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INTEGRATED FARMING (1 jdl)

L. Gradiz, A. Sugimoto, K. Ujihara, S. Fukuhara, A.K. Kahi, H. Hirooka, Beef cow-calf production system integrated with sugarcane production: Simulation model development and application in Japan,
Agricultural Systems, Volume 94, Issue 3, Special Section: sustainable resource management and policy options for rice ecosystems, International symposium on sustainable resource management and policy options for rice ecosystems, June 2007, Pages 750-762, ISSN 0308-521X, DOI: 10.1016/j.agsy.2007.03.003.
(http://www.sciencedirect.com/science/article/pii/S0308521X07000467)
Abstract:

The objective of this study was to develop a simulation model for the integration of a beef cow-calf production system and sugarcane production system on Tanegashima Island. A survey was carried out to characterize and identify the role of sugarcane as an alternative feed resource and determine the different interactions within the system. The model was divided into two sub-systems; beef cow-calf and sugarcane and manure production sub-systems. The model is able to simulate the total requirement for energy and protein, and subsequent losses of nitrogen via faeces and urine, throughout the reproductive cycle of a mature cow and the growing stages of her calf. It also estimates the area under sugarcane cultivation for feed and the area on which manure can be applied to complement inorganic fertilizer. A linear programming (LP) approach was used to formulate the least-cost diet and a system simulation method was used to calculate the nitrogen (N) excretion for a cow and her post-weaning calf in the different physiological stages. The model was used to evaluate two scenarios (integrated and specialized scenarios) using production conditions on Tanegashima Island. In the integrated scenario, sugarcane tops were the principal roughage source and organic (manure) was used to complement inorganic fertilizer. In the specialized scenario, Italian ryegrass was the principal feed source and manure was not used. These two scenarios were compared based on the respective feed and fertilizer costs, and the difference between the two scenarios was evaluated as the merit of integration. Sensitivity analyses were also performed to determine the effects of changes in nutritional and management conditions, animal genotype parameters and manure variables on economic variables. The results showed that feed and fertilizer costs were lower in the integrated than in the specialized scenario. Economic variables were sensitive to changes in feeding strategies, especially the metabolizability of feed, days of availability of sugarcane tops, mature liveweight, and manure variables. Utilization of sugarcane tops and manure is economically feasible under the conditions on Tanegashima Island. It is

proposed that the developed model is capable of evaluating the biological and economic interaction of beef cow-calf production and sugarcane production systems.

Keywords: Beef cow-calf; Sugarcane tops; Integrated system; Simulation model; Least-cost diet; Manure

CROP HUSBANDRY (5 jdl)

Noel A. Tejera, Rosa Rodes, Eduardo Ortega, Rosario Campos, Carmen Lluch, Comparative analysis of physiological characteristics and yield components in sugarcane cultivars,

Field Crops Research, Volume 102, Issue 1, 30 April 2007, Pages 64-72, ISSN 0378-4290, DOI: 10.1016/j.fcr.2007.02.002.
(http://www.sciencedirect.com/science/article/pii/S0378429007000287)

Abstract:

Sugarcane in an important crop due to the economic value of its products. Physiological characteristics and yield components of sugarcane were studied in three field-grown sugarcane cultivars B 63118, POJ 2878 and Ja 60-5. Three growth stages were identified: formative phase (until 140 DAP), grand growth (140-300 DAP) and maturity (after 300 DAP). Results indicated that cultivars showed contrasting yield mainly after 300 DAP. At ripening, the most productive cultivar (Ja 60-5) achieved higher leaf area, an optimum leaf area index for light interception, a high and stable net assimilation rate and an elevated leaf area and biomass duration. In addition, this cultivar showed the higher density and lower area of leaf sieve elements as compared with other, which could influence the high translocation rate (1.85 cm min-1) at 8 MAP. The higher efficiency of this process in Ja 60-5 might also be supported by a higher (15-25%) apparent free space of stem parenchyma as compared with POJ 2878 and B 63118. Our results suggest that Ja 60-5 reduced carbon partitioned to foliar respiration which led to a higher partitioning of sucrose to stems evidenced by a higher Pol%.

Keywords: Growth analysis; Partitioning; Saccharum spp.; Sugarcane; Yield components

R.A. Gilbert, C.R. Rainbolt, D.R. Morris, J.M. McCray, Sugarcane growth and yield responses to a 3-month summer flood,

Agricultural Water Management, Volume 95, Issue 3, March 2008, Pages 283-291, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.10.009.
(http://www.sciencedirect.com/science/article/pii/S0378377407002673)

Abstract:

Sugarcane (Saccharum spp.) in south Florida is often subjected to flooding due to interacting effects of soil subsidence, pumping restrictions, and tropical storms. While there has been considerable research on the response of sugarcane cultivars to high water tables and periodic flooding, there is a lack of information on commercial

cultivar yield response to long-term flooding. An experiment was established in Belle Glade, FL to examine the effect of a 3-month summer flood (July-September) on the growth and yield of cultivars CP 80-1743 and CP 72-2086 during the plant cane (2003) and second ratoon (2005) crop. Harvest samples were taken early-, mid-, and late-season. Flooding sugarcane in the summer caused sequentially greater yield reductions throughout the harvest season in plant cane. Sucrose yields for flooded cane, compared with the non-flooded control, were 9.6 t sucrose ha-1 versus 11.7 t sucrose ha-1 early, 9.2 t sucrose ha-1 versus 12.8 t sucrose ha-1 mid-season and 7.8 t sucrose ha-1 versus 12.3 t sucrose ha-1 at late harvest. In the second ratoon crop, flooding reduced sugarcane tonnage and sucrose yield by 54-64% across sampling dates, and preliminary results indicated that flooding reduced leaf nutrient content by 10-78%. Yield reductions due to flooding in both crops were attributed more to reduced tonnage rather than sucrose content. CP 72-2086 yielded 18-28% greater sucrose than CP 80-1743 when harvested late. However the flood x cultivar interaction was not significant as both cultivars recorded similar yield reductions under flooded conditions. Our results identified severe yield losses caused by a 3-month summer flood in these cultivars, particularly in ratoon crops. Strategies to increase summer on-farm water storage in Florida should focus on short-duration periodic flooding rather than long-term flooding.

Keywords: Sugarcane; Flood; Growth; Nutrient concentration; Yield; Florida; Water table

S.K. Shukla, R.L. Yadav, P.N. Singh, Ishwar Singh, Potassium nutrition for improving stubble bud sprouting, dry matter partitioning, nutrient uptake and winter initiated sugarcane (Saccharum spp. hybrid complex) ratoon yield,

European Journal of Agronomy, Volume 30, Issue 1, January 2009, Pages 27-33, ISSN 1161-0301, DOI: 10.1016/j.eja.2008.06.005.
(http://www.sciencedirect.com/science/article/pii/S1161030108000816)

Abstract:

A field experiment was conducted for two crop cycles during 2003-2005 and 2004-2006 at Indian Institute of Sugarcane Research, Lucknow to improve bud sprouting, dry matter accumulation (DMA), nutrient uptake and ratoon yield by using potassium fertilizer. Potassium (K) fertigation in standing plant cane increased the number of buds per stubble and number of stalks in ratoon cane. K content of stubble increased by 16.7% with K fertigation. The content of reducing sugars in buds at the time of ratoon initiation improved significantly with K fertigation. It improved dry matter accumulation, number of millable canes, individual cane weight, ratoon cane and sugar yields. Thus, it could be concluded that application of 66 kg K ha-1 with irrigation water in standing plant cane before harvest improved bud sprouting, dry matter accumulation and nutrient uptake in ratoon crop. Irrigation in standing plant cane increased ratoon cane (69.9 t ha-1) and sugar yields (7.6 t ha-1). This increase for ratoon cane and sugar yield was 8.7 and 5.55%, respectively over the control. Further, it increased ratoon cane yield by 15.21% (74.1 t ha-1) and sugar yields by 13.9% (8.2 t ha-1) with

K fertigation over the control. Thus, K nutrition holds great promise for improving growth of ratoon cane and sugar yields.

Keywords: Dry matter accumulation; Nutrient uptake; Reducing sugars; Potassium supply; Sugarcane ratoon; Sugar yield

A. Singels, M.A. Smit, Sugarcane response to row spacing-induced competition for light,
Field Crops Research, Volume 113, Issue 2, 3 August 2009, Pages 149-155, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.04.015.
(http://www.sciencedirect.com/science/article/pii/S0378429009001063)

Abstract:

Information about crop response to row spacing (RS) in sugarcane is often contradictory and there is a lack of understanding of competition for light. This study aimed to gain a better understanding of how competition for light affects leaf and tiller development, radiation capture and conversion to biomass, and its partitioning between leaves and stalks. A first ratoon crop of cultivar NCo376 was started on 29 August 2003 (when the plant crop was cut back) at Mount Edgecombe, South Africa (29[degree sign]42'18.4"S, 31[degree sign]02'48.5"E, 105 m). A wagon wheel design was used with RS ranging from 0.36 m to 2.66 m and the crop received adequate water and nutrients. Radiation interception was measured within cane rows (FIINTRA) and across cane rows (FIINTER). FIINTRA was not affected by RS and maximum FIINTRA (defined as the first value above 0.9) was reached simultaneously for all RS. The progression of FIINTER differed substantially between the different RS. Maximum green leaf number was attained when FIINTRA reached 90% and coincided with the occurrence of peak tiller density. Thereafter there was a gradual decline in green leaf number caused by intra-row competition for light. As soon as FIINTER exceeded a value of 90%, there was a drastic reduction in green leaf number due to a sharp acceleration in leaf senescence rate induced by inter-row competition for light. Inter-row competition had an effect on aboveground biomass accumulation of RS of less than 1.37 m from before the first sampling at 730 [degree sign]Cd (base temperature of 16 [degree sign]C). For RS of 1.73 m the competition effect commenced sometime between the first and second sampling (at 948 [degree sign]Cd). There appeared to be no inter-row competition effect for RS of 2.15 m and more. Radiation use efficiency seemed unaffected by RS (average value of 1.50 g MJ-1), although the increase in biomass yield (22% per metre reduction in RS) could not be fully explained by a concurrent increase in intercepted radiation (source size--18% per metre reduction in RS). Sink size (stalk density) responded more to a decrease in RS than source size (intercepted radiation) and the latter became insufficient to fill the sink to capacity when row spacing was less than 1.37 m. Conversely, sink size appeared to be the limiting factor for wider RS as evidenced by a similar mass per stalk for different RS. The stalk partition fraction of biomass increments was unaffected by row spacing, although the start of stalk growth was delayed with decreasing RS in terms of the threshold biomass required for stalk partitioning to commence. This resulted in lower final stalk fractions for narrower RS. The information obtained in this study enabled important new insights

into underlying mechanisms of row spacing-induced competition effects on sugarcane growth and development. It should be useful for improving crop models' ability to predict crop response to row spacing more accurately and in a more functional manner. The improved understanding could highlight avenues for effective crop improvement (e.g. ideal canopy development sub-traits) and crop management (e.g. weed and water management).

Keywords: Row spacing; Fractional interception; Thermal time; Tiller density; Green leaf number; Biomass; Stalk mass; Competition

Diego O. Ferraro, Dario E. Rivero, Claudio M. Ghersa, An analysis of the factors that influence sugarcane yield in Northern Argentina using classification and regression trees,
Field Crops Research, Volume 112, Issues 2-3, 26 June 2009, Pages 149-157, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.02.014.
(http://www.sciencedirect.com/science/article/pii/S0378429009000628)

Abstract:

Multi-location trials are commonly used to estimate the effects of different explanatory factors on crop yield. Conversely, the analysis of production databases could also be useful for exploring and understanding such effects. These data require flexible and robust methods for dealing with multivariate, non-linear and unbalanced data structures, high-order interactions and missing values. In this paper, we explore the issue of crop yield explanation using a 5-year period (1999-2005) of sugarcane (Saccharum officinarum L.) yield data from Northern Argentina. Using a data mining technique such as classification and regression trees (CART) we show that farm membership (FARM) was among the main splitting factors for total cane per hectare (TCH) cluster variability. Crop class (AGE) was at the second level in the hierarchy and values of AGE higher than 2,5 splitted low and medium from the high TCH clusters. Sugarcane cultivar (VAR) was the most important explanatory factor regarding total sugar per hectare (TSH), and crop class (AGE) was second in importance. In this case, farm membership did not appear among the main splitting factors. The growth period duration, field area and precipitation did not show remarkable importance values for explaining final TCH and TSH values. By-year CART models also showed low values of importance of weather related variables across the years analyzed suggesting that other environmental conditions than precipitation is controlling yearly variation in sugar and cane yield (e.g. radiation, water-use efficiency or temperature regime). The CART analysis developed here is the first systematic analysis for explanatory factors of biomass and sugar content in Argentina's cane most productive region. However, we believe this methodology could be applicable for a wider geographic area and other sugarcane production regions as well as other cropping systems. Although regression trees provide less formal statistical inference, its results could be added as an additional analytical tool to traditional experimental analyses that use mixed models. Also, they could be useful for elaborating hypotheses and suggest mechanistic studies to test them.

Keywords: Data mining; CART analysis; Cane yield variability; Non-parametric method

PLANT PROPAGATION (1 jdl)

Ariel D. Arencibia, Aydiloide Bernal, Liu Yang, Leidy Cortegaza, Elva R. Carmona, Alicia Perez, Chun-Jin Hu, Yang-Rui Li, Carlos M. Zayas, Ignacio Santana, New role of phenylpropanoid compounds during sugarcane micropropagation in Temporary Immersion Bioreactors (TIBs),
Plant Science, Volume 175, Issue 4, October 2008, Pages 487-496, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2008.05.024.
(http://www.sciencedirect.com/science/article/pii/S0168945208001593)
Abstract:
The genomic characterization of sugarcane plants has been achieved by suppressing key genes of the phenylpropanoid pathway; as a result, a new function of phenolic metabolites has been characterized during micropropagation in TIBs. Genes related to cell metabolism and development (10), plant defenses (9), phenylpropanoids (7), methyl jasmonate response (5), ethylene (5), oxidative burst (3) and, auxins (3) pathways, among others (8) were found to be induced in sugarcane plants micropropagating in TIBs with phenolic metabolites, supporting that phenylpropanoids might act as elicitor molecules of others biochemical pathways. During adaptation to natural conditions, plants micropropagated in TIBs with highest levels of phenolics displayed an increased number of functional roots, a high growth rate and, an early ability to be colonized by the natural sugarcane endophytic Gluconacetobacter diazotrophicus.
Keywords: Phenolic compounds; Micropropagation; Sugarcane; Temporary Immersion Bioreactors (TIBs)

PLANT GENETICS AND BREEDING (7 jdl)

R.A. Gilbert, J.M. Shine Jr., J.D. Miller, R.W. Rice, C.R. Rainbolt, The effect of genotype, environment and time of harvest on sugarcane yields in Florida, USA,
Field Crops Research, Volume 95, Issues 2-3, 15 February 2006, Pages 156-170, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.02.006.
(http://www.sciencedirect.com/science/article/pii/S0378429005000602)
Abstract:
Sugarcane (Saccharum spp.) is grown across different production environments and is harvested over a 5-month (mid-October-mid-March) period in Florida. While many studies have examined genotype x environment interactions and their implications for breeding program design, knowledge is limited regarding interactions

of genotype, environment and time of harvest and their implications for growers. Three non-confounded data sets ('case studies') were analyzed to determine the effects of these three factors on kilograms of sugar per ton (KST), tons of cane per hectare (TCH) and tons of sugar per hectare (TSH) for recently released cultivars in south Florida. Cultivar (genotype), environment, time of harvest and their interactions had significant effects on KST, TCH and TSH. Sugarcane KST and TSH were reduced by 28 and 29%, respectively, when harvested in mid-October compared to optimum harvest dates in February. TSH varied from 2 to 46% across environments. The Lakeview 'warmland' site near Lake Okeechobee recorded significantly higher TCH and TSH than other sites, and cultivars CP88-1508 and CP88-1834 recorded higher relative yields at Lakeview. Cultivar TSH varied up to 51% across the case studies. CP89-2143 had significantly higher KST than other cultivars in all 21 pairwise comparisons in the three case studies, and a remarkably high, stable KST ranking across environments. Growers in the Everglades Agricultural Area interested in improving sugarcane crop sucrose concentration should plant CP89-2143. However, significant genotype x environment interactions for other cultivars support continued multi-locational evaluation of sugarcane germplasm both during the breeding program and following cultivar release.

Keywords: Sugarcane; Genotype; Environment; Time of harvest

Vikas Y Patade, P Suprasanna, VA Bapat, Gamma Irradiation of Embryogenic Callus Cultures and In vitro Selection for Salt Tolerance in Sugarcane (Saccharum officinarum L.),

Agricultural Sciences in China, Volume 7, Issue 9, September 2008, Pages 1147-1152, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60158-3.
(http://www.sciencedirect.com/science/article/pii/S1671292708601583)

Abstract:

Radiation induced mutagenesis followed by in vitro selection was employed for salt tolerance in popular Indian sugarcane (Saccharum officinarum L.) cv. CoC-671. Embryogenic calli were gamma irradiated and exposed to different levels of NaCl (42.8, 85.6, 128.3, 171.1, 213.9, 256.7, 299.5, or 342.2 mM). The relative growth rate (RGR) decreased progressively with increasing salt stress and was the least with a salt stress of 256.7 mM (0.25 +/- 0.009), almost 10 fold lesser than the control. The RGR was significantly lower in 85.6 mM and higher salt stressed calli than the control. The survival percent also decreased, with an increase in NaCl concentration. In case of 10 and 20 Gy irradiated calli, regeneration was observed up to 85.6 mM NaCl selection, medium, whereas, higher treatments (128.3 mM and beyond) exhibited browning initially. However, in the subsequent subcultures, regeneration was obtained in the case of 10 and 20 Gy irradiated calli on 128.3 and 171.1 mM NaCl selections. Higher dose of gamma irradiation (40 Gy) also showed regeneration, but only with 85.6 mM NaCl selection. The unirradiated calli regenerated the highest number of plantlets followed by 10 and 20 Gy irradiated calli on salt selection. A total of 147 plantlets were selected from different salt levels. The salt selected plants are being tested for their field performance.

Keywords: sugarcane; in vitro mutagenesis; in vitro selection; salt tolerance

Fabiana Aparecida Rodrigues, Marcelo Luiz de Laia, Sonia Marli Zingaretti, Analysis of gene expression profiles under water stress in tolerant and sensitive sugarcane plants, ***Plant Science***, Volume 176, Issue 2, February 2009, Pages 286-302, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2008.11.007.
(http://www.sciencedirect.com/science/article/pii/S0168945208003282)

Abstract:

Water stress decreases plant productivity. To detect genes expressed under drought conditions, we performed a gene expression study using drought tolerant (SP83-5073) and sensitive (SP90-1638) sugarcane plants. Gene expression profiles were monitored by macroarray membranes containing 3575 cDNA clones from sugarcane leaf libraries, and the results were confirmed by real time PCR analysis. In the tolerant cultivar, we identified 165 genes that were expressed in response to water stress, in contrast with the sensitive cultivar, in which a higher number of genes (n = 432) were responsive to the stress treatment. The number of expressed genes in the sensitive cultivar increased with the severity of water deficit. In despite few genes had been differentially expressed in tolerant plants, 94% of them were up-regulated by stress, while 45% of the genes expressed in sensitive plants were down-regulated under water stress conditions. Comparing the gene expression profiles verified 91 common genes between both cultivars, the majority of which were up-regulated by water deficit. Genes were organized according to roles in cellular metabolism. Important stress-related pathways were repressed in sensitive plants. In both cultivars, we observed a great number of unknown genes, which will provide news insights in water deficit tolerance studies.

Keywords: Water stress; Transcriptome; Macroarray; Gene expression; Sugarcane

R.A. Gilbert, N.C. Glynn, J.C. Comstock, M.J. Davis, Agronomic performance and genetic characterization of sugarcane transformed for resistance to sugarcane yellow leaf virus,
Field Crops Research, Volume 111, Issues 1-2, 15 March 2009, Pages 39-46, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.10.009.
(http://www.sciencedirect.com/science/article/pii/S0378429008002104)

Abstract:

Sugarcane yellow leaf virus (SCYLV, a Poleovirus of the Luteoviridae family) is already widespread in Florida, and resistance in the Canal Point (CP) sugarcane population is limited. Genetic transformation of sugarcane for disease resistance holds promise but tissue culture and transformation processes produce undesirable agronomic characteristics necessitating thorough field evaluation. A 3-year sugarcane (a complex hybrid of Saccharum species) field study was conducted in Belle Glade, FL with the following objectives: (1) thoroughly evaluate the agronomic performance of

two transgenic lines transformed for SCYLV resistance (6-1, 6-2) compared with parental cultivar control CP 92-1666, (2) determine level of SCYLV resistance in the transgenic lines, and (3) characterize genetic differences in the transgenic lines compared with CP 92-1666 using simple sequence repeat (SSR) genotyping. Sugarcane yields of CP 92-1666 were superior to both transgenic lines, as well as tissue culture (C-1) and nptII marker gene (20-1) controls, in the plant cane, first ratoon and second ratoon crops. CP 92-1666 recorded an average of 6.5-8.7 tons sucrose ha-1 yr-1 more than genotypes subjected to tissue culture and biolistic transformation. However, SCYLV infection rates in transgenic lines were only 0-5%, compared with 98% in CP 92-1666. Kanamycin field assays indicated that selectable marker gene nptII was stably expressed in all co-transformed lines. SSR genotyping showed 35 additional fragments to be present and 25 existing fragments absent among 6-1, 6-2, C-1 and 20-1 compared with CP 92-1666. Although all clones had unique genotypes, the four regenerated clones showed a greater genetic distance from the donor clone CP 92-1666 (mean GD 0.4) than to one another (mean GD 0.03). This study reports the first successful gene transfer of SCYLV resistance in sugarcane and the first report of variations in microsatellite repeat number associated with regeneration from embryogenic callus. Our results highlight the potential of genetic transformation methods to incorporate desirable traits into sugarcane, combined with the necessity of thorough agronomic evaluation of transgenic genotypes. Transgenic lines 6-1 and 6-2 are being used as parents in crosses designed to combine SCYLV resistance from these genotypes with agronomic characteristics of high-yielding materials.

Keywords: Sugarcane; Yellow leaf syndrome; Disease resistance; Florida; Transgenic

Sarah E. Lingle, Ryan P. Viator, Richard M. Johnson, Thomas L. Tew, Deborah L. Boykin, Recurrent selection for sucrose content has altered growth and sugar accumulation in sugarcane,

Field Crops Research, Volume 113, Issue 3, 4 September 2009, Pages 306-311, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.06.015.
(http://www.sciencedirect.com/science/article/pii/S0378429009001518)

Abstract:

Sucrose content is one of the main factors sugarcane (Saccharum spp. hybrids) breeders use in selecting new cultivars. To determine how growth and sugar content have been altered by six cycles of recurrent selection for sucrose, five cultivars from the first generation (released from 1924 to 1933) were compared with five cultivars from the seventh generation (released from 2003 to 2007). In July of 2006 and 2007, we flagged 20 stalks per plot and marked the top internode that was just beginning to elongate. We then sampled one stalk per plot at weekly to biweekly intervals for 12 weeks. We measured stalk length and internode number, and the length, fresh weight, dry weight, water content, and sugar content of the marked internode. Stalks from the Generation 7 cultivars were taller, and had more internodes than those from Generation 1 cultivars. The marked internodes of Generation 7 and Generation 1 cultivars had similar elongation rates during early development, but elongation ended

earlier in Generation 7 cultivars so that internodes of Generation 7 cultivars were shorter when fully elongated than those of Generation 1 cultivars. These shorter internodes had lower fresh weights, but similar dry weights as the longer Generation 1 internodes. Water content also decreased faster in Generation 7 than Generation 1 internodes. Generation 7 internodes had more total sugar and more sucrose throughout development. Generation 7 internodes also maintained a higher sucrose:total sugar ratio until the end of the sampling period. We conclude that recurrent selection for sucrose content in sugarcane has altered the allocation of photosynthate from growth to storage within the internode. This is possibly due to a change in the regulation of sucrose metabolism within the internode.

Keywords: Sugarcane; Growth; Stalk; Internode; Breeding; Yield components; Dry weight; Assimilate partitioning; Sucrose; Sugar

You-Xiong QUE, Zhi-Xia YANG, Li-Ping XU, Ru-Kai CHEN, Isolation and Identification of Differentially Expressed Genes in Sugarcane Infected by Ustilago scitaminea,
Acta Agronomica Sinica, Volume 35, Issue 3, March 2009, Pages 452-458, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60068-1.
(http://www.sciencedirect.com/science/article/pii/S1875278008600681)

Abstract:

The objective of this study was to survey the molecular mechanism of resistance to sugarcane smut (Ustilago scitaminea Syd.). Two sugarcane (Saccharum officinarum complex) varieties NCo376 with high resistance and F134 with susceptibility were infected by U. scitaminea and the genes associated with the smut resistance were detected with 12 anchored primers and 8 random primers via differential display reverse transcription PCR (DDRT-PCR). Seven differentially expressed fragments were obtained through cloning, sequencing, and semiquantitative RT-PCR validation. The results of Blast in GenBank showed that they shared high homology (35-99%) with cytochrome C oxidase (CCO) gene, ribosomal protein gene, NAD-dependent malic enzyme gene, aminotransferase gene, binding protein gene, RNA polymerase specific transcription initation factor and retrotransposon. The results of semiquantitative RT-PCR showed that CCO gene expression was regulated by U. scitaminea and salicylic acid, and was independent of H2O2. Besides, CCO gene was expressed in root, stalk, and leaf of sugarcane at relatively low levels. Thereby, the phytoalexin induced by CCO gene was inferred to inhibit the pathogen after infection.

Keywords: sugarcane; Ustilago scitaminea; mRNA differential display; RT-PCR

You-Xiong QUE, Li-Ping XU, Jian-Wei LIN, Ru-Kai CHEN, Isolation and Characterization of NBS-LRR Resistance Gene Analogs from Sugarcane,
Acta Agronomica Sinica, Volume 35, Issue 4, April 2009, Pages 631-639, ISSN 1875-2780, DOI: 10.1016/S1875-2780(08)60076-0.
(http://www.sciencedirect.com/science/article/pii/S1875278008600760)

Abstract:

For the purpose of isolating resistance gene analogs (RGAs) from sugarcane (Saccharum officinarum Roxb.) with primers from the conservative sequences of nucleotide-binding site (NBS), 6 forward and 10 backward primers were designed according to the conserved motifs in the NBS regions of 3 typical NBS-LRR resistance genes RPS2, N, and L6. The homologous PCR was used to amplify NBS sequences from genomic DNA and cDNA of smut-resistant sugarcane variety NCo376. A total of 11 RGAs were obtained, of which 5 from the genomic DNA and 6 from the cDNA. Sequence analysis showed that these RGAs comprised of the conserved domains P-loop, Kinase-2a, Kinase-3a, and HD, which was conserved in NBS-LRR type of disease-resistance gene. The last amino acid in the alignment was residue W in LLVLDDV (W/D) motif, which is typical in non-TIR-NBS-LRR type of genes, indicating only non-TIR-NBS-LRR type resistance genes in the genome of sugarcane. The 11 RGAs, together with RPS2 and Xa1, were clustered into one group, and N and L6 were in another group. One RGA, termed PIC (EF059974), was validated through real-time PCR. The result showed that the expression of PIC gene was induced by Ustilago scitaminea and salicylic acid, but inhibited by hydrogen peroxide. The PIC gene had constitutive expressions in leaves, stalks, and roots of sugarcane, with the strongest expression in leaves.

Keywords: Saccharum officinarum; NBS-LRR; resistance gene analogs; resistance to smut

FERTILIZING (2 jdl)

D.W. Isa, G. Hofman, O. van Cleemput, Uptake and balance of fertilizer nitrogen applied to sugarcane,

Field Crops Research, Volume 95, Issues 2-3, 15 February 2006, Pages 348-354, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.04.009.
(http://www.sciencedirect.com/science/article/pii/S0378429005000936)

Abstract:

During the 2000/2001 and 2001/2002 cropping seasons, a study was conducted at the Tanganyika Planting Company (TPC) estate in Tanzania, to investigate the uptake and balance of mineral N applied as urea (60 kg ha-1) and ammonium sulphate (AS) (40 kg ha-1) on a saline (pH 8.8) and a non-saline (pH 7.8) soil. Both fertilizers were labelled with 10 at.% 15N excess. The results showed high recoveries (>90%) in the sugarcane plant growing on a non-saline soil for N applied as both urea and ammonium sulphate. On a saline soil, recoveries were lower but depended on the form of N, being lower (~34%) with urea than with ammonium sulphate (~77%). These lower recoveries of N in the plant were also associated with lower recoveries in the soil-plant system and imply that there were significant losses of N to the environment in this soil. Possible causes for the losses were discussed.

Keywords: Nitrogen; 15N recovery; Loss; Urea; Ammonium sulphate; Uptake

Dasha Ram, Muni Ram, Ranjeet Singh, Optimization of water and nitrogen application to menthol mint (Mentha arvensis L.) through sugarcane trash mulch in a sandy loam soil of semi-arid subtropical climate,

Bioresource Technology, Volume 97, Issue 7, May 2006, Pages 886-893, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.04.047.
(http://www.sciencedirect.com/science/article/pii/S096085240500235X)

Abstract:

Studies were carried out to optimize the use of water and nutrients by the crop with three moisture regimes [0.9, 1.2 and 1.5 irrigation water:cumulative pan evaporation (IW:CPE) ratios], two variables of organic mulch (control and sugarcane trash at 7 t/ha) and three levels of nitrogen (0, 100 and 200 kg/ha). Soil moisture regimes maintained at 1.2 IW:CPE ratio significantly increased the crop growth and herb and essential oil yields as compared with that of 0.9 IW:CPE ratio. The increase in herb yield due to 1.5 and 1.2 IW:CPE ratios was recorded to be 28.5% and 19%, respectively, over the irrigation given at 0.9 IW:CPE ratio, with the corresponding increase in essential oil yield to the extent of 23.5% and 15.5%. Interaction effect of moisture regimes and nitrogen rates indicated that increasing levels of irrigation at the highest level of N (200 kg/ha) improved essential oil yield of the crop. Application of N at 200 kg/ha in the mulched plots significantly enhanced the N uptake by the crop and essential oil yield over the control and 100 kg N/ha applied in the mulched/or unmulched plots and 200 kg N/ha applied in the unmulched plots. Application of organic mulch and nitrogen at 200 kg/ha improved the water use efficiency (WUE) in menthol mint crop. Higher moisture regimes maintained up to 1.2 IW:CPE ratio increased the WUE. The quality of essential oil in terms of its major constituent, menthol, improved slightly with 1.2 IW:CPE ratio as compared to 0.9 and 1.5 IW:CPE ratios at first and second harvests of the crop. It is recommended that menthol mint crop could be grown profitably by providing 16 irrigations, that is 80 cm water (based on 1.2 IW:CPE ratio) and nitrogen at 200 kg/ha in the sugarcane trash mulched plots, which could give a highest benefit:cost ratio from menthol mint cropping.

Keywords: Menthol mint crop; Sugarcane trash mulch; Irrigation; Nitrogen fertilization

IRRIGATION (3 jdl)

Bob Wiedenfeld, Effects of irrigation water salinity and electrostatic water treatment for sugarcane production,

Agricultural Water Management, Volume 95, Issue 1, January 2008, Pages 85-88, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.10.004.
(http://www.sciencedirect.com/science/article/pii/S0378377407002600)

Abstract:

Excess salinity in irrigation water reduces sugarcane yield and juice quality. This study was conducted to compare the effect of irrigation with water of 1.3 dS m-1 vs. 3.4 dS m-1 on sugarcane yield and quality, and to evaluate whether an electrostatic

conditioning treatment of the water influenced the salt effects. The study was conducted in a commercial field divided into large plots ranging from 1.0 to 1.2 ha in size. Cane and sugar yields were reduced approximately 17% by the 3.4 dS m-1 water compared to the 1.3 dS m-1 water, but juice quality parameters were not affected. Conditioning of the irrigation water using a device called an `electrostatic precipitator' which claimed to affect various water properties had no effect on cane yield, juice quality or soil salinity levels. The detrimental effect of the high salt irrigation water was somewhat less than might be expected, probably due to good late summer rainfall which may have flushed the root zone from the excessive salts.

