traore, S. Treche, Changes in nutrient composition, phytate and cyanide contents and [alpha]-amylase activity during cereal malting in small production units in Ouagadougou (Burkina Faso), Food Chemistry, Volume 88, Issue 1, November 2004, Pages 105-114, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2004.01.032.

(http://www.sciencedirect.com/science/article/B6T6R-4C76D1X-1/2/c5b9c7f7576cc975709b237ff3c37521)
Abstract:
The different traditional processes used in cereal malting were characterised and some biochemical modifications occurring in seeds during malting were studied to examine the possibility of using malted cereal flours to reduce the viscosity of gruels prepared from infant flours. Five production units (PU) of malted red sorghum seeds, two PU of malted millet seeds and one PU of malted maize seeds were selected as a function of the ability of the malt flours to fluidify high energy density gruels. Each of the 8 PU were monitored throughout the malt production process in order to describe rigorously the different steps in their malting process and to establish a detailed general production diagram. Samples were collected after soaking, germination, maturation, drying, and degerming and at the final product. They were analysed for nutrient, phytate and cyanide contents and [alpha]-amylase activity. For the 3 types of cereals, malting increased protein content while it decreased lipid and ash contents. A significant increase was observed in sucrose, glucose and fructose contents during malting, in particular during the germination step. The decrease in phytate content during malting was more obvious in millet seeds than in red sorghum and maize seeds. [alpha]-amylase activity increased during malting in all 3 types of cereals but more in red sorghum seeds than in millet and maize seeds. Cyanide content considerably increased during malting, particularly in red sorghum seeds. Sucrose content decreased during maturation while glucose and fructose contents increased. Traditional manual degerming reduced fibre and ash contents in all 3 types of cereals. Degerming had little effect on phytate content but reduced cyanide content to an acceptable level for human consumption even if it did not allow the complete elimination of cyanide. Unfortunately, degerming was accompanied by a decrease in [alpha]-amylase activity. The maturation step should be eliminated from the malting process (biochemical characteristics were not much affected as a result) and degerming of the seeds has to be systematically conducted after sun drying to achieve a significant reduction in cyanide content. Flours from malted red sorghum or millet seeds presented useful characteristics ([alpha]-amylase activity and nutrient contents) for incorporation in infant flours to improve the energy and nutrient density of gruels.
Keywords: Malting; Cereal; [alpha]-Amylase; Phytate; Cyanide

Magdi A. Osman, Changes in sorghum enzyme inhibitors, phytic acid, tannins and in vitro protein digestibility occurring during Khamir (local bread) fermentation, Food Chemistry, Volume 88, Issue 1, November 2004, Pages 129-134, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2003.12.038.
(http://www.sciencedirect.com/science/article/B6T6R-4C47NMR-3/2/058dab8cbdf1e49e5756b2935230ac96)
Abstract:
Effects of traditional fermentation on enzyme inhibitors, phytic acid, tannin content and in vitro digestibility of three local sorghum varieties were investigated. During a 24 h fermentation, enzyme inhibitory activities were significantly decreased. Trypsin inhibitory activity was reduced by 58%, 43% and 31% in Hamra, Shahla and Baidha, respectively, whereas amylase inhibitory activity was reduced by 74, 75 and in the three varieties after a 24 h fermentation. Phytic acid contents of the three varieties were markedly reduced as a result of fermentation. Tannin content of Hamra, Shahla and Baidha were significantly reduced by, respectively, 31%, 15% and 35% after fermentation. Fermentation significantly improved the in vitro digestibility of sorghum proteins.
Keywords: Trypsin inhibitor; Amylase inhibitor; Phytic acid; Tannins; In vitro protein digestibility

Vasudeva G. Kamath, Arun Chandrashekar, P.S. Rajini, Antiradical properties of sorghum (Sorghum bicolor L. Moench) flour extracts, Journal of Cereal Science, Volume 40, Issue 3, November 2004, Pages 283-288, ISSN 0733-5210, DOI: 10.1016/j.jcs.2004.08.004.

(http://www.sciencedirect.com/science/article/B6WHK-4DN1HB0-1/2/486c24bd220b1d4033982e4fb924025f)
Abstract:
Epidemiological studies support the belief that whole grains are protective against several chronic diseases. The health benefits of whole grains are attributed in part to their unique phytochemical composition. Major phytochemicals in grains include various classes of phenolic compounds, flavonoids and coumarin derivatives, etc. Phenolic compounds present in grains possess antioxidant properties that are associated with the health benefits of grains and grain products. Sorghum is one of the main staple cereal grains in hot dry tropics and ranks fifth among cereal crops in the world. Although sorghum is rich in phenolics and tannins which are proven anticancer and cardioprotective constituents, human consumption of sorghum is limited. To our knowledge, there is limited literature on the profile of antioxidant phytochemicals in the local white variety of sorghum. Hence, the objective of this study was to investigate the antioxidant property of white sorghum flour extracts in vitro and also to identify the fractions responsible for the antioxidant activity. In the present study, we analyzed the antioxidative properties of various extracts (water, 60% methanol, 60% ethanol, and 60% t-butanol) of white sorghum flour employing the 1,1-diphenyl-2-picrylhydrazyl (DPPH) model system. Phenolics, antiradical and antioxidant activities were also examined in chromatographic sub-fractions of the soxhlet methanolic extract. Our results indicated that the various extracts exhibited significant antioxidant activity that did not correlate with the phenolic content. Further, two sub-fractions eluted with methanol and acetone/methanol were found to possess strong antioxidant activity in two assay systems. Our results suggest that a diet rich in sorghum may be useful in combating diseases in which free radical production plays a key role.
Keywords: Sorghum flour extract; Phenolics; Radical scavenging activity; Antioxidant activity; Polyphenols

Z.G. Weinberg, G. Ashbell, Y. Chen, M. Gamburg, S. Sela, The effect of sewage irrigation on safety and hygiene of forage crops and silage, Animal Feed Science and Technology, Volume 116, Issues 3-4, 15 October 2004, Pages 271-280, ISSN 0377-8401, DOI: 10.1016/j.anifeedsci.2004.07.009.
(http://www.sciencedirect.com/science/article/B6T42-4D7CF4D-1/2/70d438ded7b1381f44fdccf8ba50a085)
Abstract:
The aim was to evaluate the safety of summer forage crops in Israel irrigated with secondary-treated sewage water. Nitrates levels and the incidence of Escherichia coli and Salmonella in corn and sorghum intended for silage were determined, as well as the fates of E. coli and added nitrates, during ensiling.
E. coli and Salmonella were found in 9 and 1, respectively, out of 41 samples of forage crops that had been irrigated with sewage water. E. coli disappeared from the silage following the decrease in pH, but was found in decaying parts of commercial silages in which the pH increased.
The concentration of nitrates in summer forage crops was usually below the critical level, which is toxic to cattle. The lower parts of the plants contained more nitrates than the other parts. The highest levels of nitrates were found in plants, which were irrigated with captured flood water.
The conclusions of this study are that nitrates, E. coli and Salmonella from forage crops irrigated with sewage water are not likely to pose a health risk to cattle if the ensiling process is adequate.
Keywords: Forage crops; Silage; Sewage irrigation; Hygiene

G. O. Omanya, B. I. G. Haussmann, D. E. Hess, B. V. S. Reddy, M. Kayentao, H. G. Welz, H. H. Geiger, Utility of indirect and direct selection traits for improving Striga resistance in two sorghum recombinant inbred populations, Field Crops Research, Volume 89, Issues 2-3, 8 October 2004, Pages 237-252, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.02.003.

(http://www.sciencedirect.com/science/article/B6T6M-4C47R40-3/2/a9a54c5ecdfa2aadf08f2a6054746fc2)

Abstract:
Breeding of sorghum (Sorghum bicolor L. Moench) for resistance to the parasitic weed Striga hermonthica (Del.) Benth. has been hampered by the difficulty of evaluating host resistance in the field and lack of reliable screening techniques. Therefore, we investigated the value of various indirect and direct measures of Striga resistance as selection traits. Two sorghum recombinant inbred populations of 226 F3:5 lines each were developed from the crosses (1) IS 9830xE 36-1 and (2) N 13xE 36-1. Striga-resistant line IS 9830 is characterized by low stimulation of Striga seed germination, whereas Striga-susceptible line E 36-1 produces germination stimulants in abundance. Line N 13 possesses 'mechanical' resistance and probably also an antibiosis mechanism. Resistance was assessed in 1997 and 1998 using in vitro agar-gel assays with Striga seeds from Kenya, Mali, and Niger, pot trials in the respective three countries, and field experiments in Kenya and Mali. The agar-gel assay proved to be a useful, precise and fast indirect selection method to screen for sorghum entries with the low-stimulant character. However, correlation analysis showed that this resistance mechanism was ineffective in some environments, especially in Kenya, pointing to the necessity of field evaluation. Because of low heritability estimates and moderate to low correlations to Striga resistance under field conditions, pot screening appeared to be of limited use in breeding programs. The field trials confirmed the effectiveness of several direct measures of Striga resistance in sorghum: emerged Striga counts, Striga severity index, and area under the Striga number or severity progress curves. A two-row plot field layout with an empty row between plots, coupled with artificial infestation of test rows, lattice design and six replications offered an improved screening procedure that achieved high heritability. Significant genotypexenvironment interactions in the field experiments stress the importance of multi-locational trials to achieve stable Striga resistance.
Keywords: Striga hermonthica; Sorghum bicolor; Resistance breeding; Quantitative genetic parameters

Sudha K. Nair, B. M. Prasanna, R. S. Rathore, T. A. S. Setty, R. Kumar, N. N. Singh, Genetic analysis of resistance to sorghum downy mildew and Rajasthan downy mildew in maize (Zea mays L.), Field Crops Research, Volume 89, Issues 2-3, 8 October 2004, Pages 379-387, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.02.017.
(http://www.sciencedirect.com/science/article/B6T6M-4C53R0C-1/2/27436474722d7b9769931e3dd2700f54)

Abstract:
Among the various maize diseases, downy mildews assume considerable importance in tropical and sub-tropical regions of the world. The present study was aimed at detailed genetic analysis of resistance to two downy mildew pathogens of maize, sorghum downy mildew (Perenosclerospora sorghi; SDM) and Rajasthan downy mildew (Perenosclerospora heteropogoni; RDM). Experiments were carried out under rigorous inoculation conditions against SDM and RDM, using a half 5x5 diallel set, and a 6x3 linextester set, that were developed using inbred lines showing distinct responses against downy mildews. Resistance to both SDM and RDM were found to be polygenically based, with the dominance of resistance over susceptibility. Although this was predominantly partial in case of SDM, it was mostly complete with respect to RDM. The mode of inheritance of resistance to RDM was less complex compared to that of SDM. Additive genetic components play an important role in imparting resistance to both SDM and RDM, although non-additive gene action also contributed significantly to RDM resistance. The study also revealed the potential utility of inbred lines such as NAI116 in devising a breeding strategy for integrated resistance to the two downy mildews.
Keywords: Zea mays L.; Inbreds; Downy mildews; Resistance; Genetic basis

J.F.J. Torres-Acosta, D.E. Jacobs, A. Aguilar-Caballero, C. Sandoval-Castro, M. May-Martinez, L.A. Cob-Galera, The effect of supplementary feeding on the resilience and resistance of browsing Criollo kids against natural gastrointestinal nematode infections during the rainy season in tropical Mexico, Veterinary Parasitology, Volume 124, Issues 3-4, 5 October 2004, Pages 217-238, ISSN 0304-4017, DOI: 10.1016/j.vetpar.2004.07.009.
(http://www.sciencedirect.com/science/article/B6TD7-4D8VJY5-1/2/ebe1ac8451510e3950cb526644803d26)
Abstract:
The objective was to determine the effect of supplementary feeding on the resilience and resistance of Criollo kids against natural gastrointestinal nematode (GIN) infections, when browsing native vegetation during the wet season in tropical Mexico. Thirty-four 2-month old Criollo kids, raised nematode free, were included at weaning in a 22-week trial. The kids were placed into four groups. Two groups of 8 kids were offered 100 g/day soybean and sorghum meal (26%:74%, respectively fresh basis) (treated/supplemented (T-S) and infected/supplemented (I-S)). Two groups remained with no supplement for the duration of the trial (infected/non-supplemented (I-NS) (n = 10) and treated/non-supplemented (T-NS) (n = 8)). Kids in groups T-S and T-NS were drenched with 0.2 mg of moxidectin/kg body weight orally (Cydectin, Fort Dodge) every 28 days. Groups I-S and I-NS were naturally infected with GIN. The animals browsed native vegetation (for an average of 7 h/day) together with a herd of 120 naturally infected adult goats. Cumulative live weight gain (CLWG), packed cell volume (PCV), haemoglobin (Hb), total plasma protein and plasma albumin were recorded every 14 days as measurements of resilience. Resistance parameters (faecal egg counts (FEC) and peripheral eosinophil counts (PEC)) were also measured. Bulk faecal cultures were made for each group every 28 days. Every month a new pair of tracer kids assessed the infectivity of the vegetation browsed by the animals. The T-S group had the highest CLWG, PCV and Hb compared to the other three groups ($P < 0.001$). The I-S and T-NS group had similar mean CLWG and PCV ($P > 0.05$), while the I-NS group had the poorest CLWG, PCV and Hb ($P < 0.001$). The PEC of supplemented kids (I-S and T-S) was higher than in the I-NS and T-NS kids ($P < 0.05$). No effect of supplementary feeding was found in the FEC. Tracer kids and faecal cultures showed that kids suffered mixed infections with Haemonchus contortus, Trichostrongylus colubriformis and Oesophagostomum columbianum. Supplementary feeding improved resilience of browsing Criollo kids against natural GIN infections and was economically feasible. Improved resistance was also suggested by the PEC but was not confirmed in the FEC.
Keywords: Goat; Gastrointestinal nematodes; Supplementary feeding; Resilience; Resistance

