PADI TEEAL 2008

1. **Maximum outcrossing rate and genetic compatibility between red rice (Oryza sativa) biotypes and ClearfieldTM rice**
   Shivrain-V-K. Burgos-N-R. Gealy-D-R. Moldenhauer-K-A-K. Baquireza-C-J, Weed Science, 2008, 56 (6), p. 807-813
   Abstract: The transfer of the imazethapyr-resistant gene from ClearfieldTM (CL) rice to red rice is an ecological risk. Flowering synchronization and genetic compatibility between cultivated rice and red rice could influence gene transfer. We examined the (1) variability in maximum outcrossing rate between 12 red rice biotypes and 'CL161' rice during their peak flowering overlap in the field and (2) genetic compatibility of red rice biotypes with CL161 rice. Experiments were conducted at Stuttgart, AR, and Fayetteville, AR, from 2005 to 2007. To evaluate the flowering synchrony of red rice and CL161 rice as well as its impact on outcrossing rate, field experiments were conducted at four planting times from early April to late May. The red rice biotypes were planted in the middle row of nine-row CL161 plots and flowering was monitored. Outcrosses were evaluated in subsequent years by herbicide response and simple-sequence-repeat marker assays. To determine compatibility, manual crosses were performed between 12 red rice biotypes and CL161 rice in the greenhouse. The flowering duration of all red rice types ranged from 5 to 16 d after the onset of flowering in contrast to 6 d in CL161 rice. Ten of the twelve types of red rice had more than or equal to 70% overlap in flowering time with CL161 rice in at least one planting date. The maximum field outcrossing rate between red rice biotypes and CL161 ranged from 0.03 to 0.25%. The field outcrossing rate between red rice biotypes differed ($P<0.01$), but flowering synchronization was not directly related to outcrossing rate. Manual crosses resulted in seed sets of 49 to 94%. The majority of red rice biotypes had similar compatibility with CL161 rice. Thus, other factors must contribute to hybridization rates in the field. Follow-up experiments should investigate other plant factors and environmental influence on hybridization rate
   Other Title: Maximum outcrossing rate and genetic compatibility between red rice (Oryza sativa) biotypes and ClearfieldTM rice
   Descriptors: biotypes. breeding-methods. compatibility. crop-production. ecology. field-experimentation. field-tests. flowering. flowering-date. gene-transfer. herbicide-resistance. herbicides. hybridization. imazethapyr. outcrossing. pesticide-resistance. pesticides. planting-date. rice. weeds

2. **Iron and zinc biofortification in polished rice and accumulation in rice plant (Oryza sativa L.) as affected by nitrogen fertilization**
   Zhang-J. Wu-L-H. Wang-M-Y, Acta Agricultura Scandinavica. Section B, Plant Soil Science, 2008, 58 (3), p. 267-272
   Abstract: With focus on maximizing grain yield in rice (Oryza sativa L.) production, especially in China, information available in the literature on how nitrogen (N) fertilization of rice crops affects biofortification of iron (Fe) and (Zn) in grains is limited. The objective of the experiment was to investigate to what degree application of N fertilizer attained the optimum Fe and Zn concentration in rice grains as well as grain yield under pot conditions. Two rice cultivars of the indica 'Zhenong 952' and the japonica 'Bing 98110', grown widely in the area of the Yangtse River Δ in southern China, and fertilized with four rates of urea (0, 0.50, 1.00 and 1.50 g N pot-1), were investigated. The results showed that, in the pot trails, the optimum

application of N alone on rice crops could increase the concentration of Fe in the polished rice. By considering both health and commercial reasons, when N application reached 1.00 g pot-1, the optimal Fe and Zn concentrations were attained as well as grain yield for 'Zhenong 952', and for 'Bing 98110' the optimum N application was 1.50 g pot-1. Fe appeared not to be so easily mobilized as Zn in the plant. The ratio of Zn deposited in the brown rice was about 40% of total Zn in the plant, irrespective of N application. However, deposited Fe was only about 3% of total Fe. Fe concentration in brown rice was only about 1/2 that in rice husk, 1/5 that in peduncles, 1/10 that in leaves, and only a little more than 1% of that in roots. These results suggested if we wanted to increase the amount of Fe in grains the translocation mechanism of Fe in rice plant must be clearly understood first
Other Title: Iron and zinc biofortification in polished rice and accumulation in rice plant (Oryza sativa L.) as affected by nitrogen fertilization
Descriptors: application rates; crop quality; crop yield; iron; nitrogen fertilizers; nutritive value; rice; urea fertilizers; zinc East Asia; Asia; Developing Countries; Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

3. **Amino acid substitutions in the acetolactate synthase gene of red rice (*Oryza sativa*) confer resistance to imazethapyr**
Sales-M-A. Shivrain-V-K. Burgos-N-R. Kuk-Y-I, Weed Science, 2008, 56 (4), p. 485-489
Abstract: Two red rice accessions from Arkansas have been found to be resistant to the labelled rate of imazethapyr, which is used to control red rice in ClearfieldTM rice. Full-length amplification of the acetolactate synthase (ALS) gene in imazethapyr-resistant red rice revealed a coding sequence of 1,935 base pairs, which is the same as that of the cultivated rice. Coding sequences were generated from four red rice accessions collected from different geographical regions in Arkansas, consisting of accessions that were either resistant or susceptible to imazethapyr. Nucleotide sequence alignments identified six base polymorphisms, three of which resulted in amino acid substitutions in the ALS gene. One amino acid substitution, Gly654Glu, involves a residue required for imazethapyr binding to the ALS. The other substitution, Val669Met, implies conformational changes in the ALS structure that enhances binding of thiamine diphosphate, an ALS cofactor. These novel amino acid substitutions first reported for ALS-resistant red rice accessions support the hypothesis that ALS-resistant red rice can evolve with sustained herbicide selection pressure. Thus, it behooves growers to integrate the Cleafield rice technology with other tools to achieve a successful, long-term weed management program
Other Title: Amino acid substitutions in the acetolactate synthase gene of red rice (Oryza sativa) confer resistance to imazethapyr
Descriptors: amplification. crop-production. herbicides. imazethapyr. nucleotide-sequences. pesticides. resistance. rice. thiamin. tools. weeds