Keywords: Soil salinity; Sugarcane juice quality; Sugarcane yield

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Keywords: Soil salinity; Sugarcane juice quality; Sugarcane yield

Patricia Battie Laclau, Jean-Paul Laclau, Growth of the whole root system for a plant crop of sugarcane under rainfed and irrigated environments in Brazil,

Field Crops Research, Volume 114, Issue 3, 12 December 2009, Pages 351-360, ISSN 0378-4290, DOI: 10.1016/j.fcr.2009.09.004.
(http://www.sciencedirect.com/science/article/pii/S0378429009002391)

Abstract:

Sugarcane crops are managed over 8 million hectares in Brazil and future extensions might occur on less favorable lands where irrigation would be necessary to increase and stabilize yields. Root growth was studied by sequential soil coring under rainfed and irrigated conditions for one cultivar widely planted in Brazil. Root length densities (RLD) were measured 34, 49, 125, 179, 241 and 322 days after planting

(DAP) down to a depth of 1 m. At the harvest (332 DAP), root intersects (a proxy for RLD) were counted on two vertical trench walls in each water supply regime, down to a depth of 6.0 m. The highest RLD in deep layers (below a depth of 0.6 m) were observed in the rainfed crop from 125 DAP onwards. By contrast, the highest RLD in the upper layers during dry periods were found in the irrigated crop. The maximum depth reached by roots at the harvest was little affected by irrigation: 4.70 m and 4.25 m in the rainfed and irrigated crop, respectively. About 50% of root intersects were observed below the depth of 1 m in the two water supply regimes. This pattern suggested a strong genetic control of root growth in deep soil layers. The total amount of root intersects 332 DAP was 49% higher in the rainfed crop than in the irrigated crop, and root distribution was more homogeneous. Mean root front velocity was about 0.5 cm day-1 the first 4 months after planting and increased thereafter up to the end of the harvest (1.86 cm day-1 and 1.75 cm day-1 on average in the rainfed and the irrigated crops, respectively). Our study pointed out the necessity to take into account the development of sugarcane roots in deep soil layers to improve our understanding of net primary production control by water availability.

Keywords: Sugarcane; Roots; Deep soil; Root front; Irrigation; Water stress

SOIL CULTIVATION (11 jdl)

M.V. Braunack, J. Arvidsson, I. Hakansson, Effect of harvest traffic position on soil conditions and sugarcane (Saccharum officinarum) response to environmental conditions in Queensland, Australia,

Soil and Tillage Research, Volume 89, Issue 1, August 2006, Pages 103-121, ISSN 0167-1987, DOI: 10.1016/j.still.2005.07.004.
(http://www.sciencedirect.com/science/article/pii/S0167198705002084)

Abstract:

Field trials were conducted for a period of 5 years at two locations in north Queensland and with four sugarcane varieties to quantify the effect of harvest traffic on soil physical properties and sugarcane growth. The trials were conducted under rain-fed conditions. Treatments consisted of wheel traffic directly over the planted row, 0.1 m from the row and down the middle of the inter-row, by fully laden haulout equipment immediately after harvest. The equipment varied between sites, with low ground pressure tyres being used at one-site and high ground pressure tyres being used at the other site. This reflected commonly used harvesting equipment for each area. Gravimetric soil water content was 23-29 and 26.5-33% at the time of treatment application, which corresponds, to 0.7-0.9 and 0.8-1.0 of the plastic limit for the respective soils. Undisturbed cores were extracted for determination of bulk density and saturated hydraulic conductivity. Soil cone resistance was measured in the field. All measurements were made before and after impact on the plant crop and after impact on each ratoon crop. Stalk numbers, heights of stalks and number of gaps in cane rows were recorded to assess treatment effects, and final yield was measured. Experimental design was split-plot, with the main plot being position of wheel impact

and the plot being split by varieties. Saturated hydraulic conductivity decreased and bulk density increased and soil cone resistance was variable in the row after traffic over the row compared with the near- and inter-row positions. Stalk numbers and heights and yield indicated little difference with respect to treatment, but there was a significant varietal difference. The varieties Q138 and Q124 were taller and had greater yield than Q117 and Q115. The effect of traffic appeared to be cumulative, as the degree of soil compactness and bulk density increased, with treatment differences becoming significant with each additional year of traffic. Traffic over the row resulted in a yield loss compared with traffic near-the-row and down the inter-row.To predict crop response to machinery traffic in the Australian sugar industry the model of Arvidsson and Hakansson [Arvidsson J., Hakansson, I., 1991. A model for estimating crop yield losses caused by soil compaction. Soil Tallage Res. 20, 319-332] was modified. Several changes were necessary, since the original model was developed for a cropping system based on annual cultivation, whereas sugarcane is a perennial crop grown in rows with no annual cultivation. The modified model was validated using data from the trials described in this paper. Agreement between measured yield loss and predicted yield loss was reasonable. This is the first attempt to provide the Australian sugar industry with a tool to assess the yield loss due to harvesting traffic and the economic cost of that loss. The model has the potential to provide, with further development, an indication to growers as to the benefit of restricting traffic to the inter-row area, restricting the number of passes by haulouts, harvesting under drier soil conditions and using high flotation haulout equipment. This should aid in more informed management decisions with respect to harvesting equipment or to the consequences of harvesting under adverse soil conditions.

Keywords: Harvesting traffic; Soil physical conditions; Sugarcane; Soil compaction; Modeling; Yield loss; Bulk density; Hydraulic conductivity; Cone resistance

M.V. Braunack, D. McGarry and Sugar Yield Decline Joint Venture, Traffic control and tillage strategies for harvesting and planting of sugarcane (Saccharum officinarum) in Australia,
Soil and Tillage Research, Volume 89, Issue 1, August 2006, Pages 86-102, ISSN 0167-1987, DOI: 10.1016/j.still.2005.07.002.
(http://www.sciencedirect.com/science/article/pii/S0167198705002060)

Abstract:

Two separate field trials were conducted at two sites; one trial determined the effect of matching crop row spacing and equipment track width on soil physical properties in the crop row and subsequent crop performance (Tully and Ingham, Qld, Australia). The second trial examined the effect of cultivating the old crop row only compared with cultivating the whole field on seedbed parameters for planting sugarcane (Feluga near Tully and Bundaberg, Qld, Australia). The trials were designed to test components of a potential new farming system for the sugar industry.

The Australian sugar industry practices a form of controlled traffic in that harvesting traffic occurs in about the same position for up to four years. However, there is a mis-

match between crop row spacing (1.5 m) and equipment track width (1.83 m). Single rows grown at 1.5 m spacing (random traffic, RT) were compared with dual rows (0.3 m between dual rows) grown at 1.8 m spacing (controlled traffic, CT). Soil bulk density and penetrometer resistance in the row was greater and saturated hydraulic conductivity was lower under the random traffic rows compared with the controlled traffic rows. Crop yields were variable, but tended to be greater under controlled traffic than random traffic conditions. It is thought that the benefits of controlled traffic in the sugar industry would increase with time. A field trial compared conventional land preparation with intensive cultivation and a 6-10 month bare fallow and three different types of reduced tillage. Treatments included mechanical stool removal with a 6-10 month bare fallow, chemically spraying the stool with a 6-10 month fallow period followed by cultivating the row prior to planting and mechanical stool removal and replanting with no fallow period. The crop was planted directly back into the previous crop row in all treatments. Reducing the number of cultivations did not compromise seedbed conditions, since similar aggregate size distributions were measured under all tillage strategies. Stalk counts and final yields indicated that crop response was not significantly ($P < 0.05$) affected by reducing the number of tillage operations. Soil fauna counts showed that there were higher numbers under reduced tillage compared with conventional cultivation. Our results indicate that controlled traffic and reduced tillage improves soil properties in the crop row compared with random traffic and conventional tillage as currently practiced, and we think that further improvement over time can be expected if controlled traffic and reduced tillage is continued. It is suggested that the combination of controlled traffic and reduced tillage could form the basis of a farming system for the Australian sugar industry to protect the soil resource and maintain long-term productivity.

Keywords: Controlled traffic; Sugarcane; Soil compaction; Seedbed; Soil fauna; Tillage; Planting; Australia; Cambisol; Vertisol; Luvisol

J. Naranjo de la F., S. Salgado-Garcia, L.C. Lagunes-Espinoza, E. Carrillo-Avila, D.J. Palma-Lopez, Changes in the properties of a Mexican Fluvisol following 30 years of sugarcane cultivation,
Soil and Tillage Research, Volume 88, Issues 1-2, July 2006, Pages 160-167, ISSN 0167-1987, DOI: 10.1016/j.still.2005.05.006.
(http://www.sciencedirect.com/science/article/pii/S0167198705001650)

Abstract:

A study to evaluate the changes in the fertility of Fluvisols under continuous cultivation of sugarcane was conducted in the vicinity of the Santa Rosalia sugar refinery. About 4000 ha of Fluvisols have been under sugarcane cultivation for more than 30 years. Three representative plots under monoculture for 5, 10, 20 and 30 years, were selected under on-farm conditions. Several samples were obtained from crop row and inter-row zones, at 0-30 cm soil depth, and composited into four samples for each plot. Soil samples were analyzed for pH, organic matter, total organic C, total nitrogen, available phosphorus, exchangeable potassium, calcium and magnesium, cation exchange capacity, texture and bulk density. There were significant changes in

the soil chemical properties due to 30 years of monoculture, except for OM, exchangeable K, Ca, Mg and CEC. Total soil organic C, total N and P declined by 17, 21 and 37%, respectively, by 30 years of monoculture of sugarcane. These losses mainly occurred during the first 20 years of cultivation. However, the adverse effect of decline in soil fertility was not reflected in the sugarcane yields. The 67% increase in yields observed between 5 and 30 years of monoculture may be attributed to the adoption of recommended cultural practices and to farmer's experience. Soil physical properties were not affected by the intensive sugarcane cultivation. A complete adoption of recommended practices by SR among farmers and a revision of the N and P fertilization rate are necessary to maintain the fertility of sugarcane soils.

Keywords: Saccharum officinarum; Soil fertility changes; Long-term monoculture; Fluvisol

Michael J. Bell, Graham R. Stirling, Clive E. Pankhurst, Management impacts on health of soils supporting Australian grain and sugarcane industries,
Soil and Tillage Research, Volume 97, Issue 2, December 2007, Pages 256-271, ISSN 0167-1987, DOI: 10.1016/j.still.2006.06.013.
(http://www.sciencedirect.com/science/article/pii/S016719870600153X)

Abstract:

The grain and sugarcane industries are the dominant cropping enterprises in Australia. Both are facing similar problems in maintaining productivity and profitability, although the management practices employed to achieve these objectives in the two industries differ markedly. The farming systems of both industries have evolved in recent years as our understanding of the physical and chemical benefits of practices like residue retention, reduced tillage and controlled traffic have improved. However the impact of such practices is often evaluated in terms of cost savings, operational efficiencies and efficient capture and use of water. Soil health has not always been an important consideration in system change in either industry, with the exception that crop rotation has always been recognised as important in minimising the impact of soil-borne pathogens. Rotations have been a key feature of grain cropping systems and short duration legume fallows are becoming more prevalent in the sugar industry after more than 25 years of monocultures. However, intensification of cropping in recent years has meant that the pasture leys that were once a dominant component of the grain rotation systems are increasingly being supplanted by short duration cropping breaks with grain legume or other non-cereal crops. Soil organic C has generally been recognised as an important component of soil fertility, but more for the role it plays in soil physical and chemical fertility. Links between organic matter status and soil biological health, and particularly to farming system viability and sustainability, have proven difficult to quantify. This has been partly due to a lack of tools or criteria for monitoring relevant soil properties and also to our limited understanding of the interactions between soil health and other system components. However recent studies are suggesting that the amount and quality of organic matter returned as roots and residues, and the placement of that residue relative to areas of future crop root activity, may be significant factors in the sustainable farming systems of the future.

This paper identifies key issues associated with current and developing farming systems in the grain and sugar industries in Australia, and assesses the impact of management practices employed in those systems on soil health. It also identifies some key challenges facing soil biologists and farming systems researchers who are trying to achieve improvements in soil health and sustainability.

Keywords: Sugarcane; Cereal grain; Tillage; Residue management; Rotation; Soil health

A.J.N. Silva, M.R. Ribeiro, F.G. Carvalho, V.N. Silva, L.E.S.F. Silva, Impact of sugarcane cultivation on soil carbon fractions, consistence limits and aggregate stability of a Yellow Latosol in Northeast Brazil,

Soil and Tillage Research, Volume 94, Issue 2, June 2007, Pages 420-424, ISSN 0167-1987, DOI: 10.1016/j.still.2006.09.002.
(http://www.sciencedirect.com/science/article/pii/S0167198706002030)

Abstract:

The effects of continuous sugarcane (Saccharum officinarum) cropping on the properties of a cohesive Yellow Latosol were studied in the region of the Coastal Tablelands, Northeast Brazil. Four areas were studied at Caete mill, municipality of Sao Miguel dos Campos, Alagoas State, involving a native forest (Tn), and sugarcane fields cultivated for periods of 2 years (T2), 18 years (T18) and 25 years (T25). Samples were collected from each area at 0-0.2 and 0.2-0.4 m depth, to determine total organic C, physical fractionation of soil organic matter and consistence limits. Undisturbed samples were collected to determine wet aggregate mean weight-diameter, dry mean weight diameter and aggregate stability. In relation to the soil under native forest, total organic C and particulate organic matter contents were reduced after 2 years of cultivation. Sugarcane cropping for a longer period promoted a recuperation of soil organic matter content. The decrease of total organic C and reduction in aggregate stability and plastic limit after 2 years of sugarcane cultivation rendered the soil more susceptible to compaction.

Keywords: Soil organic carbon; Particulate organic matter; Aggregate stability; Coastal tableland soils; Sugarcane

Russ W. Gesch, Don C. Reicosky, Robert A. Gilbert, Dolen R. Morris, Influence of tillage and plant residue management on respiration of a Florida Everglades Histosol,

Soil and Tillage Research, Volume 92, Issues 1-2, January 2007, Pages 156-166, ISSN 0167-1987, DOI: 10.1016/j.still.2006.02.004.
(http://www.sciencedirect.com/science/article/pii/S0167198706000493)

Abstract:

Subsidence of drained, high organic matter Histosols in the Everglades Agricultural Area (EAA) is a concern for the sustainability of crop production in southern Florida. Histosol subsidence is primarily due to oxidation of organic matter by aerobic microorganisms, but far less is known about the influence of agricultural

practices. The use of shallow tillage, as opposed to deep tillage, combined with proper plant residue management, may help to reduce the present rate of subsidence and soil CO2 emissions. The present study was conducted on a Lauderhill soil (euic, hyperthermic, Lithic Haplosaprist) previously cropped in sugarcane (Saccharum spp.). The objectives were to (1) determine the effects of tillage depth on short-term CO2 losses in a herbicide-killed weedy residue covered field and another field kept fallow without residue cover, and (2) compare soil respiration measurements made with two different dynamic closed-system portable chamber techniques. Four tillage practices common to the EAA were used to produce soil disturbance ranging in depth from approximately 20 to 300 mm. These practices included switch plowing, disk harrowing, and single and multiple tine cultivation. Twenty-four hours after tillage, cumulative CO2 loss from the deepest tillage treatment (switch plow; 300 mm deep) was as much as 33 times greater than that from the no-till (control) treatment. Cumulative CO2 loss following intermediate tillage (disk harrow; 78-145 mm deep) was as much as 2.3-fold greater than the no-till treatment, but shallower tillage (tine cultivation; 20-41 mm deep) was generally not different. Short-term tillage-induced CO2 loss was primarily related to soil moisture content and soil porosity. Soil respiration measurements made with the two chamber techniques agreed well with each other except for the deepest tillage treatment, where the larger chamber measured CO2 flux that was approximately 10 times greater than for the smaller chamber. Results indicate that minimum or no-tillage may reduce short-term tillage-induced CO2 emissions on organic soils, thus minimizing soil subsidence.

Keywords: Histosol; Soil respiration; Tillage; Residue management

Saowakon Hemwong, Georg Cadisch, Banyong Toomsan, Viriya Limpinuntana, Patma Vityakon, Aran Patanothai, Dynamics of residue decomposition and N2 fixation of grain legumes upon sugarcane residue retention as an alternative to burning,
Soil and Tillage Research, Volume 99, Issue 1, April 2008, Pages 84-97, ISSN 0167-1987, DOI: 10.1016/j.still.2008.01.003.
(http://www.sciencedirect.com/science/article/pii/S0167198708000123)

Abstract:

Burning of sugarcane residues contributes to air pollution and sugarcane producers have been forced to abandon it. The change from burning to residue retention is likely to alter the cycling of nutrients. Additionally, there is often a time gap of 6-8 months between two different sugarcane cycles during which legumes could be planted. Thus, the objective of this study was to assess the effects of burning, mulching or incorporation of sugarcane residues on residue decomposition and N mineralization (sugarcane residue management period) and subsequently upon ploughing (legume period) on N dynamics, N2 fixation, development and nutrient yields of groundnut and soybean grown between two sugarcane cycles on a sandy soil in Northeast Thailand. Soil microbial biomass N increased when sugarcane residues were incorporated instead of burned or surface applied at 14 days after initiation of cane residue management. Thereafter, high net N mineralization was accompanied by a reduction in microbial biomass N, indicating that mineralized N was derived from

microbial N turnover. However, upon ploughing after 96 days the different previous sugarcane residue management strategies had no significant (P > 0.05) effect on net mineral N and microbial biomass N during the subsequent legume period. Although, 15N enrichment in control reference plants and plant N uptake indicated significant N immobilization effects persisting into the legume crop phase, the proportion of N derived from N2 fixation (%Ndfa) or amount of N2 fixed were not significantly different between sugarcane residue management treatments. Soybean fixed more N2 (78%Ndfa, 234 kg N fixed ha-1) than groundnut (67%Ndfa, 170 kg N fixed ha-1) due to its larger N demand and a poorer utilization of soil N (64 kg N ha-1 vs. 85 kg N ha-1). Groundnut led to a positive soil N balance while that of soybean was negative due to its high nitrogen harvest index. Legume residues returned 61 and 146 kg N ha-1 to the soil for soybean and groundnut, respectively, compared to only 34-39 kg N ha-1 by fallow weeds. Sugarcane residue retention improved soil organic carbon and N content. The results suggested that although a change from burning to sugarcane residues retention led to alterations in N cycling and improved soil organic matter it did not significantly affect N2 fixation due to the uniforming action of ploughing and the extended time gap between sugarcane residue incorporation and legume planting.

Keywords: Sugarcane residues; Burning; Incorporation; Mulching; N immobilization; N2 fixation; Groundnut; Soybean

S.K. Shukla, R.L. Yadav, Archna Suman, P.N. Singh, Improving rhizospheric environment and sugarcane ratoon yield through bioagents amended farm yard manure in udic ustochrept soil,
Soil and Tillage Research, Volume 99, Issue 2, June 2008, Pages 158-168, ISSN 0167-1987, DOI: 10.1016/j.still.2008.02.007.
(http://www.sciencedirect.com/science/article/pii/S016719870800024X)

Abstract:

A field experiment was conducted for two crop cycles during 2003-2005 and 2004-2006 at the Indian Institute of Sugarcane Research, Lucknow in subtropical India. Trichoderma viride and Gluconacetobacter diazotrophicus amended farm yard manure (FYM) increased organic carbon (19.44 Mg ha-1) and available nitrogen (260 kg N ha-1) content of soil from 14.78 Mg ha-1 (OC) and 204 kg N ha-1 observed under farmer's practice (sole N application). Application of bioagents amended FYM improved soil porosity and reduced compaction (bulk density--1.39 Mg m-3 over 1.48 Mg m-3 under farmer's practice). Sugarcane ratoon crop removed the highest amount of nitrogen (N--165.7 kg ha-1), phosphorus (P--24.01 kg ha-1) and potassium (K--200.5 kg ha-1) in the plots receiving FYM with Trichoderma and Gluconacetobacter. Inoculation of FYM with bioagents improved population of ammonifying and nitrifying bacteria in the soil. Phosphorus and potassium uptake of the crop was greatest in the plots receiving FYM, Trichoderma and Gluconacetobacter. Bioagents (Trichoderma and Gluconacetobacter) amended FYM increased ratoon cane (70.2 Mg ha-1) and sugar yields (7.93 Mg ha-1) compared with control (62.3 and 7.06 Mg ha-1 ratoon cane and sugar yields, respectively).

Keywords: Dry matter accumulation; Bulk density; Ammonifying and nitrifying bacteria; Available nutrients in soil; NPK uptake; Ratoon yield

Saowakon Hemwong, Georg Cadisch, Banyong Toomsan, Viriya Limpinuntana, Patma Vityakon, Aran Patanothai, Dynamics of residue decomposition and N2 fixation of grain legumes upon sugarcane residue retention as an alternative to burning,
Soil and Tillage Research, Volume 99, Issue 1, April 2008, Pages 84-97, ISSN 0167-1987, DOI: 10.1016/j.still.2008.01.003.
(http://www.sciencedirect.com/science/article/pii/S0167198708000123)

Abstract:

Burning of sugarcane residues contributes to air pollution and sugarcane producers have been forced to abandon it. The change from burning to residue retention is likely to alter the cycling of nutrients. Additionally, there is often a time gap of 6-8 months between two different sugarcane cycles during which legumes could be planted. Thus, the objective of this study was to assess the effects of burning, mulching or incorporation of sugarcane residues on residue decomposition and N mineralization (sugarcane residue management period) and subsequently upon ploughing (legume period) on N dynamics, N2 fixation, development and nutrient yields of groundnut and soybean grown between two sugarcane cycles on a sandy soil in Northeast Thailand. Soil microbial biomass N increased when sugarcane residues were incorporated instead of burned or surface applied at 14 days after initiation of cane residue management. Thereafter, high net N mineralization was accompanied by a reduction in microbial biomass N, indicating that mineralized N was derived from microbial N turnover. However, upon ploughing after 96 days the different previous sugarcane residue management strategies had no significant ($P > 0.05$) effect on net mineral N and microbial biomass N during the subsequent legume period. Although, 15N enrichment in control reference plants and plant N uptake indicated significant N immobilization effects persisting into the legume crop phase, the proportion of N derived from N2 fixation (%Ndfa) or amount of N2 fixed were not significantly different between sugarcane residue management treatments. Soybean fixed more N2 (78%Ndfa, 234 kg N fixed ha-1) than groundnut (67%Ndfa, 170 kg N fixed ha-1) due to its larger N demand and a poorer utilization of soil N (64 kg N ha-1 vs. 85 kg N ha-1). Groundnut led to a positive soil N balance while that of soybean was negative due to its high nitrogen harvest index. Legume residues returned 61 and 146 kg N ha-1 to the soil for soybean and groundnut, respectively, compared to only 34-39 kg N ha-1 by fallow weeds. Sugarcane residue retention improved soil organic carbon and N content. The results suggested that although a change from burning to sugarcane residues retention led to alterations in N cycling and improved soil organic matter it did not significantly affect N2 fixation due to the uniforming action of ploughing and the extended time gap between sugarcane residue incorporation and legume planting.

Keywords: Sugarcane residues; Burning; Incorporation; Mulching; N immobilization; N2 fixation; Groundnut; Soybean

Archna Suman, K.P. Singh, Pushpa Singh, R.L. Yadav, Carbon input, loss and storage in sub-tropical Indian Inceptisol under multi-ratooning sugarcane,
Soil and Tillage Research, Volume 104, Issue 2, July 2009, Pages 221-226, ISSN 0167-1987, DOI: 10.1016/j.still.2009.02.008.
(http://www.sciencedirect.com/science/article/pii/S0167198709000555)

Abstract:

Changes in residue management and incorporation of organic manures may help in carbon sequestration, restoring soil organic carbon (SOC) and sustaining the productivity of land under a cropping system. An experiment of multi-ratooning sugarcane (Saccharum officinarum L.) was initiated in 2003 in Inceptisols of Indian subtropics, to assess the effect of different organic manures and chemical fertilizer, on the crop productivity and soil quality. The annual sugarcane shoot biomass production in organic manure treatments was at par with the chemically fertilized treatment. Gross input of carbon (GIC) by the sugarcane crop was estimated to be 11.7-12.4 t ha-1 y-1 in different organic manure treatments compared to 8.4 and 5.0 t ha-1 y-1 in NPK and control treatments, respectively. The respiratory loss of C (RLC) increased linearly with increasing input of C in soil and it ranged from 3.3 to 4.1 t ha-1 y-1 in different treatments with maximum in FYM and minimum in control treatment. The sugarcane biomass added in the soil humified at a rate constant of 0.38 in sub-tropical conditions and an addition of 3.9 t C ha-1 y-1 is required to maintain SOC in equilibrium. After 5 years of sugarcane cropping (one plant + four ratoons) an increase of 2.3-17.1 t ha-1 in SOC over initial content was recorded with different treatments. Results in coming years from this long-term experiment shall add to the present calculated relationships between carbon addition and storage in sugarcane multi-ratooning crop production system under sub-tropical condition of India.

Keywords: Sugarcane; Multi-ratooning; C-sequestration; Soil organic carbon; Gross input of carbon; Decay constant

R.B. Silva, K.P. Lancas, E.E.V. Miranda, F.A.M. Silva, F.H.R. Baio, Estimation and evaluation of dynamic properties as indicators of changes on soil structure in sugarcane fields of Sao Paulo State - Brazil,
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 265-270, ISSN 0167-1987, DOI: 10.1016/j.still.2008.10.018.
(http://www.sciencedirect.com/science/article/pii/S016719870800189X)

Abstract:

The indiscriminate management and use of soils without moisture control has changed the structure of it due to the increment of the traffic by agricultural machines through the years, causing in consequence, a soil compaction and yield reduction in the areas of intensive traffic. The purpose of this work was to estimate and to evaluate the performance of preconsolidation pressure of the soil and shear stress as indicators of changes on soil structure in fields cropped with sugarcane, as well as the impact of management processes in an Eutrorthox soil structure located in Sao Paulo State. The

experimental field was located in Piracicaba's rural area (Sao Paulo State, Brazil) and has been cropped with sugarcane, in the second harvest cycle. The soil was classified by EMBRAPA [EMBRAPA, 1999. Centro Nacional de Pesquisa de Solos. Sistema Brasileiro de Classificacao de Solos, Embrapa, Brasilia, 412 pp.] as an Eutrorthox. Undisturbed samples were collected and georeferenced in a grid of 60 m x 60 m from two depths: 0-0.10 m (superficial layer - SL) and in the layer of greatest mechanical resistance (LGMR), previously identified by cone index (CI). The investigated variables were pressure preconsolidation ([sigma]p), apparent cohesion (c) and internal friction angle ([phi]). The conclusions from the results were that the SLSC was predicted satisfactorily from [sigma]p as a function of soil moisture; thus, decisions about machinery size and loading (contact pressures) can be taken. Apparent cohesion (c), internal friction angle ([phi]) and the Coulomb equation were significantly altered by traffic intensity. The [sigma]p, c and [phi] maps were shown to be important tools to localize and visualize soil compaction and mechanical resistance zones. They constitute a valuable resource to evaluate the traffic impact in areas cropped with sugarcane in State of Sao Paulo, Brazil.

Keywords: Soil compaction; Preconsolidation pressure; Shear stress; Sugarcane; Trafficability

CROPPING PATTERN AND SYSTEMS (3 jdl)

C.N. Bezuidenhout, A. Singels, Operational forecasting of South African sugarcane production: Part 1 - System description,

Agricultural Systems, Volume 92, Issues 1-3, January 2007, Pages 23-38, ISSN 0308-521X, DOI: 10.1016/j.agsy.2006.02.001.
(http://www.sciencedirect.com/science/article/pii/S0308521X06000151)

Abstract:

Commercial sugarcane crops in South Africa are grown under a wide range of agronomic and socio-economic conditions. These factors, together with climatic variation have resulted in a 17% variation in sugarcane production and there is considerable scope to improve productivity through accurate and timeous forecasts. This paper reports on the development of an operational crop forecasting system based on a simulation model. The country's entire area of sugar production was subdivided into homogeneous climate zones using a wide range of data and expert opinion. These zones serve as simulation units within the system and model input and area aggregation data were obtained for each climate zone. Irrigation is simulated according to typical, zone specific strategies taking into account water use restrictions. Simulations of crops growing in the current year are completed using 10 historic seasons to substitute the remainder of the season. The selection of these seasons is based on the climate outlook. Reports containing information for national, regional and site specific cane production are generated and distributed to industry stakeholders. To the authors' knowledge, this is the first national scale model-based operational yield forecasting system for sugarcane. Possible future improvements to the system may

include stochastic input variables, more representative irrigation simulations, quantifying forecast uncertainty and providing suitable reference crop yield. The system is evaluated in another paper.

Keywords: Crop forecasting; Model; Sugarcane; Climate forecast; Canesim; Yield forecast

C.N. Bezuidenhout, A. Singels, Operational forecasting of South African sugarcane production: Part 2 - System evaluation,
Agricultural Systems, Volume 92, Issues 1-3, January 2007, Pages 39-51, ISSN 0308-521X, DOI: 10.1016/j.agsy.2006.03.002.
(http://www.sciencedirect.com/science/article/pii/S0308521X06000515)

Abstract:

The performance of a model-based crop forecasting system is assessed in this paper. The operational error associated with a forecast originates from two independent sources. First, the system error reflects the system's ability to match yields simulated from historic data to actual yields. The system error is due to factors such as model and data inaccuracies, incorrect aggregation assumptions and the system's inability to reflect all the compelling factors, like pest and diseases, climatic disasters and suboptimal crop management. Second, the climate error reflects inaccuracies of the operational yield forecasts associated with the assumed future climate. The purpose of the study was to assess the performance of a system to forecast sugarcane yields by quantifying the accuracy of (1) estimates based on complete sets of actual weather data and (2) operational system forecasts with incomplete sets of actual weather data. Estimates and forecasts were compared to actual yields recorded from 1980 to 2004. Industry production data from 1980 to 2002, corrected for various time trends, were used to calculate the system error for mills and the industry. The skill of estimation was calculated by comparing the size of the system error with the observed seasonal variation. On an industry scale, estimates captured 57% of inter-annual variability. Production at most mills was also simulated well, with some exceptions in irrigated areas. Operational forecasts issued between January and April for the industry between 1998 and 2004 had an average forecast error of 4.0%, which is 2.2% lower than the equivalent mill committee forecasts. The study provides ample evidence that industry stakeholders could use information from this system to enhance their management of sugarcane production.

Keywords: Crop forecasting; Forecast skill; Model; Canesim; Regional validation; Sugarcane; System error; Climate error

R.L. Yadav, Archna Suman, S.R. Prasad, O. Prakash, Effect of Gluconacetobacter diazotrophicus and Trichoderma viride on soil health, yield and N-economy of sugarcane cultivation under subtropical climatic conditions of India,
European Journal of Agronomy, Volume 30, Issue 4, May 2009, Pages 296-303, ISSN 1161-0301, DOI: 10.1016/j.eja.2009.01.002.
(http://www.sciencedirect.com/science/article/pii/S1161030109000045)
Abstract:

Intensive cropping and exhaustive nature of sugarcane-wheat-rice cropping system in the Indo-Gangetic Plains of South Asia have led to the depletion of soil organic carbon content and inherent soil fertility resulting in a serious threat to the sustainability of these production systems. Bioagents like Gluconacetobacter diazotrophicus and Trichoderma viride have great potential to restore soil fertility and promote sugarcane growth. Field experiments, therefore, have been conducted to study the integrated effect of bioagents (G. diazotrophicus and T. viride), Farm Yard Manure (FYM) and fertilizer N on sugarcane rhizosphere, crop yield and N economy for two crop cycles during 2004-2006 and 2005-2007 crop seasons at Lucknow, in the middle Indo-Gangetic plain region. Both bioagents could survive and colonize sugarcane rhizosphere and FYM improved their colonization. Enhanced soil microbial population and microbial carbon (SMC) and nitrogen (SMN) with increasing N level were probably due to more available N in the soil. FYM/bioagents amendment further enhanced the microbial carbon. The uniform increase in the fraction of SMC and SMN of total organic carbon indicated that immobilization/mineralization was being maintained in the soil where enhanced microbial biomass might act later as a source of nutrients. Bioagents ammended FYM enhanced the uptake of N, P and K in sugarcane at all the levels of fertilizer N. It was mainly due to the enhanced nutrient availability in the rhizospheric soil as the soil organic C and available N, P and K content increased with the application of bioagents/FYM. A saving of 76.3 kg N ha-1 was envisaged by the use of G. diazotrophicus inoculated FYM with marginal (2.4 t ha-1) decline in the cane yield. Application of T. viride enriched FYM, however, brought economy in the use of fertilizer N by 45.2 kg ha-1 and also increased the yield by 6.1 t ha-1compared to the control treatment. Overall, strategic planning in terms of an integrated application of these bioagents/manures with fertilizer N will not only sustain soil fertility but will also benefit farmers in terms of reducing their dependence and expenditure on chemical fertilizers.
Keywords: **Bioagent; Sugarcane; Soil health; Organic carbon; Gluconacetobacter; Trichoderma; Soil microbial biomass; N-economy**

PLANT PHYSIOLOGY AND BIOCHEMISTRY (5 jdl)

Noel Tejera, Eduardo Ortega, Rosa Rodes, Carmen Lluch, Nitrogen compounds in the apoplastic sap of sugarcane stem: Some implications in the association with endophytes,
Journal of Plant Physiology, Volume 163, Issue 1, 4 January 2006, Pages 80-85, ISSN 0176-1617, DOI: 10.1016/j.jplph.2005.03.010.
(http://www.sciencedirect.com/science/article/pii/S0176161705001227)

Abstract: Summary

Several nitrogen compounds were identified and quantified in the apoplastic and symplastic sap of sugarcane stems. The sap of stems was composed mainly of soluble sugars, which constituted 95% of the total organic compounds detected. Sap also contained nitrogen compounds, with amino acids (50-70% of N) and proteins (20-30% of N), being the main nitrogenous substances, as well as inorganic forms as ammonium, nitrite and nitrate, in low concentrations (<20% of N). Serine, proline, alanine and aspartic acid together represented around 60% of the amino acids of the sap of both field grown and high nitrogen fertilized plants, and non-nitrogen fertilized plants inoculated with Gluconacetobacter diazotrophicus. The total amino acid content of apoplastic sap was six to nine times lower in non-nitrogen fertilized plants than in fertilized ones. The possible roles of these substances to regulate endophytic associations with sugarcane are also discussed.