P. K. Ghosh, P. Ramesh, K. K. Bandyopadhyay, A. K. Tripathi, K. M. Hati, A. K. Misra, C. L. Acharya, Comparative effectiveness of cattle manure, poultry manure, phosphocompost and fertilizer-NPK on three cropping systems in vertisols of semi-arid tropics. I. Crop yields and system performance, Bioresource Technology, Volume 95, Issue 1, October 2004, Pages 77-83, ISSN 0960-8524, DOI: 10.1016/j.biortech.2004.02.011.
(http://www.sciencedirect.com/science/article/B6V24-4C2FF56-1/2/934494cd662abed7452a3b86eb9e07ef)
Abstract:
A field experiment was conducted on deep vertisols of Bhopal, India to evaluate the manural potential of three organic manures: farmyard manure (FYM), poultry manure (PM), phosphocompost (PC) vis-a-vis 0%, 75% and 100% recommended dose of fertilizer-NPK and to find out the most productive cropping system at various combinations of organic manures and chemical fertilizers. The seed yield of intercrop soybean (population converted to 100%) was 8.7% less than sole soybean whereas the grain yield of intercrop sorghum was 9.5% more than that of sole sorghum. However, the productivity in terms of soybean equivalent yield (SEY) was relatively high in intercropping system. The increasing NPK dose from 0% to 100% significantly improved

SEY in sole sorghum and soybean/sorghum intercropping system and the integrated use of organics and inorganics recorded significantly more SEY than inorganics. The effect of nutrient management followed the order; 75% NPK + 5 t FYM ha-1 > 75% NPK + 1.5 t PM ha-1 > 75% NPK + 5 t PC ha-1 > 100% NPK. Sorghum, both as sole and intercrop, responded more to PM while soybean to FYM. Application of 75% NPK in combination with PM or FYM or PC to preceding rainy season crops (soybean and sorghum) and 75% NPK to wheat produced significantly higher grain yield of wheat than those in inorganics and control indicating noticeable residual effect on the succeeding wheat crop and saving of 25% fertilizer-NPK. The effect of PC on rainy season crops was not as prominent as those of FYM and PM, but its residual effect on grain yield of wheat was comparable to those two organic manures. Among the cropping systems, soybean as preceding crop recorded the highest seed yield of wheat and was on a par with that of soybean/sorghum intercropping system. The yield of wheat following sorghum was the lowest. The total system productivity (TSP) was the highest in sorghum + soybean-wheat system and the lowest in the soybean-wheat system.
Keywords: Cattle manure; Poultry manure; Phosphocompost; Yield; Cropping systems; Vertisols

P. K. Ghosh, Ajay, K. K. Bandyopadhyay, M. C. Manna, K. G. Mandal, A. K. Misra, K. M. Hati, Comparative effectiveness of cattle manure, poultry manure, phosphocompost and fertilizer-NPK on three cropping systems in vertisols of semi-arid tropics. II. Dry matter yield, nodulation, chlorophyll content and enzyme activity, Bioresource Technology, Volume 95, Issue 1, October 2004, Pages 85-93, ISSN 0960-8524, DOI: 10.1016/j.biortech.2004.02.012.
(http://www.sciencedirect.com/science/article/B6V24-4C2FF56-2/2/abd4325833864948776059 72bf37caf4)
Abstract:
A field experiment was conducted on a deep Vertisol of Bhopal, India to compare root and shoot biomass, chlorophyll content, enzyme activity and nodulation in three cropping systems at three combinations of organic manure and inorganic-fertilizer: 75%NPK + 5 t farmyard manure (FYM), 75%NPK + 1.5 t poultry manure (PM), and 75%NPK + 5 t phosphocompost (PC) vis-a-vis 0%, 75% and 100% of fertilizer-NPK. In general, nodule number and its mass were lower in intercrop soybean than sole soybean. Also there was decrease in the nodule number with higher NPK dose. The FYM treated plots recorded 22.0% and 7.6% higher nodule mass than poultry manure and phosphocompost plots, respectively. Also, the total chlorophyll content was higher in organically treated plots than that in 100% NPK particularly at 30 days after sowing (DAS, pre-flowering). In sorghum the peak nitrate reductase (NR) activity was recorded at 60 DAS while in soybean it was at 30 DAS. The NR activity was higher in intercrop sorghum than that in sole sorghum. Maximum NR activity was observed in 100% NPK. Soybean/sorghum intercropping system recorded significantly higher root and shoot biomass than sole soybean and sorghum. The crop growth rates were relatively rapid during 30-60 DAS and followed the order; intercropping > sole sorghum > sole soybean. With the increase in NPK dose from 0% to 100% there was significant improvement in the dry matter (DM) production in sole sorghum and soybean/sorghum intercropping system. Soybean as preceding crop recorded the highest DM, chlorophyll content, NR activity in wheat while these values were the lowest in sorghum-wheat system.
Keywords: Cattle manure; Poultry manure; Phosphocompost; Nodulation; Cropping systems; Enzyme activity; Chlorophyll; Vertisols

Elevina Eduviges Perez Sira, Mary Lares Amaiz, A laboratory scale method for isolation of starch from pigmented sorghum, Journal of Food Engineering, Volume 64, Issue 4, October 2004, Pages 515-519, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2003.11.019.
(http://www.sciencedirect.com/science/article/B6T8J-4BG3S7F-2/2/be0a4b38bb75a0eeef4d873f7cc33278)
Abstract:

Sodium bisulfite and sodium hypochlorite at various concentrations in alkaline medium were assayed to bleach dark sorghum grains, before starch isolation. After testing different concentrations of the reagents, and time of exposure into the reagent method 2C was chosen. It used an alkaline mix of sodium hypochlorite 5.25% solution and 50 g KOH. As a result, an easy and quick method to isolate white starch from dark sorghum is reported. Percent of purity of the isolated starch from dark seed samples were compared to that exhibited by starch isolated from white sorghum grains, and slight differences between the isolates were recorded. These differences were attributed to the unequal isolation methods and/or varietal differences. The yield of the starch from dark seed samples was 30 +/- 1%.
Keywords: Starch; Sorghum; Sorghum bicolor; Isolation method

Kirsten A. Nielsen, Charlotte H. Gotfredsen, Morten J. Buch-Pedersen, Henriette Ammitzboll, Ole Mattsson, Jens O. Duus, Ralph L. Nicholson, Inclusions of flavonoid 3-deoxyanthocyanidins in Sorghum bicolor self-organize into spherical structures, Physiological and Molecular Plant Pathology, Volume 65, Issue 4, October 2004, Pages 187-196, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2005.02.001.
(http://www.sciencedirect.com/science/article/B6WPC-4FT3KK5-1/2/70f69f3214d876662845bee0c2bcc0cc)
Abstract:
Sorghum (Sorghum bicolor L.) produces 3-deoxyanthocyanidin phytoalexins. They accumulate as inclusions in cells and inhibit infection in a site-specific response. Inclusions are self-organizing 3-deoxyanthocyanidins. In aqueous solution, protons and acetate counter-ions condition self-stacking. Non-vesicular cytoplasmic trafficking of inclusions to sites of ingress is discussed. It is suggested that re-arrangements in plant cells under attack direct accumulation of inclusions to penetration sites. Nuclear migration, cytoplasmic streaming and intracellular pH provide an environment for inclusion trafficking and release of the phytoalexins. Luteolinidin, when self-organized as pigmented inclusions, mediates disruption of plant and fungal plasma membranes as well as reconstructed bilayer liposomes.
Keywords: Phytoalexin; 3-deoxyanthocyanidin; Sorghum bicolor; Bipolaris maydis; Liposomes; Inclusions; Luteolinidin; Flavonoid; Apigenididin; Appresoria; Germ tube; Bilayers; Confocal microscopy; Protoplast; Colletothricum graminicola; Cochliobolus heterostrophus

Marcela Simontacchi, Sebastian Jasid, Susana Puntarulo, Nitric oxide generation during early germination of sorghum seeds, Plant Science, Volume 167, Issue 4, October 2004, Pages 839-847, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2004.05.028.
(http://www.sciencedirect.com/science/article/B6TBH-4CKNF6F-1/2/0587d8dbc2af9e4eedb6a62d73a82f02)
Abstract:
Germination of sorghum embryonic axes, defined as the development of a root 1-2 mm long, started after 24 h of imbibition. A distinctive EPR signal for the adduct MGD-Fe-NO was detected in the homogenates from axes isolated from seeds imbibed in the presence of 12 mM nitrate in a time-dependent manner. Also a close association between MGD-Fe-NO adduct content in the homogenates and nitrate supplementation to the incubation medium was observed. The activities of the NADH-dependent nitrate reductase (NR) and nitric oxide synthase were measured in axes, by the detection of NO by EPR under conditions of maximal supplementation of substrates. A significant increase in both enzymatic activities was determined between 24 and 30 h of imbibition. Total content in sorghum axes of [beta]-carotene and [alpha]-tocopherol increased significantly as the germination occurred, however the total content of tocopherols was not affected over the studied period. The data reported here are the first observations employing EPR to assess for NR and NOS activities simultaneously in an active growing tissue. Moreover, since the increase in NO

content preceded the initiation of phase II of development and the sharp increase in oxygen consumption, a potential role for NO as a signal molecule should be considered.
Keywords: Antioxidants; Lipid radicals; Nitrate reductase; Nitric oxide; Nitric oxide synthase; Tocopherol

M. Avondo, L. Lutri, P. Pennisi, Feeding behaviour of Comisana rams as affected by crude protein level of concentrate, Small Ruminant Research, Volume 55, Issues 1-3, October 2004, Pages 135-140, ISSN 0921-4488, DOI: 10.1016/j.smallrumres.2004.01.006.
(http://www.sciencedirect.com/science/article/B6TC5-4C1NFP1-1/2/e412cc2152af07a50ddcddb74d46952d)
Abstract:
Two groups of 10 Comisana rams at maintenance were fed hay and two concentrates characterized by different CP levels (20% H and 13% L). During two experimental periods, two types of hay were given: a poor-quality mixed hay from a weedy vetch and barley sward, and a good-quality sorghum hay. Dry matter intake was higher with the low-quality hay (on average: 2494.7 g per day versus 2133.1 g per day). The protein level of concentrates gave rise to different reactions in the animals in relation to the type of hay administered: with the mixed hay, no significant differences in intake were observed between the two groups (2505.0 and 2484.5 g per day, respectively, for H and L groups); with the sorghum hay, the group receiving the higher protein concentrate significantly reduced intake (2094.3 g per day versus 2171.9 g per day; $P<0.05$). The variations in intake caused by the two concentrates and the two hays did not result in similar variations in the ram performance.
Keywords: Rams; Intake; Crude protein; Concentrate; Hay

V. K. Saini, S. C. Bhandari, J. C. Tarafdar, Comparison of crop yield, soil microbial C, N and P, N-fixation, nodulation and mycorrhizal infection in inoculated and non-inoculated sorghum and chickpea crops, Field Crops Research, Volume 89, Issue 1, 10 September 2004, Pages 39-47, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.01.013.
(http://www.sciencedirect.com/science/article/B6T6M-4C0V74B-4/2/10d9e019b85d8607b143a1ed924c719e)
Abstract:
A field experiment was conducted on a clay loam soil to assess the response of crops to inoculation and inorganic and organic fertilizers. Microbial biomass C, N and P under sorghum (Sorghum bicolor L.) and chickpea (Cicer arietinum L.) were significantly higher ($r=0.641$-0.735, $P<0.01$) when a combination of Azospirillum brasilense or Rhizobium, Bacillus megaterium and Glomus fasciculatum were used, and was maximum with 50% recommended fertilizers (40 kg N ha-1 and 8.73 kg P ha-1 for sorghum; 10 kg N ha-1 and 8.73 kg P ha-1 for chickpea) along with bioinoculants. Biomass C, N and P in the rhizosphere soil of sorghum-chickpea sequences were greater after 30 days and decreased subsequently (at 60 days or at harvest). A strong correlation ($P<0.01$) of biomass C, N and P was observed with N and P uptake of sorghum and chickpea indicating the role of microorganisms in crop response. Azospirillum population in the rhizosphere improved significantly from 38.0 cfu g-1 under recommended fertilizer to 176.8 cfu g-1 under farm yard manure (FYM) and bioinoculants. Nodule dry weight and acetylene reduction activity (ARA) were significantly higher in the treatments receiving Rhizobium inoculation. Vesicular arbuscular mycorrhizal (VAM) infectivity was also improved significantly with combined inoculants and FYM compared to sole application of FYM or fertilizers (N and P). Application of fertilizer nutrients along with FYM, use of nitrogen fixers, phosphate solubilizers and VAM significantly increased grain ($r=0.618$, $P<0.05$) and straw yields ($r=0.602$, $P<0.05$) and, in general, decreased C:N and C:P ratio. The results suggested that for maximum crop yield only 50% of the required fertilizer might be supplied along with bioinoculants.