4. **Interactions between arbuscular mycorrhizal fungi (*Glomus intraradices*, Glomeromycota) and amoebae (*Acanthamoeba castellanii*, Protozoa) in the rhizosphere of rice (*Oryza sativa*)**

Herdler-S. Kreuzer-K. Scheu-S. Bonkowski-M, Soil Biology & Biochemistry, 2008, 40 (3), p. 660-668

Abstract: Rice plants (Oryza sativa L.) were grown in microcosms containing soil with a diverse bacterial community (control) and inoculated either with an axenic arbuscular mycorrhizal fungus (Glomus intraradices) or an axenic inoculum of protozoan grazers of bacteria (Acanthamoeba castellanii), or both, in a factorial design. Amoebae and mycorrhiza affected the root architecture of rice in opposite directions, with mycorrhiza reducing and protozoa increasing early root growth. Rice biomass did not increase in presence of mycorrhiza (x1.08), but strongly increased in presence of Acanthamoebae (x1.29). The positive effects of amoebae were always reduced when plants were also infected with mycorrhiza. Microbial biomass increased (x1.4) and microbial growth was less limited by phosphorus in presence of mycorrhiza. However, plant phosphorus uptake did not increase, rather, plant concentrations of carbon and nutrients decreased in presence of mycorrhiza, suggesting a sequestration of resources during the establishment of a mycorrhizal network. Amoebae strongly interacted with, and partly compensated for, the effects of mycorrhiza, demonstrating that interactions between AM fungi and the microbial food web in the rhizosphere significantly feed back on early plant performance

Other Title: Interactions between arbuscular mycorrhizal fungi (Glomus intraradices, Glomeromycota) and amoebae (Acanthamoeba castellanii, Protozoa) in the rhizosphere of rice (Oryza sativa)

Descriptors: carbon. endomycorrhizas. mycorrhizal-fungi. mycorrhizas. plant-morphology. rhizosphere. rice. roots. vesicular-arbuscular-mycorrhizas

5. **Natural tolerance to imazethapyr in red rice (Oryza sativa)**

Kuk-Y-I. Burgos-N-R. Shivrain-V-K, Weed Science, 2008, 56 (1), pages 1-11

Abstract: Red rice is a major weed problem in rice production of the southern United States and other rice-producing countries. One hundred thirty red rice accessions from 26 rice-growing counties in Arkansas, USA, were tested for tolerance to imazethapyr in seed- and whole-plant response bioassays. The red rice accessions were compared with imazethapyr-resistant (Clearfield) rice cultivars (CL121, CL161 and CL-XL8) and conventional rice cultivars (Bengal, Dongjin, Drew and Wells). Red rice accessions 79, 84, and 118 showed 17-, 48-, and 37-fold more tolerance to imazethapyr, respectively, than the standard susceptible red rice accession (82) in whole-plant bioassays. The imazethapyr-resistant rice cultivars, CL121, CL161, and CL-XL8 were 41-, >177-, and 48-fold more resistant to imazethapyr, respectively, than the susceptible standard. The imazethapyr-tolerant red rice and Clearfield cultivars were generally cross tolerant to other acetolactate synthase (ALS; EC 4.1.3.18) inhibiting herbicides such as imazapyr, imazaquin, imazamox, and pyrithiobac. The tolerance level of red rice or rice to imidazolinone herbicides was highest with imazaquin and lowest with imazapyr. The imazethapyr-tolerant red rice accessions and Clearfield rice were susceptible to glufosinate and glyphosate. The ALS enzyme of tolerant red rice accessions was less sensitive to imazethapyr than the susceptible standard, but tolerance at the enzyme level was less than at the whole-plant level. Therefore, tolerance of red rice to imazethapyr may involve other mechanisms besides an insensitive target site. We learned that a few imazethapyr-tolerant red rice populations existed probably before Clearfield rice was introduced, supporting the hypothesis that evolution of herbicide-resistant red rice populations can happen with intensive herbicide selection pressure

6. **Other Title:** Natural tolerance to imazethapyr in red rice (Oryza sativa)
   Descriptors: cross-resistance. enzyme-inhibitors. genotypes. glufosinate. glyphosate. herbicide-resistance. herbicide-resistant-weeds. herbicides. imazamox. imazapyr. imazaquin. imazethapyr. pyrithiobac. rice. weeds

Overexpression of a TFIIIA-type zinc finger protein gene ZFP252 enhances drought and salt tolerance in rice (Oryza sativa L.)
Xu-DongQing. Huang-Ji. Guo-ShuQiao. Yang-Xia. Bao-YongMei. Tang-HaiJuan. Zhang-HongSheng, FEBS Letters, 2008, 582 (7), pages 1037-1043
Abstract: We previously identified a salt and drought stress-responsive TFIIIA-type zinc finger protein gene ZFP252 from rice. Here we report the functional analysis of ZFP252 using gain- and loss-of-function strategies. We found that overexpression of ZFP252 in rice increased the amount of free proline and soluble sugars, elevated the expression of stress defense genes and enhanced rice tolerance to salt and drought stresses, as compared with ZFP252 antisense and non-transgenic plants. Our findings suggest that ZFP252 plays an important role in rice response to salt and drought stresses and is useful in engineering crop plants with enhanced tolerance to salt and drought stresses
Author Variant: D. Q. H.-J. G.-S. Q. Y.-X. B.-Y. M. T.-H. J. Z.-H. S. Xu
Other Title: Overexpression of a TFIIIA-type zinc finger protein gene ZFP252 enhances drought and salt tolerance in rice (Oryza sativa L.)
Descriptors: chemical-composition. DNA-binding-motifs. drought. drought-resistance. gene-expression. genes. plant-composition. proline. rice. salinity. salt-tolerance. stress. stress-response. sugar-content