Keywords: Amino acids; Apoplast; Endophyte; Nitrogen compounds; Sugarcane

Lafras Uys, Frederik C. Botha, Jan-Hendrik S. Hofmeyr, Johann M. Rohwer, Kinetic model of sucrose accumulation in maturing sugarcane culm tissue,
Phytochemistry, Volume 68, Issues 16-18, Dynamic Metabolic Networks, August-September 2007, Pages 2375-2392, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2007.04.023.
(http://www.sciencedirect.com/science/article/pii/S0031942207002798)

Abstract:

Biochemically, it is not completely understood why or how commercial varieties of sugarcane (Saccharum officinarum) are able to accumulate sucrose in high concentrations. Such concentrations are obtained despite the presence of sucrose synthesis/breakdown cycles (futile cycling) in the culm of the storage parenchyma. Given the complexity of the process, kinetic modelling may help to elucidate the factors governing sucrose accumulation or direct the design of experimental optimisation strategies. This paper describes the extension of an existing model of sucrose accumulation (Rohwer, J.M., Botha, F.C., 2001. Analysis of sucrose accumulation in the sugar cane culm on the basis of in vitro kinetic data. Biochem. J. 358, 437-445) to account for isoforms of sucrose synthase and fructokinase, carbon partitioning towards fibre formation, and the glycolytic enzymes phosphofructokinase (PFK), pyrophosphate-dependent PFK and aldolase. Moreover, by including data on the maximal activity of the enzymes as measured in different internodes, a growth model

was constructed that describes the metabolic behaviour as sugarcane parenchymal tissue matures from internodes 3-10. While there was some discrepancy between modelled and experimentally determined steady-state sucrose concentrations in the cytoplasm, steady-state fluxes showed a better fit. The model supports a hypothesis of vacuolar sucrose accumulation against a concentration gradient. A detailed metabolic control analysis of sucrose synthase showed that each isoform has a unique control profile. Fructose uptake by the cell and sucrose uptake by the vacuole had a negative control on the futile cycling of sucrose and a positive control on sucrose accumulation, while the control profile for neutral invertase was reversed. When the activities of these three enzymes were changed from their reference values, the effects on futile cycling and sucrose accumulation were amplified. The model can be run online at the JWS Online database (http://jjj.biochem.sun.ac.za/database/uys).

Keywords: Sugarcane; Kinetic modelling; Metabolic control analysis; Plant metabolism; Sucrose accumulation

Joaquim Mauricio Duarte-Almeida, Giuseppina Negri, Antonio Salatino, Joao Ernesto de Carvalho, Franco Maria Lajolo, Antiproliferative and antioxidant activities of a tricin acylated glycoside from sugarcane (Saccharum officinarum) juice,

Phytochemistry, Volume 68, Issue 8, April 2007, Pages 1165-1171, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2007.01.015.
(http://www.sciencedirect.com/science/article/pii/S0031942207000544)

Abstract:

From sugarcane juice, a flavone, identified by spectroscopic methods as tricin-7-O-[beta]-(6''-methoxycinnamic)-glucoside, was isolated, in addition to orientin. The tricin derivative was shown to have antioxidant activity higher than Trolox(R) by means of the DPPH assay and lower by the [beta]-carotene/linoleic acid system. It showed in vitro antiproliferative activity against several human cancer cell lines, with higher selectivity toward cells of the breast resistant NIC/ADR line.

Keywords: Saccharum officinarum; Poaceae; Sugarcane; Flavonoids; Tricin; Orientin; Antioxidant; Antiproliferative

F.G. Loiret, B. Grimm, M.R. Hajirezaei, D. Kleiner, E. Ortega, Inoculation of sugarcane with Pantoea sp. increases amino acid contents in shoot tissues; serine, alanine, glutamine and asparagine permit concomitantly ammonium excretion and nitrogenase activity of the bacterium,

Journal of Plant Physiology, Volume 166, Issue 11, 15 July 2009, Pages 1152-1161, ISSN 0176-1617, DOI: 10.1016/j.jplph.2009.01.002.
(http://www.sciencedirect.com/science/article/pii/S0176161709000042)

Abstract: Summary

Pantoea sp. is an endophytic nitrogen-fixing bacterium isolated from sugarcane tissues. The aim of the present study was to determine the contents of amino acids in sugarcane as a result of inoculation of nodes and nodal roots with Pantoea sp. strain

9C and to evaluate the effects of amino acids on growth, nitrogenase activity and ammonium excretion of the bacterium. Content of almost all amino acids increased in 30-day-old plantlets by root inoculation. The most abundant amino acids in shoot tissues were asparagine and proline, and those in nodal roots were asparagine, proline, aspartic acid, glutamic acid and serine. The bacterium was able to grow on all tested amino acids except histidine, isoleucine and leucine. Nitrogenase Pantoea sp. was partially inhibited by 1, 2 or 5 mmol L-1 and completely inhibited by 10 mmol L-1 of NH4+ in the media. Pantoea sp. showed nitrogenase activity in 5 mmol L-1 of serine, asparagine, threonine, alanine, proline, tyrosine, valine, methionine, lysine, phenylalanine, cysteine, tryptophan, citrulline and ornithine. Pantoea sp. did not excrete ammonium when it grew in vivo conditions favoring nitrogen fixation; however, ammonium was detected in the supernatant when 5 mmol L-1 asparagine, aspartic acid, alanine, serine or glutamine was added to the medium. The highest ammonium concentration in the supernatant was detected, when Pantoea grew on serine. Ammonium in the supernatant and nitrogenase activity were only detectable concomitantly when the medium was supplemented with serine, alanine, glutamine or asparagine. We discuss roles of amino acids on plant-bacteria interaction during the colonization of sugarcane plants.

Keywords: Amino acid; Nitrogenase; Pantoea; Plant-endophyte interaction; Sugarcane

Altaf Hussain, Muhammad Hamid Rashid, Raheela Perveen, Muhammad Ashraf, Purification, kinetic and thermodynamic characterization of soluble acid invertase from sugarcane (Saccharum officinarum L.),
Plant Physiology and Biochemistry, Volume 47, Issue 3, March 2009, Pages 188-194, ISSN 0981-9428, DOI: 10.1016/j.plaphy.2008.11.001.
(http://www.sciencedirect.com/science/article/pii/S0981942808002118)

Abstract:

We report for the first time kinetic and thermodynamic properties of soluble acid invertase (SAI) of sugarcane (Saccharum officinarum L.) salt sensitive local cultivar CP 77-400 (CP-77). The SAI was purified to apparent homogeneity on FPLC system. The crude enzyme was about 13 fold purified and recovery of SAI was 35%. The invertase was monomeric in nature and its native molecular mass on gel filtration and subunit mass on SDS-PAGE was 28 kDa. SAI was highly acidic having an optimum pH lower than 2. The acidic limb was missing. Proton transfer (donation and receiving) during catalysis was controlled by the basic limb having a pKa of 2.4. Carboxyl groups were involved in proton transfer during catalysis. The kinetic constants for sucrose hydrolysis by SAI were determined to be: km = 55 mg ml-1, kcat = 21 s-1, kcat/km = 0.38, while the thermodynamic parameters were: [Delta]H* = 52.6 kJ mol-1, [Delta]G* = 71.2 kJ mol-1, [Delta]S* = -57 J mol-1 K-1, [Delta]G*E-S = 10.8 kJ mol-1 and [Delta]G*E-T = 2.6 kJ mol-1. The kinetics and thermodynamics of irreversible thermal denaturation at various temperatures 53-63 [degree sign]C were also determined. The half -life of SAI at 53 and 63 [degree sign]C was 112 and 10 min, respectively. At 55 [degree sign]C, surprisingly the half -life increased to twice that at 53 [degree sign]C.

[Delta]G*, [Delta]H* and [Delta]S* of irreversible thermal stability of SAI at 55 [degree sign]C were 107.7 kJ mol-1, 276.04 kJ mol-1 and 513 J mol-1K-1, respectively.

Keywords: Enthalpy; Entropy; Gibbs energy; Salinity; Sucrose hydrolysis; Thermostability

PLANT PHYSIOLOGY- NUTRITION (18 jdl)

Diego Alejandro Sampietro, Marta Amelia Vattuone, Maria Ines Isla, Plant growth inhibitors isolated from sugarcane (Saccharum officinarum) straw,

Journal of Plant Physiology, Volume 163, Issue 8, 3 July 2006, Pages 837-846, ISSN 0176-1617, DOI: 10.1016/j.jplph.2005.08.002.
(http://www.sciencedirect.com/science/article/pii/S017616170500249X)

Abstract: Summary

Several compounds related with plant defense and pharmacological activities have been isolated from sugarcane. Straw phytotoxins and their possible mechanisms of growth inhibition are largely unknown. A bioassay-guided fractionation of the phytotoxic constituents leachated from a sugarcane straw led to the isolation of trans-ferulic (trans-FA), cis-ferulic (cis-FA), vanillic (VA) and syringic (SA) acids. The straw leachates and their identified constituents significantly inhibited root growth of lettuce and four weeds. VA was more phytotoxic to root elongation than FA and SA. The identified phenolic compounds significantly increased leakage of root cell constituents, inhibited dehydrogenase activity and reduced chlorophyll content in lettuce. VA and FA inhibited mitotic index while SA increased cell division. Additive (VA-FA and FA-SA) and synergistic (VA-SA) interactions on root growth were observed at the response level of EC25. Although the isolated compounds differed in their relative phytotoxic activities, the observed physiological responses suggest that they have a common mode of action. HPLC analysis indicated that sugarcane straw can potentially release 1.43 (ratio 2:1, trans:cis), 1.14 and 0.14 mmol kg-1 (straw dry weight) of FA, VA and SA, respectively. As phenolic acids are often found spatially concentrated in the top soil layers under plant straws, further studies are needed to establish the impact of these compounds in natural settings.

Keywords: Bioassay-guided isolation; Phenolic acids; Phytotoxins; Straw leachate; Sugarcane

Abdul Wahid, Alia Ghazanfar, Possible involvement of some secondary metabolites in salt tolerance of sugarcane,

Journal of Plant Physiology, Volume 163, Issue 7, 3 May 2006, Pages 723-730, ISSN 0176-1617, DOI: 10.1016/j.jplph.2005.07.007.
(http://www.sciencedirect.com/science/article/pii/S0176161705002415)

Abstract: Summary

Accumulation of toxic ions in plant tissues modulates the levels of primary and secondary metabolites, which may be related to salinity tolerance. In this study two sugarcane clones, CP-4333 (tolerant) and HSF-240 (sensitive), were exposed to salinity levels at the formative stage, and evaluated three times at 10-day intervals. Although net rate of photosynthesis (Pn), leaf area, length and dry weight of shoots were decreased in both clones, the CP-4333 showed less reduction compared to HSF-240. Both clones displayed a general tendency to accumulate Na+ and Cl- and little K+, though CP-4333 accumulated less Na+ and more K+ compared to HSF-240, and thus showed a higher K+:Na+ ratio. The carotenoid (CAR) content remained steady, while total chlorophyll (CHL) was slightly reduced in the tolerant clone and significantly reduced in HSF-240. In contrast, soluble phenolics (PHE), anthocyanins (ANT) and flavones (FLA) levels were 2.5, 2.8 and 3.0 times greater in CP-4333 in comparison with HSF-240. The decrease in Pn and most secondary metabolites demonstrated by the sensitive clone, but not evidenced in the tolerant clones, suggest that the presence of those metabolites is related to increased salt tolerance of sugarcane. The increased synthesis of PHE, ANT and FLA seems to protect sugarcane from ion-induced oxidative stress, probably due to a common structural skeleton, the phenyl group, of those metabolites. CAR, as components of the light harvesting center (LHC) and biosynthesized in chloroplasts, may confer resistance to this organelle. The PHE, ANT and FLA synthesized in the cytosol may protect cells from ion-induced oxidative damage by binding the ions and thereby showing reduced toxicity on cytoplasmic structures.

Keywords: Cytosol; Ions toxicity; Salt tolerance; Secondary metabolites; Sugarcane

Joseph C.V. Vu, Leon H. Allen Jr., Russ W. Gesch, Up-regulation of photosynthesis and sucrose metabolism enzymes in young expanding leaves of sugarcane under elevated growth CO2,

Plant Science, Volume 171, Issue 1, July 2006, Pages 123-131, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2006.03.003.

(http://www.sciencedirect.com/science/article/pii/S0168945206000823)

Abstract:

Midday leaf CO2 exchange rate (CER), concentration of chlorophyll (Chl) and soluble protein and activity of the primary enzymes involved in leaf photosynthesis and sucrose metabolism were determined during leaf ontogeny for sugarcane plants grown at ambient (360 [mu]mol mol-1) and double-ambient (elevated, 720 [mu]mol mol-1) CO2. Although leaf CER of both CO2 treatments increased and was highest at 14 days after leaf emergence (DALE), leaf CER of the elevated-CO2 plants, however, was 20, 7 and 10% greater than that of the ambient-CO2 plants at 7, 14 and 32 DALE, respectively. Elevated-CO2 plants also had up to 51% lower stomatal conductance and 39% less transpiration, which resulted in 26-52% greater water-use efficiency (WUE) than ambient-CO2 plants, during leaf growth and development. Concentrations of total Chl and soluble protein and activities of RuBP carboxylase-oxygenase

(Rubisco), PEP carboxylase (PEPC), NADP-malate dehydrogenase (NADP-MDH), pyruvate Pi dikinase (PPDK) and sucrose-P synthase (SPS), expressed on a leaf area basis, generally followed leaf CER patterns during leaf ontogeny. For the elevated-CO2 plants, total Chl and soluble protein were 31 and 15% greater, and Rubisco, PPDK and NADP-MDH were up-regulated by 21, 117 and 174%, respectively, at 14 DALE, whereas PEPC and NADP-malic enzyme tended to be lower than or similar to the ambient-CO2 plants throughout leaf development. In addition, leaf SPS activity was increased by 13 and 37% and leaf sucrose concentration was 31 and 19% higher at 7 and 14 DALE, respectively, under elevated growth CO2. At final harvest, elevated growth [CO2] enhanced leaf area by 31%, leaf fresh weight by 13.5%, stem fresh weight by 55.5%, total above-ground plant fresh weight by 44%, and stem juice volume by 83%. The up-regulation of the key photosynthesis and sucrose metabolism enzymes at early stages of leaf development would indicate an acclimation to elevated growth [CO2] for the C4 sugarcane plant. An up-regulation of the enzymes, together with a reduction in leaf stomatal conductance and transpiration and an improvement in leaf WUE and plant water status, could lead to an enhancement in leaf area, plant biomass accumulation and sucrose production for the CO2-enriched sugarcane plants.

Keywords: Rising atmospheric CO2; C4 photosynthetic enzymes; Sucrose metabolism

M. Madhaiyan, S. Poonguzhali, S.P. Sundaram, Tongmin Sa, A new insight into foliar applied methanol influencing phylloplane methylotrophic dynamics and growth promotion of cotton (Gossypium hirsutum L.) and sugarcane (Saccharum officinarum L.),

Environmental and Experimental Botany, Volume 57, Issues 1-2, August 2006, Pages 168-176, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2005.05.010.
(http://www.sciencedirect.com/science/article/pii/S0098847205000729)

Abstract:

Foliar applied methanol has been purported to enhance growth and yield of cotton and sugarcane possibly by stimulation of plant hormone production mediated by pink-pigmented facultative methylotrophic (PPFMs) bacteria. In vitro studies were performed on the relations between leaf methanol and pectin methylesterase (PME: EC 3.1.1.11) in young and old leaves of cotton and sugarcane. Results of field trials and pot culture studies of cotton showed that application of 30% methanol or PPFMs as foliar spray significantly increased plant height, plant dry weight, leaf area, boll number, and boll dry weight, leading to an increase of seed cotton yield (SCY) over control. Foliar application of PPFMs increased plant height and specific leaf area of sugarcane and led to a cane yield increase of 9.8% over control. The overall PPFMs population in the phyllosphere of cotton remained higher than sugarcane. Applications of methanol or PPFMs increased the total cytokinins in cotton and sugarcane. The methanol emission process, regulated by PME activity that catalyzes demethoxylation of pectins, could trigger PPFMs population on the leaf surface and subsequent cytokinin production in plants, and might play a role in plant growth promotion. In our

study, the foliar applications of methanol or PPFMs increased the PPFM populations and cytokinin production resulting in increased yield in cotton and sugarcane.

Keywords: Leaf methanol; Pectin; Pectin methylesterase; Methylobacterium; PPFMs; Cytokinins

J.C.S. Allison, N.W. Pammenter, R.J. Haslam, Why does sugarcane (Saccharum sp. hybrid) grow slowly?,

South African Journal of Botany, Volume 73, Issue 4, November 2007, Pages 546-551, ISSN 0254-6299, DOI: 10.1016/j.sajb.2007.04.065.
(http://www.sciencedirect.com/science/article/pii/S0254629907003067)

Abstract:

Sugarcane grows comparatively slowly in dry mass during both the early and the late part of its growth period. Rate of leaf production increases less with temperature than in other tall warm-climate grasses. This leads to a comparatively low rate of tillering, and a delayed start of stem elongation. Consequently, there is a comparatively lengthy period of `lost time' before the stimulus of the elongating stem leads to an increase in dry mass growth rate. The slow growth during the late part of the growth period is associated with a decrease in rate of stem elongation and an increase in the mass of non-structural material in the stem. Rate of respiration (total `dark', and maintenance) is lower at normal temperature than other warm-climate grasses. A low rate of maintenance respiration should decrease the fraction of assimilate that must be expended to maintain the large non-structural mass in the stem. The slow stem elongation during the late part of the growth period might be indicative of a decrease in rate of respiration, reflecting rate of metabolism, hence of synthesis of structural dry mass, to the benefit of storage of sucrose. The growth pattern of sugarcane may be `optimal' for maximising sucrose yield, balancing delayed growth with decreased respiratory carbon loss.

Keywords: Assimilate portioning; Growth; Metabolism and respiration; Storage; Sugarcane

Julio C. Borges, Thiago C. Cagliari, Carlos H.I. Ramos, Expression and variability of molecular chaperones in the sugarcane expressome,

Journal of Plant Physiology, Volume 164, Issue 4, 5 April 2007, Pages 505-513, ISSN 0176-1617, DOI: 10.1016/j.jplph.2006.03.013.
(http://www.sciencedirect.com/science/article/pii/S0176161706001283)

Abstract: Summary

Molecular chaperones perform folding assistance in newly synthesized polypeptides preventing aggregation processes, recovering proteins from aggregates, among other important cellular functions. Thus their study presents great biotechnological importance. The present work discusses the mining for chaperone-related sequences within the sugarcane EST genome project database, which resulted in approximately 300 different sequences. Since molecular chaperones are highly

conserved in most organisms studied so far, the number of sequences related to these proteins in sugarcane was very similar to the number found in the Arabidopsis thaliana genome. The Hsp70 family was the main molecular chaperone system present in the sugarcane expressome. However, many other relevant molecular chaperones systems were also present. A digital RNA blot analysis showed that 5'ESTs from all molecular chaperones were found in every sugarcane library, despite their heterogeneous expression profiles. The results presented here suggest the importance of molecular chaperones to polypeptide metabolism in sugarcane cells, based on their abundance and variability. Finally, these data have being used to guide more in deep analysis, permitting the choice of specific targets to study.

Keywords: Expressed sequence tags; Heat shock proteins; Molecular chaperones; SUCEST; Sugarcane.

Maria Lorena Sereno, Raul S. Almeida, Deborah S. Nishimura, Antonio Figueira, Response of sugarcane to increasing concentrations of copper and cadmium and expression of metallothionein genes,

Journal of Plant Physiology, Volume 164, Issue 11, 9 November 2007, Pages 1499-1515, ISSN 0176-1617, DOI: 10.1016/j.jplph.2006.09.007.
(http://www.sciencedirect.com/science/article/pii/S0176161706002604)

Abstract: Summary

Sugarcane (Saccharum spp.) offers the potential to be a phytoremediator species due to its outstanding biomass production, but its prospective metal accumulation and tolerance have not been fully characterized. Sugarcane plantlets were able to tolerate up to 100 [mu]M of copper in nutrient solution for 33 days, with no significant reduction in fresh weight, while accumulating 45 mg Cu kg-1 shoot dry weight. Higher levels of copper in solution (250 and 500 [mu]M) were lethal. Sugarcane displayed tolerance to 500 [mu]M Cd without symptoms of toxicity, accumulating 451 mg Cd kg-1 shoot dry weight after 33 days, indicating its potential as Cd phytoremediator. DNA gel blot analyses detected 8 fragments using a metallothionein (MT) Type I probe, while 10 were revealed for the MT Type II and 8 for MT Type III. The number of genes for each type of MT in sugarcane might be similar to the ones identified in rice considering the interspecific origin of sugarcane cultivars. MT Type I gene appeared to present the highest level of constitutive expression, mainly in roots, followed by MT Type II, corroborating the expression pattern described based on large-scale expressed sequence tags sequencing. MT Type II and III genes were more expressed in shoots, where MT I was also importantly expressed. Increasing Cu concentration had little or no effect in modulating MT genes expression, while an apparent minor modulation of some of the MT genes could be detected in Cd treatments. However, the level of response was too small to explain the tolerance and/or accumulation of Cd in sugarcane tissues. Thus, cadmium tolerance and accumulation in sugarcane might derive from other mechanisms, although MT may be involved in oxidative responses to high levels of Cd. Sugarcane can be considered a potential candidate to be tested in Cd phytoremediation.

Keywords: Gene expression; Heavy metal; Hyperaccumulator; Metal-chelating peptides; Phytoremediation

Lafras Uys, Frederik C. Botha, Jan-Hendrik S. Hofmeyr, Johann M. Rohwer, Kinetic model of sucrose accumulation in maturing sugarcane culm tissue,
Phytochemistry, Volume 68, Issues 16-18, Dynamic Metabolic Networks, August-September 2007, Pages 2375-2392, ISSN 0031-9422, DOI: 10.1016/j.phytochem.2007.04.023.
(http://www.sciencedirect.com/science/article/pii/S0031942207002798)

Abstract:

Biochemically, it is not completely understood why or how commercial varieties of sugarcane (Saccharum officinarum) are able to accumulate sucrose in high concentrations. Such concentrations are obtained despite the presence of sucrose synthesis/breakdown cycles (futile cycling) in the culm of the storage parenchyma. Given the complexity of the process, kinetic modelling may help to elucidate the factors governing sucrose accumulation or direct the design of experimental optimisation strategies. This paper describes the extension of an existing model of sucrose accumulation (Rohwer, J.M., Botha, F.C., 2001. Analysis of sucrose accumulation in the sugar cane culm on the basis of in vitro kinetic data. Biochem. J. 358, 437-445) to account for isoforms of sucrose synthase and fructokinase, carbon partitioning towards fibre formation, and the glycolytic enzymes phosphofructokinase (PFK), pyrophosphate-dependent PFK and aldolase. Moreover, by including data on the maximal activity of the enzymes as measured in different internodes, a growth model was constructed that describes the metabolic behaviour as sugarcane parenchymal tissue matures from internodes 3-10. While there was some discrepancy between modelled and experimentally determined steady-state sucrose concentrations in the cytoplasm, steady-state fluxes showed a better fit. The model supports a hypothesis of vacuolar sucrose accumulation against a concentration gradient. A detailed metabolic control analysis of sucrose synthase showed that each isoform has a unique control profile. Fructose uptake by the cell and sucrose uptake by the vacuole had a negative control on the futile cycling of sucrose and a positive control on sucrose accumulation, while the control profile for neutral invertase was reversed. When the activities of these three enzymes were changed from their reference values, the effects on futile cycling and sucrose accumulation were amplified. The model can be run online at the JWS Online database (http://jjj.biochem.sun.ac.za/database/uys).

Keywords: Sugarcane; Kinetic modelling; Metabolic control analysis; Plant metabolism; Sucrose accumulation

Axel T. Lehrer, Ewald Komor, Carbon dioxide assimilation by virus-free sugarcane plants and by plants which were infected by Sugarcane Yellow Leaf Virus, ***Physiological and Molecular Plant Pathology***, Volume 73, Issue 6, December 2008, Pages 147-153, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2009.05.002.
(http://www.sciencedirect.com/science/article/pii/S0885576509000241)

Abstract:

Infection of sugarcane by Sugarcane Yellow Leaf Virus (SCYLV) remains mostly asymptomatic. The assimilation rates and the water relations parameters were measured to test whether the plants are already inflicted by the infection. The assimilation rate and the stomatal conductance were 10-30% higher in virus-free plants than in infected plants. The observed differences were significant in young potted plants, not in older field plants. Virus-free leaves had a higher bundle sheath leakiness and a lower 13C discrimination rate than infected leaves. The water relations parameters of SCYLV-infected asymptomatic plants showed resemblance to those of salinity- and drought-stressed plants.

Keywords: Photosynthesis; Saccharum spec. hybrid (sugarcane); Sugarcane yellow leaf virus (SCYLV); Yellow leaf (YL, YLS); Water relations parameters

Maria Blanch, Maria-Estrella Legaz, Carlos Vicente, Xanthan production by Xanthomonas albilineans infecting sugarcane stalks,
Journal of Plant Physiology, Volume 165, Issue 4, 13 March 2008, Pages 366-374, ISSN 0176-1617, DOI: 10.1016/j.jplph.2007.03.008.
(http://www.sciencedirect.com/science/article/pii/S0176161707001125)

Abstract: Summary

Xanthomonas albilineans is the causal organism of leaf scald, a bacterial vascular disease of sugarcane. Xanthomonas may invade the parenchyma between the bundles and cause reddened pockets of gum, identified as a xanthan-like polysaccharide. Since xanthan contains glucuronic acid, the ability of Xanthomonas to produce an active UDP glucose dehydrogenase is often seen as a virulence factor. X. albilineans axenically cultured did not secrete xanthans to Willbrink liquid media, but the use of inoculated sugarcane tissues for producing and characterizing xanthans has been required. A hypothesis about the role of sugarcane polysaccharides to assure the production of bacterial xanthan is discussed.

Keywords: Glucuronic acid; Glycoproteins; Sugarcane; Xanthans; Xanthomonas albilineans

A.J. McCormick, M.D. Cramer, D.A. Watt, Culm sucrose accumulation promotes physiological decline of mature leaves in ripening sugarcane,
Field Crops Research, Volume 108, Issue 3, 23 September 2008, Pages 250-258, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.06.004.
(http://www.sciencedirect.com/science/article/pii/S0378429008001263)

Abstract:

Photosynthetic activity in C4 sugarcane has been suggested to be regulated by the demand for photoassimilate from sink tissues, including culm storage of sucrose and other components of the plant (e.g. roots and shoot primordia). This study examined the extent to which sink-demand influences leaf photosynthetic activity and controls leaf turnover in field-grown sugarcane. To increase sink-demand on selected leaves, plants were defoliated apart from the immature leaf before the first fully expanded leaf (2nd leaf) and the mature 8th leaf. Changes in leaf gas exchange and fluorescence characteristics were recorded for both leaves over a 28 d period. Variations in leaf and culm sucrose and hexose concentrations and allocation of 14C-labelled photosynthate were also measured. A decrease in culm internodal sucrose concentrations in partially defoliated plants was associated with significant increases in assimilation (A) and electron transport rates (ETR) for both leaves 2 and 8. Conversely, accumulation of sucrose in the culms of control plants was related to a decline in photosynthetic rates in leaf 8 during the treatment period. Leaves 2 and 8 of defoliated plants (27 d) were characterised by an increase in partitioning of 14C to mature and immature internodes, respectively, compared to control plants. In addition, hexose levels in leaves of defoliated plants decreased significantly (36% and 48% decrease in leaves 2 and 8, respectively) compared to corresponding leaves of untreated controls over the duration of the experiment, indicating that the signaling mechanisms regulating the decline in leaf photosynthetic activity are likely hexose-mediated. It was concluded that leaf physiological ageing in sugarcane was promoted by sucrose accumulation during culm maturation as a consequence of decreased sink-demand for photosynthate.

Keywords: Hexose; Leaf; Photosynthesis; Senescence; Sink; Source; Sucrose; Sugarcane

Alistair James McCormick, Michael D. Cramer, Derek A. Watt, Regulation of photosynthesis by sugars in sugarcane leaves,
Journal of Plant Physiology, Volume 165, Issue 17, 28 November 2008, Pages 1817-1829, ISSN 0176-1617, DOI: 10.1016/j.jplph.2008.01.008.
(http://www.sciencedirect.com/science/article/pii/S0176161708000333)

Abstract: Summary

In sugarcane, increased sink demand has previously been shown to result in increased photosynthetic rates that are correlated with a reduction in leaf hexose concentrations. To establish whether sink limitation of photosynthesis is a result of sugar accumulation in the leaf, excision and cold-girdling techniques were used to modify leaf sugar concentrations in pot-grown sugarcane. In excised leaves that were preincubated in darkness for 3 h, sucrose accumulation was reduced but accumulated again upon transfer to the light, while hexose concentrations remained lower than in controls (7.7 [mu]mol mg-1 FW versus 18.6 [mu]mol mg-1 FW hexose in controls). These results were associated with a 66% and 59% increase in photosynthetic assimilation (A) and electron transport rate (ETR), respectively, compared to controls maintained in the light. Similar increases in photosynthesis were observed when dark-

treated leaves were supplied with 5 mM sorbitol, but not when supplied with 5 mM sucrose. Further analyses of 14C-labeled sugars indicated rapid turnover between sucrose and hexose. Cold-girdling (5 [degree sign]C) increased sucrose and hexose levels and resulted in a decline of photosynthetic rates over 5 d (48% and 35% decline in assimilation rate and ETR, respectively). These sugar-induced changes in photosynthesis were independent of changes in stomatal conductance. This study demonstrates that the down-regulation of photosynthesis in response to culm sugar accumulation reported previously could be due to the knock-on effect of accumulation of sugar in leaf tissue, and supports the contention that hexose, rather than sucrose, is responsible for the modulation of photosynthetic activity.

Keywords: Hexose; Leaf; Photosynthesis; Sucrose; Sugarcane

M.T. Elsayed, M.H. Babiker, M.E. Abdelmalik, O.N. Mukhtar, D. Montange, Impact of filter mud applications on the germination of sugarcane and small-seeded plants and on soil and sugarcane nitrogen contents,

Bioresource Technology, Volume 99, Issue 10, July 2008, Pages 4164-4168, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.08.079.
(http://www.sciencedirect.com/science/article/pii/S0960852407007274)

Abstract:

The impact of filter mud (FM) on the germination of sugarcane (Saccharum spp.), guar (Cyamopsis tetragonoloba), maize (Zea mays), groundnut (Arachis hypogaea) and sesame (Sesamum indicum), and the nitrogen content of soil and sugarcane were investigated. Experiments were set up in 2004 at the Kenana Sugarcane Estate, Sudan. For this study, 1:0, 3:1, 1:1, 1:3 and 0:1 FM/soil (w/w) mixtures were used. The results showed that FM had no adverse impact on germination. Soil organic carbon and total nitrogen after 3 months increased with an increase in the FM content of the mixture. The impact of 100 t of dry FM was compared to a control without FM, and to inorganic nitrogen fertilizer applications of 0, 55, 110, 165 and 220 Kg N/ha. Cane yield, number of stalks, soil and leaf analysis results were determined after 6 months. FM treated soil gave a higher cane yield and stalk number. Leaf analysis showed no significant difference in nutrient content.

Keywords: Sugarcane; Filter mud; Germination; Soil organic matter

Roberta M. Chagas, Joaquim A.G. Silveira, Rafael V. Ribeiro, Victor A. Vitorello, Helaine Carrer, Photochemical damage and comparative performance of superoxide dismutase and ascorbate peroxidase in sugarcane leaves exposed to paraquat-induced oxidative stress,

Pesticide Biochemistry and Physiology, Volume 90, Issue 3, March 2008, Pages 181-188, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2007.11.006.
(http://www.sciencedirect.com/science/article/pii/S004835750700154X)

Abstract:

The physiological responses of sugarcane (Saccharum officinarum L.) to oxidative stress induced by methyl viologen (paraquat) were examined with respect to photochemical activity, chlorophyll content, lipid peroxidation and superoxide dismutase (SOD) and ascorbate peroxidase (APX) activities. Thirty-day-old sugarcane plants were sprayed with 0, 2, 4, 6 and 8 mM methyl viologen (MV). Chlorophyll fluorescence was measured after 18 h and biochemical analyses were performed after 24 and 48 h. Concentrations of MV above 2 mM caused significant damage to photosystem II (PSII) activity. Potential and effective quantum efficiency of PSII and apparent electron transport rate were greatly reduced or practically abolished. Both chlorophyll and soluble protein contents steadily decreased with MV concentrations above 2 mM after 24 h of exposure, which became more pronounced after 48 h, achieving a 3-fold decrease. Insoluble protein contents were little affected by MV. Oxidative stress induced by MV was evidenced by increases in lipid peroxidation. Specific activity of SOD increased, even after 48 h of exposure to the highest concentrations of MV, but total activity on a fresh weight basis did not change significantly. Nondenaturing PAGE assayed with H2O2 and KCN showed that treatment with MV did not change Cu/Zn-SOD and Mn-SOD isoform activities. In contrast, APX specific activity increased at 2 mM MV but then dropped at higher doses. Oxidative damage induced by MV was inversely related to APX activity. It is suggested that the major MV-induced oxidative damages in sugarcane leaves were related to excess H2O2, probably in chloroplasts, caused by an imbalance between SOD and APX activities, in which APX was a limiting step. Reduced photochemical activity allowed the early detection of the ensuing oxidative stress.