Keywords: Crop yield; Microbial C, N, P; Nitrogen fixation; Mycorrhizal infection; Sorghum; Chickpea

A. Folliard, P. C. S. Traore, M. Vaksmann, M. Kouressy, Modeling of sorghum response to photoperiod: a threshold-hyperbolic approach, Field Crops Research, Volume 89, Issue 1, 10 September 2004, Pages 59-70, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.01.006.
(http://www.sciencedirect.com/science/article/B6T6M-4C0V74B-1/2/11dcdbce93f106b012567eebd4f75bf1)
Abstract:
High photoperiod sensitivity is a singular trait for adaptation of sorghum to environmental constraints in sudano-sahelian West Africa. Difficulties encountered by selected models such as CERES-sorghum and STICS to simulate crop development may result from the representation of sorghum response to daylength during the photoperiod inductive phase. Four modeling approaches combining two temperature and photoperiod responses (linear, hyperbolic) and two calculation methods for development rates (cumulative, threshold) were evaluated to simulate time to panicle initiation (PI) in highly photoperiod sensitive Guinea sorghum variety CSM388. In the cumulative method, development rates were computed as summations of daily photothermal ratios, whereas in the threshold method accumulated degree days were tested against thermal time requirement to PI modulated by current photoperiod. Each model was calibrated based on observations from a Sotuba, Mali (12[degree sign]39'N) planting date experiment spanning a 2-month period in 1996. Observed time from emergence to PI decreased from 54 to 22 days for a 20 min variation in daylength. Apparent higher performance by threshold methods was further tested against a 1994 independent dataset featuring three latitudes and a much wider range of sowing dates extending from February to September. Results validate the superiority of threshold over cumulative methods and confirm the better fit of a hyperbolic temperature and photoperiod response. A threshold-hyperbolic modeling approach is believed to be more consistent with crop physiology as it associates cumulative (temperature) processes and trigger (photoperiod) events that better reflect the concepts of quantitative plant growth and qualitative plant development. Its mathematical form and computational simplicity should ensure wide applicability for varietal screening over a large range of photoperiod sensitivities including neutral cultivars, and easy implementation into existing models.
Keywords: Sorghum; Development rate; Photoperiod sensitivity; Phenological modeling

M. Handan Cubuk, H.A.Hasan A. Heperkan, Investigation of pollutant formation of Sweet Sorghum-lignite (Orhaneli) mixtures in fluidised beds, Biomass and Bioenergy, Volume 27, Issue 3, September 2004, Pages 277-287, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2004.02.001.
(http://www.sciencedirect.com/science/article/B6V22-4C1FBSC-2/2/89cd386e0c91a39f0bbf1118f2f243fa)
Abstract:
Most of the Turkish lignites have undesired fuel properties and they are extremely pollutant. In this study, Sweet Sorghum was chosen as the energy plant. Combustion experiments of lignite and lignite-Sweet Sorghum mixtures were carried out in a fluidised bed system. The fuel-feeding ratio was set such that the thermal output of the system remained constant. Addition of Sweet Sorghum to the lignite reduces the pollutant concentration. The results were supported by experimental results.
Keywords: Sweet sorghum; Sorgum bicolor; Lignite; Co-combustion; Fluidised bed; Pollutant

R. Sinicio, Generalised Longevity Model for Orthodox Seeds, Biosystems Engineering, Volume 89, Issue 1, September 2004, Pages 85-92, ISSN 1537-5110, DOI: 10.1016/j.biosystemseng.2004.05.008.

(http://www.sciencedirect.com/science/article/B6WXV-4CYR0KS-2/2/882d852c0f8611d01b4728b5c3748899)
Abstract:
The research objectives were to improve the probit model for predicting longevity of orthodox seeds by taking into account the seed composition, and to conduct an error analysis to determine the uncertainties involved in the probit model for three seed species (chickpea, cowpea, and soya bean). Multiple linear regression method was employed to determine the dependency of the viability constants of the probit model on seed composition. Probit equations, already developed for six seed species (barley, chickpea, cowpea, groundnut, sorghum, and soya bean), were used to generate a data set in the ranges of 5-25% moisture content and -20 to 70 [degree sign]C temperature. The improved model obtained, called a generalised longevity model, can be used to predict seed viability as a function of initial seed viability, time period, and seed temperature, moisture content, and composition (carbohydrate, lipid, and protein fractions). The average error for predicting seed viability by using the proposed model (5[middle dot]8%) was much lower than the average uncertainty of the probit equations (33[middle dot]9%). The generalised longevity model could be used for seed species with known composition and unknown viability constants. Further research is recommended to validate the proposed model by using experimental data of different seed species.

B. U. Singh, P. G. Padmaja, N. Seetharama, Biology and management of the sugarcane aphid, Melanaphis sacchari (Zehntner) (Homoptera: Aphididae), in sorghum: a review, Crop Protection, Volume 23, Issue 9, September 2004, Pages 739-755, ISSN 0261-2194, DOI: 10.1016/j.cropro.2004.01.004.
(http://www.sciencedirect.com/science/article/B6T5T-4C0TFBJ-1/2/f1fb555894408cb75ab2333d155486dc)
Abstract:
The sugarcane aphid, Melanaphis sacchari (Zehntner, 1897) is a key pest on sorghum and sugarcane in many areas of Africa, Asia, Australia, the Far East, and parts of Central and South America. The status of research of its geographical distribution, host range, nature of damage, extent of crop losses, and ecobiology in sorghum is summarized and research programs in different countries are reviewed. Numerous germplasm accessions, A/B- and R-lines, agronomic elite lines, hybrids, and varieties, identified as sources of resistance providing genetic diversity from different countries are listed. Studies on the components of resistance showed the predominance of antixenosis for colonization/establishment on IS 1144C, IS 12664C, and TAM 428, and antibiosis was observed on IS 12609C, IS 12664C, and TAM 428 for least number of days to reproduction, greater mortality, shorter longevity, and production of no or fewer nymphs. The morpho-physiological traits and biochemical factors associated with resistance have been discussed. There is a significant decline in diastase activity but increase in crude fiber and carbohydrates in the grain due to infestation by M. sacchari. It is a vector of three persistent viruses (millet red leaf, sugarcane yellow leaf, and sugarcane mosaic viruses). Among the control tactics, cultural practices, natural enemies, and chemical control together can prevent the sugarcane aphid from reaching the economic threshold levels. Current progress has been reviewed and ideas for future research are suggested.
Keywords: Biology; Management; Mechanisms of resistance,Melanaphis sacchari; Sorghum; Sugarcane aphid; Varietal resistance

M.N. Emmambux, M. Stading, J.R.N. Taylor, Sorghum kafirin film property modification with hydrolysable and condensed tannins, Journal of Cereal Science, Volume 40, Issue 2, September 2004, Pages 127-135, ISSN 0733-5210, DOI: 10.1016/j.jcs.2004.08.005.
(http://www.sciencedirect.com/science/article/B6WHK-4DN1HB0-2/2/8dca3c15f643e15d7631585a5a6a5041)

Abstract:
Films made from kafirin, the prolamin protein of sorghum, could be an environmental-friendly alternative to synthetic plastic packaging films. However, because protein-based films have inferior functional properties to synthetic plastic packaging, tannic acid (TA) and sorghum-condensed tannins (SCT) were added at up to 20% (w/w) as modifying agents during kafirin film casting. Both TA and SCT were bound to kafirin protein in the film. Freeze-fracture surfaces of tannin-modified kafirin films were observed to be different from the control. Modification with both tannins at increasing levels resulted in an increase in tensile stress and Young's modulus by two-fold and four-fold, respectively, but a three-fold decrease in %strain and a 12-15% decrease in water absorbed. Modification with TA and SCT did not change the apparent water vapour permeability. However, a significant quadratic decrease was observed for oxygen permeability. The glass transition temperature (Tg) of the films showed a quadratic increase with increase in TA and SCT level. These findings indicate that TA and SCT can modify the properties of kafirin films. This probably there are no decreasing free volume in the film and possibly also by decreasing chain mobility between kafirin polypeptides by cross-linking.
Keywords: Sorghum; Kafirin; Film; Tannin; Plastic

Paul H. Goodwin, Richard P. Oliver, Tom Hsiang, Comparative analysis of expressed sequence tags from Malva pusilla, Sorghum bicolor, and Medicago truncatula infected with Colletotrichum species, Plant Science, Volume 167, Issue 3, September 2004, Pages 481-489, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2004.04.014.
(http://www.sciencedirect.com/science/article/B6TBH-4CDJBHH-2/2/79984200c1373a535f4d990e1896fcc2)
Abstract:
To assess relative gene expression, expressed sequence tag redundancy was compared between EST collections from susceptible Malva pusilla and Medicago truncatula inoculated with Colletotrichum gloeosporioides f. sp. malvae and C. trifolii, respectively, and resistant and susceptible Sorghum bicolor inoculated with C. graminicola (=C. sublineolum). EST redundancies from the fungal-inoculated S. bicolor and M. truncatula were also compared to healthy S. bicolor and M. truncatula. Several of the more redundant plant ESTs in the C. gloeosporioides f. sp. malvae-M. pusilla interaction represented genes encoding pathogenesis-related proteins, such as [beta]-1,3-glucanase, osmotin and chitinase, but a number of other ESTs, such as those for cysteine proteinase, heat shock protein and glutathione S-transferase, were also relatively abundant. Differences in EST redundancy between different interactions included a greater abundance of heat shock protein ESTs in the susceptible S. bicolor interaction, and a greater abundance of cysteine proteinase ESTs in the resistant S. bicolor and susceptible M. truncatula interactions. Using EST redundancy to compare gene expression between different host plants interacting with Colletotrichum species provides a useful basis for selecting genes for further study in plant-Colletotrichum interactions.
Keywords: Expressed sequence tag; Hemibiotrophy; Resistance; Susceptibility

P. K. Ghosh, Growth, yield, competition and economics of groundnut/cereal fodder intercropping systems in the semi-arid tropics of India, Field Crops Research, Volume 88, Issues 2-3, 10 August 2004, Pages 227-237, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.01.015.
(http://www.sciencedirect.com/science/article/B6T6M-4C40V5T-2/2/8030c1306732106c6ca627bd1dae8d0e)
Abstract:
Intercropping legumes with non-legume crops during the rainy season (wet season) is a common practice in the semi-arid tropics of India. Of late, the concept of intercropping has also been utilized in irrigated (dry season) situations. In a 2-year field study during the dry season (February-May), we assessed yield, competition and economics in a groundnut/cereal fodder intercropping

system compared with monocropped groundnut. Maize (Zea mays L.), sorghum (Sorghum bicolor (L.) Moench) and pearl millet (Pennisetum glaucum L.) were grown for fodder. One cutting for all and two cuttings (first at 50 days after sowing and second at 95 days after sowing) for sorghum and pearl millet were made. In intercrops one row of cereal fodder was sown between every three rows of groundnut (1:3). The green fodder yields and pod yield of groundnut were lower in intercropped than in monoculture plots. The highest green fodder yield in intercrops was recorded in pearl millet with two cuts (16.5 t ha-1) followed by pearl millet with one cut (11.8 t ha-1) and sorghum with two cuts (10.7 t ha-1). In intercrops the growth and yield of groundnut were affected by cereal fodder and intensity of cutting. A significant (*P<0.05) reduction in leaf area index (LAI) and crop growth rate (CGR) was observed in the groundnut-pearl millet system over sole groundnut. Decrease in nodule mass at pod filling stages in groundnut ranged from 3.5 to 11.0% when intercropped with cereal fodders compared to sole groundnut crop. Groundnut yield was reduced more due to pearl millet and sorghum with two cuts. However, maize as the associated crop produced 9.0 t green fodder ha-1 and affected the groundnut less with respect to pod yield (5.76% reduction), yield attributes, CGR, LAI and nodule dry mass. Of the two cutting situations under intercropping, one cut gave 9.9% higher yield of groundnut as compared to two cuts. A higher land equivalent ratio (LER) and relative crowding coefficient (RCC) value leads to a crop yield advantage. Accordingly, yield advantage was greater in case of the groundnut/maize association. The competition ratio (CR) is a better indication of performance than RCC. The CRs of pearl millet and sorghum with two cuts were greater than maize but the corresponding CRs of groundnut were less. Thus, pearl millet and sorghum were more competitive, and groundnut under these two crops was affected more. The maximum monetary advantage was also recorded for the groundnut/maize intercropping system.
Keywords: Zea mays; Sorghum bicolor; Pennisetum glaucum; Arachis hypogaea; Cereal fodder; Fodder yield; Intensity of cutting; Intercrops; Competition indices