7. **Uptake of selected PAHs from contaminated soils by rice seedlings (Oryza sativa) and influence of rhizosphere on PAH distribution**
   Su-Yu-Hon. Zhu-Yong-Guan. (ygzhu@rcees.ac.cn), Environmental Pollution, 2008, 155 (2), pages 359-365
   Abstract: The uptake of selected polycyclic aromatic hydrocarbons (PAHs) by rice (Oryza sativa) seedlings from spiked aged soils was investigated. When applied to soils aged for 4 months, naphthalene, phenanthrene, and pyrene exhibited volatilization loss of 98, 95, and 30%, respectively, with the remaining fraction being fixed by soil organic matter and/or degraded by soil microbes. In general, concentrations of the three PAHs in rice roots were greater than those in the shoots. The concentrations of root associated PHN and PYR increased proportionally with both soil solution and rhizosphere concentrations. PAH concentrations in shoots were largely independent of those in soil solution, rice roots, or rhizosphere soil. The relative contributions of plant uptake and plant-promoted rhizosphere microbial biodegradation to the total mass balance were 0.24 and 14%, respectively, based on PYR concentrations in rhizosphere and non-rhizosphere soils, the biomass of rice roots, and the dry soil weight.
   Other Title: Uptake of selected PAHs from contaminated soils by rice seedlings (Oryza sativa) and influence of rhizosphere on PAH distribution
   Descriptors: Pollution Assessment Control and Management; Agronomy (Agriculture) soil contamination

8. **Laboratory Study of Vibrio cholerae O1 Survival on Three Types of Boiled Rice (Oryza sativa L.) Held at Room Temperature**
   Tang-Joh. Huat-Ye. Leong-Yap-Kok. (ykleong@medic.ukm.my). Lian-Hing-Hian, Journal of Food Protection, 2008, 71 (12), pages 2453-2459
   Abstract: This Study examined whether the survival of Vibrio cholerae 01 oil contaminated cooked rice was influenced by the type of rice. Vibrios survived unchanged on clumps of glutinous white rice (wet, grains adhered) held at room temperature for 24 h. On nonglutinous white rice (slightly moist, grains separate). 30% viable vibrios remained at 24 h. On nonglutinous brown rice (moist, separate, covered with a mucus-like substance), the number of vibrios increased 2.7-fold at 24 h. Survival rates of vibrios on the surfaces of a row of five cooked rice grains alter 2 If of exposure at room temperature were 86, 29, 12, and 4% for glutinous rice, white rice, and the endosperm and pericarp of brown rice, respectively. (Each boiled brown rice grain surface was partly pericarp and partly endosperm, which became exposed by a rupture of the pericarp.) Covering each inoculated grain with a similar cooked rice grain surface increased the corresponding figures to 93, 99. 60, and 94%. Scanning electron microscopy revealed that each type of cooked grain Surface possessed a distinct microtopography. For example, the surfaces of glutinous rice grains consisted of separated overlapping strips with many holes, while the pericarps of brown rice were flat interspersed with small pits. In conclusion, each type of boiled rice produced a distinct Survival pattern of V. cholerae O1 caused by both the distinct,ross features and the fine surface characteristics of the rice. The significance of this finding is that the type of rice Consumed can be a factor in cholera transmission by contaminated rice
   Other Title: Laboratory Study of Vibrio cholerae O1 Survival on Three Types of Boiled Rice (Oryza sativa L.) Held at Room Temperature
   Descriptors: Methods and Techniques; Foods cholera; Cholera (MeSH); bacterial disease survival rate, room temperature, microtopography, surface characteristic, boiled glutinous white rice (grain product), boiled nonglutinous white rice (grain product), boiled nonglutinous brown rice (grain product)

9. **Nonindependent domestication of the two rice subspecies, Oryza sativa ssp indica and ssp japonica, demonstrated by multilocus microsatellites**
   Gao-Li-zhi. (lgao@mail.kib.ac.cn). Innan-Hidek, Genetics, 2008, 179 (2), pages 965-976
   Abstract: The origins of the Asian cultivated rice Oryza sativa from its wild ancestor O. rufipogon have been debated for decades. The question mainly concerns whether it originated monophyletically or polyphyletically. To shed light on the origins and demographic history of rice domestication, we genotyped a total of 92 individual plants from the two O. sativa subspecies and O. rufipogon for 60 microsatellites. An approximate Bayesian method was applied to estimate demographic parameters for O. rafitpogon vs. O. sativa ssp. indica and O. rufipogon vs. O. sativa ssp. japonica. We showed that the japonica subspecies suffered a more severe bottleneck than the indica subspecies and thus a greater loss of genetic variation during its domestication. Across microsatellite loci there is a significant positive correlation in the reduction of genetic diversity between the two subspecies. The results suggest that completely independent domestication of indica and japonica subspecies may not explain our data and that there is at least partial sharing of their ancestral populations and/or recent gene flow between them

Other Title: Nonindependent domestication of the two rice subspecies, Oryza sativa ssp indica and ssp japonica, demonstrated by multilocus microsatellites
Descriptors: Methods and Techniques; Population Genetics (Population Studies); Mathematical Biology (Computational Biology) genetic variation, gene flow, domestication, demographic history

10. **Genetic diversity analysis of traditional and improved cultivars of Pakistani rice (Oryza sativa L.) using RAPD markers**
Rabbani-Malik-Ashiq. (rabbani316@yahoo.com). Pervaiz-Zahida-Hassan. (zahidahasan82pk@yahoo.co.uk). Masood-Muhammad-Shahid. (shahid617@yahoo.com), Electronic Journal of Biotechnology, 2008, 11 (3), pages 1-10
Abstract: The molecular marker is a useful tool for assessing genetic variations and resolving cultivar identities. Information on genetic diversity and relationships among rice genotypes from Pakistan is currently very limited. The objective of this study was to evaluate the genetic polymorphisms and identities of 10 traditional, 28 improved and 2 Japanese cultivars of rice using the random amplified polymorphic DNA technique. Twenty-five decamer-primers could generate a total of 208 RAPD fragments, of which 186 or 89.4% were polymorphic. The number of amplification products produced by each primer varied from 4 to 16 with an average of 8.3 bands primer-1. The size of amplified fragments were ranged from 200 to 4000 bp. Pair-wise Nei and Li's similarity had estimated the range of 0.50 to 0.96 between rice cultivars. Based on analysis performed on a similarity matrix using UPGMA, 40 cultivars were grouped into 3 main clusters corresponding to aromatic, non-aromatic and japonica group. There were a few of independent cultivars. The cluster analysis had placed most of the aromatic cultivars into a close relation showing a high level of genetic relatedness. However, the clusters formed by the aromatic cultivars were distinct from those of non-aromatic and japonica types. Interestingly, a number of improved and traditional cultivars originating from diverse sources did not form well defined groups and were interspersed, indicating no association between the RAPD patterns and the geographic origin of the cultivars. The information generated from this study can be used to maximize selection of diverse parents and broaden the germplasm base in the future of rice breeding programs
Other Title: Genetic diversity analysis of traditional and improved cultivars of Pakistani rice (Oryza sativa L.) using RAPD markers
Descriptors: Methods and Techniques; Molecular Genetics (Biochemistry and Molecular Biophysics); Agronomy (Agriculture) genetic diversity, genetic relatedness, rice breeding program, rice genotype