Keywords: Antioxidative enzymes; Antioxidative response; Chlorophyll fluorescence; Oxidative stress; Saccharum officinarum L.; Sugarcane

A.J. McCormick, M.D. Cramer, D.A. Watt, Culm sucrose accumulation promotes physiological decline of mature leaves in ripening sugarcane,
Field Crops Research, Volume 108, Issue 3, 23 September 2008, Pages 250-258, ISSN 0378-4290, DOI: 10.1016/j.fcr.2008.06.004.
(http://www.sciencedirect.com/science/article/pii/S0378429008001263)

Abstract:

Photosynthetic activity in C4 sugarcane has been suggested to be regulated by the demand for photoassimilate from sink tissues, including culm storage of sucrose and other components of the plant (e.g. roots and shoot primordia). This study examined the extent to which sink-demand influences leaf photosynthetic activity and controls leaf turnover in field-grown sugarcane. To increase sink-demand on selected leaves, plants were defoliated apart from the immature leaf before the first fully expanded leaf (2nd leaf) and the mature 8th leaf. Changes in leaf gas exchange and fluorescence characteristics were recorded for both leaves over a 28 d period. Variations in leaf and culm sucrose and hexose concentrations and allocation of 14C-labelled photosynthate were also measured. A decrease in culm internodal sucrose

concentrations in partially defoliated plants was associated with significant increases in assimilation (A) and electron transport rates (ETR) for both leaves 2 and 8. Conversely, accumulation of sucrose in the culms of control plants was related to a decline in photosynthetic rates in leaf 8 during the treatment period. Leaves 2 and 8 of defoliated plants (27 d) were characterised by an increase in partitioning of 14C to mature and immature internodes, respectively, compared to control plants. In addition, hexose levels in leaves of defoliated plants decreased significantly (36% and 48% decrease in leaves 2 and 8, respectively) compared to corresponding leaves of untreated controls over the duration of the experiment, indicating that the signaling mechanisms regulating the decline in leaf photosynthetic activity are likely hexose-mediated. It was concluded that leaf physiological ageing in sugarcane was promoted by sucrose accumulation during culm maturation as a consequence of decreased sink-demand for photosynthate.

Keywords: Hexose; Leaf; Photosynthesis; Senescence; Sink; Source; Sucrose; Sugarcane

Alistair James McCormick, Michael D. Cramer, Derek A. Watt, Regulation of photosynthesis by sugars in sugarcane leaves,
Journal of Plant Physiology, Volume 165, Issue 17, 28 November 2008, Pages 1817-1829, ISSN 0176-1617, DOI: 10.1016/j.jplph.2008.01.008.
(http://www.sciencedirect.com/science/article/pii/S0176161708000333)

Abstract: Summary

In sugarcane, increased sink demand has previously been shown to result in increased photosynthetic rates that are correlated with a reduction in leaf hexose concentrations. To establish whether sink limitation of photosynthesis is a result of sugar accumulation in the leaf, excision and cold-girdling techniques were used to modify leaf sugar concentrations in pot-grown sugarcane. In excised leaves that were preincubated in darkness for 3 h, sucrose accumulation was reduced but accumulated again upon transfer to the light, while hexose concentrations remained lower than in controls (7.7 [mu]mol mg-1 FW versus 18.6 [mu]mol mg-1 FW hexose in controls). These results were associated with a 66% and 59% increase in photosynthetic assimilation (A) and electron transport rate (ETR), respectively, compared to controls maintained in the light. Similar increases in photosynthesis were observed when dark-treated leaves were supplied with 5 mM sorbitol, but not when supplied with 5 mM sucrose. Further analyses of 14C-labeled sugars indicated rapid turnover between sucrose and hexose. Cold-girdling (5 [degree sign]C) increased sucrose and hexose levels and resulted in a decline of photosynthetic rates over 5 d (48% and 35% decline in assimilation rate and ETR, respectively). These sugar-induced changes in photosynthesis were independent of changes in stomatal conductance. This study demonstrates that the down-regulation of photosynthesis in response to culm sugar accumulation reported previously could be due to the knock-on effect of accumulation of sugar in leaf tissue, and supports the contention that hexose, rather than sucrose, is responsible for the modulation of photosynthetic activity.

Keywords: Hexose; Leaf; Photosynthesis; Sucrose; Sugarcane

Roberta M. Chagas, Joaquim A.G. Silveira, Rafael V. Ribeiro, Victor A. Vitorello, Helaine Carrer, Photochemical damage and comparative performance of superoxide dismutase and ascorbate peroxidase in sugarcane leaves exposed to paraquat-induced oxidative stress,

Pesticide Biochemistry and Physiology, Volume 90, Issue 3, March 2008, Pages 181-188, ISSN 0048-3575, DOI: 10.1016/j.pestbp.2007.11.006.
(http://www.sciencedirect.com/science/article/pii/S004835750700154X)

Abstract:

The physiological responses of sugarcane (Saccharum officinarum L.) to oxidative stress induced by methyl viologen (paraquat) were examined with respect to photochemical activity, chlorophyll content, lipid peroxidation and superoxide dismutase (SOD) and ascorbate peroxidase (APX) activities. Thirty-day-old sugarcane plants were sprayed with 0, 2, 4, 6 and 8 mM methyl viologen (MV). Chlorophyll fluorescence was measured after 18 h and biochemical analyses were performed after 24 and 48 h. Concentrations of MV above 2 mM caused significant damage to photosystem II (PSII) activity. Potential and effective quantum efficiency of PSII and apparent electron transport rate were greatly reduced or practically abolished. Both chlorophyll and soluble protein contents steadily decreased with MV concentrations above 2 mM after 24 h of exposure, which became more pronounced after 48 h, achieving a 3-fold decrease. Insoluble protein contents were little affected by MV. Oxidative stress induced by MV was evidenced by increases in lipid peroxidation. Specific activity of SOD increased, even after 48 h of exposure to the highest concentrations of MV, but total activity on a fresh weight basis did not change significantly. Nondenaturing PAGE assayed with H2O2 and KCN showed that treatment with MV did not change Cu/Zn-SOD and Mn-SOD isoform activities. In contrast, APX specific activity increased at 2 mM MV but then dropped at higher doses. Oxidative damage induced by MV was inversely related to APX activity. It is suggested that the major MV-induced oxidative damages in sugarcane leaves were related to excess H2O2, probably in chloroplasts, caused by an imbalance between SOD and APX activities, in which APX was a limiting step. Reduced photochemical activity allowed the early detection of the ensuing oxidative stress.

Keywords: Antioxidative enzymes; Antioxidative response; Chlorophyll fluorescence; Oxidative stress; Saccharum officinarum L.; Sugarcane

Joseph C.V. Vu, Leon H. Allen Jr., Stem juice production of the C4 sugarcane (Saccharum officinarum) is enhanced by growth at double-ambient CO2 and high temperature,

Journal of Plant Physiology, Volume 166, Issue 11, 15 July 2009, Pages 1141-1151, ISSN 0176-1617, DOI: 10.1016/j.jplph.2009.01.003.
(http://www.sciencedirect.com/science/article/pii/S0176161709000030)

Abstract: Summary

Two cultivars of sugarcane (Saccharum officinarum cv. CP73-1547 and CP88-1508) were grown for 3 months in paired-companion, temperature-gradient, sunlit

greenhouses under daytime [CO2] of 360 (ambient) and 720 (double ambient) [mu]mol mol-1 and at temperatures of 1.5 [degree sign]C (near ambient) and 6.0 [degree sign]C higher than outside ambient temperature. Leaf area and biomass, stem biomass and juice and CO2 exchange rate (CER) and activities of ribulose bisphosphate carboxylase-oxygenase (Rubisco) and phosphoenolpyruvate carboxylase (PEPC) of fully developed leaves were measured at harvest. On a main stem basis, leaf area, leaf dry weight, stem dry weight and stem juice volume were increased by growth at doubled [CO2] or high temperature. Such increases were even greater under combination of doubled [CO2]/high temperature. Plants grown at doubled [CO2]/high temperature combination averaged 50%, 26%, 84% and 124% greater in leaf area, leaf dry weight, stem dry weight and stem juice volume, respectively, compared with plants grown at ambient [CO2]/near-ambient temperature combination. In addition, plants grown at doubled [CO2]/high temperature combination were 2-3-fold higher in stem soluble solids than those at ambient [CO2]/near-ambient temperature combination. Although midday CER of fully developed leaves was not affected by doubled [CO2] or high temperature, plants grown at doubled [CO2] were 41-43% less in leaf stomatal conductance and 69-79% greater in leaf water-use efficiency, compared with plants grown at ambient [CO2]. Activity of PEPC was down-regulated 23-32% at doubled [CO2], while high temperature did not have a significant impact on this enzyme. Activity of Rubisco was not affected by growth at doubled [CO2], but was reduced 15-28% at high temperature. The increases in stem juice production and stem juice soluble solids concentration for sugarcane grown at doubled [CO2] or high temperature, or at doubled [CO2]/high temperature combination, were partially the outcome of an increase in whole plant leaf area. Such increase would enhance the ongoing and cumulative photosynthetic capability of the whole plant. The results indicate that a doubling of [CO2] would benefit sugarcane production more than the anticipated 10-15% increase for a C4 species.
Keywords: Elevated atmospheric CO2 and temperature; Leaf photosynthesis; Plant biomass; Stem juice; Sugarcane

PLANT PHYSIOLOGY-GROWTH AND DEVELOPMENT (5 jdl)

M.A. Smit, A. Singels, The response of sugarcane canopy development to water stress,
Field Crops Research, Volume 98, Issues 2-3, August-September 2006, Pages 91-97, ISSN 0378-4290, DOI: 10.1016/j.fcr.2005.12.009.
(http://www.sciencedirect.com/science/article/pii/S0378429005002832)
Abstract:

Water stress is a common occurrence in dryland crop production, including sugarcane production. A good understanding of how crops respond to water stress is a prerequisite for choosing the best cultivar and management practices to optimally exploit natural resources. One aspect of sugarcane growth and development that has not been investigated thoroughly is how canopy development is affected by water

stress. The aim of this study was to gain a better understanding of the effect of water stress on various canopy development processes and interception of radiation. An experiment was conducted on a rainshelter facility at Mount Edgecombe, South Africa. The crop was planted and grown to four months age under optimal conditions. Subsequently, water was withheld from one half of the experiment for a period of 42 days. Soil water content for the stressed plots decreased from a field capacity of 26% at the start of drying to 15% on day 15 and a permanent wilting point of 10.5% at approximately day 40. Shoot and leaf development and interception of radiation were measured and related to soil water content, leaf water potential and stomatal conductance.Leaf senescence responded the most to drying (220% increase in leaf senescence rate as RSWC dropped from 0.7 to 0.3), followed by leaf appearance (96% decrease) and shoot senescence (113% increase for N22 and no response for NCo376). Cultivar NCo376 was able to maintain canopy development processes longer under conditions of increasing water stress than N22, at least initially. This was evidenced by lower rates of shoot senescence and leaf senescence (initially). NCo376 also maintained high stomatal conductance and leaf water potentials for longer during the drying process and at lower soil water content values than N22. The information obtained in this study should assist in simulating canopy responses in a more mechanistic way.
Keywords: Crop canopy; Leaf senescence; Leaf appearance; Radiation interception; Leaf water potential; Stomatal conductance

M.T. Elsayed, M.H. Babiker, M.E. Abdelmalik, O.N. Mukhtar, D. Montange, Impact of filter mud applications on the germination of sugarcane and small-seeded plants and on soil and sugarcane nitrogen contents,
Bioresource Technology, Volume 99, Issue 10, July 2008, Pages 4164-4168, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.08.079.
(http://www.sciencedirect.com/science/article/pii/S0960852407007274)
Abstract:
The impact of filter mud (FM) on the germination of sugarcane (Saccharum spp.), guar (Cyamopsis tetragonoloba), maize (Zea mays), groundnut (Arachis hypogaea) and sesame (Sesamum indicum), and the nitrogen content of soil and sugarcane were investigated. Experiments were set up in 2004 at the Kenana Sugarcane Estate, Sudan. For this study, 1:0, 3:1, 1:1, 1:3 and 0:1 FM/soil (w/w) mixtures were used. The results showed that FM had no adverse impact on germination. Soil organic carbon and total nitrogen after 3 months increased with an increase in the FM content of the mixture. The impact of 100 t of dry FM was compared to a control without FM, and to inorganic nitrogen fertilizer applications of 0, 55, 110, 165 and 220 Kg N/ha. Cane yield, number of stalks, soil and leaf analysis results were determined after 6 months. FM treated soil gave a higher cane yield and stalk number. Leaf analysis showed no significant difference in nutrient content.
Keywords: Sugarcane; Filter mud; Germination; Soil organic matter

Vikas Y Patade, P Suprasanna, VA Bapat, Gamma Irradiation of Embryogenic Callus Cultures and In vitro Selection for Salt Tolerance in Sugarcane (Saccharum officinarum L.),
Agricultural Sciences in China, Volume 7, Issue 9, September 2008, Pages 1147-1152, ISSN 1671-2927, DOI: 10.1016/S1671-2927(08)60158-3.
(http://www.sciencedirect.com/science/article/pii/S1671292708601583)

Abstract:

Radiation induced mutagenesis followed by in vitro selection was employed for salt tolerance in popular Indian sugarcane (Saccharum officinarum L.) cv. CoC-671. Embryogenic calli were gamma irradiated and exposed to different levels of NaCl (42.8, 85.6, 128.3, 171.1, 213.9, 256.7, 299.5, or 342.2 mM). The relative growth rate (RGR) decreased progressively with increasing salt stress and was the least with a salt stress of 256.7 mM (0.25 +/- 0.009), almost 10 fold lesser than the control. The RGR was significantly lower in 85.6 mM and higher salt stressed calli than the control. The survival percent also decreased, with an increase in NaCl concentration. In case of 10 and 20 Gy irradiated calli, regeneration was observed up to 85.6 mM NaCl selection, medium, whereas, higher treatments (128.3 mM and beyond) exhibited browning initially. However, in the subsequent subcultures, regeneration was obtained in the case of 10 and 20 Gy irradiated calli on 128.3 and 171.1 mM NaCl selections. Higher dose of gamma irradiation (40 Gy) also showed regeneration, but only with 85.6 mM NaCl selection. The unirradiated calli regenerated the highest number of plantlets followed by 10 and 20 Gy irradiated calli on salt selection. A total of 147 plantlets were selected from different salt levels. The salt selected plants are being tested for their field performance.

Keywords: sugarcane; in vitro mutagenesis; in vitro selection; salt tolerance

Vikas Yadav Patade, Sujata Bhargava, Penna Suprasanna, Halopriming imparts tolerance to salt and PEG induced drought stress in sugarcane,
Agriculture, Ecosystems & Environment, Volume 134, Issues 1-2, November 2009, Pages 24-28, ISSN 0167-8809, DOI: 10.1016/j.agee.2009.07.003.
(http://www.sciencedirect.com/science/article/pii/S0167880909002060)

Abstract:

Sugarcane, a glycophyte grown in the tropical and subtropical regions, is frequently subjected to soil salinity, affecting the yield and quality of the harvest. The ameliorative efficiency of salt priming on emergence and plantlet growth was examined in sugarcane cultivars which are known to vary in salt tolerance under field conditions. Salt priming with NaCl (100 mM) improved both the percent and rate of germination of the sets of the tolerant (Co 62175) and moderately tolerant (CoM 265) varieties compared to sensitive (CoC 671) and test variety (Co 86032). Salt priming during germination also improved the growth performance of two-month-old sugarcane plants in terms of shoot length, shoot and root fresh weight when subjected to 15 day iso-osmotic (-0.7 MPa) NaCl (150 mM) or polyethylene glycol (PEG 8000; 20%, w/v) stress. The primed plants exhibited lower salt- and dehydration-induced leaf

senescence. The results suggest salt priming as an efficient approach for imparting abiotic stress tolerance in sugarcane.

Keywords: Sugarcane; Salt priming; Seed germination index; Iso-osmotic salt or PEG stress

Cha-um Suriyan, Kirdmanee Chalermpol, Proline Accumulation, Photosynthetic Abilities and Growth Characters of Sugarcane (Saccharum officinarum L.) Plantlets in Response to Iso-Osmotic Salt and Water-Deficit Stress,
Agricultural Sciences in China, Volume 8, Issue 1, January 2009, Pages 51-58, ISSN 1671-2927, DOI: 10.1016/S1671-2927(09)60008-0.
(http://www.sciencedirect.com/science/article/pii/S1671292709600080)

Abstract:

The aim of this study was to investigate the biochemical, physiological and morphological responses of sugarcane to iso- osmotic salt and water-deficit stress. Disease-free sugarcane plantlets derived from meristem cuttings were photo-autotrophically grown in MS media and subsequently exposed to -0.23 (control), -0.67 or -1.20 MPa iso-osmotic NaCl (salt stress) or mannitol (water-deficit stress). Chlorophyll a (Chl a), chlorophyll b (Chl b), total carotenoids (Cx+c), maximum quantum yield of PSII (Fv/Fm), photon yield of PSII ([Phi]PSII), stomatal conductance (Gs) and transpiration rate (E) in the stressed plantlets were significantly reduced when compared to those of plantlets of the control group (without mannitol or NaCl), leading to net-photosynthetic rate (Pn) and growth reduction with positive correlation. In addition, physiological changes and growth parameters of plantlets in the salt stress conditions were more sharply reduced than those in water- deficit stress conditions. On the other hand, the proline content and non-photochemical quenching (NPQ) in the leaves of stressed plantlets increased significantly, especially in response to iso-osmotic salt stress. The chlorophyll pigments in iso-osmotic stressed leaves were significantly degraded (r2 = 0.93), related to low water oxidation (r2 = 0.87), low netphotosynthetic rate (r2 = 0.81), and growth reduction (r2 = 0.97). The multivariate biochemical, physiological and growth parameters in the present study should be further used to develop salt, or drought, tolerance indices in sugarcane breeding programs.

Keywords: growth performances; net-photosynthetic rate; pigment degradation; proline; water oxidation

PESTS OF PLANTS (10 jdl)

P.R. Samson, T.N. Staier, J.I. Bull, Evaluation of an application procedure for Metarhizium anisopliae in sugarcane ratoons for control of the white grub Dermolepida albohirtum,
Crop Protection, Volume 25, Issue 8, August 2006, Pages 741-747, ISSN 0261-2194, DOI: 10.1016/j.cropro.2005.10.007.
(http://www.sciencedirect.com/science/article/pii/S026121940500267X)
Abstract:
The biological control product BioCane(TM), containing spores of the fungal pathogen Metarhizium anisopliae isolate FI-1045, is available for soil application against the white grub Dermolepida albohirtum (Waterhouse) in sugarcane in Australia. Currently, BioCane(TM) granules can only be applied in plant crops, where they are distributed in a horizontal band in the planting furrows and covered with soil. Options for management of D. albohirtum would be broadened if M. anisopliae could also be effectively applied in ratoon crops. We evaluated the efficacy of spores of M. anisopliae sprayed as an aqueous suspension into two vertical slots cut into the soil in the rows of sugarcane ratoons. We were able to achieve vertical bands of spores, as determined by collecting soil samples at incremental depths and counting colonies after plating on artificial media, although spores were concentrated towards the bottom of the slot. Numbers of white grubs were reduced by treatment in some trials in comparison to untreated plots, but results were inferior to those obtained using the standard chemical insecticide, imidacloprid (Confidor(R)). When a low application rate of M. anisopliae was combined with bifenthrin (Talstar(R)), only bifenthrin was shown to contribute to efficacy with no interaction between effects of the two products, despite promising results in a previous bioassay. Application of M. anisopliae is not likely to be an economically viable treatment for sugarcane ratoons using this technique.
Keywords: Sugarcane white grubs; Greyback canegrub; Imidacloprid; Bifenthrin

S. Berry, V.W. Spaull, P. Cadet, Impact of harvesting practices on nematode communities and yield of sugarcane,
Crop Protection, Volume 26, Issue 8, August 2007, Pages 1239-1250, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.10.022.
(http://www.sciencedirect.com/science/article/pii/S0261219406003449)
Abstract:
On the sandy soils in South Africa damage by plant parasitic nematodes to sugarcane occurs equally in both the plant and ratoon crops. In Australia and Burkina Faso, ratoon crops are less susceptible than plant crops. The aim of the present work was to investigate whether differences in stubble or stool size, resulting from the different harvesting practices in Australia, Burkina Faso and South Africa, affected yield loss in ratoon crops under South African conditions. The Australian hilling up method (producing a larger below-ground stool) had little effect on nematode abundance and population structure but did exhibit reduced yield loss from nematodes

in ratoon crops. A large above-ground stubble (similar to that produced by the Burkina Faso harvest method), on its own, was not associated with reduced yield loss. However when a pretrashing treatment was performed just before harvest, then a significant reduction in yield loss occurred in the following crop. Harvest procedures that produced an above-ground stubble were associated with a significantly altered nematode community structure, with increased relative proportions of Helicotylenchus dihystera and decreased proportions of Xiphinema elongatum. Such nematode communities are known to be less pathogenic to sugarcane.

Keywords: Harvesting practice; Hilling up; Nematodes; Stool; Stubble; Sugarcane

P.R. Samson, Farming practices for managing Inopus rubriceps (Macquart) (Diptera: Stratiomyidae) in sugarcane in Australia,
Crop Protection, Volume 26, Issue 7, July 2007, Pages 983-990, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.09.006.
(http://www.sciencedirect.com/science/article/pii/S0261219406002833)

Abstract:

Larvae of the sugarcane soldier fly, Inopus rubriceps (Macquart), attack the roots of sugarcane in Australia, reducing crop yields and forcing the premature removal of crops. Manipulation of farming practices may help to manage this pest, by affecting its population dynamics directly, or indirectly via natural enemies. Six different crop management procedures were applied in large unreplicated plots on six farms. Numbers of larval I. rubriceps and other large soil fauna were assessed in soil cores in each of 4 years, while surface-active predators were collected in pitfall traps in one year. Numbers of I. rubriceps in newly planted sugarcane crops were reduced when crops were planted after a long break (up to 1 year) compared with a short break of about 3 months, and this difference was maintained into the first ratoon in the 2nd year after planting. Long breaks managed with herbicide or that included a soybean rotation were equally as effective as a fallow maintained bare by cultivation. The addition of organic matter as mill mud (mill waste) or cane trash did not affect numbers of I. rubriceps. Numbers of predatory beetles (Carabidae, Staphylinidae and Elateridae) were not affected by the different practices, numbers of ants were greater in short-break plots in one of the study years, and numbers of earthworms were greater in plots with mill mud. The significance of factors that might increase mortality of I. rubriceps was examined by correlation between annual inter-generational mortality and densities of other faunal groups. There was evidence for an association between an increase in mortality of the pest and densities of ants and of predatory Coleoptera, particularly the staphylinid Thyreocephalus chalcopterus (Erichson), in some datasets. Soil concentrations of spores of the entomopathogenic fungus Metarhizium anisopliae (Metschnikoff) Sorokin in the root zone of new plant crops were higher after minimum tillage planting back into the old cane rows than after conventional soil preparation and planting. Sugar yields were lower when cane was planted after a long break than when cane was planted sooner, perhaps because of the shorter growing time of the crop but perhaps also because of the use of experimental planting equipment that might not

have been optimal. Despite this, a long break is likely to reduce the risk of damaging I. rubriceps infestations in subsequent cane crops, with either a rotation with soybeans or spraying out the old crop with herbicide being the preferred options. These practices have been adopted by many affected cane farmers when replacing crops damaged by I. rubriceps.

Keywords: Soil insects; Soldier fly; Metarhizium anisopliae; Minimum tillage; Conservation biological control; Cultural control; Break crops

F.P.F. Reay-Jones, M.O. Way, T.E. Reagan, Economic assessment of controlling stem borers (Lepidoptera: Crambidae) with insecticides in Texas rice,
Crop Protection, Volume 26, Issue 7, July 2007, Pages 963-970, ISSN 0261-2194, DOI: 10.1016/j.cropro.2006.09.002.
(http://www.sciencedirect.com/science/article/pii/S0261219406002791)

Abstract:

A 4-year field study was conducted to evaluate insecticide applications on infestations of the stem borers Diatraea saccharalis (F.) and Eoreuma loftini (Dyar) in rice, Oryza sativa L. Except for rice yield in 2002, whiteheads per square meter and rice yield were significantly affected by insecticide treatments in each year of the study. Biorational insecticides (diflubenzuron, novaluron and tebufenozide) did not significantly ($P>0.05$) reduce injury and yield in 2002. Applications of diflubenzuron and novaluron at 14 days after flood were not as effective in reducing injury as lambda-cyhalothrin. In 2005, applications of methoxyfenozide at the 2.5-5 cm panicle stage significantly ($P<0.05$) reduced injury, but differences in yield were not detected. The greatest reduction in whiteheads (14-fold) was achieved with two applications of lambda-cyhalothrin (at the 5 cm panicle and heading stages) with and without the seed treatment fipronil in 2002. Economic analyses showed outcomes ranging from a net loss of -$594/ha for lambda-cyhalothrin applied at before flood in 2005 to a net benefit of $172/ha for lambda-cyhalothrin applied twice at the 5 cm panicle and late boot/heading stages in 2004. Foliar applications generally resulted in net increased benefit for all treatments. Combined with other management tactics such as the use of resistant cultivars, judicial use of insecticides can help farmers manage stem borers in rice in Texas.

Keywords: Mexican rice borer; Sugarcane borer; Diatraea saccharalis; Eoreuma loftini; Biorational insecticide

J. Omarjee, J. Balandreau, V.W. Spaull, P. Cadet, Relationships between Burkholderia populations and plant parasitic nematodes in sugarcane,
Applied Soil Ecology, Volume 39, Issue 1, May 2008, Pages 1-14, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2007.11.001.
(http://www.sciencedirect.com/science/article/pii/S0929139307001588)
Abstract:

It is suggested that the bacterium Burkholderia tropica might be used to reduce nematode damage in sugarcane by promoting certain nematode species to create a less pathogenic nematode community. This suggestion arises from an investigation of the plant parasitic nematodes and their relationship with Burkholderia species along a sugarcane row. During the course of this analysis sugarcane root and soil samples were taken at intervals (15, 45, 55, 75, 80, 85, 120, 150, 185, 190, 195 m) along a 200 m cane row across a cane field for nematode and bacterial analyses at various times after planting. Soil physical and chemical characteristics were similar at all sampling points. The numbers of culturable bacteria and Burkholderia were significantly greater during the early part of the crop cycle when plants were younger. The diversity of the Burkholderia communities was characterized by groups using Amplified Ribosomal 16S rDNA Restriction Analysis. Six groups were present. Burkholderia species in each group were identified using 16S rDNA sequencing. It was observed that B. ambifaria and B. cenocepacia, were dominant at all sampling dates, although less so as the crop aged. The common nematode species were Pratylenchus zeae, Paratrichodorous minor, Xiphinema elongatum and Helicotylenchus dihystera. A spatial association of nematodes and Burkholderia species along the cane row was identified using Principle Component Analysis (ADE-4 software). The more pathogenic X. elongatum, was associated with B. graminis, B. silvatlantica, B. gladioli, B. fungorum and was dominant at the beginning of the cane row where planting started. In contrast the less pathogenic species H. dihystera and P. zeae, were associated with B. tropica and were more common towards the end of the cane row where planting ended. Coinertia analysis revealed that B. tropica was positively correlated with H. dihystera and P. zeae, but negatively correlated with X. elongatum.
Keywords: Biocontrol; Burkholderia; Nematodes; Sugarcane

W.H. White, R.P. Viator, E.O. Dufrene, C.D. Dalley, E.P. Richard Jr., T.L. Tew, Re-evaluation of sugarcane borer (Lepidoptera: Crambidae) bioeconomics in Louisiana, ***Crop Protection***, Volume 27, Issue 9, September 2008, Pages 1256-1261, ISSN 0261-2194, DOI: 10.1016/j.cropro.2008.03.011.
(http://www.sciencedirect.com/science/article/pii/S0261219408000690)
Abstract:

The sugarcane borer, Diatraea saccharalis (F.) (Lepidoptera: Crambidae), is the key insect pest of sugarcane, Saccharum spp., grown in Louisiana. For more than 40 years, Louisiana sugarcane farmers have used a value of 10% internodes bored at harvest as the economic injury level (EIL). Three plant-cane studies were conducted to re-evaluate the long-standing sugarcane borer EIL level using the most recently released varieties of sugarcane. Varieties were exposed to artificially enhanced borer

infestations; the experimental treatments consisted of borer control with insecticides or no control. Data were collected on infestation intensity, damage intensity, and associated yield losses. Crop yields from plots were obtained by mechanical harvesting, and losses were classified as field losses, e.g. losses of gross tonnage in the field and factory losses, e.g., losses that were realized at the factory as cane is being milled. Farm income is based on the product of these two measures of yield, i.e. cane yieldxsugar yield. In our study, seasonal stalk-infestation counts did not reveal any indication of preference by the borer moths for a specific variety; infestation pressure was generally uniform within a season among the varieties that we planted. Significant differences were detected among the varieties for harvest percentage of internodes bored as well as yields between borer-controlled and non-controlled plots ($P<0.05$). In general, varieties were less susceptible to losses in the field (sugarcane yields) than in the factory (sugar yields). As a group, the most recent varieties released to Louisiana growers exhibit more tolerance to the borer than varieties grown 40 years ago. The percent reduction in sugar/ha loss per 1% internodes bored has decreased from an average of 0.74 for varieties grown in the 1960s to 0.61 as a mean for the newly released varieties. Although the cost associated with an insecticide application for sugarcane borer control has increased nearly 4-fold from 1971 to present, sugar yields have increased by approximately 60% allowing farmers to offset some of these increased costs. Our economic analysis indicates that the EIL of 10% internodes bored is too high, considering the high yielding potential and susceptibility of currently grown varieties. For the most at risk farmer, the tenant farmer, a more appropriate value for the EIL is 6% internodes bored. However, this EIL can be raised 12% if a resistant variety is grown.

Keywords: Diatraea saccharalis; Integrated pest management; Host plant resistance; Saccharum spp.

Fangneng Huang, Rogers Leonard, Steven Moore, Bisong Yue, Roy Parker, Thomas Reagan, Michael Stout, Don Cook, Waseem Akbar, Charles Chilcutt, William White, Donna Lee, Stephen Biles, Geographical susceptibility of Louisiana and Texas populations of the sugarcane borer, Diatraea saccharalis (F.) (Lepidoptera: Crambidae) to Bacillus thuringiensis Cry1Ab protein,
Crop Protection, Volume 27, Issues 3-5, March-May 2008, Pages 799-806, ISSN 0261-2194, DOI: 10.1016/j.cropro.2007.11.007.
(http://www.sciencedirect.com/science/article/pii/S0261219407002876)

Abstract:

The susceptibilities of 18 field populations of the sugarcane borer, Diatraea saccharalis (F.), to two sources of Bacillus thuringiensis (Bt) Cry1Ab protein were determined using laboratory bioassays. Fifteen of the 18 field populations were collected from seven locations across Louisiana and the other three populations were sampled from the Gulf Coast area of Texas during 2004-2006. Neonates of D. saccharalis were exposed to a meridic diet treated with selected concentrations of Cry1Ab protein. Larval mortality was measured at 7 days after inoculation. Statistically significant differences in median lethal concentrations (LC50s) were detected among

insect populations from different geographical locations, but the field populations remained as susceptible as a laboratory strain of D. saccharalis that had been maintained in the laboratory for >20 years without exposure to any chemical insecticides or Bt toxins. The LC50s of Cry1Ab protein, which was extracted from DKC69-70 Bt corn hybrid, ranged from 0.03 to 0.32 [mu]g/g for the seven field populations collected during 2004. The LC50 values based on bioassays with purified, trypsin-activated Cry1Ab protein from a recombinant Escherichia coli culture were 0.03-0.17 [mu]g/g for the 11 field populations collected during 2005-2006. Small changes in Cry1Ab susceptibility were detected among crops, years of sampling, or locations. All field-collected insect populations, except one, exhibited lower LC50 values than the laboratory strain. The results of this study suggest that field populations of D. saccharalis remain generally susceptible to the Cry1Ab protein after 8 years use of transgenic Bt corn in Louisiana and the Gulf Coast area of Texas.