R. Kenga, S. O. Alabi, S. C. Gupta, Combining ability studies in tropical sorghum (Sorghum bicolor (L.) Moench), Field Crops Research, Volume 88, Issues 2-3, 10 August 2004, Pages 251-260, ISSN 0378-4290, DOI: 10.1016/j.fcr.2004.01.002.
(http://www.sciencedirect.com/science/article/B6T6M-4BS0FT1-1/2/7bad6ce14b87f03e98d6fad05fb957f5)
Abstract:
Sorghum varieties grown in West Africa usually have low production potential. Information on combining ability of diverse open-pollinated cultivars and gene pools is needed for efficient choice of breeding methods and parental materials to use in developing breeding programs to increase production. Twenty parental lines including 15 restorers and 5 male-sterile A-lines were mated. The 20 parents were sampled from elite germplasm available for cultivar development in the region. Combining ability studies were conducted on these parents along with their F1 hybrids for grain yield, days to anthesis, plant height, inflorescence length, threshing percentage, and seed mass in 2 years and in two locations. Each location-year combination was considered as an environment. For each trait, general combining ability (GCA) and specific combining ability (SCA) effects were estimated using the line-tester method of analysis. Highly significant GCA effects of males were found for all traits under study. Significant SCA was detected in all traits except inflorescence length. From the ratio of general combining ability to specific combining ability non-additive gene action was predominant for most traits. Parental lines with good performance per se and good performance in crosses for most agronomic traits included: ICSA 902 NG, NR 71182-2, NR 71182-3, CS 144, and Damougari. Both additive and non-additive gene effects are involved in variations observed among crosses. Hybrid breeding could contribute to sorghum improvement in the dry land agriculture of West Africa. Importance of genotype-environment interaction underlines the necessity of evaluating breeding materials under broad range of conditions. The various traits studied can be improved through breeding procedures using a range of different intra-population

and inter-population selection procedures. In hybrid breeding procedures, testing of parent lines for general combining ability should be supplemented by evaluation of individual F1 hybrids for specific combining ability.
Keywords: Combining ability; Hybrid breeding; Sorghum bicolor; Tropical landrace

Jayanand Boddu, Catherine Svabek, Rajandeep Sekhon, Amanda Gevens, Ralph L. Nicholson, A. Daniel Jones, Jeffery F. Pedersen, David L. Gustine, Surinder Chopra, Expression of a putative flavonoid 3'-hydroxylase in sorghum mesocotyls synthesizing 3-deoxyanthocyanidin phytoalexins, Physiological and Molecular Plant Pathology, Volume 65, Issue 2, August 2004, Pages 101-113, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2004.11.007.
(http://www.sciencedirect.com/science/article/B6WPC-4F9FPX0-2/2/11f542f18455c700eab774f0f933d4cf)
Abstract:
In sorghum, ingress of Cochliobolus heterostrophus stimulates the synthesis of 3-deoxyanthocyanidins that act as phytoalexins. Apigeninidin and luteolinidin are two major phytoalexins induced in the first 24 h after infection. In an attempt to understand genetic regulation of the biosynthesis of sorghum phytoalexins, we isolated a differentially expressed partial cDNA. Characterization and comparison showed that this cDNA sequence corresponds to a putative flavonoid 3'-hydroxylase. Full length sequence characterization allowed us to establish that the sorghum putative f3'h cDNA encodes a peptide of 517 amino acids that has domains conserved among cytochrome P450 proteins functioning in the flavonoid biosynthetic pathway. Heterologous expression of the putative f3'h cDNA in Escherichia coli yielded a membrane preparation that catalyzed the hydroxylation of naringenin. We show here that transcription of the flavonoid 3'-hydroxylase was coordinately regulated with that of chalcone synthase and dihydroflavonol reductase, and expression of these genes was induced within the first 24 h of fungal challenge. Synthesis of apigeninidin and luteolinidin followed the induced expression of the f3'h gene, implicating its role in fungal induced expression of sorghum phytolaexins.
Keywords: Apigeninidin; Cochliobolus heterostrophus; Cytochrome P450; Eriodictyol; Flavonoid 3'-hydroxylase; Luteolinidin; Naringenin; Phytoalexin; Sorghum bicolor; 3-Deoxyanthocyanidins

J. C. Lopez-Gutierrez, M. Toro, D. Lopez-Hernandez, Arbuscular mycorrhiza and enzymatic activities in the rhizosphere of Trachypogon plumosus Ness. in three acid savanna soils, Agriculture, Ecosystems & Environment, Volume 103, Issue 2, Soil Processes under Pastures in Intertropical Areas, July 2004, Pages 405-411, ISSN 0167-8809, DOI: 10.1016/j.agee.2003.12.011.
(http://www.sciencedirect.com/science/article/B6T3Y-4BMTHW9-3/2/ba9f9bfe47106417c4e5bb9a46144e52)
Abstract:
Phosphorus (P) is one of the most limiting macronutrients in savannas. Seasonality strongly affects nutrition processes in such ecosystems. We studied arbuscular mycorrhizae (AM), microbial and phosphatase activity in the rhizosphere of Trachypogon plumosus Ness. in three acid savanna soils differing in taxonomic order and P content. Microbial number and activity, P mineralization and AM dynamics were quantified in rhizospheric samples of T. plumosus during the dry and the rainy season at three sites in the Estacion Experimental La Iguana, Guarico State, Venezuela. Soils were characterized and infective AM propagules enumerated using the most probable number method on Sorghum vulgare Pers. Acid phosphatase activity (APA), dehydrogenase activity (DHA) and number of bacteria and fungi were determined in rhizospheric samples. AM colonized root length percentage (%CRL) was also determined in T. plumosus. Our data showed that the three soil orders had a very low fertility. AM infective potential showed values similar to those reported for tropical savannas. Also, AM %CRL was high for a grass species. APA increased in the rainy season in all cases. However, DHA and microbial counts decreased during

the rainy season suggesting that soil microorganisms do not mediate the increase in APA. AM colonization, seasonal changes in microbial activity and in APA seemed to be important processes for P availability and T. plumosus P-uptake in savanna ecosystems.
Keywords: Phosphatase; Savanna; Dehydrogenase; Arbuscular mycorrhiza; Trachypogon

E. Habyarimana, P. Bonardi, D. Laureti, V. Di Bari, S. Cosentino, C. Lorenzoni, Multilocational evaluation of biomass sorghum hybrids under two stand densities and variable water supply in Italy, Industrial Crops and Products, Volume 20, Issue 1, 5th European Symposium on Industrial Crops and Products and the 3rd International Congress and Trade Show GreenTech 2002, July 2004, Pages 3-9, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.12.020.
(http://www.sciencedirect.com/science/article/B6T77-4BVRY96-1/2/33bd8a39cf232c2ec0f7ce0a0453819e)
Abstract:
Sorghum, a C4 plant particularly resistant to drought and high temperatures, is highly competitive amongst biomass crops in dry areas where irrigation water supply is a limiting factor during crop development. This work was undertaken to assess the plant stand density response for the aboveground biomass production in sorghum hybrids under variable regimes of water supply in Italy. The results showed that water stress causes a decrease in dry matter yield to a level yet agronomically interesting. Total dry matter yield versus stand density relationship was dependent on water regime and sorghum genotype. High stand density (20 plants m-2) outyielded the low one (10 plants m-2) under humid conditions whilst the two population stands had statistically comparable biomass yields under water stressed environments. A dichotomous density response was noticed under humid conditions where one group of hybrids (H128, Abetone, ABF14, ABF20, and ABF306) displayed an increasing biomass production while the second one (H132, ABF18, ABF25, and ABF11) had a steady performance in spite of the increasing plant stand.
Keywords: Sorghum hybrid; Plant density; Biomass; Water supply

E. Habyarimana, D. Laureti, M. De Ninno, C. Lorenzoni, Performances of biomass sorghum [Sorghum bicolor (L.) Moench] under different water regimes in Mediterranean region, Industrial Crops and Products, Volume 20, Issue 1, 5th European Symposium on Industrial Crops and Products and the 3rd International Congress and Trade Show GreenTech 2002, July 2004, Pages 23-28, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.12.019.
(http://www.sciencedirect.com/science/article/B6T77-4BYC4TT-1/2/6cef28f8353066172bb38b9ad5572e1c)
Abstract:
Sorghum bicolor (L.) Moench is a multifunctional crop that can be successfully grown in areas where water supply is limited. The aim of this study was to evaluate sorghum genotypes for biomass performance and drought resistance in field conditions in Italy. Data from a survey conducted on 75 lines and two hybrids revealed that tropical sorghum landraces can achieve high yields (33-51 t ha-1 under irrigation, and 20-29 t ha-1 under rain-fed conditions) of total aboveground dry biomass. Performance under rain-fed conditions was significantly associated with green leaf area retention (r: -0.47; P: 0.001), plant height (r: 0.50; P: 0.001), and maturity (r: 0.61; P: 0.001). Differences in biomass production potential could explain the observed dry matter yield variability in sorghum materials under water stressed conditions. A stay-green source (SDS 1948-3) along with two senescent types (IS 23509 and IS 33350) were identified and could be of great interest in drought resistance breeding research. The need for developing drought tolerant sorghum hybrids in order to increase and stabilize biomass production is highlighted.
Keywords: Sorghum bicolor; Biomass yield; Drought stress; Field evaluation; Mediterranean region

Stefano Amaducci, Andrea Monti, Gianpietro Venturi, Non-structural carbohydrates and fibre components in sweet and fibre sorghum as affected by low and normal input techniques, Industrial

Crops and Products, Volume 20, Issue 1, 5th European Symposium on Industrial Crops and Products and the 3rd International Congress and Trade Show GreenTech 2002, July 2004, Pages 111-118, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.12.016.
(http://www.sciencedirect.com/science/article/B6T77-4C04XNV-1/2/082fc820191941ca8474b9e286d8cb4f)
Abstract:
Since sorghum could be considered a multipurpose crop, the evaluation of the effects of agrotechniques on qualitative parameters is important to chose the most suitable destination. Two agrotechniques (low and normal input), two sorghum genotypes (sweet and fibre) and two plant populations (10 and 20 plants m-2) were compared in a factorial design with four replications in North Italy (44[degree sign]33'N, 11[degree sign]21'E, 32 m a.s.l) over the 3 years 1997-1999. Normal input increased biomass yield (11%) and dry leaves (16%) only of sweet sorghum. In 1999 normal input determined 30% more above ground dry matter and 18% more dry stems compared to the low input technique. Genotypes employed had a very different performance. On average panicles represented 2 and 28% of the whole dry matter of sweet (Keller) and fibre (H128) genotypes, respectively. Input level and plant density did never influence fibre chemical composition. Cellulose and hemicellulose content of stem were significantly lower in 1999 and they were negatively correlated with stem yield. Growing conditions never influenced lignin and its average content was 5.4% on stem dry matter. The higher stem yield in 1999 compared to 1998 may explain the higher cellulose and hemicellulose production in 1999 (+32 and +38%, respectively). Higher plant density was associated to the higher content of sucrose and lower content of glucose and fructose. Year and input level did not influence sucrose content of stem that on average was 31%. The clearly higher sucrose yield of 1999 (57 and 73% more than 1997 and 1998, respectively) was due to the higher stem yields.
Keywords: Sweet sorghum; Fibre sorghum; Sugar; Cellulose; Agrotechnique

B. Clerget, M. Dingkuhn, J. Chantereau, J. Hemberger, G. Louarn, M. Vaksmann, Does panicle initiation in tropical sorghum depend on day-to-day change in photoperiod?, Field Crops Research, Volume 88, Issue 1, 10 June 2004, Pages 21-37, ISSN 0378-4290, DOI: 10.1016/j.fcr.2003.11.008.
(http://www.sciencedirect.com/science/article/B6T6M-4BHVH73-1/2/144c9178ce9577d566c5d8dd10c21e43)
Abstract:
Sorghum is known as a short day plant requiring short photoperiods (PP) to flower. However, in field experiments based on monthly plantings reported elsewhere, panicle initiation took place during long days as well as during short days even for highly photoperiod-sensitive varieties thought to be of the absolute type, or was particularly early for the sowings in September, well before days were shortest. In order to investigate these contradictory results, three tropical sorghum varieties of different photoperiod sensitivity were planted monthly in Mali and the dates of panicle initiation (PI) were recorded. The results indicate that the common concepts of a gradual (linear, or quantitative) response of photoperiod-induced phase (PIP) to PP at PI (PPi) (case of the variety Sariaso 10) or a threshold-type response (hyperbolic, or absolute; cases of CSM 335 and IRAT 174) could be reproduced for the sowing dates falling into the wet season (May-October), but did not describe adequately crop behaviour during the remaining months of the year. The same varieties were tested in controlled environments with four differential PP treatments composed of three different initial PP (12 h 15 min, 12 h 00 min and 11 h 45 min) and two opposite rates of day length change (+/-1 min/day). Thus after 15 days, two pairs of treatments with opposite day length changes reached the same average PP (12 h 07 min and 11 h 52 min) and after 30 d, another pair reached a similar average PP (12 h 00 min). In 2001, 2 varieties reached PI earlier under decreasing days and the same average PP, but no such additional effect of the rate of change of PP was observed in 2002. Modelling exercises showed that field variation in the duration to PI was

better explained with rate of change of PP than with absolute PP observed during PIP, and best with a combination of both factors in an additive model. It is concluded that in tropical sorghum, floral induction is strongly associated with a negative rate of change of day length in the field, and under certain circumstances under controlled conditions, but more evidence is needed to ascertain the capability of sorghum to sense the rate of change of PP before a definite model can be formulated.
Keywords: Photoperiod sensitivity; Rate of day length change; Panicle initiation; Modelling; Sorghum [Sorghum bicolor (L.) Moench]