11. **Genetic analysis of grain yield conditioned on its component traits in rice (Oryza sativa L.)**
Liu-G-F. Yang-J. Xu-H-M. Hayat-Y. Zhu-J, Australian Journal of Agricultural Research, 2008, 59 (2), pages 189-195
Abstract: The molecular marker is a useful tool for assessing genetic variations and resolving cultivar identities. Information on genetic diversity and relationships among rice genotypes from Pakistan is currently very limited. The objective of this study was to evaluate the genetic polymorphisms and identities of 10 traditional, 28 improved and 2 Japanese cultivars of rice using the random amplified polymorphic DNA technique. Twenty-five decamer-primers could generate a total of 208 RAPD

fragments, of which 186 or 89.4% were polymorphic. The number of amplification products produced by each primer varied from 4 to 16 with an average of 8.3 bands primer-1. The size of amplified fragments were ranged from 200 to 4000 bp. Pair-wise Nei and Li's similarity had estimated the range of 0.50 to 0.96 between rice cultivars. Based on analysis performed on a similarity matrix using UPGMA, 40 cultivars were grouped into 3 main clusters corresponding to aromatic, non-aromatic and japonica group. There were a few of independent cultivars. The cluster analysis had placed most of the aromatic cultivars into a close relation showing a high level of genetic relatedness. However, the clusters formed by the aromatic cultivars were distinct from those of non-aromatic and japonica types. Interestingly, a number of improved and traditional cultivars originating from diverse sources did not form well defined groups and were interspersed, indicating no association between the RAPD patterns and the geographic origin of the cultivars. The information generated from this study can be used to maximize selection of diverse parents and broaden the germplasm base in the future of rice breeding programs
Other Title: Genetic diversity analysis of traditional and improved cultivars of Pakistani rice (Oryza sativa L.) using RAPD markers
Descriptors: Methods and Techniques; Molecular Genetics (Biochemistry and Molecular Biophysics); Agronomy (Agriculture) genetic diversity, genetic relatedness, rice breeding program, rice genotype

12. **Estimating the economic value of rice (Oryza sativa L.) as a function of harvest moisture content**
Siebenmorgen-T-J. Cooper-N-T-W. Bautista-R-C. Counce-P-A. Wailes-E. Watkins-K-B, Applied Engineering in Agriculture, 2008, 24 (3), pages 359-369
Abstract: The net value (NV) of rice, as affected by drying costs and milling quality changes associated with harvesting rice at various moisture contents (MCs), was studied using a five-year data set comprising eight cultivars harvested over a range of MCs from 11 southern U.S. locations. A quadratic relationship was used to characterize the change in NV across harvest MC (HMC); this relationship was due to the progressively-increasing fee structure for commercial drying costs and the quadratic nature of head rice yield (HRY) changes with HMC. A sensitivity analysis revealed that as the price of brokens increased, there was a slight decrease in the HMC at which net value was maximized. Relative to the price of brokens, the optimum HMC was not influenced by fluctuations in head rice price. At a given HMC, the NV of a rice bulk increased with the price of brokens, and the extent of the increase was heavily influenced by the HRY versus HMC relationship. In all instances, the optimal HMC to maximize HRY (HMCopt-HRY) was greater than the HMC corresponding to the maximum NV (HMCopt-NV). When HMC, NV and HRY were plotted regardless of cultivar, location, or harvest year, the MC at which HRY was maximized was 21.7% whereas the MC at which NV was maximized was 18.5%, representing a 3.2 percentage point difference between HMCopt-HRY and HMCopt-NV
Other Title: Estimating the economic value of rice (Oryza sativa L.) as a function of harvest moisture content
Descriptors: agricultural-prices. costs. cultivars. drying. economic-analysis. milling-quality. moisture-content. rice

13. **Iron-fortified parboiled rice - A novel solution to high iron density in rice-based diets**
Prom-u-Thai-Chanakan. (chanakan@uq.edu.au). Fukai-Sh. Godwin-Ian-D. Rerkasem-Benjava. Huang-Longbi, Food Chemistry, 2008, 110 (2), pages 390-398
Abstract: The present study pioneered an investigation of a novel and cost-effective approach to fortify Fe in rice and to greatly improve Fe nutrition in rice-based diets through parboiling, though it remains at its preliminary phase. Rice grains of seven cultivars were parboiled in deionised water containing different levels of Fe chelate made by mixing different proportions of Fe sulfate (FeSO4) with ethylenediaminetetra-acetic acid disodium salt (Na(2)EDTA). Adding Fe to the parboiling water resulted in an increased Fe concentration in the most grain, effectively where FeSO4 and Na(2)EDTA were mixed at 2:1 molar ratio (11.16 g Fe per 100 g raw paddy grain). This treatment resulted in Fe concentrations in white rice milled for 60 s and 120 s, which were 20-50 times higher than those in the unfortified milled raw rice grains. The Fe concentrations in milled rice grains were 50-150 mg Fe kg(-1) in 60 s milled grains with a slight reduction in 120 s milled grains. Perls Prussian blue staining of the cross section of Fe-fortified parboiled rice grains suggested inward movement of added Fe into the endosperm through the apoplastic pathway in the dorsal region of the rice grain. The retention rates of fortified Fe varied among the different cultivars, possibly due to different physical-chemical properties of the grains. The percentages of soluble fraction of the total Fe were higher than 50% in all cultivars tested, indicating its high bioavailability potential, though it remains to be evaluated. The present findings provided a preliminary basis for further investigation of this innovative technique, before its adoption by parboiled rice industry, such as optimising the levels of Fe addition and industrial process and Fe bioavailability in Fe-fortified-parboiled rice.
Other Title: Iron-fortified parboiled rice - A novel solution to high iron density in rice-based diets
Descriptors: Nutrition; Foods parboiled rice (grain product), bioavailability potential