Keywords: Diatraea saccharalis; Cry1Ab; Bacillus thuringiensis; Susceptibility; Field corn

Cintia N.B. Carneiro, Renato A. DaMatta, Richard I. Samuels, Carlos P. Silva, Effects of entomopathogenic bacterium Photorhabdus temperata infection on the intestinal microbiota of the sugarcane stalk borer Diatraea saccharalis (Lepidoptera: Crambidae),

Journal of Invertebrate Pathology, Volume 99, Issue 1, September 2008, Pages 87-91, ISSN 0022-2011, DOI: 10.1016/j.jip.2008.03.004.
(http://www.sciencedirect.com/science/article/pii/S0022201108000682)

Abstract:

Photorhabdus temperata is an entomopathogenic bacterium that is associated with nematodes of the Heterorhabditidae family in a symbiotic relationship. This study investigated the effects of P. temperata infection on the intestinal microbiota of the sugarcane stalk borer Diatraea saccharalis. Histopathology of the infection was also investigated using scanning electron microscopy. Groups of 20 larvae were infected by injection of approximately 50 bacterial cells directly into the hemocoel. After different periods of infection, larvae were dissected and different tissues were used for bacterial cell quantification. P. temperata was highly virulent with an LD50 of 16.2 bacterial cells at 48 h post-infection. Infected larvae started dying as soon as 30 h post-infection with a LT50 value of 33.8 h (confidence limits 32.2-35.6) and an LT90 value of 44.8 h (CL 40.8-51.4). Following death of the larvae, bacteria from the midgut did not invade the hemocoel. In the midgut epithelium, P. temperata occupied the space underneath the basal lamina. The cultivable intestinal bacterial populations decreased as soon as 1 h post-infection and at 48 h post-infection, 90% of the gut microbiota had died. The role of P. temperata in control of the midgut microbiota was discussed.

Keywords: Diatraea saccharalis; Photorhabdus temperata; Infection; Intestinal microbiota; Insect digestion

J. Omarjee, J. Balandreau, V.W. Spaull, P. Cadet, Relationships between Burkholderia populations and plant parasitic nematodes in sugarcane,
Applied Soil Ecology, Volume 39, Issue 1, May 2008, Pages 1-14, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2007.11.001.
(http://www.sciencedirect.com/science/article/pii/S0929139307001588)
Abstract:

It is suggested that the bacterium Burkholderia tropica might be used to reduce nematode damage in sugarcane by promoting certain nematode species to create a less pathogenic nematode community. This suggestion arises from an investigation of the plant parasitic nematodes and their relationship with Burkholderia species along a sugarcane row. During the course of this analysis sugarcane root and soil samples were taken at intervals (15, 45, 55, 75, 80, 85, 120, 150, 185, 190, 195 m) along a 200 m cane row across a cane field for nematode and bacterial analyses at various times after planting. Soil physical and chemical characteristics were similar at all sampling points. The numbers of culturable bacteria and Burkholderia were significantly greater during the early part of the crop cycle when plants were younger. The diversity of the Burkholderia communities was characterized by groups using Amplified Ribosomal 16S rDNA Restriction Analysis. Six groups were present. Burkholderia species in each group were identified using 16S rDNA sequencing. It was observed that B. ambifaria and B. cenocepacia, were dominant at all sampling dates, although less so as the crop aged. The common nematode species were Pratylenchus zeae, Paratrichodorous minor, Xiphinema elongatum and Helicotylenchus dihystera. A spatial association of nematodes and Burkholderia species along the cane row was identified using Principle Component Analysis (ADE-4 software). The more pathogenic X. elongatum, was associated with B. graminis, B. silvatlantica, B. gladioli, B. fungorum and was dominant at the beginning of the cane row where planting started. In contrast the less pathogenic species H. dihystera and P. zeae, were associated with B. tropica and were more common towards the end of the cane row where planting ended. Coinertia analysis revealed that B. tropica was positively correlated with H. dihystera and P. zeae, but negatively correlated with X. elongatum.
Keywords: Biocontrol; Burkholderia; Nematodes; Sugarcane

G.A.A. Elbadri, Il Sung Moon, P. Wani, K. Bukhari, Dong Woon Lee, Ho Yul Choo, Description of Helicotylenchus zeidani sp. nov., a new species of nematode from Guneid sugarcane, Sudan,
Journal of Asia-Pacific Entomology, Volume 12, Issue 3, September 2009, Pages 155-157, ISSN 1226-8615, DOI: 10.1016/j.aspen.2009.02.007.
(http://www.sciencedirect.com/science/article/pii/S1226861509000314)
Abstract:

A study was done on the taxonomy and morphology of plant parasitic nematodes (Tylenchida) found in a Guneid sugarcane factory field of Saccharum officinarum (sugarcane), in Gezira state, Sudan. The samples were collected from around the root zone of sugarcane stools at a depth of 10 to 15 cm. One new species belonging to Hoplolaimidae was identified and studied. Helicotylenchus zeidani sp.

nov. is characterized by a smooth head and a conical tail with a projection. It is 0.72 mm (0.62 to 0.81 mm) long, a = 32.4 (25.6 to 36.6), c = 36.9 (29.2 to 53.1) with a medium sized body and shorter stylet.

Keywords: Helicotylenchus zeidani sp. nov.; Plant parasitic nematode; Sugarcane; Sudan

Malcolm G. Keeping, Olivia L. Kvedaras, Anthony G. Bruton, Epidermal silicon in sugarcane: Cultivar differences and role in resistance to sugarcane borer Eldana saccharina,

Environmental and Experimental Botany, Volume 66, Issue 1, April 2009, Pages 54-60, ISSN 0098-8472, DOI: 10.1016/j.envexpbot.2008.12.012.
(http://www.sciencedirect.com/science/article/pii/S0098847208001706)

Abstract:

Silicon (Si) application can significantly increase resistance of plants to insect herbivory. In sugarcane, Si-mediated resistance to the lepidopteran stem borer Eldana saccharina involves reduced survival, feeding efficiency and stalk penetration. In a pot trial, this study examined: (1) the effect of calcium silicate treatment on the accumulation of amorphous epidermal Si at three sites on the sugarcane stalk where the borer may penetrate, and (2) whether the accumulation of epidermal Si at these sites in Si-treated and control cane plants varied between a borer-resistant (N33) and borer-susceptible (N11) cultivar. Sections of mature stalk were subjected to Energy Dispersive X-ray (EDX) microanalysis to locate and quantify Si accumulation in the stem epidermis. In both cultivars, Si-treated plants had increased silica in each epidermal tissue zone (internode, root band, leaf bud). X-ray mapping confirmed that Si accumulation was restricted mainly to the epidermis of the internode and root band, but was sparse in the underlying tissues. By contrast, there was no evident concentration of Si in the bud scale epidermis compared with the underlying bud tissue. We contend that these patterns of Si deposition, especially at the internode and root band, may explain the previously reported enhanced resistance of Si+ sugarcane to penetration and feeding by E. saccharina at these sites. This is consistent with an hypothesis of increased mechanical hindrance to feeding in Si-treated plants. At all sites, epidermal Wt% of Si was higher in N33 plants (both Si+ and Si-) than in N11 plants, indicating that the higher total stalk Si recorded for N33 compared with N11 was expressed to an appreciable degree at the epidermal level. If amorphous Si increases mechanical resistance to stalk penetration, then the low Si content of the bud scale epidermis compared with the internode and root band epidermis may in part explain the observation that the leaf bud is a preferred entry point on the sugarcane stalk for E. saccharina larvae.

Keywords: Silica; Epidermis; Host-plant resistance; Stalk borer; Pyralidae; X-ray microanalysis

PLANT DISEASES (7 jdl)

Chun Shi, Fritz Thummler, Albrecht E. Melchinger, Gerhard Wenzel, Thomas Lubberstedt, Comparison of transcript profiles between near-isogenic maize lines in association with SCMV resistance based on unigene-microarrays,
Plant Science, Volume 170, Issue 1, January 2006, Pages 159-169, ISSN 0168-9452, DOI: 10.1016/j.plantsci.2005.08.016.
(http://www.sciencedirect.com/science/article/pii/S0168945205003249)

Abstract:

The molecular mechanisms underlying the development and progression of sugarcane mosaic virus (SCMV) infection in maize are poorly understood. A transcript profiling study based on maize unigene-microarrays was conducted to identify genes associated with SCMV resistance in the near-isogenic line (NIL) pair F7+ (SCMV resistant) and F7 (susceptible). Altogether, 497 differentially expressed genes were identified in 4 comparisons addressing constitutive genetic differences, inducible genetic differences, compatible reaction, and incompatible reaction. Compared to a suppression subtractive hybridization (SSH) approach on the same materials, expression patterns of microarray-ESTs and SSH-ESTs were consistent for the same comparisons despite technical discrepancies. Pathogen-induced transcripts were underrepresented on the unigene-microarray, consequently fewer microarray-ESTs (45.8%) were classified into pathogenesis-related categories than SSH-ESTs (60.5%). Moreover, fewer microarray-ESTs (4) co-segregated with Scmv QTL than SSH-ESTs (18). However, our results demonstrate that the microarray experiments complement the SSH-macroarray studies. Good candidate genes (CGs) associated with SCMV resistance can be chosen from three classes: (i) positional CGs co-localized with major Scmv QTL, (ii) functional CGs exhibiting the homology to pathogenesis-related genes, or (iii) differentially expressed ESTs showing consistent expression pattern in both approaches.

Keywords: Sugarcane mosaic virus (SCMV); Unigene-microarray; Suppression subtractive hybridization (SSH); Maize; Near isogenic lines (NILs); Expression profiling

Axel T. Lehrer, Paul H. Moore, Ewald Komor, Impact of sugarcane yellow leaf virus (ScYLV) on the carbohydrate status of sugarcane: Comparison of virus-free plants with symptomatic and asymptomatic virus-infected plants,
Physiological and Molecular Plant Pathology, Volume 70, Issues 4-6, April-June 2007, Pages 180-188, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2007.09.005.
(http://www.sciencedirect.com/science/article/pii/S0885576507000902)

Abstract:

The carbohydrate concentration of old and young sugarcane plants, either virus-free or infected by sugarcane yellow leaf virus, was compared. Internode lengths and fresh weights of symptomatic plants were reduced, but not the sucrose concentrations. Starch and sucrose concentration in green leaf tops of mature (18 months old) was the

highest in asymptomatic plants followed by symptomatic, and then by virus-free plants. Carbohydrates increased during daytime by 5-20%. The carbohydrate concentration in leaves of young, 6 months old plants was much lower than in mature plants and it increased to 500% during daytime. Asymptomatic leaves had a higher level of carbohydrates, especially starch, from late afternoon until the end of the night, suggesting a reduction of assimilate export.

Keywords: Assimilate export; Carbon assimilation; Hexoses; Saccharum spec.; Sucrose; Starch

Zhang-Ying XI, Shu-Hong ZHANG, Xin-Hai LI, Chuan-Xiao XIE, Ming-Shun LI, Zhuan-Fang HAO, De-Gui ZHANG, Ye-Hong LIANG, Li BAI, Shi-Huang ZHANG, Identification and Mapping of a Novel Sugarcane Mosaic Virus Resistance Gene in Maize,
Acta Agronomica Sinica, Volume 34, Issue 9, September 2008, Pages 1494-1499, ISSN 1875-2780, DOI: 10.1016/S1875-2780(09)60002-X.
(http://www.sciencedirect.com/science/article/pii/S187527800960002X)

Abstract:

Sugarcane mosaic virus (SCMV) causes considerable damage to maize (Zea mays L.) in China. Characterization of resistance gene(s) serves as the basis for effective selection in resistance breeding programs. The objective of this study was to identify novel genes conferring resistance to SCMV from maize germplasm in China. A total of 21 BC2F3 populations derived from 8 maize intercross combinations were artificially inoculated with SCMV under field conditions. The numbers of resistant and susceptible plants in the BC2F3 population Ye 478 x Hai 9-21 were consistent with the theoretical 1:3 phenotypic ratio, suggesting that a recessive gene derived from the resistant parent Hai 9-21 was responsible for resistance to SCMV. Bulked segregant analysis (BSA) and simple sequence repeat (SSR) marker analysis were used to verify the recessive resistance gene that was designated scm3. Gene scm3 was located in bin 3.04-3.05, flanked by SSR markers umc1965 and bnlg420 with genetic distances of 45.7 and 6.5 cM, respectively. Four additional linked markers were detected, which were associated with scm3 gene in the order of umc1965-scm3-bnlg420-umc1307-umc2265-bnlg2241-umc2166.

Keywords: maize dwarf mosaic virus; sugarcane mosaic virus (SCMV); resistance gene; molecular marker; gene mapping

S.-L. Yan, A.T. Lehrer, M.R. Hajirezaei, A. Springer, E. Komor, Modulation of carbohydrate metabolism and chloroplast structure in sugarcane leaves which were infected by Sugarcane Yellow Leaf Virus (SCYLV),
Physiological and Molecular Plant Pathology, Volume 73, Issues 4-5, November 2008, Pages 78-87, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2009.02.004.
(http://www.sciencedirect.com/science/article/pii/S0885576509000046)

Abstract:

Non-symptomatic sugarcane plants infected with Sugarcane Yellow Leaf Virus showed starch in mesophyll and bundle sheath cells. In situ-hybridization of mRNAs of sucrose-phosphate phosphatase and ADP-glucose pyrophosphorylase revealed that infected leaves contained SPPase and AGPase in mesophyll cells, Kranz cells and bundle sheath cells. In contrast virus-free leaves contained SPPase only in Kranz cells and AGPase only in bundle sheath cells. Infected leaves exhibited ultrastructural changes in Kranz cell chloroplasts and a shift of the chlorophyll a/b ratio. No obstruction of plasmodesmata was observed. The results indicate that SCYLV-infected plants, even when visually non-symptomatic, underwent strong metabolic and ultrastructural changes.

Keywords: **ADP-glucose pyrophosphorylase; Chlorophyll breakdown; Chloroplast ultrastructure; In situ hybridization; Plasmodesmata; Saccharum spec. hybrid; Starch; Sucrose-phosphate phosphatase**

Axel T. Lehrer, Ewald Komor, Carbon dioxide assimilation by virus-free sugarcane plants and by plants which were infected by Sugarcane Yellow Leaf Virus, ***Physiological and Molecular Plant Pathology***, Volume 73, Issue 6, December 2008, Pages 147-153, ISSN 0885-5765, DOI: 10.1016/j.pmpp.2009.05.002.
(http://www.sciencedirect.com/science/article/pii/S0885576509000241)

Abstract:

Infection of sugarcane by Sugarcane Yellow Leaf Virus (SCYLV) remains mostly asymptomatic. The assimilation rates and the water relations parameters were measured to test whether the plants are already inflicted by the infection. The assimilation rate and the stomatal conductance were 10-30% higher in virus-free plants than in infected plants. The observed differences were significant in young potted plants, not in older field plants. Virus-free leaves had a higher bundle sheath leakiness and a lower 13C discrimination rate than infected leaves. The water relations parameters of SCYLV-infected asymptomatic plants showed resemblance to those of salinity- and drought-stressed plants.

Keywords: **Photosynthesis; Saccharum spec. hybrid (sugarcane); Sugarcane yellow leaf virus (SCYLV); Yellow leaf (YL, YLS); Water relations parameters**

Maria Blanch, Maria-Estrella Legaz, Carlos Vicente, Xanthan production by Xanthomonas albilineans infecting sugarcane stalks,
Journal of Plant Physiology, Volume 165, Issue 4, 13 March 2008, Pages 366-374, ISSN 0176-1617, DOI: 10.1016/j.jplph.2007.03.008.
(http://www.sciencedirect.com/science/article/pii/S0176161707001125)

Abstract: Summary

Xanthomonas albilineans is the causal organism of leaf scald, a bacterial vascular disease of sugarcane. Xanthomonas may invade the parenchyma between

the bundles and cause reddened pockets of gum, identified as a xanthan-like polysaccharide. Since xanthan contains glucuronic acid, the ability of Xanthomonas to produce an active UDP glucose dehydrogenase is often seen as a virulence factor. X. albilineans axenically cultured did not secrete xanthans to Willbrink liquid media, but the use of inoculated sugarcane tissues for producing and characterizing xanthans has been required. A hypothesis about the role of sugarcane polysaccharides to assure the production of bacterial xanthan is discussed.

Keywords: Glucuronic acid; Glycoproteins; Sugarcane; Xanthans; Xanthomonas albilineans

Zhang-Ying XI, Shu-Hong ZHANG, Xin-Hai LI, Chuan-Xiao XIE, Ming-Shun LI, Zhuan-Fang HAO, De-Gui ZHANG, Ye-Hong LIANG, Li BAI, Shi-Huang ZHANG, Identification and Mapping of a Novel Sugarcane Mosaic Virus Resistance Gene in Maize,

Acta Agronomica Sinica, Volume 34, Issue 9, September 2008, Pages 1494-1499, ISSN 1875-2780, DOI: 10.1016/S1875-2780(09)60002-X.
(http://www.sciencedirect.com/science/article/pii/S187527800960002X)

Abstract:

Sugarcane mosaic virus (SCMV) causes considerable damage to maize (Zea mays L.) in China. Characterization of resistance gene(s) serves as the basis for effective selection in resistance breeding programs. The objective of this study was to identify novel genes conferring resistance to SCMV from maize germplasm in China. A total of 21 BC2F3 populations derived from 8 maize intercross combinations were artificially inoculated with SCMV under field conditions. The numbers of resistant and susceptible plants in the BC2F3 population Ye 478 x Hai 9-21 were consistent with the theoretical 1:3 phenotypic ratio, suggesting that a recessive gene derived from the resistant parent Hai 9-21 was responsible for resistance to SCMV. Bulked segregant analysis (BSA) and simple sequence repeat (SSR) marker analysis were used to verify the recessive resistance gene that was designated scm3. Gene scm3 was located in bin 3.04-3.05, flanked by SSR markers umc1965 and bnlg420 with genetic distances of 45.7 and 6.5 cM, respectively. Four additional linked markers were detected, which were associated with scm3 gene in the order of umc1965-scm3-bnlg420-umc1307-umc2265-bnlg2241-umc2166.

Keywords: maize dwarf mosaic virus; sugarcane mosaic virus (SCMV); resistance gene; molecular marker; gene mapping

RENEWABLE ENERGY RESOURCES (10 jdl)

Ghulam Rasul, Astrid Appuhn, Torsten Muller, Rainer Georg Joergensen, Salinity-induced changes in the microbial use of sugarcane filter cake added to soil,
Applied Soil Ecology, Volume 31, Issues 1-2, January 2006, Pages 1-10, ISSN 0929-1393, DOI: 10.1016/j.apsoil.2005.04.007.
(http://www.sciencedirect.com/science/article/pii/S0929139305000995)
Abstract:

A laboratory experiment was carried out to prove the hypothesis that the decomposition of a complex organic substrate is reduced by the lower content of fungal biomass in a saline soil in comparison to a non-saline soil under acidic conditions. Three different rates (0.5, 1.0, and 2.0%) of sugarcane filter cake were added to both soils and incubated for 63 days at 30 [degree sign]C. In the saline control soil without amendment, cumulative CO2 production was 70% greater than in the corresponding non-saline control soil, but the formation of inorganic N did not differ between these two soils. However, nitrification was inhibited in the saline soil. The increase in cumulative CO2 production by adding filter cake was similar in both soils, corresponding to 29% of the filter cake C at all three addition rates. Also, the increases in microbial biomass C and biomass N were linearly related to the amount of filter cake added, but this increase was slightly higher for both properties in the saline soil. In contrast to microbial biomass, the absolute increase in ergosterol content in the saline soil was on average only half of that in the non-saline soil and it also showed strong temporal changes during the incubation: a strong initial increase after adding the filter cake was followed by a rapid decline. The addition of filter cake led to immobilisation of inorganic N in both soils. This immobilisation was not expected, because the total C-to-total N ratio of the filter cake was below 13 and the organic C-to-organic N ratio in the 0.5 M K2SO4 extract of this material was even lower at 9.2. The immobilisation was considerably higher in the saline soil than in the non-saline soil. The N immobilisation capacity of sugarcane filter cake should be considered when this material is applied to arable sites at high rations.
Keywords: Microbial biomass C; Biomass N; Ergosterol; CO2 production; N mineralisation

P. Keshavanath, Shivanna, B. Gangadhara, Evaluation of sugarcane by-product pressmud as a manure in carp culture,
Bioresource Technology, Volume 97, Issue 4, March 2006, Pages 628-634, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.03.019.
(http://www.sciencedirect.com/science/article/pii/S0960852405001872)
Abstract:

The effectiveness of pressmud, a sugarcane by-product, was tested as a manure in the production of natural food and carp, by conducting two experiments. The first experiment, of 5 weeks duration, examined the effect of pressmud addition on water quality and natural food production. This study was carried out in fibreglass tubs

(1.54 m3) with a 5 cm mud layer, employing pressmud at dosages of 5000, 10,000 and 15,000 kg ha-1 for treatments T1, T2 and T3, respectively. Unfertilized tubs served as control (T0). The second experiment of 120-day duration to study the effect on growth, survival and quality of common carp was conducted in 25 m2 cement tanks with 15 cm-mud bottom, using the same dosages of pressmud. The control tanks in this experiment were manured with cattle dung at 10,000 kg ha-1 (T0). Application of pressmud enhanced ($P < 0.05$) natural food production, with the greatest effect noted in treatment T3. Fish growth was significantly greater ($P < 0.05$) in treatments T2 and T3, there being no difference in growth between the control (T0) and 5000 kg pressmud treatment (T1). The greatest survival and production were obtained under treatment T2, which indicates that the dosage of 10,000 kg ha-1 pressmud is optimal for carp culture. A significant effect ($P < 0.05$) of pressmud on carcass protein was observed. Organoleptic quality of both raw flesh and cooked meat of carp was not affected ($P > 0.05$) by pressmud treatment.

Keywords: Pressmud; Natural food; Carp production; Flesh quality

Letha Dawson, Raj Boopathy, Use of post-harvest sugarcane residue for ethanol production,

Bioresource Technology, Volume 98, Issue 9, July 2007, Pages 1695-1699, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.07.029.
(http://www.sciencedirect.com/science/article/pii/S0960852406003622)

Abstract:

Agricultural residues are produced in large quantities throughout the world. Approximately, 1 kg of residue is produced for each kilogram of grains harvested. This ratio of grain/residue translates into an excess of 40 billion ton of crop residue produced each year in the USA. These residues are renewable resources that could be used to produce ethanol and many other value added products. In this study, we demonstrate that the post-harvest sugar cane residue could be used to produce fuel grade ethanol. A chemical pre-treatment process using alkaline peroxide or acid hydrolysis was applied to remove lignin, which acts as physical barrier to cellulolytic enzymes. Yeast Saccharomyces cerevisiae ATCC strain 765 was used in the experiment. The pre-treatment process effectively removed lignin. Ethanol production in the culture sample was monitored using high performance liquid chromatography. The results indicate that ethanol can be made from the sugarcane residue. The fermentation system needs to be optimized further to scale up the process for large-scale production of ethanol from sugar cane residue.

Keywords: Ethanol; Cellulose; Lignin; Acid hydrolysis; Yeast

Wen-Tien Tsai, Hsiao-Hsuan Mi, Yuan-Ming Chang, Shyh-Yu Yang, Jeng-Hung Chang, Polycyclic aromatic hydrocarbons (PAHs) in bio-crudes from induction-heating pyrolysis of biomass wastes,

Bioresource Technology, Volume 98, Issue 5, March 2007, Pages 1133-1137, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.04.007.

(http://www.sciencedirect.com/science/article/pii/S0960852406001660)

Abstract:

The aim of this work was to prepare the bio-crudes from agricultural wastes (i.e., rice straw, rice husk, sugarcane bagasse and coconut shell) by using induction-heating pyrolysis at specified conditions. The quantitative analysis of 21 priority pollutant polycyclic aromatic hydrocarbons (PAHs) in bio-crudes examined using gas chromatography/mass spectrometry (GC/MS) revealed that the PAHs in bio-crudes were primarily dominant in the low molecular weight (LMW) PAHs, including naphthalene (1.10-2.45 mg/L) and acenaphthene (0.72-7.61 mg/L). However, by considering carcinogenic potency, the bio-crudes from rice husk and sugarcane bagasse contained higher contents of benzo[a]pyrene (BaP) (0.52 and 0.92 mg/L, respectively) as compared to those from rice straw and coconut shell.

Keywords: Bio-crude; Pyrolysis; Gas chromatography/mass spectrometry; Polycyclic aromatic hydrocarbons; Biomass waste

Anuj Kumar Chandel, Rajeev Kumar Kapoor, Ajay Singh, Ramesh Chander Kuhad, Detoxification of sugarcane bagasse hydrolysate improves ethanol production by Candida shehatae NCIM 3501,

Bioresource Technology, Volume 98, Issue 10, July 2007, Pages 1947-1950, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.07.047.

(http://www.sciencedirect.com/science/article/pii/S0960852406003889)

Abstract:

Sugarcane bagasse hydrolysis with 2.5% (v/v) HCl yielded 30.29 g/L total reducing sugars along with various fermentation inhibitors such as furans, phenolics and acetic acid. The acid hydrolysate when treated with anion exchange resin brought about maximum reduction in furans (63.4%) and total phenolics (75.8%). Treatment of hydrolysate with activated charcoal caused 38.7% and 57.5% reduction in furans and total phenolics, respectively. Laccase reduced total phenolics (77.5%) without affecting furans and acetic acid content in the hydrolysate. Fermentation of these hydrolysates with Candida shehatae NCIM 3501 showed maximum ethanol yield (0.48 g/g) from ion exchange treated hydrolysate, followed by activated charcoal (0.42 g/g), laccase (0.37 g/g), overliming (0.30 g/g) and neutralized hydrolysate (0.22 g/g).

Keywords: Candida shehatae; Acid hydrolysis; Detoxification; Ethanol; Laccase

Isaias C. Macedo, Joaquim E.A. Seabra, Joao E.A.R. Silva, Green house gases emissions in the production and use of ethanol from sugarcane in Brazil: The 2005/2006 averages and a prediction for 2020,

Biomass and Bioenergy, Volume 32, Issue 7, July 2008, Pages 582-595, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2007.12.006.

(http://www.sciencedirect.com/science/article/pii/S0961953407002310)

Abstract:

This work presents the evaluation of energy balance and GHG emissions in the production and use of fuel ethanol from cane in Brazil for 2005/2006 (for a sample of mills processing up to 100 million tons of sugarcane per year), and for a conservative scenario proposed for 2020. Fossil energy ratio was 9.3 for 2005/2006 and may reach 11.6 in 2020 with technologies already commercial. For anhydrous ethanol production the total GHG emission was 436 kg CO2 eq m-3 ethanol for 2005/2006, decreasing to 345 kg CO2 eq m-3 in the 2020 scenario. Avoided emissions depend on the final use: for E100 use in Brazil they were (in 2005/2006) 2181 kg CO2 eq m-3 ethanol, and for E25 they were 2323 kg CO2 eq m-3 ethanol (anhydrous). Both values would increase about 26% for the conditions assumed for 2020 mostly due to the large increase in sales of electricity surpluses. A sensitivity analysis has been performed (with 2005/2006 values) to investigate the impacts of the huge variation of some important parameters throughout Brazilian mills on the energy and emissions balance. The results have shown the high impact of cane productivity and ethanol yield variation on these balances (and the impacts of average cane transportation distances, level of soil cultivation, and some others) and of bagasse and electricity surpluses on GHG emissions avoidance.

Keywords: Energy balance; CO2; Nitrous oxide; Methane; Fertilizers; Diesel consumption; Cane residues; Trash burning; Avoided emissions; Ethanol blends

M.A. Renouf, M.K. Wegener, L.K. Nielsen, An environmental life cycle assessment comparing Australian sugarcane with US corn and UK sugar beet as producers of sugars for fermentation,

Biomass and Bioenergy, Volume 32, Issue 12, December 2008, Pages 1144-1155, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.02.012.
(http://www.sciencedirect.com/science/article/pii/S0961953408000561)

Abstract:

Sugarcane is a highly suitable substrate for the production of bio-products. As well as producing high yields of sugar, much of the plant's fibre is also recovered and used as a source of renewable energy. A life cycle assessment (LCA) of sugarcane production and processing in Australia was performed to develop an environmental profile of sugarcane as a source of bio-products. The application examined was fermentation products from sugar. The sugarcane results were compared with results for other sugar producing crops--US corn and UK sugar beet--to gauge its relative environmental performance. The results show sugarcane to have an advantage in respect of energy input, greenhouse gas emissions and possibly acidification potential due to its high saccharide yield and the displacement of fossil fuels with surplus renewable energy from cane fibre (bagasse). However Australian sugarcane can exhibit high nitrous oxide emissions, which would reduce greenhouse gas advantages in some regions. For eutrophication, sugar beet provides advantages due to the avoided production of other agricultural crops displaced by the use of beet pulp as an animal feed. The three factors found to have the most influence on the environmental

impacts of these agro-industrial systems were the commodities displaced by by-products, agricultural yields, and nitrogen use efficiency.

Keywords: Saccharum officinarum; Beta vulgaris; Zea mays; Life cycle assessment; Bio-products; Energy; Greenhouse gases; Eutrophication; Acidification; Nitrous oxide

Edward Smeets, Martin Junginger, Andre Faaij, Arnaldo Walter, Paulo Dolzan, Wim Turkenburg, The sustainability of Brazilian ethanol--An assessment of the possibilities of certified production,
Biomass and Bioenergy, Volume 32, Issue 8, Developments in International Bioenergy trade & markets - Results from work of IEA Bioenergy Task 40, August 2008, Pages 781-813, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.01.005.
(http://www.sciencedirect.com/science/article/pii/S0961953408000159)

Abstract:

In this article the environmental and socio-economical impacts of the production of ethanol from sugarcane in the state of Sao Paulo (Brazil) are evaluated. Subsequently, an attempt is made to determine to what extent these impacts are a bottleneck for a sustainable and certified ethanol production. Seventeen environmental and socio-economic areas of concern are analysed. Four parameters are used to evaluate if an area of concern is a bottleneck: (1) the importance of the area of concern, based on the severity of the impact and the frequency of which an aspect is mentioned in the literature as an area of concern, (2) the availability of indicators and criteria, (3) the necessity of improvement strategies to reach compliance with Brazilian and/or (inter) national legislation, standards, guidelines and sustainability criteria, and (4) the impact of these improvement strategies on the costs and potential of ethanol production. Fourteen areas of concern are classified as a minor or medium bottleneck. For 7 areas of concern the additional costs to avoid or reduce undesirable effects have been calculated at [less-than-or-equals, slant]+10% for each area of concern. Due to higher yields and overlapping costs the total additional production costs of compliance with various environmental and socio-economic criteria are about +36%. This study also shows that the energy input to output ratio can be increased and the greenhouse gas emissions reduced by increasing the ethanol production per tonne cane and by increasing the use of sugarcane waste for electricity production. A major bottleneck for a sustainable and certified production is the increase in cane production and the possible impacts on biodiversity and the competition with food production. Genetically modified cane is presently being developed, but is at this moment not (yet) applied. Both a ban on and the allowance of the use of genetically modified cane could become a major bottleneck considering the potentially large benefits and disadvantages, that are both highly uncertain at this moment. The approach demonstrated in this report provides a useful framework for the development of a practically applicable certification system, but further monitoring and research is required to reduce gaps in knowledge in combination with stakeholder consultation (particularly with respect to the three bottlenecks identified in this article).

Keywords: Sugarcane; Ethanol; Sustainability; Certification system; Sao Paulo; Brazil

Arnaldo Walter, Frank Rosillo-Calle, Paulo Dolzan, Erik Piacente, Kamyla Borges da Cunha, Perspectives on fuel ethanol consumption and trade,
Biomass and Bioenergy, Volume 32, Issue 8, Developments in International Bioenergy trade & markets - Results from work of IEA Bioenergy Task 40, August 2008, Pages 730-748, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.01.026.
(http://www.sciencedirect.com/science/article/pii/S0961953408000317)

Abstract:

Since the year 2000 or so there has been a rapid growth on fuel ethanol production and consumption, particularly in US and Brazil. Ethanol trade represented about 10% of world consumption in 2005, Brazil being the main exporter. The most important consumer markets--US and European Union (EU)--have trade regimes that constrained the comparative advantages of the most efficient producers, such as Brazil. This paper evaluates the fuel ethanol market up to 2030 together with the potential for international biotrade. Based on forecasts of gasoline consumption and on targets and mandates of fuel ethanol use, it is estimated that demand could reach 272 Gl in 2030, displacing 10% of the estimated demand of gasoline (Scenario 1), or even 566 Gl in the same year, displacing about 20% of the gasoline demand (Scenario 2). The analysis considers fuel ethanol consumption and production in US, EU-25, Japan, China, Brazil and the rest of the world (ROW-BR). Without significant production of ethanol from cellulosic materials in this period, displacing 10% of the gasoline demand in 2030, at reasonable cost, can only be accomplished by fostering fuel ethanol production in developing countries and enhancing ethanol trade. If the US and EU-25 reach their full production potential (based on conventional routes), the minimum amount that could be traded in 2030 would be about 34 Gl. Displacing 20% of the gasoline demand by 2030 will require the combined development of second-generation technologies and large-scale international trade in ethanol fuel. Without second-generation technologies, Scenario 2 could become a reality only with large-scale production of ethanol from sugarcane in developing countries, e.g., Brazil and ROW-BR could be able to export at least 14.5 Gl in 2010, 73.9 Gl in 2020 and 71.8 Gl in 2030.