H. A. Torbert, S. A. Prior, H. H. Rogers, G. B. Runion, Elevated atmospheric CO2 effects on N fertilization in grain sorghum and soybean, Field Crops Research, Volume 88, Issue 1, 10 June 2004, Pages 57-67, ISSN 0378-4290, DOI: 10.1016/j.fcr.2003.11.011.
(http://www.sciencedirect.com/science/article/B6T6M-4BHCKMF-3/2/3073c4ccdc552498b5ae7bc5c1b3eb2c)
Abstract:
Increasing atmospheric CO2 concentration has led to concerns about global changes to the environment. One area of global change that has not been fully addressed is the effect of elevated atmospheric CO2 on agriculture production inputs. Elevated CO2 concentration alterations of plant growth and C:N ratios may modify C and N cycling in soil and N fertility. This study was conducted to examine the effects of legume, soybean (Glycine max (L.) Merr.), and non-legume, grain sorghum (Sorghum bicolor (L.) Moench.) carbon dioxide-enriched agro-ecosystems on N soil fertility in a Blanton loamy sand (loamy siliceous, thermic, Grossarenic Paleudults). The study was a split-plot design replicated three times with crop species (soybean and grain sorghum) as the main plots and CO2 concentration (ambient and twice ambient) as subplots using open top field chambers. Fertilizer application was made with 15N-depleted NH4NO3 to act as a fertilizer tracer. Elevated CO2 increased total biomass production in all 3 years of both grain sorghum (average 30%) and soybean (average 40%). With soybean, while no impact on the plant C:N ratio was observed, the total N content was greatly increased (average 29%) due to increased atmospheric N2 fixation with elevated CO2 concentration. With grain sorghum, the total N uptake was not affected, but the C:N ratio was markedly increased (average 31%) by elevated CO2. No impact of elevated CO2 level was observed for fertilizer N in grain sorghum. The results from this study indicated that while elevated CO2 may enhance crop production and change N status in plant tissue, changes to soil N fertilizer application practices may not be needed.
Keywords: Carbon dioxide; Fertilizer nitrogen dynamics; 15N; Glycine max; Sorghum bicolor

Attanda Mouinou Igue, Thomas Gaiser, Karl Stahr, A soil and terrain digital database (SOTER) for improved land use planning in Central Benin, European Journal of Agronomy, Volume 21, Issue 1, June 2004, Pages 41-52, ISSN 1161-0301, DOI: 10.1016/S1161-0301(03)00062-5.
(http://www.sciencedirect.com/science/article/B6T67-49CS184-4/2/877710a5c83ee3fbe18d7ecf361d2769)
Abstract:
The soil is a natural resource, non-renewable in the short term and expensive either to reclaim or to improve following erosion or degradation. In the Republic of Benin (West Africa) the increasing pressure on land caused by steady population growth induces soil degradation. The reduced site productivity calls for an information system on soil resources, which allows the analysis of land suitability, potential food production, environmental impact of land use and the identification of conservation measures. On the basis of such a system, sound policy formulation and development planning at all levels can be carried out, utilizing both internal and external resources efficiently. For the central part of Benin, the development of a soil information system has been initiated. The data structure for the description of the land resources was established according to the Soil and Terrain Digital Database (SOTER) manual (Global and National Soils and Terrain Digital

Databases (SOTER). Procedures Manual. International Soil Reference and Information Centre, Wageningen, The Netherlands, 1993) with slight modifications (Mitteilg. Dtsch. Bodenkdl. Ges. 76 (1995) 1221). Based on field observations and data analysis, land areas have been delineated showing similar response to management practices. On the uppermost level, seven so called `terrain units' could be distinguished. The main differentiating criteria were landscape morphology, geology and hydromorphy. The terrain units are subdivided at a second level into 25 terrain components according to the soil parent material and landform. The FAO/ITC land suitability procedure was used to identify crop specific constraints to the production of sorghum, cowpea, maize, cotton, groundnuts and cassava. With regard to the soil induced limitations to crop production, unfavorable textural properties prevail, except for terrain components on gabbro or basaltic parent material. Unfavorable climatic conditions determine the suitability of this region for cotton, maize and cassava production. The ranking of the physical suitability of the six crops for Central Benin was in the order sorghum>groundnut>cowpea, cassava>maize>cotton. The problem of interannual variability of precipitation and its effects on the climatic suitability is discussed.
Keywords: Benin; Soil data base; Land suitability classification; Soil and climate variability

Laura Ercoli, Marco Mariotti, Alessandro Masoni, Iduna Arduini, Growth responses of sorghum plants to chilling temperature and duration of exposure, European Journal of Agronomy, Volume 21, Issue 1, June 2004, Pages 93-103, ISSN 1161-0301, DOI: 10.1016/S1161-0301(03)00093-5.
(http://www.sciencedirect.com/science/article/B6T67-49HDX26-3/2/52aed7f10b817c6485d59ede6b496602)
Abstract:
Sorghum is a species sensitive to chilling temperatures. In the cultivation areas at higher latitudes chilling sensitivity may significantly influence plants growth in early spring, resulting in significant yield reductions. The effects of chilling stress were investigated in a controlled environment experiment on sorghum plants fertilised with 0 and 44 mg per pot of N. Plants were grown at 27 [degree sign]C until eighth leaf development stage, exposed to 2, 5, and 8 [degree sign]C for time period varying from 1 to 8 days, and then returned to 27 [degree sign]C. Dry weight of plants, leaf area and N and P concentration and content were determined before and after each period of cold treatment and after a 10-day recovery period. Plant relative growth rate (RGR), leaf relative growth rate (RLGR) and N and P uptake rates were calculated during the chilling and the recovery period. Chilling treatments greatly inhibited sorghum growth and N uptake during chilling exposure. The nature and severity of chilling damage was a function of the severity and duration of the exposure: plants suffered short chilling injury at all temperatures, when the duration of chilling was prolonged plants were able to react to chilling, but the ability of the plant to adapt decreased with the decrease of temperature. Plant shoot growth was found to be more sensitive to chilling than leaf area growth and non-fertilised plants were more tolerant to chilling than N-fertilised plants. Also the ability of the plant to recover was a function of the severity and duration of the exposure and of N availability. The recovery of growth rate decreased as temperature was lower and as exposure was longer. Non-fertilised plants were able to recover higher growth rates following chilling stress than N-fertilised plants, while for N uptake the reverse was true, with N-fertilised plants having higher N uptake rates than non-fertilised ones.
Keywords: Chilling; N level; Recovery; Relative growth rate; Relative leaf growth rate; Sorghum; Temperature

I. Barikmo, F. Ouattara, A. Oshaug, Protein, carbohydrate and fibre in cereals from Mali--how to fit the results in a food composition table and database, Journal of Food Composition and Analysis, Volume 17, Issues 3-4, Papers from the Joint Meeting of the 5th International Food Data Conference and the 27th US National Nutrient Databank Conference, June-August 2004, Pages 291-300, ISSN 0889-1575, DOI: 10.1016/j.jfca.2004.02.008.

(http://www.sciencedirect.com/science/article/B6WJH-4CG7FR0-5/2/88029e684bd9e5e271ae1c60c876737d)
Abstract:
During the past 5 years, the main staple foods (cereals) used in Mali have been collected to develop a food composition table and database. We present recent results of protein, carbohydrate and fibre content for some cereals. Samples were collected from five different regions. To reduce laboratory costs, composite samples (cs) were made. The cereals analysed were sorghum (Sorghum bicolor) (cs=142), millet (Pennisetum glaucum) (cs=163), maize (Zea mays) (cs=107), wheat (Triticum aestivum) (cs=123), rice (Oryza sativa) (cs=151) and fonio (Digitaria exilis) (cs=104). Fonio is an old cereal cultivated across the dry savannahs in West Africa, and is very popular in Mali. All samples were cleaned and processed (ready to cook) before analysis. Detailed sampling plans were used. For total nitrogen, Kjeldahl and Dumas combustion methods were used. Methods used for carbohydrate (sugar and starch) were polarimetric, spectrophotometric and HPLC, and a gravimetric method was used for fibre. The mean+/- content of protein for 100 g cereal was: in millet 7.9+/-1.4 g, sorghum 10.3+/-0.7 g, maize 7.6+/-1.1 g, rice 6.3+/-0.3 g, wheat 10.6+/-1.1 g and fonio 7.2+/-0.4 g. The mean+/- content of carbohydrate and fibre per 100 g cereal was: in millet 65.8+/-10.1 and 6.2+/-2.3 g, sorghum 73.5+/-4.3 and 4.7+/-0.1 g, maize 73.0+/-10.2 and 4.6+/-1.3 g, rice 83.7+/-7.8 and 1.1+/-0.0 g, wheat 75.1+/-1.8 and 3.0+/-0.0 g and fonio 74.3+/-0.1 and 2.2+/-0.3 g, respectively. As indicated by the standard deviations there were considerable geographical differences in nutrient content for the same cereal. There is no apparent explanation for these differences. Until this is explored further, it is necessary to develop separate tables for different regions.
Keywords: Food composition table; Database; Africa; Mali; Cereal; Protein; Carbohydrate; Fibre

Abelardo Herrera, Simon J. Tellez-Luis, Juan J. Gonzalez-Cabriales, Jose A. Ramirez, Manuel Vazquez, Effect of the hydrochloric acid concentration on the hydrolysis of sorghum straw at atmospheric pressure, Journal of Food Engineering, Volume 63, Issue 1, June 2004, Pages 103-109, ISSN 0260-8774, DOI: 10.1016/S0260-8774(03)00288-7.
(http://www.sciencedirect.com/science/article/B6T8J-49CT06H-6/2/38e104de96b172f69b6b8456a7b9f7c6)
Abstract:
Sorghum straw is a raw material useful for the xylose production by hydrolysis. The main application of xylose is its bioconversion to xylitol, a functional sweetener with important technological properties. The objective of this work was to study the hydrolysis of sorghum straw with hydrochloric acid at 100 [degree sign]C. Several concentrations of HCl (2-6%) and reaction time (0-300 min) were evaluated. Kinetic parameters of mathematical models for predicting the concentration of xylose, glucose, acetic acid and furfural in the hydrolysates were found and used to optimise the process and compared with results reported in the literature using other conditions and acids. Optimal conditions found for hydrolysis were 6% HCl at 100 [degree sign]C for 83 min, which yielded a solution with 21.3 g xylose/l, 4.7 g glucose/l, 0.8 g furfural/l and 2.8 g acetic acid/l.
Keywords: Xylose; Sorghum; Straw; Modelling; Acid hydrolysis

Calvin Onyango, Thomas Henle, Thea Hofmann, Thomas Bley, Production of high energy density fermented uji using a commercial alpha-amylase or by single-screw extrusion, Lebensmittel-Wissenschaft und-Technologie, Volume 37, Issue 4, June 2004, Pages 401-407, ISSN 0023-6438, DOI: 10.1016/j.lwt.2003.10.010.
(http://www.sciencedirect.com/science/article/B6WMV-4BG3MD7-1/2/28917ac35f672b952bec478f013a870c)
Abstract:
The effects of alpha-amylase and extrusion on the viscosity and energy density of uji, a spontaneously fermented thin porridge from different combinations of maize, finger millet, sorghum

and cassava, were investigated. Fermentation alone was not able to reduce the viscosity of uji, but addition of 0.1-2.1 ml/100 ml alpha-amylase to the fermented slurry or extrusion of the fermented and dried flour at 150-180[degree sign]C and a screw speed of 200 rpm reduced the viscosity of 20 g/100 ml uji from 6000-7000 to 1000-2000 cP, measured at 40[degree sign]C and a shear rate of 50 s-1. The amount of flour required to make uji could thus be increased by a factor of 2.0-2.5 and consequently it was possible to produce uji with acceptable energy densities (0.6-0.8 kcal/g) for child feeding.
Keywords: Fermentation; Viscosity; Energy density; Extrusion; Weaning foods

Gualbert Gbehounou, Etienne Adango, J.C.Jonas Cyrille Hinvi, Richard Nonfon, Sowing date or transplanting as components for integrated Striga hermonthica control in grain-cereal crops?, Crop Protection, Volume 23, Issue 5, May 2004, Pages 379-386, ISSN 0261-2194, DOI: 10.1016/j.cropro.2003.09.014.
(http://www.sciencedirect.com/science/article/B6T5T-4B0X5RF-1/2/02b1315a6990b9528922ffd14d321b6f)
Abstract:
A study on the effect of sowing date on Striga hermonthica infestation of maize and sorghum indicated a linear relationship. When sowing was delayed for 30 days crops were 3.5-5 times less infested than after early sowing. This effect of delayed sowing cannot be explained by a change in the root distribution of the host plants. It may be caused by a combined effect of a dying-off process of the seeds and excess soil moisture. It may not be related to the occurrence of secondary dormancy. Although measurements of soil moisture content did not show measurable differences in the course of the rainy season, it may be assumed that this resulted in leaching of host root exudates following heavy showers, which would reduce Striga germination. Despite a higher infestation, early sowing gave higher crop yields compared to late sowing. Therefore, delayed sowing does not seem to be a practical control method for farmers in Benin. However, transplanting after cultivation in a Striga-free nursery for 4-6 weeks, which may be comparable to late sowing is a better alternative as it combines the respective beneficial effects of early sowing and the effects on Striga of delayed planting.
Keywords: Striga hermonthica; Sowing date; Cereal crops; Secondary dormancy; Dying-off; Transplanting