14. **An ecofriendly approach to process rice bran for high quality rice bran oil using supercritical carbon dioxide for nutraceutical applications**
Balachandran-C. Mayamol-P-N. Thomas-S. Divya-Sukumar. Sundaresan-A. Arumughan-C,
Bioresource Technology, 2008, 99 (8), pages 2905-2912
Abstract: An integrated approach to extraction and refining of RBO using supercritical carbon dioxide (SC-CO2) in order to preserve the nutritionally important phytochemicals is reported here. Process variables such as pressure, temperature, time, solvent flow rate and packing material on extraction yield and quality of RBO were investigated using a pilot model SC-CO2 extraction system. Three isobaric (350, 425 and 500 bar), three isothermal temperatures (50, 60 and 70 deg C), three extraction times (0.5, 1 and 1.5 h), at 40 g/min CO2 flow rate and three packing materials (pebbles, glass beads and structured SS rings) were employed. The RBO yield with SC-CO2 extraction increased with temperature and time under isobaric conditions. At the 60 deg C isotherm, an increase in the RBO yield was obtained with an increase in the pressure and time. The RBO yield increased significantly with structured SS rings used as packing material. The RBO extracted with SC-CO2 had negligible phosphatides, wax and prooxidant metals (Fe and Cu) and was far superior

in color quality when compared with RBO extracted with hexane. At the optimum condition of extraction at 500 bar, 60 deg C for 1.5 h, with structured SS rings used as packing material, the yield of RBO was comparable with that of hexane extraction (22.5%). The phytochemical contents of the RBO under the optimum conditions were in the range of tocols, 1500-1800 ppm; sterols, 15,350-19,120 ppm and oryzanol 5800-11,110 ppm
Other Title: An ecofriendly approach to process rice bran for high quality rice bran oil using supercritical carbon dioxide for nutraceutical applications
Descriptors: carbon-dioxide. extraction. flow. food-packaging. pressure. purification. rice-bran. rice-oil. temperature. time. waste-utilization

15. **Effect of fluidising velocity on the combustion of rice husk in a bench-scale fluidised bed combustor for the production of amorphous rice husk ash**
Rozainee-M. Ngo-S-P. Salema-A-A. Tan-K-G. Ariffin-M. Zainura-Z-N, Bioresource Technology, 2008, 99 (4), pages 703-713
Abstract: This study was focused on investigating the optimum fluidising velocity during the combustion of rice husk in a bench-scale fluidised bed combustor (ID 210 mm) to obtain low carbon ash in the amorphous form. When all other parameters are held constant, the optimum fluidizing velocity aids in almost complete combustion, thereby releasing the entrapped carbon for further conversion. This results in ash with consistently low carbon content (less than 2 wt%). The range of fluidising velocities investigated was from as low as 1.5 Umf to as high as 8 Umf. It was found that the optimum fluidising velocity was approximately 3.3 Umf as the mixing of rice husk with the bed was good with a high degree of penetration into the sand bed. The resulting ash retained its amorphous form with low residual carbon content (at 2.88 wt%) and minimal sand contamination as shown by the X-ray diffraction analysis
Other Title: Effect of fluidising velocity on the combustion of rice husk in a bench-scale fluidised bed combustor for the production of amorphous rice husk ash
Descriptors: ash. carbon. combustion. fluidized-beds. production. rice-husks. sand. silica. temperature. velocity

16. **Effects of maceration of rice straw on voluntary intake and performance of growing beef cattle fed rice straw-based rations**
Nader-G-A. Robinson-P-H, Animal Feed Science and Technology, 2008, 146 (1-2), pages 74-86
Abstract: Effects of field scale maceration on voluntary intake of rice straw, diet digestibility of neutral detergent fibre (aNDF) and performance of growing cattle were evaluated through chemical, in vitro and animal feeding experiments over a 3-year period. Due to the sequential nature of the study (i.e., a discrete experiment was completed in each year), the method of maceration differed among years. However, in each year, replicated rice fields of approximately 2.4 ha each, which had been managed similarly during growth, were harvested with or without maceration immediately after harvest. While no quantitative measure of maceration was applied in any experiment, the extent of maceration in year 1 was visually judged to be very light, characterized by only a few stem punctures and no longitudinal stem shredding. In year 2, the extent of stem puncture was increased, most internodes were crushed and a small amount of longitudinal shredding had occurred and, in year 3, the amount of internode crushing and longitudinal shredding was extreme. In each feeding

experiment, cattle were managed in groups of 8-10 and fed the experimental diets for a 14-day adaptation period prior to weighing on day 0 of the study. Diets consisted of lucerne hay, concentrate ingredients and rice straw that were fed for ad libitum intake. In general, the chemical composition of the rice straw was typical of California rice straw and, in spite of some differences due to maceration within year, there was no consistent impact on any analyte among years. In each year, the macerated rice straw had a numerically higher calculated metabolizable energy value, but these differences failed to reach statistical significance. The 30 h in vitro digestibility of aNDF in the faeces of cattle fed macerated straw was lower (P<0.01) in each study, although the absolute level of aNDF in faeces did not differ. Whole tract digestion of dietary aNDF was not impacted by rice straw maceration in experiment 1, was weakly numerically increased in experiment 2 (i.e., P=0.45), and approached statistical significance in experiment 3 (i.e., P=0.07), as the degree of maceration increased. Voluntary dry matter (DM) intake was numerically lower in cattle fed macerated rice straw in each experiment, and both the numerical extent and statistical support for that decline increased from experiments 1 to 3 as the degree of maceration of the rice straw increased, such that the 0.47 kg/d decline in DM intake by feeding macerated straw in experiment 3 was different (i.e., P<0.01). However, body weight gain was not impacted in any experiment and a shift from less efficient to more efficient gain/feed ratio from experiments 1 to 3 failed to reach statistical significance in any year. Maceration, in spite of substantial changes to the physical nature of the rice straw, failed to substantively impact animal performance
Other Title: Effects of maceration of rice straw on voluntary intake and performance of growing beef cattle fed rice straw-based rations
Language: English
Descriptors: animal-feeding. beef-cattle. body-weight. chemical-composition. composition. crop-residues. diets. digestibility. digestion. dry-matter. energy-value. evaluation. faeces. feeding. feeds. fibres. forage. hay. in-vitro. in-vitro-digestibility. intake. lucerne. lucerne-hay. metabolizable-energy. methodology. rice. rice-straw. straw. techniques. weight-gain