Keywords: Fuel ethanol; International bioenergy trade; Market scenarios; Bioenergy

J.D. van den Wall Bake, M. Junginger, A. Faaij, T. Poot, A. Walter, Explaining the experience curve: Cost reductions of Brazilian ethanol from sugarcane,
Biomass and Bioenergy, Volume 33, Issue 4, April 2009, Pages 644-658, ISSN 0961-9534, DOI: 10.1016/j.biombioe.2008.10.006.
(http://www.sciencedirect.com/science/article/pii/S0961953408002390)

Abstract:

Production costs of bio-ethanol from sugarcane in Brazil have declined continuously over the last three decades. The aims of this study are to determine underlying reasons behind these cost reductions, and to assess whether the experience curve concept can be used to describe the development of feedstock costs and industrial production costs. The analysis was performed using average national costs data, a number of prices (as a proxy for production costs) and data on annual Brazilian production volumes. Results show that the progress ratio (PR) for feedstock costs is 0.68 and 0.81 for industrial costs (excluding feedstock costs). The experience curve of total production costs results in a PR of 0.80. Cost breakdowns of sugarcane production show that all sub-processes contributed to the total, but that increasing yields have been the main driving force. Industrial costs mainly decreased because of increasing scales of the ethanol plants. Total production costs at present are approximately 340 US$/methanol3 (16 US$/GJ). Based on the experience curves for feedstock and industrial costs, total ethanol production costs in 2020 are estimated between US$ 200 and 260/m3 (9.4-12.2 US$/GJ). We conclude that using disaggregated experience curves for feedstock and industrial processing costs provide more insights into the factors that lowered costs in the past, and allow more accurate estimations for future cost developments.

Keywords: Ethanol; Sugarcane; Cost reductions; Experience curve; Brazil

WATER RESOURCES AND MANAGEMENT (4 jdl)

P.N. Singh, S.K. Shukla, V.K. Bhatnagar, Optimizing soil moisture regime to increase water use efficiency of sugarcane (Saccharum spp. hybrid complex) in subtropical India,

Agricultural Water Management, Volume 90, Issues 1-2, 24 May 2007, Pages 95-100, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.02.008.
(http://www.sciencedirect.com/science/article/pii/S0378377407000510)

Abstract:

Field studies were conducted for 2 years in alluvial soils of north India to determine water use, water use efficiency and yield of sugarcane on a sandy loam and a silty clay loam soil under various moisture regimes. Irrigation scheduling was based on the ratio between irrigation water and cumulative pan evaporation (IW/CPE). Deep irrigations at 80 mm were applied at IW/CPE ratios of 0.25, 0.50, 0.75, 1.00 and 1.25. Total water use was higher in the plant crop than the ratoon crop under all IW/CPE ratios. Mean water use efficiency (WUE) of plant cane (71 kg/ha/mm) was also higher compared to ratoon cane (63 kg/ha/mm). On the heavier silty clay loam soil, losses through deep percolation ranged from 25 to 30% in the first crop and 7-13% in the second crop season. Maximum effective rainfall was recorded in the driest soil moisture regime. Mean cane yield on the sandy loam soil increased significantly up to 1.0 IW/CPE ratio. We conclude that in subtropical India, irrigation of sugarcane during

the tillering period should be applied at 0.75 and 1.00 IW/CPE ratios in silty clay loam and sandy loam soils, respectively.

Keywords: Soil moisture depletion; Silty clay loam; Sandy loam; IW/CPE ratio; Ratoon

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/pii/S0378377407002132)

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

H.P. Ritzema, T.V. Satyanarayana, S. Raman, J. Boonstra, Subsurface drainage to combat waterlogging and salinity in irrigated lands in India: Lessons learned in farmers' fields,
Agricultural Water Management, Volume 95, Issue 3, March 2008, Pages 179-189, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.09.012.
(http://www.sciencedirect.com/science/article/pii/S0378377407002417)
Abstract:

The introduction of irrigated agriculture in the arid and semi-arid regions of India has resulted in the development of the twin problem of waterlogging and soil salinization. It is estimated that nearly 8.4 million ha is affected by soil salinity and alkalinity, of which about 5.5 million ha is also waterlogged. Subsurface drainage is an effective tool to combat this twin problem of waterlogging and salinity and thus to protect capital investment in irrigated agriculture and increase its sustainability. In India, however, subsurface drainage has not been implemented on a large scale, in spite of numerous research activities that proved its potential. To develop strategies to implement subsurface drainage, applied research studies were set-up in five different agro-climatic sub-regions of India. Subsurface drainage systems, consisting of open and pipe drains with drain spacing varying between 45 and 150 m and drain depth between 0.90 and 1.20 m, were installed in farmers' fields. The agro-climatic and soil conditions determine the most appropriate combination of drain depth and spacing, but the drain depths are considerably shallower than the 1.75 m traditionally recommended for the prevailing conditions in India. Crop yields in the drained fields increased significantly, e.g. rice with 69%, cotton with 64%, sugarcane with 54% and wheat with 136%. These increases were obtained because water table and soil salinity levels were, respectively, 25% and 50% lower than in the non-drained fields. An economic analysis shows that the subsurface drainage systems are highly cost-effective: cost-benefit ratios range from 1.2 to 3.2, internal rates of return from 20 to 58%, and the pay-back periods from 3 to 9 years. Despite these positive results, major challenges remain to introduce subsurface drainage at a larger scale. First of all, farmers, although they clearly see the benefits of drainage, are too poor to pay the full cost of drainage. Next, water users' organisations, not only for drainage but also for irrigation, are not well established. Subsurface drainage in irrigated areas is a collective activity, thus appropriate institutional arrangements for farmers' participation and organisation are needed. Thus, to assure that drainage gets the attention it deserves, policies have to be reformulated.
Keywords: Irrigated agriculture; Subsurface drainage; Open drainage; Pipe drainage; Drain depth; Spacing; Farmers' participation; Economic benefits

R.A. Gilbert, C.R. Rainbolt, D.R. Morris, J.M. McCray, Sugarcane growth and yield responses to a 3-month summer flood,
Agricultural Water Management, Volume 95, Issue 3, March 2008, Pages 283-291, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.10.009.
(http://www.sciencedirect.com/science/article/pii/S0378377407002673)

Abstract:

Sugarcane (Saccharum spp.) in south Florida is often subjected to flooding due to interacting effects of soil subsidence, pumping restrictions, and tropical storms. While there has been considerable research on the response of sugarcane cultivars to high water tables and periodic flooding, there is a lack of information on commercial cultivar yield response to long-term flooding. An experiment was established in Belle Glade, FL to examine the effect of a 3-month summer flood (July-September) on the growth and yield of cultivars CP 80-1743 and CP 72-2086 during the plant cane (2003) and second ratoon (2005) crop. Harvest samples were taken early-, mid-, and late-season. Flooding sugarcane in the summer caused sequentially greater yield reductions throughout the harvest season in plant cane. Sucrose yields for flooded cane, compared with the non-flooded control, were 9.6 t sucrose ha-1 versus 11.7 t sucrose ha-1 early, 9.2 t sucrose ha-1 versus 12.8 t sucrose ha-1 mid-season and 7.8 t sucrose ha-1 versus 12.3 t sucrose ha-1 at late harvest. In the second ratoon crop, flooding reduced sugarcane tonnage and sucrose yield by 54-64% across sampling dates, and preliminary results indicated that flooding reduced leaf nutrient content by 10-78%. Yield reductions due to flooding in both crops were attributed more to reduced tonnage rather than sucrose content. CP 72-2086 yielded 18-28% greater sucrose than CP 80-1743 when harvested late. However the flood x cultivar interaction was not significant as both cultivars recorded similar yield reductions under flooded conditions. Our results identified severe yield losses caused by a 3-month summer flood in these cultivars, particularly in ratoon crops. Strategies to increase summer on-farm water storage in Florida should focus on short-duration periodic flooding rather than long-term flooding.

Keywords: Sugarcane; Flood; Growth; Nutrient concentration; Yield; Florida; Water table

DRAINAGE (2 jdl)

L.K. Stewart, P.B. Charlesworth, K.L. Bristow, P.J. Thorburn, Estimating deep drainage and nitrate leaching from the root zone under sugarcane using APSIM-SWIM, ***Agricultural Water Management***, Volume 81, Issue 3, 24 March 2006, Pages 315-334, ISSN 0378-3774, DOI: 10.1016/j.agwat.2005.05.002.
(http://www.sciencedirect.com/science/article/pii/S0378377405002076)

Abstract:

The Burdekin Delta (BD) is located on the dry-tropical coastal strip in North Queensland, Australia. It is one of Australia's premier sugar producing districts with approximately 40,000 ha of land under sugarcane. Because the BD borders the Great

Barrier Reef World Heritage Area (GBRWHA), industry, community, regulatory, and environmental organisations are interested in ascertaining the magnitude of deep drainage and nitrate leaching from the root zone and potential implications for the GBRWHA.Direct measurement of deep drainage and nitrate leaching is difficult, and modelling is likely to play an ever-increasing role in guiding experimental work and decision-making. Here, we describe the collection of drainage and nitrate-leaching related data collected over two cropping seasons at a specific field site within the BD and its use in the calibration and application of a drainage and nitrate-leaching model created within the Agricultural Production Systems Simulator (APSIM) modelling framework with constituent crop-growth, soil-water, and nitrogen transformation modules (Sugar, APSIM-SWIM, SoiIn2).Model application indicated that the simulated amount of drainage and nitrate leached over a cropping season compared favourably to that derived from inferred drainage and observed soil-water nitrate concentrations. Subsequent investigation of fertilizer management options using the model identified the timing and amount of both irrigation and fertilizer application as key parameters over which management control might be exploited to minimise deep drainage and flux of nitrate to groundwater.

Keywords: Modelling; Deep drainage; Nitrate leaching; Groundwater; APSIM; SWIM

Xihua Yang, Evaluation and application of DRAINMOD in an Australian sugarcane field,
Agricultural Water Management, Volume 95, Issue 4, April 2008, Pages 439-446, ISSN 0378-3774, DOI: 10.1016/j.agwat.2007.11.006.
(http://www.sciencedirect.com/science/article/pii/S0378377407002946)

Abstract:

DRAINMOD is a water management model developed to simulate the performance of drainage and water table control systems for shallow water table soils, and it has been widely used in the United States over the last 20 years. This model has been evaluated and applied for predicting water table fluctuations in a sugarcane field for acid drainage management in north-eastern New South Wales, Australia. The reliability of the model has been evaluated using 2-year experimental field data from water level recorders installed in a sugarcane field. Good agreement was found between the observed and simulated values with a standard error of about 0.07 m. However, the model is not readily applicable to daily water management in Australian soils since it requires extensive soil and climate data, which are normally not available for most Australian sugarcane areas. In this application, refinements have been attempted in evapotranspiration estimation and in soil input data preparation so that the model requires only easily obtainable input data but still retains acceptable accuracy. With these improvements, the model can be used as a practical tool for investigating drainage management options for different site conditions. This will assist decision-makers in providing appropriate subsurface drainage management policies, such as acid drainage management, in Australian estuarine sugarcane areas.

Keywords: DRAINMOD; Water management; Water table; Acid drainage

SOIL CHEMISTRY AND PHYSICS (4 jdl)

Tantely Razafimbelo, Bernard Barthes, Marie-Christine Larre-Larrouy, Edgar F. De Luca, Jean-Yves Laurent, Carlos C. Cerri, Christian Feller, Effect of sugarcane residue management (mulching versus burning) on organic matter in a clayey Oxisol from southern Brazil,
Agriculture, Ecosystems & Environment, Volume 115, Issues 1-4, July 2006, Pages 285-289, ISSN 0167-8809, DOI: 10.1016/j.agee.2005.12.014.
(http://www.sciencedirect.com/science/article/pii/S0167880906000107)
Abstract:

Changes in residue management may help sustain land productivity, and may have noticeable consequences in the global carbon budget when large areas are involved. The effects of sugarcane residue management on topsoil carbon were assessed in a clayey Oxisol of Brazil, largest world's producer of sugarcane. The carbon concentration of the whole soil and particle-size fractions were determined in a long-duration sugarcane plantation (50 years), with either a pre-harvest residue burning (BUR) or a 6-year green trash management (MUL, residue mulching). Soil carbon concentrations were greater in MUL than in BUR. The difference was significant at a 0-5 cm depth (25.2 versus 21.0 g C kg-1) but not at 5-10 cm (22.3 versus 20.5 g C kg-1); nevertheless it was significant at 0-10 cm (23.7 versus 20.7 g C kg-1). This difference resulted in carbon sequestration in MUL, which amounted to 0.65 Mg C ha-1 year-1 at 0-10 cm depth and corresponded to 14% of aboveground residue carbon returned to the soil. Differences in soil carbon between MUL and BUR mainly affected the fraction <2 [mu]m. It was hypothesized that the preferential enrichment in fine fractions resulted in a long-term carbon storage.

Keywords: Soil organic carbon; Particle-size fractionation; Sugarcane; Residue mulching; Brazil

Miguel S. Castillo, Alan L. Wright, Soil phosphorus pools for Histosols under sugarcane and pasture in the Everglades, USA,
Geoderma, Volume 145, Issues 1-2, 15 May 2008, Pages 130-135, ISSN 0016-7061, DOI: 10.1016/j.geoderma.2008.03.006.
(http://www.sciencedirect.com/science/article/pii/S0016706108000797)
Abstract:

Land use changes in the Everglades Agricultural Area (EAA) in southern Florida may influence the distribution and availability of P. Cultivated soils in the EAA are being converted back to their historic use as seasonally-flooded prairies as part of Everglades restoration projects. The objectives of this study were to determine the distribution of P in soil chemical fractions in relation to long-term land management to predict P cycling and transformations for future land uses. Soil under pasture (100 yr) and planted to sugarcane (Saccharum sp.) for 50 yr were amended with P (0, 10, 50, 150 kg P ha- 1), and its distribution in labile, Fe-Al bound P, Ca-bound P, humic-fulvic acid P, and residual P pools determined for surface soil (0-15 cm). Most P fertilizer

entered Fe-Al and Ca-bound fractions. Cultivation contributed to higher pH and increased the Ca content in soil compared to pasture due to incorporation of bedrock limestone into soil by tillage. The land uses were differentiated by P storage in different pools. Subsequently, long-term fertilization increased soil total P for cultivated soil relative to pasture, but plant-available P constituted less than 1% of the total P. Labile P increased with increasing P application rate, ranging from 1.3 to 7.2 mg kg- 1 for cultivated soil and 1.4 to 10.7 mg kg- 1 for pasture. Most of the applied P was recovered in the Fe-Al fraction for pasture and the Ca-bound P fraction for cultivated soil. The Ca-bound P fraction represented the greatest proportion of total P for sugarcane (41%), but only 12% for pasture. The majority of P in the pasture was present in the humic-fulvic acid fraction (45%), compared to only 23% for sugarcane. The higher pH of the cultivated soil (6.8) favored retention in Ca fractions while the lower pH of pasture (5.3) favored P retention in the humic-fulvic acid fraction. The proportion of total P as organic P was greater for pasture (78%) than cultivated soil (52%). Higher P levels in more recalcitrant fractions for cultivated soils indicated that more of the applied fertilizer P was sequestered in stable fractions, which decreased P availability to crops and may subsequently increase P fertilizer requirements necessary to maintain optimal plant-available nutrient levels. Subsequently, continuation of current farming practices and tillage regimes promotes the redistribution of Ca from subsurface to surface soil, which leads to greater P sequestration in the Ca-bound fraction. However, P in inorganic fractions may be released upon onset of changes in land use. Thus, conversion to seasonally-flooded prairies may have a more dramatic effect on P release from cultivated than pasture soils since cultivated soils have more P in inorganic pools.

Keywords: Everglades Agricultural Area; Histosols; Land use; Phosphorus fractionation

S.A.C. SANT'ANNA, M.F. FERNANDES, W.M.P.M. IVO, J.L.S. COSTA, Evaluation of Soil Quality Indicators in Sugarcane Management in Sandy Loam Soil,
Pedosphere, Volume 19, Issue 3, June 2009, Pages 312-322, ISSN 1002-0160, DOI: 10.1016/S1002-0160(09)60122-3.
(http://www.sciencedirect.com/science/article/pii/S1002016009601223)

Abstract:

An important factor for the sustainability of soils highly susceptible to degradation is the use of monitoring tools that promptly and realistically reflect changes imposed on soil by different cropping systems. To select soil quality indicator variables in sugarcane (Saccharum officinarum L.) production areas that fulfill the criteria of sensitivity to management practices and between-season consistency in the management discrimination, ten composite soil samples (0-10 cm) were collected in July 2005 (rainy season) and again in March 2006 (dry season) from areas under cultivation of organic sugarcane (OS), green sugarcane (GS), burned sugarcane (BS) and from an adjacent native forest (NF) area at Usina Triunfo, Boca da Mata, Alagoas, Brazil. Microbial biomass-C (MBC), total organic C (TOC), soil enzyme activity

expressed as the rate of fluorescein diacetate (FDA) hydrolysis, mean weight diameter of water-stable soil aggregates (MWD), and percentage of water-stable macroaggregates (PWSA) were analyzed. Although MBC and TOC were higher in NF than in the cultivated areas, no differences were observed in these C pools between the three sugarcane systems. The response of FDA to the site management was dependent on the sampling time. In the rainy period, the activity followed the order: NF > OS > GS > BS, whereas in the dry season, only NF differed from the other treatments. Irrespective of the sampling time, MWD and PWSA decreased in the order NF > OS = GS > BS. The variables MWD and PWSA are quite sensitive for discriminating between site management histories regardless the sampling season.

Keywords: fluorescein diacetate; green-sugarcane; organic matter management; sugarcane (Saccharum officinarum L.); sustainable agricultural use

A.R. Panosso, J. Marques Jr., G.T. Pereira, N. La Scala Jr., Spatial and temporal variability of soil CO2 emission in a sugarcane area under green and slash-and-burn managements,
Soil and Tillage Research, Volume 105, Issue 2, November 2009, Pages 275-282, ISSN 0167-1987, DOI: 10.1016/j.still.2009.09.008.
(http://www.sciencedirect.com/science/article/pii/S016719870900169X)

Abstract:

Soil management causes changes in physical, chemical, and biological properties that consequently affect soil CO2 emission (FCO2). Here, we studied the soil carbon dynamics in areas with sugarcane production in southern Brazil under two different sugarcane management systems: green (G), consisting of mechanized harvesting that produces a large amount of crop residues left on the soil surface, and slash-and-burn (SB), in which the residues are burned before manual harvest, leaving no residues on the soil surface. The study was conducted during the period after harvest in two side-by-side grids installed in adjacent areas, having 60 points each. The aim was to characterize the temporal and spatial variability of FCO2, and its relation to soil temperature and soil moisture, in a red latosol (Oxisol) where G and SB management systems have been recently used. Mean FCO2 emission was 39% higher in the SB plot (2.87 [mu]mol m-2 s-1) when compared to the G plot (2.06 [mu]mol m-2 s-1) throughout the 70-day period after harvest. A quadratic equation of emissions versus soil moisture was able to explain 73% and 50% of temporal variability of FCO2 in SB and G, respectively. This seems to relate to the sensitivity of FCO2 to precipitation events, which caused a significant increase in SB emissions but not in G-managed area emissions. FCO2 semivariogram models were mostly exponential in both areas, ranging from 72.6 to 73.8 m and 63.0 to 64.7 m for G and SB, respectively. These results indicate that the G management system results in more homogeneous FCO2 when spatial and temporal variability are considered. The spatial variability analysis of soil temperature and soil moisture indicates that those parameters do not adequately explain the changes in spatial variability of FCO2, but emission maps are clearly more homogeneous after a drought period when no rain has occurred, in both sites.

Keywords: Soil respiration; Sugarcane management; Geostatistic; Soil properties

SOIL BIOLOGY (5 jdl)

M.H. Graham, R.J. Haynes, Organic matter status and the size, activity and metabolic diversity of the soil microbial community in the row and inter-row of sugarcane under burning and trash retention,
Soil Biology and Biochemistry, Volume 38, Issue 1, January 2006, Pages 21-31, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2005.04.011.
(http://www.sciencedirect.com/science/article/pii/S0038071705001653)
Abstract:

The concentrations of organic C, labile organic fractions and the size and activity of the microbial community were measured to a depth of 30 cm below the plant row and at distances of 30 and 60 cm into the inter-row area under sugarcane under pre-harvest burning or green cane harvesting with retention of a crop residue (trash) mulch. Total root mass was similar under burning and trashing but under trashing there was a redistribution of roots towards the surface 0-10 cm in the inter-row space as roots proliferated beneath the trash mulch. Soil organic C content decreased in response to both increasing distance from the plant row (to a depth of 20 cm) and burning rather than trashing (to a depth of 10 cm). Declines in K2SO4-extractable C, light fraction C, microbial biomass C, basal respiration and aggregate stability in response to distance and burning were much more marked than those for organic C and occurred to a depth of 30 cm. Bulk density was greater under burnt than trashed sugarcane and was greater in the inter-row than row, particularly under burning. Heterotrophic functional diversity (measured by analysis of catabolic response profiles to 36 substrates) was also investigated. Principal component analysis of response profiles demonstrated that soils below the row and those under trashing at 30 cm out from this row were separated from the other soils on PC1 and the sample from the inter-row centre (60 cm out) under burning was separated from the others on PC2. Catabolic evenness was least for the latter soil. It was concluded that soil in the inter-row of burnt sugarcane receives few inputs of organic matter and that conversion to green cane harvesting with retention of a trash mulch greatly improves the organic matter, microbial and physical status of the inter-row soil.
Keywords: Light fraction; Metabolic quotient; Microbial biomass; Root biomass; Soil organic matter

Julia Peixoto de Albuquerque, Fabio Faria da Mota, Irene von der Weid, Lucy Seldin, Diversity of Paenibacillus durus strains isolated from soil and different plant rhizospheres evaluated by ARDRA and gyrB-RFLP analysis,
European Journal of Soil Biology, Volume 42, Issue 4, October-December 2006, Pages 200-207, ISSN 1164-5563, DOI: 10.1016/j.ejsobi.2006.03.002.
(http://www.sciencedirect.com/science/article/pii/S1164556306000197)
Abstract:

Strains belonging to Paenibacillus durus isolated from the rhizosphere of various grasses and from bulk soil were previously divided into five phenotypic groups (A1-A5) based on the fermentation pattern of six carbohydrates (A1: sorbitol (+), A2: dulcitol and tagatose (+), A3: starch and glycogen (+), A4: starch, glycogen and d-arabitol (+) and A5: negative for these carbohydrates). This study aimed to assess whether plant types select for specific P. durus phenotypic groups. For that purpose, polymerase chain reaction-restriction fragment length polymorphism analysis of part of genes encoding 16S rRNA (ARDRA) and DNA gyrase subunit B (gyrB-RFLP) were used to produce genetic fingerprints. ARDRA and gyrB-RFLP data were clustered together to generate a dendrogram and two main clusters were observed. Cluster I showed a predominance of strains isolated from wheat, maize and sugarcane rhizospheres. Strains isolated from maize were distributed among the five patterns of carbohydrate metabolism, while strains isolated from sugarcane showed to be predominantly able to metabolize starch and glycogen. Neither sorbitol- nor arabitol-metabolizing strains were found in cluster II, which consisted of strains isolated from soil and from all plant species used. Our results suggest that the plants influenced the diversity of P. durus in their rhizospheres.
Keywords: Paenibacillus durus; Diversity; ARDRA; gyrB-RFLP; Rhizospheres

Brigitte Engelking, Heiner Flessa, Rainer Georg Joergensen, Microbial use of maize cellulose and sugarcane sucrose monitored by changes in the 13C/12C ratio,
Soil Biology and Biochemistry, Volume 39, Issue 8, August 2007, Pages 1888-1896, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2007.02.002.
(http://www.sciencedirect.com/science/article/pii/S0038071707000697)
Abstract:

An arable soil with organic matter formed from C3-vegetation was amended initially with maize cellulose (C4-cellulose) and sugarcane sucrose (C4-sucrose) in a 67-day laboratory incubation experiment with microcosms at 25 [degree sign]C. The amount and isotopic composition (13C/12C) of soil organic C, CO2 evolved, microbial biomass C, and microbial residue C were determined to prove whether the formation of microbial residues depends on the quality of the added C source adjusted with NH4NO3 to the same C/N ratio of 15. In a subsequent step, C3-cellulose (3 mg C g-1 soil) was added without N to soil to determine whether the microbial residues formed initially from C4-substrate are preferentially decomposed to maintain the N-demand of the soil microbial community. At the end of the experiment, 23% of the two C4-substrates added was left in the soil, while 3% and 4% of the added C4-cellulose and C4-sucrose, respectively, were found in the microbial biomass. The addition of the two

C4-substrates caused a significant 100% increase in C3-derived CO2 evolution during the 5-33 day incubation period. The addition of C3-cellulose caused a significant 50% increase in C4-derived CO2 evolution during the 38-67 day incubation period. The decrease in microbial biomass C4-C accounted for roughly 60% of this increase. Cellulose addition promoted microorganisms strongly able to recycle N immediately from their own tissue by 'cryptic growth' instead of incorporating NO3- from the soil solution. The differences in quality of the microbial residues produced by C4-cellulose and C4-sucrose decomposing microorganisms are also reflected by the difference in the rates of CO2 evolution, but not in the rates of net N mineralization.

Keywords: 13C; Decomposition; N immobilization; Cryptic growth; Microbial biomass C; Microbial residues

Brigitte Engelking, Heiner Flessa, Rainer Georg Joergensen, Formation and use of microbial residues after adding sugarcane sucrose to a heated soil devoid of soil organic matter,
Soil Biology and Biochemistry, Volume 40, Issue 1, January 2008, Pages 97-105, ISSN 0038-0717, DOI: 10.1016/j.soilbio.2007.07.009.
(http://www.sciencedirect.com/science/article/pii/S0038071707003045)

Abstract:

A 67-day incubation experiment was carried out with a soil initially devoid of any organic matter due to heating, which was amended with sugarcane sucrose (C4-sucrose with a [delta]13C value of -10.5[per mille sign]), inorganic N and an inoculum for recolonisation and subsequently at day 33 with C3-cellulose ([delta]13C value of -23.4[per mille sign]). In this soil, all organic matter is in the microbial biomass or in freshly formed residues, which makes it possible to analyse more clearly the role of microbial residues for decomposition of N-poor substrates. The average [delta]13C value over the whole incubation period was -10.7[per mille sign] in soil total C in the treatments without C3-cellulose addition. In the CO2 evolved, the [delta]13C values decreased from -13.4[per mille sign] to -15.4[per mille sign] during incubation. In the microbial biomass, the [delta]13C values increased from -11.5[per mille sign] to -10.1[per mille sign] at days 33 and 38. At day 67, 36% of the C4-sucrose was left in the treatment without a second amendment. The addition of C3-cellulose resulted in a further 7% decrease, but 4% of the C3-cellulose was lost during the second incubation period. Total microbial biomass C declined from 200 [mu]g g-1 soil at day 5 to 70 [mu]g g-1 soil at day 67. Fungal ergosterol increased to 1.5 [mu]g g-1 soil at day 12 and declined more or less linearly to 0.4 [mu]g g-1 soil at day 67. Bacterial muramic acid declined from a maximum of 35 [mu]g g-1 soil at day 5 to a constant level of around 16 [mu]g g-1 soil. Glucosamine showed a peak value at day 12. Galactosamine remained constant throughout the incubation. The fungal C/bacterial C ratio increased more or less linearly from 0.38 at day 5 to 1.1 at day 67 indicating a shift in the microbial community from bacteria to fungi during the incubation. The addition of C3-cellulose led to a small increase in C3-derived microbial biomass C, but to a strong increase in C4-derived microbial biomass C. At days 45 and 67, the addition of N-free C3-cellulose

significantly decreased the C/N ratio of the microbial residues, suggesting that this fraction did not serve as an N-source, but as an energy source.

Keywords: C4-sucrose; Decomposition; Microbial biomass; Microbial residues; Muramic acid; Glucosamine

A.L.M. Oliveira, M. Stoffels, M. Schmid, V.M. Reis, J.I. Baldani, A. Hartmann, Colonization of sugarcane plantlets by mixed inoculations with diazotrophic bacteria, ***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 106-113, ISSN 1164-5563, DOI: 10.1016/j.ejsobi.2008.09.004.
(http://www.sciencedirect.com/science/article/pii/S1164556308001076)

Abstract:

Micropropagated sugarcane plants have been used in Brazil for almost three decades. Besides the improvement in plant health, micropropagated sugarcane carries no endophytic plant growth-promoting bacteria. The Brazilian inoculation technology to reintroduce diazotrophic bacteria in micropropagated sugarcane plantlets revealed a synergistic-like effect in PGP-bacteria mixed inoculations. The infection model of single diazotrophic bacteria species in sugarcane was studied in detail, but still many questions remain open. In this study we used a combined fluorescence in situ hybridization (FISH) and a cultivation based approach (MPN) to evaluate the colonization of sugarcane plantlets by mixed inocula. The highest colonization for three out of the five species studied was obtained with a mixed inoculum, when the Azospirillum amazonense showed an increase by almost 100 times in colonization and Herbaspirillum spp. and Burkholderia tropica was determined at 107 cells per gram root fresh weight. All of the inoculated bacterial species could be detected using the FISH probes 12 h after bacterial inoculation. The FISH results confirmed the MPN counts and showed differences in the population numbers and colonization behavior of particular bacterial inoculum strains in the different mixed inocula. A putative antagonistic effect among the inoculated H. seropedicae and H. rubrisubalbicans strains was observed using FISH, as well as the better competitiveness of B. tropica as compared to the A. amazonense strain. The observed data probably reflect also specific interactions with the sugarcane variety used in this particular inoculation system, and may not be generalized as a rule. This is the first study about the competition for sugarcane colonization in a mixed bacterial inoculum.

Keywords: Fluorescent in situ hybridization; Plant growth-promoting bacteria; Sugarcane inoculation

FOOD PROCESSING AND PRESERVATION (10 jdl)

Gillian Eggleston, William Harper, Determination of sugarcane deterioration at the factory: Development of a rapid, easy and inexpensive enzymatic method to measure mannitol,
Food Chemistry, Volume 98, Issue 2, 2006, Pages 366-372, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2005.07.031.
(http://www.sciencedirect.com/science/article/pii/S0308814605006138)

Abstract:

Mannitol, formed mainly by Leuconostoc mesenteroides bacteria, is a very sensitive indicator of sugarcane deterioration that directly affects processing and can predict problems from dextran and levan polysaccharides. An enzymatic method has been developed to measure mannitol in juice pressed from consignments of sugarcane delivered to the factory. This screening tool will allow factory staff to rapidly know which consignments of cane will affect processing negatively or reject consignments that will cause unacceptable processing problems. Mannitol is directly measured on a spectrophotometer using mannitol dehydrogenase as the enzyme catalyst. The stability of the reagents, limited cane juice preparation and linearity are described. This method is accurate, comparing favorably with an ion chromatography method, and can be easily performed using existing equipment in sugarcane factories. The coefficient of variation (CV) for cane juices ranged from 1.73% to 5.13% with the highest CVs occurring for low mannitol concentrations in undeteriorated cane. Mannitol can be measured after ~7 min at room temperature and within 4 min if a 40 [degree sign]C waterbath is used. The method is highly specific for mannitol and was not affected by the presence of sucrose, glucose, fructose, or dextran. The current cost is only ~60 US cents per analysis. Further studies on the viability of the method at the factory, and as a screening tool for breeding programs for cane freeze tolerance, are being undertaken.

Keywords: Mannitol enzymatic method; Mannitol dehydrogenase; Sugarcane deterioration

R. Sreenivas Rao, Ch. Pavana Jyothi, R.S. Prakasham, P.N. Sarma, L. Venkateswar Rao, Xylitol production from corn fiber and sugarcane bagasse hydrolysates by Candida tropicalis,
Bioresource Technology, Volume 97, Issue 15, October 2006, Pages 1974-1978, ISSN 0960-8524, DOI: 10.1016/j.biortech.2005.08.015.
(http://www.sciencedirect.com/science/article/pii/S0960852405004037)

Abstract:

A natural isolate, Candida tropicalis was tested for xylitol production from corn fiber and sugarcane bagasse hydrolysates. Fermentation of corn fiber and sugarcane bagasse hydrolysate showed xylose uptake and xylitol production, though these were very low, even after hydrolysate neutralization and treatments with activated charcoal and ion exchange resins. Initial xylitol production was found to be 0.43 g/g and 0.45

g/g of xylose utilised with corn fiber and sugarcane bagasse hydrolysate respectively. One of the critical factors for low xylitol production was the presence of inhibitors in these hydrolysates. To simulate influence of hemicellulosic sugar composition on xylitol yield, three different combinations of mixed sugar control experiments, without the presence of any inhibitors, have been performed and the strain produced 0.63 g/g, 0.68 g/g and 0.72 g/g of xylose respectively. To improve yeast growth and xylitol production with these hydrolysates, which contain inhibitors, the cells were adapted by sub culturing in the hydrolysate containing medium for 25 cycles. After adaptation the organism produced more xylitol 0.58 g/g and 0.65 g/g of xylose with corn fiber hydrolysate and sugarcane bagasse hydrolysate respectively.