C. M. McDonough, C. D. Floyd, R. D. Waniska, L. W. Rooney, Effect of accelerated aging on maize, sorghum, and sorghum meal, Journal of Cereal Science, Volume 39, Issue 3, May 2004, Pages 351-361, ISSN 0733-5210, DOI: 10.1016/j.jcs.2004.01.001.
(http://www.sciencedirect.com/science/article/B6WHK-4BY3PJY-1/2/9ec7f35e7d1a9ab2ac1f57774b1fc7e5)
Abstract:
Accelerated aging at 50 [degree sign]C significantly affected the physical and chemical properties of sorghum and maize. Aging caused associations between starch granules, protein matrix, and cell walls. During aging, floury areas of the endosperm became more corneous; as the endosperm hardened, strong associations between starch and protein developed, causing the endosperm to fracture through endosperm cells instead of along cell walls, which is common for non-aged maize. Aging significantly decreased the pasting viscosity of starch, molecular solubility at 85 [degree sign]C and the molecular weight of solubilized starch. Solubility of albumins and globulins decreased while solubility of proteins extracted by a reducing agent and/or in alkaline pH increased during aging. Decreased solubility and functionality of starch and protein in aged grain appear to be due to protein oxidation.
Keywords: Accelerated aging; Storage; Corn; Sorghum; Starch and protein changes; Case hardening

Joseph M. Awika, Lloyd W. Rooney, Sorghum phytochemicals and their potential impact on human health, Phytochemistry, Volume 65, Issue 9, May 2004, Pages 1199-1221, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2004.04.001.
(http://www.sciencedirect.com/science/article/B6TH7-4CB067H-3/2/dcab49d012c35b4e6eb2cff112d1e9bf)
Abstract:
Sorghum is a rich source of various phytochemicals including tannins, phenolic acids, anthocyanins, phytosterols and policosanols. These phytochemicals have potential to significantly impact human health. Sorghum fractions possess high antioxidant activity in vitro relative to other cereals or fruits. These fractions may offer similar health benefits commonly associated with fruits. Available epidemiological evidence suggests that sorghum consumption reduces the risk of certain types of cancer in humans compared to other cereals. The high concentration of phytochemicals in sorghum may be partly responsible. Sorghums containing tannins are widely reported to reduce caloric availability and hence weight gain in animals. This property is potentially useful in helping reduce obesity in humans. Sorghum phytochemicals also promote cardiovascular health in animals. Such properties have not been reported in humans and require investigation, since cardiovascular disease is currently the leading killer in the developed world. This paper reviews available information on sorghum phytochemicals, how the information relates to current phytonutrient research and how it has potential to combat common nutrition-related diseases including cancer, cardiovascular disease and obesity.
Keywords: Sorghum bicolor; Gramineae; Phytochemicals; Tannins; Anthocyanins; Phenolic acids; Phytosterols; Policosanols; Human health; Cancer; Cardiovascular disease; Obesity

J. L. Dardanelli, J. T. Ritchie, M. Calmon, J. M. Andriani, D. J. Collino, An empirical model for root water uptake, Field Crops Research, Volume 87, Issue 1, 15 April 2004, Pages 59-71, ISSN 0378-4290, DOI: 10.1016/j.fcr.2003.09.008.
(http://www.sciencedirect.com/science/article/B6T6M-4B3K22H-1/2/2d9e6ebdbf6eb0f112a8650d3e1c27af)
Abstract:
Soil water availability estimation is critical for assessing crop development and performance. During periods of soil water deficits, the capability of crop roots to extract soil water depends on the distribution and depth of its root system. Most water uptake models assume a relationship between root water extraction and root length density (RLD). However, models using RLD are difficult to test and several researchers have questioned the various proposed relationships between RLD and water uptake. A simplified water uptake model that does not use RLD was developed, but as an alternative, uses generalizations from measured soil water content changes to predict root water uptake. The daily incrementing model estimates a maximum water uptake rate by roots limited by soil water content that declines exponentially with the soil water content above the lower limit (LL) i.e., the remaining available soil water. The model assumes that: (i) the roots at a given layer have reached a minimum threshold of root density to extract water at a maximum rate; (ii) the transpiration demand is greater than the total root water uptake; and (iii) the water content at LL can be accurately measured or estimated. A critical constant (K) in the exponential model, representing the fraction of extractable water in a soil layer that can be taken up in 1 day, was found to be 0.096 for several species (cotton, maize, pearl millet, grain sorghum, soybean, sunflower and wheat), and different soil conditions. Values of K smaller than 0.096 were likely caused by root clumping in highly structured (cracking) or compacted soils, where root density was low in deeper soil layers when further downward root growth practically ceased, or by peanut whose K values was 0.064. This new empirical model should help to overcome several of the limitations of current models that rely on the use of measured or predicted RLD.
Keywords: Uptake model; Root clumping; Lower limit; Available soil water

Seungdo Kim, Bruce E. Dale, Global potential bioethanol production from wasted crops and crop residues, Biomass and Bioenergy, Volume 26, Issue 4, April 2004, Pages 361-375, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2003.08.002.
(http://www.sciencedirect.com/science/article/B6V22-49M6MJ8-4/2/eab68873d12faff5eaec9a1e0ed08383)
Abstract:
The global annual potential bioethanol production from the major crops, corn, barley, oat, rice, wheat, sorghum, and sugar cane, is estimated. To avoid conflicts between human food use and industrial use of crops, only the wasted crop, which is defined as crop lost in distribution, is considered as feedstock. Lignocellulosic biomass such as crop residues and sugar cane bagasse are included in feedstock for producing bioethanol as well. There are about 73.9 Tg of dry wasted crops in the world that could potentially produce 49.1 GL year-1 of bioethanol. About 1.5 Pg year-1 of dry lignocellulosic biomass from these seven crops is also available for conversion to bioethanol. Lignocellulosic biomass could produce up to 442 GL year-1 of bioethanol. Thus, the total potential bioethanol production from crop residues and wasted crops is 491 GL year-1, about 16 times higher than the current world ethanol production. The potential bioethanol production could replace 353 GL of gasoline (32% of the global gasoline consumption) when bioethanol is used in E85 fuel for a midsize passenger vehicle. Furthermore, lignin-rich fermentation residue, which is the coproduct of bioethanol made from crop residues and sugar cane bagasse, can potentially generate both 458 TWh of electricity (about 3.6% of world electricity production) and 2.6 EJ of steam. Asia is the largest potential producer of bioethanol from crop residues and wasted crops, and could produce up to 291 GL year-1 of bioethanol. Rice straw, wheat straw, and corn stover are the most favorable bioethanol feedstocks in Asia. The next highest potential region is Europe (69.2 GL of bioethanol), in which most bioethanol comes from wheat straw. Corn stover is the main feedstock in North America, from which about 38.4 GL year-1 of bioethanol can potentially be produced. Globally rice straw can produce 205 GL of bioethanol, which is the largest amount from single biomass feedstock. The next highest potential feedstock is wheat straw, which can produce 104 GL of bioethanol. This paper is intended to give some perspective on the size of the bioethanol feedstock resource, globally and by region, and to summarize relevant data that we believe others will find useful, for example, those who are interested in producing biobased products such as lactic acid, rather than ethanol, from crops and wastes. The paper does not attempt to indicate how much, if any, of this waste material could actually be converted to bioethanol.
Keywords: Biomass energy; Bioethanol production; E85 fuel; Lignocellulosic biomass; Starch crop

A. R. Sepaskhah, B. Ghahraman, The Effects of Irrigation Efficiency and Uniformity Coefficient on Relative Yield and Profit for Deficit Irrigation, Biosystems Engineering, Volume 87, Issue 4, April 2004, Pages 495-507, ISSN 1537-5110, DOI: 10.1016/j.biosystemseng.2003.11.008.
(http://www.sciencedirect.com/science/article/B6WXV-4BWMR2F-1/2/ef50e4df4683fede4a6177f227d233fd)
Abstract:
To avoid constructing expensive hydraulic structures for implementing new water resources, a deficit irrigation project may be designed to optimise the use of the available water resources. Previously, irrigation efficiency and uniformity coefficient have not been considered quantitatively. In fact, efficiency is a very significant factor in optimisation analysis, and the potential for increasing irrigation efficiency is one of the key reasons for deficit irrigation. In this paper, the influences of irrigation efficiency under full irrigation condition [eta]f on the performance of deficit irrigation, and the effects of deficit irrigation on improving the irrigation efficiency under deficit irrigation [eta]d have been considered for four crops of winter wheat, spring barley, maize, and sorghum in an arid region of Iran. Furthermore, the combined effects of irrigation efficiency and uniformity coefficient on deficit irrigation were investigated. Results showed that considerable

improvements can be achieved in water use efficiency under this concept. Some mathematical relationships were derived to show the quantitative increase in irrigation efficiency under deficit irrigation. These results showed that the performance of deficit irrigation is highly dependent on [eta]f, such that lower [eta]f values result in higher allowable water reduction level and also more field income. By combined analysis, water reductions for sorghum and barley were found to be economically feasible at values of irrigation efficiency lower than 1[middle dot]0, while water reduction for maize was not economically feasible at irrigation efficiencies greater than 0[middle dot]6. Water reduction for wheat was economically feasible at irrigation efficiencies of 0[middle dot]6 or lower.

A. C. Guzha, Effects of tillage on soil microrelief, surface depression storage and soil water storage, Soil and Tillage Research, Volume 76, Issue 2, April 2004, Pages 105-114, ISSN 0167-1987, DOI: 10.1016/j.still.2003.09.002.
(http://www.sciencedirect.com/science/article/B6TC6-49WMXMB-5/2/2bcf90e1387b1e06f5df54d0fe47a919)
Abstract:
Conservation of soil water is an important management objective for crop production in the semi-arid tropics where droughts are persistent. Identification of the best tillage methods to achieve this objective is thus imperative. The integrated effects of conservation tillage on soil micro topography and soil moisture on a sandy loam soil were evaluated. The field experiment consisted of five tillage treatments, namely tied ridging (TR), no till (NT), disc plough (DP), strip catchment tillage (SCT) and hand hoe (HH). Data measured in the field included soil moisture content, surface roughness, infiltration and sorghum grain yield. A depth storage model was used to estimate depression storage TR treatment and the higher the surface roughness, the greater the depression storage volume. Regression analysis showed that random roughness decreased exponentially with increase in cumulative rainfall. Higher moisture contents were associated with treatments having higher depressional storage. Infiltration rate was significantly higher in the tilled soils than the untilled soils. The DP treatment had the highest cumulative infiltration while NT had the lowest. The Infiltration model which was fitted to the infiltration data gave good fit. Grain yield was highest in TR and least in NT, whereas DP and HH had similar yields.
Keywords: Depression storage; Soil water storage; Soil microrelief; Sorghum yield; Cumulative infiltration

Tomomichi Kato, Reiji Kimura, Makio Kamichika, Estimation of evapotranspiration, transpiration ratio and water-use efficiency from a sparse canopy using a compartment model, Agricultural Water Management, Volume 65, Issue 3, 15 March 2004, Pages 173-191, ISSN 0378-3774, DOI: 10.1016/j.agwat.2003.10.001.
(http://www.sciencedirect.com/science/article/B6T3X-4B723PJ-2/2/b6d381629db7f23ade38ba50ef205d1d)
Abstract:
Using the Shuttleworth and Wallace (S-W) model, evapotranspiration (ET); transpiration ratio (T/ET), which is the ratio of transpiration (T) to ET; and water-use efficiency (WUE) were estimated for a sparsely planted sorghum canopy that was well irrigated. That model is designed to estimate separately the evaporation from soil and transpiration from crops.
The evapotranspiration estimates for both short- and long-term measurement periods coincided closely with the Bowen ratio energy balance (BREB) measurements. The transpiration ratios were affected by the canopy resistances and the soil surface resistances during the day. The regression curve between leaf area index (LAI) and transpiration ratio suggests that LAI, less than 1.6, determined the transpiration ratio in the absence of water stresses by soil water drought and extreme weather condition. The WUEs for transpiration (WUEt) and evapotranspiration (WUEet), which are the total dry matter (TDM) production for 1 kg T and ET, reached the peaks of 9.0 and

4.5 g kg-1 H2O, respectively, in the end of July when the total dry matter increasing rate was greatest. These two WUEs degraded to less than zero in the end of August when the plant biomass decreased due to drying and death. The WUEs are largely affected by the TDM seasonal increment rate.
Thus, in a sparse crop, the crop growth properties (i.e. LAI and TDM increment) mainly determine the crop water uses (i.e. the transpiration ratio and water-use efficiency) in the absence of water stresses.
Keywords: Low leaf area index; Separate estimation; Canopy stomatal resistance; Soil surface resistance; Water resource conservation