17. **Molecular evolution of the Pi-ta gene resistant to rice blast in wild rice (Oryza rufipogon)**
Huang-Chun-Li. Hwang-Shih-Yin. Chiang-Yu-Chun. Lin-Tsan-Piao. (tpl@ntu.edu.tw), Genetics, 2008, 179 (3), pages 1527-1538
Abstract: Rice blast disease resistance to the fungal pathogen Magnaporthe grisea. is triggered by a physical interaction between the protein products Of the host R (resistance) gene, Pi-ta, and the pathogen Avr (avirulence) gene, AVR-pita. The genotype variation and resistant/susceptible phenotype at the Pi-ta locus of wild rice (Oryza rufipogon), the ancestor of cultivated rice (O. sativa), was surveyed in 36 locations worldwide to study the molecular evolution and functional adaptation of the Pi-ta gene. The low nucleotide polymorphism of the Pi-ta gene of O. rufipogon was similar to that of O. sativa, but greatly differed from what has been reported for other O. rufipogon genes. The haplotypes can be subdivided into two divergent haplogroups named H1 and H2. HI is derived from H2, with nearly no variation and at a low frequency, H2 is common and is the ancestral form. The leucine-rich repeat (LRR) domain has a high ratio, and the low polymorphisin of the Pi-ta gene might. have primarily been caused by recurrent selective sweep and constraint by other putative physiological functions. Meanwhile, we provide data to show that the amino acid Ala-918 of H1 in the LRR domain has a close relationship with the resistant phenotype. HI

might have recently arisen during rice domestification and may be associated with the scenario of a blast pathogen-host shift from Italian millet to rice
Other Title: Molecular evolution of the Pi-ta gene resistant to rice blast in wild rice (Oryza rufipogon)
Language: English
Descriptors: Molecular Genetics (Biochemistry and Molecular Biophysics); Population Genetics (Population Studies) rice blast; fungal disease, infectious disease phenotype, disease resistance, molecular evolution, genotype variation

18. **Characterization of a putative rice mutant for reaction to rice tungro disease**
Zenna-N-S. Cabauatan-P-Q. Baraoidan-M. Leung-H. Choi-I-R, Crop Science, 2008, 48 (2), pages 480-486
Abstract: Artificial mutations may induce traits that are scarce among natural germplasm sources. This study was conducted to characterize a rice line derived from variety IR64 showing resistance to rice tungro disease (RTD). Approximately 24 000 lines derived from IR64 seeds treated with mutagens were evaluated for reaction to RTD. One of the lines, M4D6 83-1 (MD83), showed enhanced resistance to RTD. MD83 was resistant to rice tungro spherical virus (RTSV) and the virus vector, green leafhopper (GLH; Nephotettix virescens Distant). MD83 was crossed with susceptible varieties IR64 and Taichung Native 1. All F1 plants were susceptible to RTSV, whereas F2 and F3 progenies segregated into resistant and susceptible phenotypes in a 1:3 ratio, indicating that the resistance is controlled by a single recessive locus. Most of the F3 lines resistant to RTSV were also GLH resistant, suggesting that the resistance to RTSV and GLH was governed by the same locus. It has been difficult to prove whether the genotype MD83 was a product of a mutation event or was represented in the variety IR64 at a very low frequency
Other Title: Characterization of a putative rice mutant for reaction to rice tungro disease
Descriptors: disease-resistance. disease-vectors. insect-pests. loci. mutants. mutations. pest-resistance. plant-diseases. plant-pathogens. plant-pests. plant-viruses. rice

19. **Effects of feeding rice in substitution of corn and the degree of starch gelatinization of rice on the digestibility of dietary components and productive performance of young pigs**
Vicente-B. Valencia-D-G. Perez-Serrano-M. Lazaro-R. Mateos-G-G. (gonzalo.gmateos@upm.es), Journal of Animal Science, 2008, 86 (1), pages 119-126
Abstract: A 28-d trial was conducted to evaluate the effect of the main cereal of the diet (corn or rice), heat processing (HP) of rice, and the degree of starch gelatinization (SG) of rice on apparent total tract digestibility (ATTD) of dietary components and productive performance of pigs weaned at 25 d of age. The experimental design was a completely randomized, with 4 treatments and 8 replicates per treatment (5 pigs penned together). Control pigs were fed a complex diet without growth promoters and based on milk products, fish meal, and 50% cooked and flaked corn, with a degree of SG of 84%. Experimental groups received the same complex diet as the control group, but the corn was substituted by rice with 3 different degrees of SG; 11% that corresponded to raw rice and 52 or 76% that corresponded to cooked rice processed under 2 different conditions. Pig growth was measured at 25, 39, and 53 d of age, and ATTD was determined at 29, 39, and 53 d of age. The ATTD of all dietary

components except for N increased with age ($P < 0.01$) and were greater for the rice than for the corn diet. Heat processing of rice improved ATTD of all dietary components at 29 d of age, but no beneficial effects were observed at 39 or 53 d of age. Modifying the conditions of HP to increase the degree of SG of rice from 52 to 76% and to reduce mean particle size from 480 to 405 mu m did not result in further improvement of nutrient digestibility. From 25 to 53 d of age, pigs fed rice consumed more feed (678 vs. 618 g/d; $P < 0.05$), grew faster (466 vs. 407 g/d; $P < 0.01$), and tended to have greater G:F (0.685 vs. 0.662; $P < 0.10$) than pigs fed corn. In fact, from 25 to 39 d of age, pigs fed rice consumed 23% more feed ($P < 0.01$), grew 29% faster ($P < 0.01$), and had 5% greater G:F ($P < 0.05$) than pigs fed corn. Feeding rice improved performance of weanling pigs, and HP of rice under mild conditions enhanced diet digestibility and productive performance of pigs. Severe processing of rice increased the degree of SG but did not further improve diet digestibility or growth performance