Keywords: Corn fiber; Sugarcane bagasse; Xylitol; Candida tropicalis; Hemicellulose; Adaptation

Linchun Mao, Fei Que, Guoze Wang, Sugar metabolism and involvement of enzymes in sugarcane (Saccharum officinarum L.) stems during storage,

Food Chemistry, Volume 98, Issue 2, 2006, Pages 338-342, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2005.05.076.
(http://www.sciencedirect.com/science/article/pii/S0308814605005170)

Abstract:

Sugarcane (Saccharum officinarum L. cv. Badila) was harvested at the mature stage and stored at 2, 10, and 20 [degree sign]C for 30, 90, and 120 days, respectively. Metabolic changes in the contents of sucrose and reducing sugar in relation to the activities of soluble acid invertase (SAI), neutral invertase (NI) and sucrose-phosphate synthase (SPS), in sugarcane juice, were studied. Extractable juice, sucrose and vitamin C declined significantly with increasing storage temperatures, while respiration rate increased. There was a rapid increase in titratable acidity during storage, with a more rapid rate at higher temperatures. A sharp increase in reducing sugar was observed within 20 days at 20 [degree sign]C and 70 days at 10 [degree sign]C, followed by a rapid decrease. Both SAI and NI activities showed a sharp increase within 15 days at 20 [degree sign]C, followed by a rapid decrease, while a moderate increase occurred within 40-60 days at 10 [degree sign]C. Slight increases were observed in SPS activity within 20 days at 20 [degree sign]C and 50 days at 10 [degree sign]C. Enzyme activities remained steady or underwent a small change in canes stored at 2 [degree sign]C. Enzyme activities were significantly correlated with reducing sugar content.

Keywords: Saccharum officinarum; Sucrose; Soluble acid invertase; Neutral invertase; Sucrose-phosphate synthase

Eliane Dalva Godoy Danesi, Angelo Samir Melim Miguel, Carlota de Oliveira Rangel-Yagui, Joao Carlos Monteiro de Carvalho, Adalberto Pessoa Jr., Effect of carbon:nitrogen ratio (C:N) and substrate source on glucose-6-phosphate dehydrogenase (G6PDH) production by recombinant Saccharomyces cerevisiae, ***Journal of Food Engineering***, Volume 75, Issue 1, July 2006, Pages 96-103, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2005.03.054.
(http://www.sciencedirect.com/science/article/pii/S0260877405002190)

Abstract:

The use of lower cost components for the cultivation of a recombinant strain of Saccharomyces cerevisiae overexpressing G6PDH, recently obtained, was investigated. The utilization of yeast extract as nitrogen source and sugar cane blackstrap molasses or glucose as carbon sources was studied for G6PDH production, under three different C:N ratios: 7, 10, and 14. The results for cell concentration, enzymatic activity and total reducing sugar concentration, evaluated throughout the cultivations, demonstrated that the use of sugarcane blackstrap molasses and yeast extract, at a C:N ratio of 10, provided the highest G6PDH activity (Pmax = 5180 U/L), with a three-fold increase in comparison to the original culture medium.

Keywords: Glucose-6-phosphate dehydrogenase; Saccharomyces cerevisiae W303-181; C:N ratio; Sugarcane blackstrap molasses; Yeast extract

Lin Chun Mao, Yong Quan Xu, Fei Que, Maintaining the quality of sugarcane juice with blanching and ascorbic acid,
Food Chemistry, Volume 104, Issue 2, 2007, Pages 740-745, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2006.09.055.
(http://www.sciencedirect.com/science/article/pii/S030881460600999X)

Abstract:

The physicochemical changes in fresh sugarcane juice stored at 10 [degree sign]C were studied by determining juice yield, color, reducing sugar, titratable acidity, viscosity, pH, polyphenol oxidase (PPO), sucrose neutral invertase (SNI) and total microbial count. Results showed that blanching of stems before squeezing effectively prevented degreening and/or browning, and reduced activities of PPO and SNI in fresh sugarcane juice. Added ascorbic acid delayed the increase of reducing sugar, titratable acidity, viscosity and total microbial count, and also prevented degreening and/or browning with reduced PPO and SNI activities in fresh sugarcane juice during storage. Addition of 0.1% ascorbic acid seemed to be more effective than blanching of sugarcane stems, and was able to maintain the quality of fresh sugarcane juice for up to 5 days at 10 [degree sign]C. Deterioration of fresh sugarcane juice was demonstrated as a rapid increase of titratable acidity and viscosity with a obvious browning.

Keywords: Sugarcane; Juice; Blanching; Ascorbic acid

Gillian Eggleston, Jacob Karr, Anthony Parris, Benjamin Legendre, Viability of an enzymatic mannitol method to predict sugarcane deterioration at factories,
Food Chemistry, Volume 111, Issue 2, 15 November 2008, Pages 476-482, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.03.088.
(http://www.sciencedirect.com/science/article/pii/S0308814608004044)
Abstract:

The delivery of consignments of deteriorated sugarcane to factories can detrimentally affect multiple process units, and even lead to a factory shut-down. An enzymatic factory method was used to measure mannitol, a major degradation product of sugarcane Leuconostoc deterioration in the US, in press (consignment) and crusher juices collected across the 2004 processing season at a Louisiana factory. Weather conditions varied markedly across the season causing periods of the delivery of deteriorated sugarcane to the factory. A strong polynomial relationship existed between mannitol and haze dextran (R2 = 0.912) in press and crusher juices. Mannitol concentrations were usually higher than haze and monoclonal antibody dextran concentrations, which indicates: (i) the usefulness and higher sensitivity of mannitol to better predict sugarcane deterioration from Leuconostoc and other bacteria than dextran, and (ii) the underestimation by sugar industry personnel of the relatively large amounts of mannitol present in deteriorated sugarcane that can affect processing. Greater than ~2500 ppm/%Brix mannitol in juice predicts downstream processing problems. The enzymatic method is quantitative and could be used in a sugarcane payment formula. Approximately >300 ppm/%Brix haze dextran in raw sugar indicated that the majority of the crystals were elongated. Approximately >600 ppm/%Brix antibody dextran indicated when elongated crystals were predominant in the raw sugar. The enzymatic mannitol method underestimates mannitol in raw sugars.
Keywords: Mannitol enzymatic method; Sugarcane deterioration; Sugarcane consignments; Leuconostoc; Factory juices; Bacterial infections; Raw sugar

Amit Sharma, V. Vivekanand, Rajesh P. Singh, Solid-state fermentation for gluconic acid production from sugarcane molasses by Aspergillus niger ARNU-4 employing tea waste as the novel solid support,
Bioresource Technology, Volume 99, Issue 9, June 2008, Pages 3444-3450, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.08.006.
(http://www.sciencedirect.com/science/article/pii/S0960852407006293)
Abstract:

Solid-state fermentation (SSF) was evaluated to produce gluconic acid by metal resistant Aspergillus niger (ARNU-4) strain using tea waste as solid support and with molasses based fermentation medium. Various crucial parameters such as moisture content, temperature, aeration and inoculum size were derived; 70% moisture level, 30 [degree sign]C temperature, 3% inoculum size and an aeration volume of 2.5 l min-1 was suited for maximal (76.3 g l-1) gluconic acid production. Non-clarified molasses based fermentation media was utilized by strain ARNU-4 and maximum gluconic acid production was observed following 8-12 days of fermentation cycle. Different

concentrations of additives viz. oil cake, soya oil, jaggary, yeast extract, cheese whey and mustard oil were supplemented for further enhancement of the production ability of microorganism. Addition of yeast extract (0.5%) was observed inducive for enhanced (82.2 g l-1) gluconic acid production.

Keywords: Solid-state fermentation; Gluconic acid; Sugarcane molasses; Tea waste

Ram Chandra, Ram Naresh Bharagava, Vibhuti Rai, Melanoidins as major colourant in sugarcane molasses based distillery effluent and its degradation,

Bioresource Technology, Volume 99, Issue 11, Exploring Horizons in Biotechnology: A Global Venture, July 2008, Pages 4648-4660, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.09.057.
(http://www.sciencedirect.com/science/article/pii/S0960852407008024)

Abstract:

Melanoidins are natural condensation products of sugar and amino acids produced by non-enzymatic Maillard amino-carbonyl reaction taking place between the amino and carbonyl groups in organic substances. Melanoidins extensively exist in food products, drinks and wastewaters released from distilleries and fermentation industries. Melanoidins are very important from the nutritional, physiological and environmental aspects and due to their structural complexity, dark colour and offensive odor, these pose serious threat to soil and aquatic ecosystem that release of melanoidins cause increased load of recalcitrant organic material to natural water bodies. This then causes the problems, like reduction of sunlight penetration, decreased photosynthetic activity and dissolved oxygen concentration whereas on land, it causes reduction in soil alkalinity and inhibition of seed germination. Further, due to the possibility of complexation reactions of introduced melanoidins with metal ions, they could influence the biogeochemical cycle of many constituents in natural waters. This review presents an overview to dramatic progress to understand the synthesis, chemical structure and degradation pathway of melanoidins as well as microbial strategies for the degradation and decolourisation of melanoidins.

Keywords: Melanoidins; Sugar cane molasses; Degradation; Chemical; Microorganism

Gillian Eggleston, Jacob Karr, Anthony Parris, Benjamin Legendre, Viability of an enzymatic mannitol method to predict sugarcane deterioration at factories,

Food Chemistry, Volume 111, Issue 2, 15 November 2008, Pages 476-482, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2008.03.088.
(http://www.sciencedirect.com/science/article/pii/S0308814608004044)

Abstract:

The delivery of consignments of deteriorated sugarcane to factories can detrimentally affect multiple process units, and even lead to a factory shut-down. An enzymatic factory method was used to measure mannitol, a major degradation product

of sugarcane Leuconostoc deterioration in the US, in press (consignment) and crusher juices collected across the 2004 processing season at a Louisiana factory. Weather conditions varied markedly across the season causing periods of the delivery of deteriorated sugarcane to the factory. A strong polynomial relationship existed between mannitol and haze dextran (R2 = 0.912) in press and crusher juices. Mannitol concentrations were usually higher than haze and monoclonal antibody dextran concentrations, which indicates: (i) the usefulness and higher sensitivity of mannitol to better predict sugarcane deterioration from Leuconostoc and other bacteria than dextran, and (ii) the underestimation by sugar industry personnel of the relatively large amounts of mannitol present in deteriorated sugarcane that can affect processing. Greater than ~2500 ppm/%Brix mannitol in juice predicts downstream processing problems. The enzymatic method is quantitative and could be used in a sugarcane payment formula. Approximately >300 ppm/%Brix haze dextran in raw sugar indicated that the majority of the crystals were elongated. Approximately >600 ppm/%Brix antibody dextran indicated when elongated crystals were predominant in the raw sugar. The enzymatic mannitol method underestimates mannitol in raw sugars.

Keywords: Mannitol enzymatic method; Sugarcane deterioration; Sugarcane consignments; Leuconostoc; Factory juices; Bacterial infections; Raw sugar

U.S. Kadam, S.B. Ghosh, Strayo De, P. Suprasanna, T.P.A. Devasagayam, V.A. Bapat, Antioxidant activity in sugarcane juice and its protective role against radiation induced DNA damage,
Food Chemistry, Volume 106, Issue 3, 1 February 2008, Pages 1154-1160, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2007.07.066.
(http://www.sciencedirect.com/science/article/pii/S0308814607007479)

Abstract:

Sugarcane (Saccharum officinarum L.) juice is widely consumed by people of the tropics and subtropics. It has been used to cure jaundice and liver-related disorders in Indian systems of medicine. Its possible mechanism of action was examined in terms of antioxidant availability. The assays involved different levels of antioxidant action such as oxygen radical absorbance capacity (ORAC), radical scavenging abilities using 1,1-diphenyl-2-picryl hydrazyl (DPPH); 2,2'-azobis-3-ethyl benzthiazoline-6-sulfonic acid (ABTS); ferric reducing antioxidant power (FRAP); and protection of membranes examined by inhibition of lipid peroxidation. In addition, the content of phenols and total flavonoids were measured. The aqueous extracts of three varieties of sugarcane were studied. These varieties showed good antioxidant properties and were also able to protect against radiation induced DNA damage in pBR322 plasmid DNA and Escherishia coli cultures. In conclusion, the study reveals that the ability of sugarcane juice to scavenge free radicals, reduce iron complex and inhibit lipid peroxidation, may explain possible mechanisms by which sugarcane juice exhibits its beneficial effects in relation to its reported health benefits.

Keywords: Sugarcane (Saccharum officinarum L.); Juice; Antioxidant activity; Radioprotection; Plasmid DNA damage

FOOD COMPOSITION (3 jdl)

Maristela de Araujo Vicente, Luciano Gomes Fietto, Ieso de Miranda Castro, Ana Nery Goncalves dos Santos, Mauricio Xavier Coutrim, Rogelio Lopes Brandao, Isolation of Saccharomyces cerevisiae strains producing higher levels of flavoring compounds for production of 'cachaca' the Brazilian sugarcane spirit,
International Journal of Food Microbiology, Volume 108, Issue 1, 15 April 2006, Pages 51-59, ISSN 0168-1605, DOI: 10.1016/j.ijfoodmicro.2005.10.018.
(http://www.sciencedirect.com/science/article/pii/S0168160505005799)
Abstract:
In Brazil, spontaneous fermentation and open vessels are still used to produce cachaca (the Brazilian sugarcane spirit) and this fermentation is characterized by mixed cultures with continuous succession of yeast species. This work shows the development of a methodology for isolation of yeasts, particularly Saccharomyces cerevisiae, used in the production of cachaca. According to the proposed strategy, the strains were selected for their ability to adapt to stress conditions encountered during fermentation of the sugarcane juice such as high sucrose concentration; high temperatures and high alcohol concentration; for their capacity to flocculate; and for their higher fermentative ability. For strains with such characteristics, specific procedures were employed to select for 5,5,5-trifluoro-dl-leucine (TFL) and cerulenin-resistant strains, since these characteristics are related to a higher capacity of production of the flavoring compounds isoamyl alcohol and caproic acid, respectively. The effectiveness of such a selection strategy was documented. Taken together, the results obtained present the development of a new strategy to isolate yeast strains with appropriated characteristics to be used in the cachaca industry. Moreover, the results obtained offer an explanation for the great variability in terms of chemical composition found in products obtained even in a single distillery.
Keywords: Sugar-cane spirit; Saccharomyces cerevisiae; Flavoring compounds

R. Gamez, M. Noa, R. Mas, N. Mendoza, B. Pardo, R. Menendez, Y. Perez, R.M. Gonzalez, A. Gutierrez, G. Marrero, E. Goicochea, H. Garcia, D. Curveco, Long-term carcinogenicity of D-003, a mixture of high molecular weight acids from sugarcane wax, in Sprague Dawley rats: A 24 months study,
Food and Chemical Toxicology, Volume 45, Issue 12, December 2007, Pages 2352-2358, ISSN 0278-6915, DOI: 10.1016/j.fct.2007.05.018.
(http://www.sciencedirect.com/science/article/pii/S0278691507001810)

Abstract:

D-003 is a mixture of high molecular weight sugarcane wax aliphatic primary acids with cholesterol-lowering, anti-platelet and antioxidant effects. This study investigated the long-term oral toxicity and carcinogenicity of D-003 in Sprague Dawley rats of both sexes, randomly distributed into four groups: a control group, treated only with the vehicle, and three treated with D-003 (50, 500 and 1500 mg/kg). All treatments were given orally for 24 months. Mortality (survival analysis), clinical symptoms, weight gain, food consumption, organ weights, time-to-tumour or tumour incidence data were not shown between group differences or trends. With the exception of serum cholesterol levels, lower in D-003-treated groups (500 and 1500 mg/kg) than in the controls, no other difference in blood indicators was found. D-003 did not increase the frequency of neoplastic and non-neoplastic lesions compared with the controls. The occurrence of all malignant and mammary tumours in D-003-treated females was lower than in the controls. The lesions observed were consistent with spontaneous lesions reported in this species. In conclusion, D-003 is not toxic or carcinogenic when given orally to Sprague Dawley rats up to 1500 mg/kg for 2 years, and 1500 mg/kg was a not-observable effect dose.

Keywords: D-003; Sugar cane wax acids; Higher aliphatic primary acids; Long-term carcinogenicity; Chronic toxicity

U.S. Kadam, S.B. Ghosh, Strayo De, P. Suprasanna, T.P.A. Devasagayam, V.A. Bapat, Antioxidant activity in sugarcane juice and its protective role against radiation induced DNA damage,

Food Chemistry, Volume 106, Issue 3, 1 February 2008, Pages 1154-1160, ISSN 0308-8146, DOI: 10.1016/j.foodchem.2007.07.066.

(http://www.sciencedirect.com/science/article/pii/S0308814607007479)

Abstract:

Sugarcane (Saccharum officinarum L.) juice is widely consumed by people of the tropics and subtropics. It has been used to cure jaundice and liver-related disorders in Indian systems of medicine. Its possible mechanism of action was examined in terms of antioxidant availability. The assays involved different levels of antioxidant action such as oxygen radical absorbance capacity (ORAC), radical scavenging abilities using 1,1-diphenyl-2-picryl hydrazyl (DPPH); 2,2'-azobis-3-ethyl benzthiazoline-6-sulfonic acid (ABTS); ferric reducing antioxidant power (FRAP); and protection of membranes examined by inhibition of lipid peroxidation. In addition, the content of phenols and total flavonoids were measured. The aqueous extracts of three varieties of sugarcane were studied. These varieties showed good antioxidant properties and were also able to protect against radiation induced DNA damage in pBR322 plasmid DNA and Escherishia coli cultures. In conclusion, the study reveals that the ability of sugarcane juice to scavenge free radicals, reduce iron complex and inhibit lipid peroxidation, may explain possible mechanisms by which sugarcane juice exhibits its beneficial effects in relation to its reported health benefits.

Keywords: Sugarcane (Saccharum officinarum L.); Juice; Antioxidant activity; Radioprotection; Plasmid DNA damage

PROCESSING OF AGRICULTURAL WASTES (28 jdl)

J.L. Ren, R.C. Sun, C.F. Liu, L. Lin, B.H. He, Synthesis and characterization of novel cationic SCB hemicelluloses with a low degree of substitution,
Carbohydrate Polymers, Volume 67, Issue 3, 1 February 2007, Pages 347-357, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2006.06.002.
(http://www.sciencedirect.com/science/article/pii/S0144861706002803)
Abstract:

Novel cationic hemicelluloses from sugarcane bagasse were synthesized by quaternization with 3-chloro-2-hydroxypropyltrimethylammonium chloride (CHMAC) using sodium hydroxide as a catalyst in aqueous ethanol solution. The parameters including the molar ratio of NaOH/CHMAC (0.8-2.0), the molar ratio of CHMAC to anhydroxylose units in hemicelluloses (0.5-3.0), reaction time (0.5-2.5 h), and reaction temperature (50-80 [degree sign]C) were optimized and the extent of quaternization was measured by yield and degree of substitution (DS). A CHMAC/hemicellulose molar ratio of 1.0 and a NaOH/CHMAC molar ratio of 1.2 were found to be an optimum condition for the reaction to proceed smoothly and to yield a product with an expected DS. The structure of the cationic hemicellulosic derivative was characterized by gel permeation chromatography (GPC), Fourier transform infrared (FT-IR), and 13C nuclear magnetic resonance (NMR) spectroscopy as well as thermal analysis. It was found that the thermal stability and weight-average molecular weight of modified hemicelluloses decreased after chemical modification.
Keywords: Sugarcane bagasse; Hemicelluloses; Quaternization; FT-IR; 13C NMR

Shiyi Ou, Yanlin Luo, Feng Xue, Caihuan Huang, Ning Zhang, Zili Liu, Seperation and purification of ferulic acid in alkaline-hydrolysate from sugarcane bagasse by activated charcoal adsorption/anion macroporous resin exchange chromatography,
Journal of Food Engineering, Volume 78, Issue 4, February 2007, Pages 1298-1304, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2005.12.037.
(http://www.sciencedirect.com/science/article/pii/S0260877406000458)
Abstract:

Sugarcane bagasse is a large by-product discarded in sugarcane processing factories. In this research, sugarcane bagasse was used to prepare highly valued trans-ferulic acid by alkaline-hydrolysis and purification through combination of activated charcoal adsorption and anion macroporous resin exchange chromatography. The results showed that powdered activated charcoal had much higher adsorption capacity for ferulic acid than that of granular activated charcoal and adsorbed ferulic acid at very low concentration; the adsorbed ferulic acid could be totally washed out by 0.2 mol/l NaOH but only a small part by ethanol or acetic ether. These properties made it possible to remove other substances produced by alkaline-hydrolysis through washing out using hot water and acetic ether before desorbing ferulic acid from active charcoal by NaOH. High purity of ferulic acid was obtained by

further treatment of anion macroporous resin exchange chromatography after its washout from the activated charcoal.

Keywords: Bagasse; Ferulic acid; Purification; Activated charcoal; Anion macroporous resin exchange chromatography

Daniella Regina Mulinari, Maria Lucia C.P. da Silva, Adsorption of sulphate ions by modification of sugarcane bagasse cellulose,

Carbohydrate Polymers, Volume 74, Issue 3, 4 November 2008, Pages 617-620, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.04.014.
(http://www.sciencedirect.com/science/article/pii/S0144861708001896)

Abstract:

This work describes the preparation of sugarcane bagasse cellulose with zirconium oxychloride for adsorption of sulphate ions in aqueous solution. The materials were prepared by using an ammonium solution as precipitating agent. The obtained materials were characterized by thermogravimetry, scanning electron microscopy and surface area measurements. Sulphate ion was adsorbed on the Cell/ZrO2[middle dot]nH2O by immersing this solid in an aqueous solution of sulphate sodion. The analyses to determine the concentration after the adsorption were made using UV-vis spectrum, in a wavelength of 420 nm. The results were satisfactory showing that the Cell/ZrO2[middle dot]nH2O materials obtained presented good adsorption capacity. The adsorption capacity was 0.4 mol g-1 for both materials.

Keywords: Modified sugarcane bagasse; Adsorption; Cellulose/hydrous zirconium oxide

Gobinath Rajagopalan, Chandraraj Krishnan, [alpha]-Amylase production from catabolite derepressed Bacillus subtilis KCC103 utilizing sugarcane bagasse hydrolysate,

Bioresource Technology, Volume 99, Issue 8, May 2008, Pages 3044-3050, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.06.001.
(http://www.sciencedirect.com/science/article/pii/S0960852407004798)

Abstract:

A catabolite derepressed Bacillus subtilis strain KCC103 was used to produce [alpha]-amylase in medium containing sugarcane bagasse hydrolysate (SBH). Addition of SBH (1% reducing sugar (w/v)) to the nutrient medium supported maximum [alpha]-amylase production of 67.4 U ml-1. HPLC analysis of SBH showed the presence of glucose, xylose and arabinose in the ratio of 0.9:1.0:0.16 (w/w/w). In SBH-medium glucose and xylose were consumed completely while arabinose remained unutilized. Uptake rate of glucose was 2-folds higher than xylose but rate of [alpha]-amylase production with xylose was 1.5-folds higher than glucose. Arabinose had no effect on growth and [alpha]-amylase synthesis. Further, [alpha]-amylase production in SBH-medium was enhanced to 144.5 U ml-1 (2.2-fold) by response surface methodology where the levels of SBH, and other media components were varied. The modified

medium consisted of (in g l-1) SBH: 24; peptone: 17.43; yeast extract: 1.32 and beef extract: 1.82. High level of SBH showed no significant inhibition of [alpha]-amylase synthesis. The derepressed strain KCC103 is useful to produce [alpha]-amylase economically in short time (30-36 h).

Keywords: [alpha]-Amylase; Bacillus subtilis; Sugarcane bagasse hydrolysate; Catabolite repression; Response surface methodology

Diego T. Santos, Boutros F. Sarrouh, Juan D. Rivaldi, Attilio Converti, Silvio S. Silva, Use of sugarcane bagasse as biomaterial for cell immobilization for xylitol production, ***Journal of Food Engineering***, Volume 86, Issue 4, June 2008, Pages 542-548, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2007.11.004.
(http://www.sciencedirect.com/science/article/pii/S0260877407005687)

Abstract:

This study provides a preliminary contribution to the development of a bioprocess for the continuous production of xylitol from hemicellulosic hydrolyzate utilizing Candida guilliermondii cells immobilized onto natural sugarcane bagasse fibers. To this purpose, cells of this yeast were submitted to batch tests of 'in situ' adsorption onto crushed and powdered sugarcane bagasse after treatment with 0.5 M NaOH. The results obtained on a xylose-based semi-synthetic medium were evaluated in terms of immobilization efficiency, cell retention and specific growth rates of suspended, immobilized and total cells. The first two parameters were shown to increase along the immobilization process, reached maximum values of 50.5% and 0.31 g immobilized cells/g bagasse after 21 h and then sharply decreased. The specific growth rate of suspended cells continuously increased during the immobilization tests, while that of the immobilized ones, after an initial growth, exhibited decreasing values. Under the conditions selected for cell immobilization, fermentation also took place with promising results. The yields of xylitol and biomass on consumed xylose were 0.65 and 0.18 g/g, respectively, xylitol and biomass productivities 0.66 and 0.13 g L-1 h-1, and the efficiency of xylose-to-xylitol bioconversion was 70.8%.

Keywords: Sugarcane bagasse fibers; Biomaterial; Cell immobilization; Bioconversion; Xylitol production

Leandro Vinicius Alves Gurgel, Rossimiriam Pereira de Freitas, Laurent Frederic Gil, Adsorption of Cu(II), Cd(II), and Pb(II) from aqueous single metal solutions by sugarcane bagasse and mercerized sugarcane bagasse chemically modified with succinic anhydride,
Carbohydrate Polymers, Volume 74, Issue 4, 21 November 2008, Pages 922-929, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.05.023.
(http://www.sciencedirect.com/science/article/pii/S0144861708002555)

Abstract:

This work describes the preparation of new chelating material from mercerized sugarcane bagasse. The first part treats the chemical modification of non-mercerized sugarcane bagasse (SCB) and twice-mercerized sugarcane bagasse (MMSCB) with succinic anhydride. Mass percent gains (mpg) and degrees of succinylation (DS) of succinylated non- and twice-mercerized sugarcane bagasse 1 (SCB 1 and MMSCB 1) were calculated. MMSCB 1 exhibited an increase in mpg and DS of 49.2% and 0.9 mmol/g in relation to SCB 1. SCB 2 and MMSCB 2 were obtained by treatment of MMSCB 1 and SCB 1 with bicarbonate solution to release the carboxylate functions and characterized by FTIR. The second part evaluates and compares the adsorption capacity of SCB 2 and MMSCB 2 for Cu2+, Cd2+ and Pb2+ ions in an aqueous single metal solution. Adsorption isotherms were developed using Langmuir model. MMSCB 2 exhibited an increase in Qmax for Cd2+ (43.6 mg/g) and Pb2+ (83.3 mg/g) in relation to SCB 2.

Keywords: Mercerization; Modified sugarcane bagasse; Succinylation; Adsorption; Heavy metals

P.C. Abhilash, Nandita Singh, Influence of the application of sugarcane bagasse on lindane ([gamma]-HCH) mobility through soil column: Implication for biotreatment, ***Bioresource Technology***, Volume 99, Issue 18, December 2008, Pages 8961-8966, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.05.006.
(http://www.sciencedirect.com/science/article/pii/S0960852408004227)

Abstract:

In the present study we employed sugarcane bagasse for biotreatment of soil containing 50 mg kg-1 of lindane. Garden soil were treated with lindane and amended with varying concentrations of sugarcane bagasse (10%, 20%, 30%, 40% and 50%; w/w). Data on dissipation and degradation of lindane in soil columns (0-15, 15-30 cm) were studied at six consecutive samplings (0, 3, 7, 45 and 60 days). Treatment with 50% sugarcane bagasse resulted in >53% degradation of lindane in upper soil column with minimal leaching to lower soil column (0.002%) while highest leaching of lindane from upper soil column to lower soil column was occurred in garden soil (35.8%). Similarly, a substantial microbial biomass input has detected in amended soil than garden soil. Our results provide evidence that sugarcane bagasse can accelerate lindane degradation by enhanced microbial activity and prevent pesticide mobility through soil column by adsorption. Sugarcane bagasse could be useful as cheaper, easy available alternative for the biotreatment of lindane impacted soil.

Keywords: Lindane; Sugarcane bagasse; Soil column; Dissipation; Biotreatment

C.F. Liu, R.C. Sun, M.H. Qin, A.P. Zhang, J.L. Ren, J. Ye, W. Luo, Z.N. Cao, Succinoylation of sugarcane bagasse under ultrasound irradiation,
Bioresource Technology, Volume 99, Issue 5, March 2008, Pages 1465-1473, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.01.062.
(http://www.sciencedirect.com/science/article/pii/S0960852407001964)

Abstract:

The chemical modification of sugarcane bagasse with succinic anhydride using pyridine as solvent after ultrasound irradiation was studied. The optimized parameters included ultrasound irradiating time 0-50 min, reaction time 30-120 min, succinic anhydride concentration by the ratio of dried sugarcane bagasse to succinic anhydride from 1:0.25 to 1:1.50, and reaction temperature 75-115 [degree sign]C are required in the process. The extent of succinoylation was measured by the weight percent gain (WPG), which increased with increments of reaction time, succinic anhydride concentration, and reaction temperature. The ultrasound irradiation has a positive effect on bagasse succinoylation process. On the other hand, the ultrasonic pre-treatment application broke down the cell wall polymers, resulting in, therefore, a negative effect on the WPG. Evidences of succinoylation were also provided by FT-IR and CP MAS 13C NMR and the results showed that the succinoylation at C-2 and C-3 occurred. The thermal stability of the succinylated bagasse decreased upon chemical modification.

Keywords: Sugarcane bagasse; Succinic anhydride; Chemical modification; Succinoylation; Ultrasound irradiation

Kianoush Khosravi-Darani, Alaleh Zoghi, Comparison of pretreatment strategies of sugarcane baggase: Experimental design for citric acid production,
Bioresource Technology, Volume 99, Issue 15, October 2008, Pages 6986-6993, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.01.024.
(http://www.sciencedirect.com/science/article/pii/S0960852408000497)

Abstract:

Solid state fermentation was carried out to compare efficiency of acid, alkaline and urea pretreatment of sugarcane bagasse for production of citric acid using Aspergillus niger ATCC 9142. Plackett-Burman statistical design was used to evaluate significance of variables. Pretreatment of bagasse by urea was known as the most influential treatment to increase citric acid production (137.6 g/kg of dry sugarcane bagasse and citric acid yield of 96% based on sugar consumed). Finally, up scaling was achieved to a 20 L solid state fermentor in which humidity was constant in gas phase and urea-treated sugarcane bagasse. The produced acid concentration and yield in fermentor was 82.38 g/kg of dry substrate and 26.45 g/kg day, respectively.

Keywords: Solid state fermentation (SSF); Citric acid; Pretreatment; Sugarcane baggase; Plackett-Burman design (PBD)

Yoosup Park, W.O.S. Doherty, Peter J. Halley, Developing lignin-based resin coatings and composites,

Industrial Crops and Products, Volume 27, Issue 2, 7th Forum of the International Lignin Institute - "Bringing Lignin back to the Headlines", March 2008, Pages 163-167, ISSN 0926-6690, DOI: 10.1016/j.indcrop.2007.07.021.
(http://www.sciencedirect.com/science/article/pii/S0926669007001021)

Abstract:

Phenol in phenol formaldehyde (PF) resin has been partly substituted with lignin extracted from sugarcane bagasse. In order to optimize the lignin-based resin for applications in coating and composite materials, thermal and rheological tests were performed with different wt% of lignin substitution into PF resins. Differential scanning calorimetry scans showed a small exothermic peak and a large endothermic peak, typical of resins. The Tg of the resins was seen between 125 and 150 [degree sign]C and this transition was clearly evident when the lignin content was increased from 10 to 40 wt%. Increasing the lignin content in the PF resin increases the rate of cure and the heat of reaction. Water absorption tests show that the lignin-PF resin films are effective water-barrier coatings for cardboard substrates. It is speculated that the interaction between the substrate and the lignin-PF resin has resulted in a negative surface charge which would have contributed to the reduction in the contact angle.