Genyi Zhang, Bruce R. Hamaker, Starch-free fatty acid complexation in the presence of whey protein, Carbohydrate Polymers, Volume 55, Issue 4, 15 March 2004, Pages 419-424, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2003.11.005.
(http://www.sciencedirect.com/science/article/B6TFD-4BGHHMT-3/2/69f6df2aed0cc7cd1c461eb2f9f86b3f)
Abstract:
The effect of whey protein on starch-free fatty acid (FFA) complexation was studied in a model system composed of sorghum starch, whey protein, and different FFAs (palmitic, oleic, linoleic, and lauric acids) in a weight ratio of 20:2:1(w/w/w). Whey protein decreased the enthalpy of the melting of the starch-lipid complex by 20-30% for the FFAs except linoleic acid, and increased the reformation exothermic enthalpy by 150-350% in the DSC cooling cycle. The large difference between enthalpies upon heating and cooling in the starch-FFA sample was diminished by the addition of whey protein. X-ray diffraction data showed more pronounced crystalline order of V-type starch-FFA complexes when whey protein was present. A previously described cooling stage viscosity peak, formed due to starch-FFA-protein complexation, paralleled formation of the better defined V-type crystallite of the starch-FFA complex. Whey protein also significantly decreased the amount of starch-FFA complexation in a dilute system. The effect of protein on starch-FFA complexation was related to the formation of a three-component complex composed of starch, FFA, and protein previously identified in our laboratory.
Keywords: Starch-free fatty acid complex; Protein; Interaction

R. Zougmore, A. Mando, L. Stroosnijder, Effect of soil and water conservation and nutrient management on the soil-plant water balance in semi-arid Burkina Faso, Agricultural Water Management, Volume 65, Issue 2, 1 March 2004, Pages 103-120, ISSN 0378-3774, DOI: 10.1016/j.agwat.2003.07.001.
(http://www.sciencedirect.com/science/article/B6T3X-49S6WXH-1/2/6f2762cf351ab689bee4dadf66b82c65)
Abstract:
Degraded soils in the sub-Saharan zone are often unproductive because of nutrient imbalance and an inadequate water supply. We conducted an experiment in the northern sudanian climate zone of Burkina to study the effect of integrated local water and nutrient management practices on soil water balance, sorghum performance and sorghum's water use efficiency. The trial (Ferric Lixisol, 1.5% slope) consisted of two replications of nine treatments in which soil and water conservation (SWC) measures (stone rows, grass strips) and organic or mineral N-inputs (compost, manure, urea-N) were applied alone or in combination and compared to a control treatment with no N-input and no SWC measure. Application of compost improved soil water storage in the sorghum-rooting zone (0-80 cm) most when combined with stone rows or grass strips and when the year had well-distributed rainfall. However, during an erratic rainy season there was less soil water storage in the organic treatments than in the mineral treatment. Supplying compost increased evapotranspiration and soil drainage more than nutrient inputs did. Furthermore, stone rows allowed greater evapotranspiration and drainage than grass strips, and the two permeable barriers alone had a

significant effect on soil water storage compared with treatments without barriers. In the rain-fed cropping system studied, we found that in an erratic rainy season with frequent periods of water stress, the stone rows or grass strips combined with compost reduced runoff and increased soil water storage and sorghum biomass production. These combined practices created sound soil water conditions and were able to satisfy the sorghum's water demand for growth. We conclude that the synergistic effect of water-harvesting practices and the supply of organic or mineral resources increased water use efficiency. It seems that an optimum combination of organic resources and fertilisers could improve the water use efficiency (i.e. reduce runoff and drainage losses) and the productivity of Sahelian rain-fed agriculture.
Keywords: Stone row; Grass strip; Nutrient input; Sorghum; Water use efficiency

W. James Grichar, Brent A. Besler, Kevin D. Brewer, Effect of row spacing and herbicide dose on weed control and grain sorghum yield, Crop Protection, Volume 23, Issue 3, March 2004, Pages 263-267, ISSN 0261-2194, DOI: 10.1016/j.cropro.2003.08.004.
(http://www.sciencedirect.com/science/article/B6T5T-49NRMNP-2/2/fc3c4be4fc18ac0f2c87b518f5dfca86)
Abstract:
Field studies were conducted in 2000 and 2001 near Yoakum, Texas without irrigation to determine the effect of row spacing and herbicide dose on weed control and grain sorghum response. Atrazine or dimethenamid alone or in combination were compared under conventional row spacing (single rows spaced 91 cm apart on a bed) and twin rows (two rows spaced 20 cm apart on a single bed). Amaranthus albus (tumble pigweed) control was 100% with all treatments except dimethenamid at 0.56 kg/ha which controlled at least 96%. Panicum texanum (Texas panicum) control was less than 80% with dimethenamid at 0.56 kg/ha and atrazine at 0.56 and 1.12 kg/ha under the conventional row spacing. Under the twin-row system, P. texanum control was greater than 80% with all herbicides. Cyperus esculentus (yellow nutsedge) control was less than 70% early season with both row spacings but greater than 80% late season under the twin-row system.
Keywords: Atrazine; Dimethenamid; Amaranthus albus.; Panicum texanum Buckl.; Cyperus esculentus L.

Keum Taek Hwang, Curtis L. Weller, Susan L. Cuppett, Milford A. Hanna, Changes in composition and thermal transition temperatures of grain sorghum wax during storage, Industrial Crops and Products, Volume 19, Issue 2, March 2004, Pages 125-132, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2003.07.007.
(http://www.sciencedirect.com/science/article/B6T77-49PRKJJ-2/2/87f03f71a9c453a6e1021bd27c0700ac)
Abstract:
Grain sorghum (Sorghum bicolor) wax is composed mainly of aldehydes, alcohols, and acids. Aldehydes, comprising about one-half of the wax, are readily converted to acids in presence of air. In this study, whole sorghum wax and an aldehyde fraction from sorghum wax were subjected to oxidative conditions. Changes in the major components and thermal transition temperatures were determined using HPLC and differential scanning calorimeter (DSC), respectively. The aldehyde fraction was oxidized markedly to acids over 4 months in storage at room temperature. Acid content, in the fraction, was initially 5-7% and increased to 42-51% after 135 days in storage. Consequently, thermal transition apex and end temperatures of the fraction, which were initially 73-74 and 76-77 [degree sign]C, respectively, increased to 80-81 and 83-85 [degree sign]C, respectively, after 135 days. Whole sorghum wax, composed initially of 55% aldehydes, 37% alcohols, and 7% acids, slightly increased acid level to 8-12% during storage over 5 months under various conditions. Thermal transition temperatures of the wax changed little over all storage

conditions during 5 months of storage with 83-84 [degree sign]C for apex temperatures and 86-87 [degree sign]C for end temperatures.
Keywords: Aldehyde; Composition; Grain sorghum wax; Melting point; Storage; Transition temperature

C. F. Earp, C. M. McDonough, J. Awika, L. W. Rooney, Testa development in the caryopsis of Sorghum bicolor (L.) Moench, Journal of Cereal Science, Volume 39, Issue 2, March 2004, Pages 303-311, ISSN 0733-5210, DOI: 10.1016/j.jcs.2003.11.005.
(http://www.sciencedirect.com/science/article/B6WHK-4BNMH9W-5/2/9d4debfbc0421ae253213e225191c5c1)
Abstract:
The development of the testa in type II and type III sorghums was documented with light, fluorescence and scanning electron microscopy. The testa developed from the inner integument. The inner integument had two layers, one of which was pigmented at anthesis. By 10 dpa (days past anthesis), the testa developed into two layers, the outermost layer contained pigments while the innermost was non-pigmented, but the walls contained ferulic acid. Pigmented material was deposited differently in the two sorghum types; type II developed vesicles in which the pigments were deposited, while type III deposited the pigments along the cell walls of the integument. The method of pigment deposition may reflect the difficulty in extraction of procyanidins (tannins) for nutraceutical use. It may be more efficient to extract tannins before physiological maturity. The testa was fully developed in both types of sorghum by 22 dpa. Pigmented materials appeared in the epicarp of type III sorghum at 26 dpa due to the action of the spreader gene.
Keywords: Sorghum bicolor; Testa; Structure; Tannins; Fluorescence microscopy

John W. Groninger, Sara G. Baer, Didier-Arsene Babassana, David H. Allen, Planted green ash (Fraxinus pennsylvanica Marsh.) and herbaceous vegetation responses to initial competition control during the first 3 years of afforestation, Forest Ecology and Management, Volume 189, Issues 1-3, 23 February 2004, Pages 161-170, ISSN 0378-1127, DOI: 10.1016/j.foreco.2003.07.039.
(http://www.sciencedirect.com/science/article/B6T6X-49W354D-3/2/113ebb63b93de107c2fd9b3e3c31de8a)
Abstract:
Formerly row-cropped bottomland sites that have been planted with hardwoods through afforestation programs are typically associated with low tree stocking, slow tree growth, and an enduring influence of agricultural weeds in the herbaceous stratum. Consequently, many of the intended benefits of a forestry land use are delayed or forfeited. This study evaluates the growth of planted green ash and the development of volunteer herbaceous communities on a bottomland site in southern Illinois, USA in response to two different operational herbicide (pre-emergence sulfometuron and post-emergence glyphosate) and tillage treatments, applied individually and in combination.
Both herbicide treatments increased green ash height and diameter growth while tillage produced no response. At the end of three growing seasons, the post-emergence glyphosate treatment increased forb cover. Total grass cover was not impacted by herbicide treatments after the second growing season. During the second and third growing seasons, the pre-emergence sulfometuron treatment increased broomsedge (Andropogon virginicus L.) cover and decreased goldenrod (Solidago nemoralis Ait.) cover relative to post-emergence glyphosate and no herbicide treatments. Johnsongrass (Sorghum halepense L.) cover decreased dramatically following the first growing season in all treatments. Horseweed (Conyza canadensis L.) exhibited a complex response to silvicultural treatments through the course of the study.
Commonly used silvicultural treatments that yielded similar and positive tree growth responses differed in their impact on herbaceous community composition through the first 3 years of stand

development. These results suggest that treatment choice may have long-term implications for overstory canopy development on these and similar afforested bottomland sites characterized by presence of agricultural weeds and low tree stocking.
Keywords: Afforestation; Bottomland hardwood; Competition; Herbaceous flora; Herbicides; Tillage

E. A. Camarena, C. Gracia, J. M. Cabrera Sixto, A Mixed Integer Linear Programming Machinery Selection Model for Multifarm Systems, Biosystems Engineering, Volume 87, Issue 2, February 2004, Pages 145-154, ISSN 1537-5110, DOI: 10.1016/j.biosystemseng.2003.10.003.
(http://www.sciencedirect.com/science/article/B6WXV-4B6TYDB-1/2/d36bc895034e843cf51aee413567a68f)
Abstract:
An integrated program, called MULTIPREDIO, was developed at University of Guanajuato and University Polytechnic of Valencia using mixed integer linear programming linked to several databases contained in spreadsheets to select agricultural machinery for a multifarm system. The program selects the machinery set for each farm, which corresponds to the lowest annual mechanisation cost of the multifarm system through time. The input information consists of variable and fixed costs for 12 yr from the multifarm, the schedule of operations and the different combinations of equipment and the area of each farm. The program works under the environment of the worksheet and the user does not require knowledge of linear programming to understand the input and output of the model program. The program is capable of calculating the number of working days required for each tractor-implement at each farm in the different periods, and also allows to study the effect of changing values on fixed and variable costs through time. A case in Guanajuato, Mexico, for five farms cultivating wheat and sorghum is used to demonstrate the model application because the mechanisation costs are reduced during the passage of time (at the present value), thus affecting the optimum solution in such a way that alternative solutions are found through time. The optimum solution of the machinery park selected for the first year is not the same as that selected through other years. For the studied case three optimal solutions were found, one of them for years 1-5, another one for years 6-8 and the last one for years 9-12. In case of machinery, the optimal solution is below the quantity of tractors available on the five farms.

A. Oswald, J. K. Ransom, Response of maize varieties to Striga infestation, Crop Protection, Volume 23, Issue 2, February 2004, Pages 89-94, ISSN 0261-2194, DOI: 10.1016/S0261-2194(03)00173-X.
(http://www.sciencedirect.com/science/article/B6T5T-49FB7VP-2/2/e4c06176b9a0baba4e53b6996ee31219)
Abstract:
Striga hermonthica is endemic in the semi-arid and semi-humid areas of Sub-Sahara Africa. This plant parasite reduces crop yields of maize and sorghum, the major staple food source of the region. Presently, there are no Striga-resistant maize varieties commercially available in Western Kenya. Striga resistant or tolerant maize would form an important part of an integrated control approach. To determine the response of the maize varieties most widely grown by farmers around Lake Victoria to Striga, a field experiment was conducted at two locations and over two seasons. The results showed a high variability among commercial maize varieties with respect to the effects of Striga parasitism. Short-cycle varieties have the lowest Striga densities but produce acceptable yields only in low-stress environments. Long-cycle varieties are too susceptible to Striga and are not completely adapted to the agro-ecological conditions of the region. Some medium-cycle varieties show level of resistance and/or tolerance to Striga while others supported high numbers of Striga and had reduced yield. Nevertheless, sufficient genetic variability exists to recommend varieties suitable to enable farmers to obtain some yield advantage by selecting those with the most Striga tolerance for a range of farming situations found in Western Kenya.