Other Title: The effects of feeding rice in substitution of corn and the degree of starch gelatinization of rice on the digestibility of dietary components and productive performance of young pigs

Descriptors: Nutrition; Animal Husbandry (Agriculture) growth performance, nutrient utilization, starch gelatinization, corn diet (animal feed), rice feed (animal feed)

20. **Quantitative trait loci underlying domestication and yield-related traits in an Oryza sativa x Oryza rufipogon advanced backcross population**
Tan-Lubi. Zhang-Peijian. Liu-Fengxi. Wang-Guijua. Ye-Shen. Zhu-Zuofen. Fu-Yongca. Cai-Hongwe. Sun-Chuanqing. (suncq@cau.edu.cn), Genome, 2008, 51 (9), pages 692-704

Abstract: To understand the genetic characteristics of the traits related to differentiation between cultivated rice and its wild progenitor, genetic factors controlling domestication- and yield-related traits were identified using a BC3F2 population derived from an accession of common wild rice (donor, Oryza rufipogon Griff.) collected from Yuanjiang, Yunnan province, China, and an indica cultivar, Teqing (recipient, Oryza sativa L.). A genetic linkage map consisting of 125 simple sequence repeat (SSR) markers was constructed. Based on the phenotypes of the 383 BC3F2 families evaluated in two environments, two domestication-related morphological traits, panicle shape and growth habit, were found to be controlled by single Mendelian factors. This implies that the recessive mutations of single genes controlling some morphological traits could have been easily selected during early domestication. By single-point analysis and interval mapping, 59 putative quantitative trait loci (QTLs) that influence 11 quantitative traits were detected at two sites, and 37.5% of the QTL alleles originating from O. rufipogon had a beneficial effect for yield-related traits in the Teqing background. Regions with significant QTLs for domestication- and yield-related traits were detected on chromosomes 1, 4, 5, 7, 8, and 12. Fine mapping and cloning of these domestication-related genes and QTLs will be useful in elucidating the origin and differentiation of Asian cultivated rice in the future

Other Title: Quantitative trait loci underlying domestication and yield-related traits in an Oryza sativa x Oryza rufipogon advanced backcross population

Descriptors: Molecular Genetics (Biochemistry and Molecular Biophysics); Agronomy (Agriculture) backcross population, morphological traits, simple sequence repeat, genetic characteristics, growth habit, quantitative trait loci

21. **Parasitoid biodiversity conservation for sustainable management of the African rice gall midge, Orseolia oryzivora (Diptera: Cecidomyiidae) in lowland rice**
Nwilene-F-E. Togola-A. Agunbiade-T-A. Ogah-E-O. Ukwungwu-M-N. Hamadoun-A. Kamara-S-I. Dakouo-D,
Biocontrol Science and Technology, 2008, 18 (10), pages 1075-1081
Abstract: Platygaster diplosisae and Aprostocetus procerae attack both the African rice gall midge (AfRGM), Orseolia oryzivora, and Orseolia bonzii, a closely related gall midge that feeds on Paspalum scrobiculatum. Recent research has shown that managing this weed at the edge of rice fields offers African farmers, low-cost non-chemical control of AfRGM
Descriptors: beneficial insects; biodiversity; biological control agents; insect pests; parasitoids; plant pests; rice; sustainability; weeds Eulophidae; Hymenoptera; insects; Hexapoda; arthropods; invertebrates; animals; eukaryotes; Aprostocetus; West Africa; Africa South of Sahara; Africa; Developing Countries; ACP Countries; Commonwealth of Nations; Anglophone Africa; Orseolia; Cecidomyiidae; Diptera; Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; Paspalum; Platygasteridae;

22. **Rice seeding and nitrogen rate effects on yield and yield components of two rice cultivars**
Bond-J-A. Walker-T-W. Ottis-B-V. Harrell-D-L,
Agronomy Journal, 2008, 100 (2), p. 393-397

23. **Hybrid rice response to nitrogen fertilization for midsouthern United States rice production**
Walker-T-W. Bond-J-A. Ottis-B-V. Gerard-P-D. Harrell-D-L, Agronomy Journal, 2008, 100 (2), pages 381-386
Abstract: Field research was conducted for 2 yr to investigate the relationship between rice (Oryza sativa L.) seeding rate and preflood nitrogen (N) rate utilizing long-grain rice cultivars planted into clay and silt loam soils. Rice cultivars included 'Cheniere' and 'Wells' seeded at 162, 323, and 646 seeds m-2. Nitrogen was applied before flooding at 67, 134, and 202 kg ha-1. No response to soil texture and no interaction between seeding rate and N rate were detected for the parameters examined. The lowest applied N rate had lower yield than the other two N rates. Rough rice yields were 7564 for 67 kg N ha-1, 8520 for 134 kg N ha-1, and 9000 for 202 kg N ha-1 averaged over all cultivars, seeding rates, and soil textures. Similarly, when head rice yield was pooled across soil texture and seeding rate, head rice yield of Cheniere was independent of N rate, but head rice yield of Wells increased when the N rate was increased from 67 to 202 kg ha-1. Panicle density responded to N rate similar to rough rice yield. Panicle density increased with seeding rate up to 418 panicles m-2 at a seeding rate of 646 seeds m-2. Filled grain panicle-1 was highest at a seeding rate of 162 seeds m-2. Cheniere produced more filled grain panicle-1 while Wells had a higher 1000-grain weight. Grain yield and yield components of Cheniere and Wells respond to seeding rates and N rates independently when planted into clay or silt loam soils
Other Title: Rice seeding and nitrogen rate effects on yield and yield components of two rice cultivars
Descriptors: application-rates. crop-yield. nitrogen-fertilizers. panicles. rice. sowing-rates. yield-components