Keywords: Coatings; Composites; Lignin; Resins; Sugarcane

Umesh K. Garg, M.P. Kaur, V.K. Garg, Dhiraj Sud, Removal of Nickel(II) from aqueous solution by adsorption on agricultural waste biomass using a response surface methodological approach,

Bioresource Technology, Volume 99, Issue 5, March 2008, Pages 1325-1331, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.02.011.
(http://www.sciencedirect.com/science/article/pii/S0960852407001460)

Abstract:

In the present study, effect of adsorbent dose, pH and agitation speed on nickel removal from aqueous medium using an agricultural waste biomass, Sugarcane bagasse has been investigated. Batch mode experiments were carried out to assess the adsorption equilibrium. The influence of three parameters on the removal of nickel was also examined using a response surface methodological approach. The central composite face-centered experimental design in response surface methodology (RSM) by Design Expert Version 6.0.10 (Stat Ease, USA) was used for designing the experiments as well as for full response surface estimation. The optimum conditions for maximum removal of nickel from an aqueous solution of 50 mg/L were as follows: adsorbent dose (1500 mg/L), pH (7.52) and stirring speed (150 rpm). This was evidenced by the higher value of coefficient of determination (r2 = 0.9873).

Keywords: Response surface methodology (RSM); Central composite face-centered design (CCFD); Sugarcane bagasse (SCB); Nickel (Ni); Adsorbent

Jian Yu, Heiko Stahl, Microbial utilization and biopolyester synthesis of bagasse hydrolysates,
Bioresource Technology, Volume 99, Issue 17, November 2008, Pages 8042-8048, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.03.071.
(http://www.sciencedirect.com/science/article/pii/S0960852408003088)
Abstract:
Cellulosic biomass is a potentially inexpensive renewable feedstock for the biorefineries of fuels, chemicals and materials. Sugarcane bagasse was pretreated in dilute acid solution under moderately severe conditions, releasing sugars and other hydrolysates including volatile organic acids, furfurals and acid soluble lignin. Utilization of the hydrolysates by an aerobic bacterium, Ralstonia eutropha, was investigated to determine if the organic inhibitors can be removed for potential recycling and reuse of the process water. Simultaneous biosynthesis of polyhydroxyalkanoates (PHAs) for the production of value-added bioplastics was also investigated. An inhibitory effect of hydrolysates on microbial activity was observed, but it could be effectively relieved by using (a) a large inoculum, (b) a diluted hydrolysate solution, and (c) a tolerant strain, or a combination of the three. The major organic inhibitors including formic acid, acetic acid, furfural and acid soluble lignin were effectively utilized and removed to low concentration levels (less than 100 ppm) while at the same time, PHA biopolyesters were synthesized and accumulated to 57 wt% of cell mass under appropriate C/N ratios. Poly(3-hydroxybutyrate) was the predominant biopolyester formed on the hydrolysates, but the cells could also synthesize co-polyesters that exhibit high ductility.
Keywords: Biomass; Hydrolysates; Biorefinery; Bioplastics; Polyhydroxyalkanoates

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/pii/S0961953408000846)
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

Deepanjan Bhattacharya, Louis T. Germinario, William T. Winter, Isolation, preparation and characterization of cellulose microfibers obtained from bagasse,
Carbohydrate Polymers, Volume 73, Issue 3, 1 August 2008, Pages 371-377, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2007.12.005.
(http://www.sciencedirect.com/science/article/pii/S014486170700608X)

Abstract:

Cellulose microfibers were isolated from bagasse in three distinct stages. Initially bagasse was subjected to a conventional pulping process to eliminate lignin and hemicellulose. Whole cellulosic fibers thus obtained were then mechanically separated into their constituent microfibrils (MFs) by a two-stage homogenization process and finally acid hydrolyzed. The dimensions of the resulting micro fibers were dependent on the hydrolysis conditions. Persistent discoloration indicated that cellulose obtained from bagasse, a sugarcane by-product, was far more resistant to hydrolysis than tunicate, bacterial, or even wood celluloses. Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) indicated that the transverse size of the particles varied between 200 nm to a few microns. Solid-state NMR was also used to study the morphological changes taking place in cellulose as a result of the hydrolysis. A future goal is to use these MFs as reinforcing elements in composites with biodegradable thermoplastic co-polyesters or other common engineering thermoplastics, and this will be discussed in a subsequent report.

Keywords: Bagasse; Cellulose microfibers; Hydrolysis

Daniella Regina Mulinari, Maria Lucia C.P. da Silva, Adsorption of sulphate ions by modification of sugarcane bagasse cellulose,
Carbohydrate Polymers, Volume 74, Issue 3, 4 November 2008, Pages 617-620, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.04.014.
(http://www.sciencedirect.com/science/article/pii/S0144861708001896)

Abstract:

This work describes the preparation of sugarcane bagasse cellulose with zirconium oxychloride for adsorption of sulphate ions in aqueous solution. The materials were prepared by using an ammonium solution as precipitating agent. The obtained materials were characterized by thermogravimetry, scanning electron microscopy and surface area measurements. Sulphate ion was adsorbed on the Cell/ZrO2[middle dot]nH2O by immersing this solid in an aqueous solution of sulphate

sodion. The analyses to determine the concentration after the adsorption were made using UV-vis spectrum, in a wavelength of 420 nm. The results were satisfactory showing that the Cell/ZrO2[middle dot]nH2O materials obtained presented good adsorption capacity. The adsorption capacity was 0.4 mol g-1 for both materials.

Keywords: Modified sugarcane bagasse; Adsorption; Cellulose/hydrous zirconium oxide

Gobinath Rajagopalan, Chandraraj Krishnan, [alpha]-Amylase production from catabolite derepressed Bacillus subtilis KCC103 utilizing sugarcane bagasse hydrolysate,

Bioresource Technology, Volume 99, Issue 8, May 2008, Pages 3044-3050, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.06.001.
(http://www.sciencedirect.com/science/article/pii/S0960852407004798)

Abstract:

A catabolite derepressed Bacillus subtilis strain KCC103 was used to produce [alpha]-amylase in medium containing sugarcane bagasse hydrolysate (SBH). Addition of SBH (1% reducing sugar (w/v)) to the nutrient medium supported maximum [alpha]-amylase production of 67.4 U ml-1. HPLC analysis of SBH showed the presence of glucose, xylose and arabinose in the ratio of 0.9:1.0:0.16 (w/w/w). In SBH-medium glucose and xylose were consumed completely while arabinose remained unutilized. Uptake rate of glucose was 2-folds higher than xylose but rate of [alpha]-amylase production with xylose was 1.5-folds higher than glucose. Arabinose had no effect on growth and [alpha]-amylase synthesis. Further, [alpha]-amylase production in SBH-medium was enhanced to 144.5 U ml-1 (2.2-fold) by response surface methodology where the levels of SBH, and other media components were varied. The modified medium consisted of (in g l-1) SBH: 24; peptone: 17.43; yeast extract: 1.32 and beef extract: 1.82. High level of SBH showed no significant inhibition of [alpha]-amylase synthesis. The derepressed strain KCC103 is useful to produce [alpha]-amylase economically in short time (30-36 h).

Keywords: [alpha]-Amylase; Bacillus subtilis; Sugarcane bagasse hydrolysate; Catabolite repression; Response surface methodology

Diego T. Santos, Boutros F. Sarrouh, Juan D. Rivaldi, Attilio Converti, Silvio S. Silva, Use of sugarcane bagasse as biomaterial for cell immobilization for xylitol production,

Journal of Food Engineering, Volume 86, Issue 4, June 2008, Pages 542-548, ISSN 0260-8774, DOI: 10.1016/j.jfoodeng.2007.11.004.
(http://www.sciencedirect.com/science/article/pii/S0260877407005687)

Abstract:

This study provides a preliminary contribution to the development of a bioprocess for the continuous production of xylitol from hemicellulosic hydrolyzate utilizing Candida guilliermondii cells immobilized onto natural sugarcane bagasse fibers. To this purpose, cells of this yeast were submitted to batch tests of 'in situ'

adsorption onto crushed and powdered sugarcane bagasse after treatment with 0.5 M NaOH. The results obtained on a xylose-based semi-synthetic medium were evaluated in terms of immobilization efficiency, cell retention and specific growth rates of suspended, immobilized and total cells. The first two parameters were shown to increase along the immobilization process, reached maximum values of 50.5% and 0.31 g immobilized cells/g bagasse after 21 h and then sharply decreased. The specific growth rate of suspended cells continuously increased during the immobilization tests, while that of the immobilized ones, after an initial growth, exhibited decreasing values. Under the conditions selected for cell immobilization, fermentation also took place with promising results. The yields of xylitol and biomass on consumed xylose were 0.65 and 0.18 g/g, respectively, xylitol and biomass productivities 0.66 and 0.13 g L-1 h-1, and the efficiency of xylose-to-xylitol bioconversion was 70.8%.

Keywords: Sugarcane bagasse fibers; Biomaterial; Cell immobilization; Bioconversion; Xylitol production

Leandro Vinicius Alves Gurgel, Rossimiriam Pereira de Freitas, Laurent Frederic Gil, Adsorption of Cu(II), Cd(II), and Pb(II) from aqueous single metal solutions by sugarcane bagasse and mercerized sugarcane bagasse chemically modified with succinic anhydride,

Carbohydrate Polymers, Volume 74, Issue 4, 21 November 2008, Pages 922-929, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.05.023.
(http://www.sciencedirect.com/science/article/pii/S0144861708002555)

Abstract:

This work describes the preparation of new chelating material from mercerized sugarcane bagasse. The first part treats the chemical modification of non-mercerized sugarcane bagasse (SCB) and twice-mercerized sugarcane bagasse (MMSCB) with succinic anhydride. Mass percent gains (mpg) and degrees of succinylation (DS) of succinylated non- and twice-mercerized sugarcane bagasse 1 (SCB 1 and MMSCB 1) were calculated. MMSCB 1 exhibited an increase in mpg and DS of 49.2% and 0.9 mmol/g in relation to SCB 1. SCB 2 and MMSCB 2 were obtained by treatment of MMSCB 1 and SCB 1 with bicarbonate solution to release the carboxylate functions and characterized by FTIR. The second part evaluates and compares the adsorption capacity of SCB 2 and MMSCB 2 for Cu2+, Cd2+ and Pb2+ ions in an aqueous single metal solution. Adsorption isotherms were developed using Langmuir model. MMSCB 2 exhibited an increase in Qmax for Cd2+ (43.6 mg/g) and Pb2+ (83.3 mg/g) in relation to SCB 2.

Keywords: Mercerization; Modified sugarcane bagasse; Succinylation; Adsorption; Heavy metals

P.C. Abhilash, Nandita Singh, Influence of the application of sugarcane bagasse on lindane ([gamma]-HCH) mobility through soil column: Implication for biotreatment, ***Bioresource Technology,*** Volume 99, Issue 18, December 2008, Pages 8961-8966, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.05.006.
(http://www.sciencedirect.com/science/article/pii/S0960852408004227)

Abstract:

In the present study we employed sugarcane bagasse for biotreatment of soil containing 50 mg kg-1 of lindane. Garden soil were treated with lindane and amended with varying concentrations of sugarcane bagasse (10%, 20%, 30%, 40% and 50%; w/w). Data on dissipation and degradation of lindane in soil columns (0-15, 15-30 cm) were studied at six consecutive samplings (0, 3, 7, 45 and 60 days). Treatment with 50% sugarcane bagasse resulted in >53% degradation of lindane in upper soil column with minimal leaching to lower soil column (0.002%) while highest leaching of lindane from upper soil column to lower soil column was occurred in garden soil (35.8%). Similarly, a substantial microbial biomass input has detected in amended soil than garden soil. Our results provide evidence that sugarcane bagasse can accelerate lindane degradation by enhanced microbial activity and prevent pesticide mobility through soil column by adsorption. Sugarcane bagasse could be useful as cheaper, easy available alternative for the biotreatment of lindane impacted soil.

Keywords: Lindane; Sugarcane bagasse; Soil column; Dissipation; Biotreatment

C.F. Liu, R.C. Sun, M.H. Qin, A.P. Zhang, J.L. Ren, J. Ye, W. Luo, Z.N. Cao, Succinoylation of sugarcane bagasse under ultrasound irradiation,
Bioresource Technology, Volume 99, Issue 5, March 2008, Pages 1465-1473, ISSN 0960-8524, DOI: 10.1016/j.biortech.2007.01.062.
(http://www.sciencedirect.com/science/article/pii/S0960852407001964)

Abstract:

The chemical modification of sugarcane bagasse with succinic anhydride using pyridine as solvent after ultrasound irradiation was studied. The optimized parameters included ultrasound irradiating time 0-50 min, reaction time 30-120 min, succinic anhydride concentration by the ratio of dried sugarcane bagasse to succinic anhydride from 1:0.25 to 1:1.50, and reaction temperature 75-115 [degree sign]C are required in the process. The extent of succinoylation was measured by the weight percent gain (WPG), which increased with increments of reaction time, succinic anhydride concentration, and reaction temperature. The ultrasound irradiation has a positive effect on bagasse succinoylation process. On the other hand, the ultrasonic pre-treatment application broke down the cell wall polymers, resulting in, therefore, a negative effect on the WPG. Evidences of succinoylation were also provided by FT-IR and CP MAS 13C NMR and the results showed that the succinoylation at C-2 and C-3 occurred. The thermal stability of the succinylated bagasse decreased upon chemical modification.

Keywords: Sugarcane bagasse; Succinic anhydride; Chemical modification; Succinoylation; Ultrasound irradiation

Kianoush Khosravi-Darani, Alaleh Zoghi, Comparison of pretreatment strategies of sugarcane baggase: Experimental design for citric acid production,
Bioresource Technology, Volume 99, Issue 15, October 2008, Pages 6986-6993, ISSN 0960-8524, DOI: 10.1016/j.biortech.2008.01.024.
(http://www.sciencedirect.com/science/article/pii/S0960852408000497)

Abstract:
Solid state fermentation was carried out to compare efficiency of acid, alkaline and urea pretreatment of sugarcane bagasse for production of citric acid using Aspergillus niger ATCC 9142. Plackett-Burman statistical design was used to evaluate significance of variables. Pretreatment of bagasse by urea was known as the most influential treatment to increase citric acid production (137.6 g/kg of dry sugarcane bagasse and citric acid yield of 96% based on sugar consumed). Finally, up scaling was achieved to a 20 L solid state fermentor in which humidity was constant in gas phase and urea-treated sugarcane bagasse. The produced acid concentration and yield in fermentor was 82.38 g/kg of dry substrate and 26.45 g/kg day, respectively.

Keywords: Solid state fermentation (SSF); Citric acid; Pretreatment; Sugarcane baggase; Plackett-Burman design (PBD)

J.M. Hernandez-Salas, M.S. Villa-Ramirez, J.S. Veloz-Rendon, K.N. Rivera-Hernandez, R.A. Gonzalez-Cesar, M.A. Plascencia-Espinosa, S.R. Trejo-Estrada, Comparative hydrolysis and fermentation of sugarcane and agave bagasse, ***Bioresource Technology,*** Volume 100, Issue 3, February 2009, Pages 1238-1245, ISSN 0960-8524, DOI: 10.1016/j.biortech.2006.09.062.
(http://www.sciencedirect.com/science/article/pii/S0960852407000557)

Abstract:
Sugarcane and agave bagasse samples were hydrolyzed with either mineral acids (HCl), commercial glucanases or a combined treatment consisting of alkaline delignification followed by enzymatic hydrolysis. Acid hydrolysis of sugar cane bagasse yielded a higher level of reducing sugars (37.21% for depithed bagasse and 35.37% for pith bagasse), when compared to metzal or metzontete (agave pinecone and leaves, 5.02% and 9.91%, respectively). An optimized enzyme formulation was used to process sugar cane bagasse, which contained Celluclast, Novozyme and Viscozyme L. From alkaline-enzymatic hydrolysis of sugarcane bagasse samples, a reduced level of reducing sugar yield was obtained (11-20%) compared to agave bagasse (12-58%). Selected hydrolyzates were fermented with a non-recombinant strain of Saccharomyces cerevisiae. Maximum alcohol yield by fermentation (32.6%) was obtained from the hydrolyzate of sugarcane depithed bagasse. Hydrolyzed agave waste residues provide an increased glucose decreased xylose product useful for biotechnological conversion.

Keywords: Sugarcane; Agave; Bagasse; Fermentation; Hydrolysis

Daniella R. Mulinari, Herman J.C. Voorwald, Maria Odila H. Cioffi, Maria Lucia C.P. da Silva, Sandra M. Luz, Preparation and properties of HDPE/sugarcane bagasse cellulose composites obtained for thermokinetic mixer,
Carbohydrate Polymers, Volume 75, Issue 2, 22 January 2009, Pages 317-321, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.07.028.
(http://www.sciencedirect.com/science/article/pii/S014486170800338X)

Abstract:

The use of natural fibers as reinforcement for thermoplastics has generated much interest due to their low cost, possibility of environmental protection and use of locally available renewable resources. In this work the mechanical and morphological properties of high density polyethylene/pre-treated and modified residues from sugarcane bagasse cellulose composites were analyzed. Composites were produced by a thermokinetic mixer. The microstructural analyses of fracture surface from composites can be easily evaluated by microscopic techniques. Results showed that the modification of sugarcane bagasse cellulose with zirconium oxychloride was successfully accomplished and that this reinforcement material with high density polyethylene showed tensile strength higher than non-modified sugarcane bagasse cellulose. Modification in the sugarcane bagasse cellulose influenced directly in mechanical properties of the composite material. This can be observed by the fracture surface, which showed that modified cellulose sugarcane bagasse improved interfacial adhesion between fiber and matrix.

Keywords: Composites; Sugarcane bagasse cellulose/ZrO2[middle dot]nH2O; Mechanical properties

Julia Graciele Vieira, Geandre de Carvalho Oliveira, Guimes Rodrigues Filho, Rosana Maria Nascimento de Assuncao, Carla da Silva Meireles, Daniel Alves Cerqueira, Wanderly Geraldo Silva, Leila Aparecida de Castro Motta, Production, characterization and evaluation of methylcellulose from sugarcane bagasse for applications as viscosity enhancing admixture for cement based material,
Carbohydrate Polymers, Volume 78, Issue 4, 17 November 2009, Pages 779-783, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2009.06.016.
(http://www.sciencedirect.com/science/article/pii/S0144861709003415)

Abstract:

In previous works, methylcellulose (MC) was prepared from sugarcane bagasse cellulose in heterogeneous medium using dimethyl sulfate (DMS) as etherification agent. MC was produced in a range of degrees of substitution (DS) from 0.70 to 1.40 and the materials showed low water solubility. In this work methylcellulose was prepared with 5 h (MC5h) of reaction with reagent substitution at each hour. MC5h showed a DS of 1.89 +/- 0.04. An aqueous viscous suspension was produced with MC5h for application as viscosity enhancing admixture of cimentitious adhesive mortars. It was observed a 40.37% increase on the consistency index (CI) and a 27.70% increase on the Potential Tensile Adhesion Strength. Such characteristics show the potential of this material for the utilization in situations that require good

workability, improve viscosity and adhesive properties such as for tile setting in civil engineering.

Keywords: Sugarcane bagasse cellulose; Methylcellulose; Viscosity enhancing admixture; Mortar

S.Y. Ou, Y.L. Luo, C.H. Huang, M. Jackson, Production of coumaric acid from sugarcane bagasse,
Innovative Food Science & Emerging Technologies, Volume 10, Issue 2, April 2009, Pages 253-259, ISSN 1466-8564, DOI: 10.1016/j.ifset.2008.10.008.
(http://www.sciencedirect.com/science/article/pii/S1466856408000982)

Abstract:

Phenolic acids were released from sugarcane bagasse by alkaline hydrolysis at 30 [degree sign]C for 4 h; The alkaline hydrolysates were ultrafiltrated, the permeates purified with anion exchange resin. The phenolic acids bound by the resin were desorbed by a mixture of water-ethanol-HCl solution (36: 60: 4) after washing the resin with water, ethanol and dilute HCl respectively. The combined eluents were concentrated for crystalization, and the crystals filtered and washed using 1% (v/v) HCl. After this purification process, the purity of products reached 89.7% based on coumaric acid. Results of HPLC/MS, HPLC using standard coumaric acid and ferulic acid showed that the main component of the purified bagasse hydrolysate was p-coumaric acid rather than ferulic acid. The purified products showed the same antioxidant activity, reducing power and free radical scavenging capacity as the standard p-coumaric acid. The technology could be applied on industrial scale.Industrial relevance This research presents a technology to produce coumaric acids from sugarcane bagasse. The first step is to release coumaric acid by alkaline hydrolysis. The second step is to remove the viscous polysaccharides and protein by ultrafiltration. The third step is to purify coumaric acid from the permeate of ultrafiltration by anion chromatography, and the alkaline could be reused to hydrolyze the bagasse. The technology showed potential application on industrial scale.

Keywords: Sugarcane bagasse; Phenolic acids; Coumaric acid; Production

Ada Ruth Bertoti, Samuel Luporini, Maria Cecilia Azevedo Esperidiao, Effects of acetylation in vapor phase and mercerization on the properties of sugarcane fibers, ***Carbohydrate Polymers***, Volume 77, Issue 1, 22 May 2009, Pages 20-24, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.11.036.
(http://www.sciencedirect.com/science/article/pii/S0144861708005481)

Abstract:

Chemical modification of sugarcane bagasse fiber was achieved by mercerization reaction and esterification reaction with anhydride acetic vapor. This is a new acetylation procedure. The results show that the fiber length and diameter are reduced after the reactions. Fourier transform infrared spectroscopy (FT-IR) studies produced clear evidence of the partial acetylation reaction. Optical microscopy

revealed fibrillation in the acetylated fiber attributed to hemicellulose dissolution. The thermal stability measured by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC) increased after acetylation and decreased after mercerization. The higher thermal stability of the acetylated fiber as compared with modified fibers in liquid medium was attributed to the small quantity of water and acetic acid present for the reaction in vapor phase. The lesser tensile strength of the acetylated fiber was due to fibrillation. The porous structure obtained favors migration of the polymer chains into the fiber acetylated, and thus it should enhance the polymer-fiber adhesion in polymer composites.

Keywords: Sugarcane; Acetylation; Mercerization; Physical properties

Osvaldo Karnitz Junior, Leandro Vinicius Alves Gurgel, Rossimiriam Pereira de Freitas, Laurent Frederic Gil, Adsorption of Cu(II), Cd(II), and Pb(II) from aqueous single metal solutions by mercerized cellulose and mercerized sugarcane bagasse chemically modified with EDTA dianhydride (EDTAD),

Carbohydrate Polymers, Volume 77, Issue 3, 11 July 2009, Pages 643-650, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2009.02.016.
(http://www.sciencedirect.com/science/article/pii/S0144861709001064)

Abstract:

This work describes the preparation of new chelating materials derived from cellulose and sugarcane bagasse for adsorption of Cu2+, Cd2+, and Pb2+ ions from aqueous solutions. The first part involved the mercerization treatment of cellulose and sugarcane bagasse with NaOH 5 mol/L. Non- and mercerized cellulose and sugarcane bagasse were then reacted with ethylenediaminetetraacetic dianhydride (EDTAD) in order to prepare different chelating materials. These materials were characterized by mass percent gain, X-ray diffraction, FTIR, and elemental analysis. The second part consisted of evaluating the adsorption capacity of these modified materials for Cu2+, Cd2+, and Pb2+ ions from aqueous single metal solutions, whose concentration was determined by atomic absorption spectroscopy. These materials showed maximum adsorption capacities for Cu2+, Cd2+, and Pb2+ ions ranging from 38.8 to 92.6 mg/g, 87.7 to 149.0 mg/g, and 192.0 to 333.0 mg/g, respectively. The modified mercerized materials showed larger maximum adsorption capacities than modified non-mercerized materials.

Keywords: Adsorption; Mercerization; Modified sugarcane bagasse; Ethylenediaminetetraacetic dianhydride; Heavy metals

Hamid M. Shaikh, Kiran V. Pandare, Greeshma Nair, Anjani J. Varma, Utilization of sugarcane bagasse cellulose for producing cellulose acetates: Novel use of residual hemicellulose as plasticizer,

Carbohydrate Polymers, Volume 76, Issue 1, 2 March 2009, Pages 23-29, ISSN 0144-8617, DOI: 10.1016/j.carbpol.2008.09.014.
(http://www.sciencedirect.com/science/article/pii/S0144861708004384)

Abstract:

Sugarcane bagasse was fractionated to cellulose, hemicellulose and lignin by a proprietary steam explosion process, followed by downstream purifications, developed in our laboratory. The fractionated cellulose contained ~94% cellulose, about ~5% hemicellulose, traces of lignin (~0.2%), and ~1% ash. The cellulose was acetylated under heterogeneous conditions to obtain cellulose acetates. These were extensively characterized using FTIR, TGA, DSC, GPC, HPIC, WAXRD, and viscometry. The novel feature of this study was the utilization of the hemicellulose content (5%) of bagasse cellulose as an internal plasticizer. Through kinetic experimentation, we have demonstrated that the residual hemicellulose need not be considered as an impurity; rather it can be used in acetylated form as a plasticizer as well as a biodegradable additive for cellulose acetates made from slightly impure cellulose produced from non-wood origin. Our results therefore show how lignocellulosic agricultural wastes can be utilized to produce high value plastics.

Keywords: Sugarcane bagasse; Bagasse cellulose; Cellulose acetate; Hemicellulose; Plasticizer; Xylan acetate

MATHEMATICAL AND STATISTICAL METHODS (3 jdl)

Caroline Lejars, Pierre-Yves Le Gal, Sandrine Auzoux, A decision support approach for cane supply management within a sugar mill area,

Computers and Electronics in Agriculture, Volume 60, Issue 2, March 2008, Pages 239-249, ISSN 0168-1699, DOI: 10.1016/j.compag.2007.08.008.
(http://www.sciencedirect.com/science/article/pii/S0168169907001822)

Abstract:

Increased competition between agri-food supply chains has strained relationships between farmers and processing factories while reducing individual profit margins. Decisions at different levels of the supply chain can no longer be considered independently, since they may influence profitability throughout the supply chain. This paper presents a decision support approach based on the MAGI(R) simulation tool, which aims to facilitate discussion and negotiation between stakeholders while collectively exploring satisfactory solutions. The simulation tool helps sugarcane growers and millers in designing and assessing new ways of organizing cane supply management within a mill area. It addresses key issues such as restructuring mill areas or changing cane delivery allocation rules in order to increase total sugar production and total net revenue at the mill area level. This approach has been implemented for two mills in Reunion and one mill in South Africa. Simulations showed that sugar gains may be obtained by rearranging supply scheduling according to quality-based zoning within a mill area. Discussions led to further studies regarding the practicality of the best scenarios. MAGI(R) is now available as freeware for testing in different settings.

Keywords: Sugarcane; Supply chain; Modelling; Simulation tool; Participatory approach

P.-Y. Le Gal, J. Le Masson, C.N. Bezuidenhout, L.F. Lagrange, Coupled modelling of sugarcane supply planning and logistics as a management tool,
Computers and Electronics in Agriculture, Volume 68, Issue 2, October 2009, Pages 168-177, ISSN 0168-1699, DOI: 10.1016/j.compag.2009.05.006.
(http://www.sciencedirect.com/science/article/pii/S0168169909000921)

Abstract:

Agro-industry supply chains involving several stakeholders need coordination. Such systems, however, can be highly complex and may require a wide range of decision support. Models may be valuable when analysing complex supply chains, but are commonly specialised with little scope to evaluate a system holistically. Ideally, models with different specialised focus areas, such as a short-term logistics or seasonal planning, need to be integrated into a single descriptive framework. In this paper, such a framework is demonstrated within a sugarcane supply management regime. The aim is to couple a tactical supply planning model, named MAGI, with a daily logistics model to more holistically explore the relationships between these supply components. This will help to further identify limitations in the approach and to recommend areas for further research. The research was carried out in conjunction with an investigation into different harvest mechanisation strategies at a South African sugar mill. The mill's weekly crushing capacity, the length of the milling season and logistical harvest and transport capacities were balanced to meet supply demands over different planning horizons. The most important link between the two models was the use of production units. These units provided sufficient diversity in terms of geography and agricultural systems to accommodate both models' data requirements. The model pair was used successfully to explore the mill area's response, in terms of the number of harvesters, vehicles, length of the milling season and sensitivity to risk, after the current harvest mechanisation regime of 16% of the annual crop was escalated to 75%. This paper contains a detailed description of the mill area and the current management practices and logistical configurations used. It then describes the construction of the model pair, validation of the models, and produces plausible future scenarios to support stakeholder negotiations. Recommendations for further research are highlighted.

Keywords: Decision support; Sugar mill; Simulation; Harvest mechanisation; South Africa

Y.L. Everingham, C.W. Smyth, N.G. Inman-Bamber, Ensemble data mining approaches to forecast regional sugarcane crop production,
Agricultural and Forest Meteorology, Volume 149, Issues 3-4, 11 March 2009, Pages 689-696, ISSN 0168-1923, DOI: 10.1016/j.agrformet.2008.10.018.
(http://www.sciencedirect.com/science/article/pii/S0168192308003043)

Abstract:

Accurate yield forecasts are pivotal for the success of any agricultural industry that plans or sells ahead of the annual harvest. Biophysical models that integrate information about crop growing conditions can give early insight about the likely size of a crop. At a point scale, where highly detailed knowledge about environmental and

management conditions are known, the performance of reputable crop modelling approaches like APSIM have been well established. However, regional growing conditions tend not to be homogenous. Heterogeneity is common in many agricultural systems, and particularly in sugarcane systems. To overcome this obstacle, hundreds of model settings (`models' for convenience) that represent different environmental and management conditions were created for Ayr, a major sugarcane growing region in north eastern Australia. Statistical data mining methods that used ensembles were used to select and assign weights to the best models. One technique, called a lasso approximation produced the best results. This procedure, produced a predictive correlation (rcv) of 0.71 when predicting end of season sugarcane yields some 4 months prior to the start of the harvest season, and 10 months prior to harvest completion. This continuous forecasting methodology based on statistical ensembles represents a considerable improvement upon previous research where only categorical forecast predictions had been employed.

Keywords: Predict; Forward stagewise; Simulation; Top-down; Machine learning; Lasso

SURVEYING METHODS (2 jdl)

P.S.G. Magalhaes, D.G.P. Cerri, Yield Monitoring of Sugar Cane,
Biosystems Engineering, Volume 96, Issue 1, January 2007, Pages 1-6, ISSN 1537-5110, DOI: 10.1016/j.biosystemseng.2006.10.002.
(http://www.sciencedirect.com/science/article/pii/S1537511006003291)

Abstract:

The main objective of this paper is to present a yield monitor specifically designed for the implementation of precision agriculture in sugar cane crops. The overall system includes a mass flow sensor, a global positioning system receiver, and a data acquisition system. The concept for the sensor is based on the sugar cane yield monitor sensor developed previously at The State University of Campinas. A modified version of the sensor was designed to address the specific needs of a harvesting system, including several sensors to eliminate signal interference, and to monitor the harvesting operation. Field testing of the sugar cane yield monitor system was done during the 2004-2005 harvesting season. The system was mounted on a Case 7700 sugar cane harvester. In order to evaluate the accuracy of the system, each loaded truck was weighed on an electronic platform scale upon arrival at the sugarcane mill. The results showed that the output of the sugar cane yield monitor and the harvested load weight present a correlation of 0[middle dot]66, and the system performance was stable and reliable during tests. A sugar cane yield map was generated in a 43 ha area plot of a sugar plantation, located in Araras, the state of Sao Paulo, Brazil. The results showed that the yield monitor designed and evaluated is accurate, with a mean error of 4[middle dot]3% where the maximum error never exceeds 6[middle dot]4%, and is capable of measuring the yield variability.

P.-Y. Le Gal, P.W.L. Lyne, E. Meyer, L.-G. Soler, Impact of sugarcane supply scheduling on mill sugar production: A South African case study,
Agricultural Systems, Volume 96, Issues 1-3, March 2008, Pages 64-74, ISSN 0308-521X, DOI: 10.1016/j.agsy.2007.05.006.
(http://www.sciencedirect.com/science/article/pii/S0308521X07000789)
Abstract:

The South African sugar industry has to improve its efficiency in order to remain competitive internationally. There is a potential to enhance profitability by examining the interactions between stakeholders within the supply chain at the mill area level. Three parties are generally involved: the grower, the haulier and the miller who operate as independent entities in order to harvest, transport and process the sugarcane from the fields to the mill. The sugar production depends on the way cane delivery is managed according to parameters such as capacities along the chain and the quality of the sugarcane in terms of RV % cane index (recoverable value as a percentage of the sugarcane mass). This study investigates the opportunity to exploit the geographical and temporal variations in RV production by modifying cane supply schedules during a season. A decision support tool known as Magi(R) was used to model the supply chain and compare supply scenarios sourcing cane from various areas in order to maximise the RV yield. The Sezela Mill supply area on the South Coast of KwaZulu Natal was chosen for a case study. Two quality-based sub-areas were defined, i.e., the coastal sub-area which usually has a lower-quality product at the beginning of the season and the inland sub-area which begins with a higher-quality product. Four scenarios representing cane delivery at different starting and ending dates for each sub-area were simulated using Magi(R). The results showed that by splitting the mill supply area into homogenous zones and adapting allocation according to cane quality variations, total RV gains could account for up to 7.44 millions SA Rand (793000 [euro]) and 2.7% of the seasons' mill production, and existing capacities throughout the chain could sustain increased delivery throughputs. Implications of this new organization on delivery allocation between growers within a sub-area and on harvest operation at the farm level as well as on the cane payment system are briefly discussed.
Keywords: Modelling; Simulation; Cane quality; Cane delivery; Capacity planning