Keywords: Striga hermonthica; Maize varieties; Striga tolerance; Striga resistance

Peter S. Belton, John R. N. Taylor, Sorghum and millets: protein sources for Africa, Trends in Food Science & Technology, Volume 15, Issue 2, February 2004, Pages 94-98, ISSN 0924-2244, DOI: 10.1016/j.tifs.2003.09.002.
(http://www.sciencedirect.com/science/article/B6VHY-49S7YBX-4/2/98f3fda1165ddff1139f6fcdaad60573)
Abstract:
Sorghum and millets are vitally important cereals for the maintenance of food security in Africa. They represent about half the total cereal production on the continent and as such are a major source of protein for the population. They are still under researched compared to other cereals. This paper reports on a conference recently held in Africa to explore the current state of knowledge on the proteins of these cereals and to suggest routes to the better exploitation for enhanced nutritional and functional properties

J. Yu, M. R. Tuinstra, M. M. Claassen, W. B. Gordon, M. D. Witt, Analysis of cold tolerance in sorghum under controlled environment conditions, Field Crops Research, Volume 85, Issue 1, 8 January 2004, Pages 21-30, ISSN 0378-4290, DOI: 10.1016/S0378-4290(03)00125-4.
(http://www.sciencedirect.com/science/article/B6T6M-495VHVN-2/2/cd8ceceb808edaad8ac3851a31617905)
Abstract:
Grain sorghum (Sorghum bicolor (L.) Moench) originated in the semi-arid tropics and is generally sensitive to low-temperature stress. Early planting and use of minimum tillage necessitate the development of sorghum hybrids with early season cold tolerance. Genetic variability for cold tolerance exists in sorghum and has been detected by early planting under field conditions and by analysis of seeds and plants under growth chamber conditions. There is limited information on the efficiency of evaluating cold tolerance under growth chamber conditions and the relationship with field performance. The objectives of this study were to quantify the variability of cold tolerance in commercial hybrid seed lots under growth chamber conditions, to exam different components of cold tolerance and their relationships, and to evaluate the consistency of lab test results with data from field tests. Thirty commercial hybrid seed lots were evaluated by growing the entries under 15/10, 13/10, 11/8, and 25/20 [degree sign]C day/night temperature in a 13/11 h cycle in a growth chamber. Traits measured included emergence percentage, emergence index, shoot and root dry weight, seedling height, and vigor score. Significant genotypic differences were detected for all traits. Correlations among the traits were significant and favorable, which confirmed that simultaneous improvement of these traits should be possible. The same seed lots were also evaluated in a soil-free plate-based assay, in which percent germination, and shoot and root elongation of the seed lots grown in dark at 15 [degree sign]C were measured. Results from both laboratory tests, soil-based and plate-based, were correlated with data collected in a field study, which was conducted to evaluate cold tolerance of commercial sorghum hybrids at Manhattan, Hesston, Bellville, and Garden City, KS in 1998 and 1999. Single-trait correlations between lab and field studies were significant. Differentiation based on rank-summation index of common traits, rank-summation index correlations and the overlap of best entries, further provided strong support of the efficiency of predicting and identifying elite hybrids using growth chamber assays.
Keywords: Sorghum; Cold tolerance

S. L. Patil, M. N. Sheelavantar, Effect of cultural practices on soil properties, moisture conservation and grain yield of winter sorghum (Sorghum bicolar L. Moench) in semi-arid tropics of India, Agricultural Water Management, Volume 64, Issue 1, 1 January 2004, Pages 49-67, ISSN 0378-3774, DOI: 10.1016/S0378-3774(03)00178-1.

(http://www.sciencedirect.com/science/article/B6T3X-48YVX1S-7/2/51e7bf665a9c84d22916f39474a8dec0)
Abstract:
A field experiment was laid out during winter seasons of 1994-1995 and 1995-1996 on deep black clayey soils (Vertisols) at Regional Research Station, Bijapur, in the northern dry zone of Karnataka State (Zone 3) of south India to evaluate the effect of cultural practices on soil moisture conservation, soil properties, root growth and yield of sorghum (Sorghum bicolar L. Moench). Lay out of plots with in situ moisture conservation practices reduced bulk density, increased infiltration rate, porosity, improved root growth and grain yield of winter sorghum. Conservation and availability of higher amount of moisture and nutrients during various stages of crop growth with moisture conservation practices resulted in better crop growth with higher amount of dry matter production and its translocation to ear in winter sorghum. Compartmental bunding and ridges and furrows increased the grain yield by 22.8 and 25.6% (mean of 1994-1995 and 1995-1996), respectively, over flat bed with similar trend observed during 1994-1995 and 1995-1996. Among organic sources, incorporation of Leucaena loppings improved soil physico-chemical properties, conserved higher amount of moisture and increased winter sorghum yield to a greater extent than farmyard manure and vermicompost. Average grain yield (1994-1995 and 1995-1996) of winter sorghum increased by 11.7% with Leucaena application as compared to vermicompost. Grain yield increased significantly by 20% with application of 25 kg N ha-1 and further increase in nitrogen dose up to 50 kg ha-1, increased the grain yield by 30.5% in the pooled data.
Keywords: In situ moisture conservation practices; Organic sources; Nitrogen; Black soil; Sorghum

J. M. Triggs, B. A. Kimball, P. J. Pinter Jr., G. W. Wall, M. M. Conley, T. J. Brooks, R. L. LaMorte, N. R. Adam, M. J. Ottman, A. D. Matthias, S. W. Leavitt, R. S. Cerveny, Free-air CO2 enrichment effects on the energy balance and evapotranspiration of sorghum, Agricultural and Forest Meteorology, Volume 124, Issues 1-2, 20 July 2004, Pages 63-79, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2004.01.005.
(http://www.sciencedirect.com/science/article/B6V8W-4BXTJWN-2/2/89bb82c163b63dd8e946235d1c235de2)
Abstract:
Increasing atmospheric carbon dioxide (CO2) likely will affect future water requirements of most plants, including agricultural crops. This research quantifies such effects on the energy balance and evapotranspiration (ET) of sorghum (Sorghum bicolor (L.) Moench, a C4 grain crop) using a residual energy balance approach. During the summer and autumn of 1998 and 1999, sorghum was grown under free-air CO2 enrichment (FACE) conditions near Maricopa, Arizona.
Latent heat flux ([lambda]ET) was determined by subtracting soil heat flux (G0) and sensible heat flux (H) from net radiation (Rn) values in both Control CO2 plots (about 370 [mu]mol mol-1) and FACE plots (Control + 200 [mu]mol mol-1). Rn was observed using net radiometers. G0 was measured with soil heat flux plates at a depth of 10 mm, then corrected for heat storage above the plates. H was determined using measurements of air temperature from aspirated psychrometers, leaf temperature from infrared thermometers, and wind data from a three-cup anemometer. Both FACE and Control plots were divided into semicircular halves to allow a well-watered (Wet) treatment and a drought-stressed (Dry) treatment. This allowed comparisons of the FACE effect on ET in normal and water-stressed conditions. Under Wet conditions, FACE decreased [lambda]ET by 13.8+/-1.8% in 1998, and 11.8+/-1.9% in 1999. Drought-stress resulted in a reduction in [lambda]ET of 8.5+/-3.7% for the FACE treatments in 1998, but an increase in [lambda]ET of 10.5+/-5.1% in 1999. When soil water was readily available, midday canopy temperatures in the FACE plots were increased by 1.47+/-0.09 [degree sign]C in 1998, and 1.85+/-0.20 [degree sign]C in 1999, indicative of increased stomatal resistance due to CO2 enrichment. These data suggest that soil water availability is a determining factor for the FACE effect.

Water use efficiency (WUE) increased about 28% due to elevated CO2 under Wet conditions due to a savings of water for about the same growth, whereas under Dry conditions it increased about 16% due to much greater relative growth on only a slightly higher amount of water.
Keywords: Sorghum; Sorghum bicolor; Evapotranspiration; Energy balance; Climate change; CO2; Micrometeorology

C. F. Earp, C. M. McDonough, L. W. Rooney, Microscopy of pericarp development in the caryopsis of Sorghum bicolor (L.) Moench, Journal of Cereal Science, Volume 39, Issue 1, January 2004, Pages 21-27, ISSN 0733-5210, DOI: 10.1016/S0733-5210(03)00060-2.
(http://www.sciencedirect.com/science/article/B6WHK-49YD0CX-1/2/33425409980998e8c39a0e5b90b9c09f)
Abstract:
Five sorghum varieties typifying differences in pericarp thickness were harvested at 0-34 days post anthesis, prepared and viewed by fluorescence, bright field, polarized light, and scanning electron microscopy. The development of the pericarp at various stages is described. The pericarp reached its maximum size around 21 days post anthesis. Compound starch granules were present in the ovary wall at anthesis and disappeared at 10-14 days post anthesis; only simple granules remained. The differences in pericarp thickness among the varieties are related to the quantity of starch in the mesocarp cells; the thick pericarp varieties contain more starch. All five varieties had maximum pericarp thickness at 5-7 days post anthesis, but values varied widely among grains. Few starch granules remained in the varieties with thin pericarps at maturity. These varieties carried the dominant Z gene. At maturity starch remained in varieties with thick pericarps; the recessive zz may have blocked resorption or stimulated extra production of the granules. A large range of pericarp thickness is possible when the z gene is recessive.
Keywords: Development; Sorghum bicolor; Caryopsis; Structure; Pericarp thickness

Sujata Bhargava, Sharayu Paranjpe, Genotypic variation in the photosynthetic competence of Sorghum bicolor seedlings subjected to polyethylene glycol-mediated drought stress, Journal of Plant Physiology, Volume 161, Issue 1, 2004, Pages 125-129, ISSN 0176-1617, DOI: 10.1078/0176-1617-01126.
(http://www.sciencedirect.com/science/article/B7GJ7-4DPXG97-FK/2/3b9870a65b04fad792504a812298084b)
Abstract: Summary
Eleven varieties of Sorghum bicolor, subjected to PEG-mediated drought stress were compared for their photosynthetic performance. The varieties differed in their relative water content over a range of PEG concentrations (0-25 percnt;). CO2 assimilation, stomatal conductance and the quantum yield of PSII electron transport decreased with increasing PEG concentrations in all varieties. However the intercellular CO2 concentration showed a nonlinear PEG concentration-dependent change. At lower PEG concentrations there was a decrease in the levels of intercellular CO2 concentration in all varieties that could be attributed to stomatal closure. At higher PEG concentrations, some varieties showed an increase in the intercellular CO2 concentration, indicating an inhibition of photosynthetic activity due to non-stomatal effects, while others did not. It was seen that the varieties differed in the stress thresholds at which stomatal and metabolic limitations to photosynthesis occur. These differences in the photosynthetic adaptation of Sorghum varieties could be useful in identifying genotypes showing large differences in photosynthetic adaptation, which could be useful in mapping photosynthetic traits for drought stress tolerance.
Keywords: Sorghum bicolor; PEG-mediated drought stress; photosynthesis; intercellular CO2 concentration; stomatal and metabolic inhibition

C.Y. Kudadjie, P.C. Struik, P. Richards, S.K. Offei, Assessing production constraints, management and use of sorghum diversity in north-east Ghana: a diagnostic study, NJAS - Wageningen Journal

of Life Sciences, Volume 52, Issues 3-4, 2004, Pages 371-391, ISSN 1573-5214, DOI: 10.1016/S1573-5214(04)80022-8.
(http://www.sciencedirect.com/science/article/B94T2-4WFBS5G-8/2/e3f1423a9825ca21342f173fed5e2454)
Abstract:
This paper reports on the results of a diagnostic study conducted to assess the problems and needs of sorghum farmers in north-east Ghana with the aim of determining the type of research that would be useful for them in their own context. The importance of the crop and its position within the cropping system are identified. Sorghum is still an integral part of the livelihoods of farmers. The crop is very versatile and not only contributes to food security but also plays a part in the socio-cultural, socioeconomic, and religious aspects of the lives of farmers. Farmers have different uses for the varieties they grow, which depends on the morphological, agronomic and gastronomic traits of the crop. Sorghum varieties introduced from the research institutions have several problems including lodging, poor grain quality, bird damage and precocious germination. Farmers have developed management strategies for dealing with some of these problems. Nevertheless, further work is required by breeders to make the varieties more acceptable to users. Sorghum production constraints identified include poor soils, erratic rainfall and pest infestation of the grain during storage. The diagnostic study suggests that because farmers produce their own seed, enhancing their ability to improve the quality of their seed would be of benefit to them. The study further underscores the importance and value of diversity for farmers. It also highlights their understanding of diversity, and management and use of variation in their agronomic practices. Areas identified for further research together with farmers aim at enhancing farmers' knowledge towards strengthening their practices in diversity management and improving seed storage practices.
Keywords: farmers' knowledge; Sorghum bicolor; maize; seed management; biodiversity; variety