24. **Germination ecology of southern crabgrass (Digitaria ciliaris) and India crabgrass (Digitaria longiflora): two important weeds of rice in tropics**
Chauhan-B-S. Johnson-D-E, Weed Science, 2008, 56 (5), pages 722-728
Abstract: Southern and India crabgrass are important grass weeds of rice in many tropical countries. Environmental factors influenced seed germination and seedling emergence of these weeds. Seeds of both species germinated at a range of alternating temperatures (25/15, 30/20, and 35/25 C day/night), though the germination of southern crabgrass was reduced at the lowest alternating temperatures (25/15 C). Light stimulated germination of both species; however, a small proportion of southern crabgrass seeds germinated in the dark. Germination of India crabgrass was influenced to a greater degree by increasing salt and water stresses than was southern crabgrass. Seeds of both species germinated over a wide range of pH between 5 and 10. Seedling emergence of both species (98% for southern crabgrass and 94% for India crabgrass) was greatest for seeds placed on the soil surface. Seed burial depth of 2 cm completely inhibited emergence of India crabgrass, whereas for southern crabgrass, this depth was 8 cm. Knowledge gained from this study is expected to contribute to developing components of integrated weed management strategies for these species
Descriptors: ecology. emergence. environmental-factors. germination. rice. seed-germination. seedling-emergence. seedlings. seeds. soil. temperature. tropics. weed-control. weeds

25. **Germination ecology of goosegrass (Eleusine indica): an important grass weed of rainfed rice**
Chauhan-B-S. Johnson-D-E, Weed Science, 2008, 56 (5), pages 699-706
Abstract: Goosegrass is considered one of the most important grassy weeds of rice, particularly in rain-fed environments. Experiments were conducted in laboratory, screenhouse, and field to study the germination ecology of goosegrass seeds. In the laboratory, germination was greater at higher alternating temperatures (30/20 and 35/25 C) than at the lowest alternating temperatures (25/15 C). An after-ripening period of at least 3 mo was required to improve the germination of goosegrass. Germination was tolerant of salt stress but sensitive to a high degree of water stress. A pH range of 5 to 10 did not influence seed germination (92 to 95%). In the screenhouse study, seedling emergence of goosegrass was greatest (82%) for seeds placed on the soil surface, but decreased exponentially after that, no seedlings emerged at a burial depth of 8 cm. Seedling emergence and seedling dry matter declined markedly with the addition of crop residue to the soil surface at rates equivalent to 4 to 6 ton (t) ha-1. In the field, seedling emergence of goosegrass was greater under zero-till (ZT; 16 to 18%) than under minimum tillage (MINT; 8 to 11%). Because seedling emergence was greater from surface-sown seeds and emergence was favoured by ZT, this species is likely to become a problematic weed in ZT systems. The information gained from this study could be used in developing effective weed management strategies
Other Title: Germination ecology of goosegrass (Eleusine indica): an important grass weed of rainfed rice
Descriptors: after-ripening. crop-residues. ecology. emergence. germination. minimum-tillage. rice. ripening. seed-germination. seedling-emergence. seedlings. seeds. soil. temperature. tillage. water-stress. weed-control. weeds

26. **Seed germination ecology of purple-leaf button weed (Borreria ocymoides) and Indian heliotrope (Heliotropium indicum): two common weeds of rain-fed rice**
Chauhan-B-S. Johnson-D-E, Weed Science, 2008, 56 (5), pages 670-675
Abstract: Purple-leaf button weed and Indian heliotrope are widespread and common weed species of rain-fed rice in many tropical countries. The influence of various environmental factors on seed germination of these species was studied. Seeds of both species germinated at a range of alternating temperatures (25/15, 30/20, and 35/25 C day/night). Germination of purple-leaf button weed was similar among light conditions after an after-ripening period of 3 mo, whereas germination of Indian heliotrope was always greater in light. Seed germination of both species was not affected by a high level of salt and a range of pH between 5 and 9, but was sensitive to high degrees of water stress. Seed burial strongly inhibited germination and emergence of these species. Seedling emergence of purple-leaf button weed (82 to 86%) and Indian heliotrope (70%) was optimal when seeds were sown in the top 0.2-cm soil layer. A burial depth of 2 cm completely inhibited emergence of Indian heliotrope, whereas, for purple-leaf button weed, this depth was 5 cm. Most of these seeds germinated, however, when brought to the soil surface. The information gained from this study would help in predicting the potential of these species for spreading into new areas, and could contribute to their control
Other Title: Seed germination ecology of purple-leaf button weed (Borreria ocymoides) and Indian heliotrope (Heliotropium indicum): two common weeds of rain-fed rice
Descriptors: after-ripening. ecology. effects. emergence. environmental-factors. germination. light-relations. ripening. seed-germination. seedling-emergence. seedlings. seeds. soil. temperature. tropics. water-stress. weeds

27. **Germination ecology of two troublesome Asteraceae species of rainfed rice: Siam weed (Chromolaena odorata) and coat buttons (Tridax procumbens)**
Chauhan-B-S. Johnson-D-E,
Weed Science, 2008, 56 (4), pages 567-573
Abstract: Siam weed and coat buttons are among the most troublesome Asteraceae weed species of rainfed rice. The influence of various environmental factors on seed germination and seedling emergence of these weeds was determined. Germination response of both species was greater at the warmer fluctuating temperatures (30/20 and 35/25 C) than at the colder temperatures (25/15 C). Light stimulated germination in both species; however, some seeds still germinated in the dark. Both species were moderately tolerant of salt and water stress, but Siam weed tolerated more stresses than coat buttons. At the soil surface, Siam weed and coat buttons emergence was 75 and 76%, respectively, but this declined rapidly with increasing soil depths. Neither species emerged from depths exceeding 3 cm. Seedling emergence and seedling dry matter of both species were greatly reduced with the addition of crop residue to the soil surface at rates equivalent to 4 to 6 t ha-1. The information gained in this study will be used to facilitate development of effective weed control programmes
Other Title: Germination ecology of two troublesome Asteraceae species of rainfed rice: Siam weed (Chromolaena odorata) and coat buttons (Tridax procumbens)
Descriptors: control-programmes. crop-residues. ecology. effects. emergence. environmental-factors. germination. seed-germination. seedling-emergence. seedlings. seeds. soil. temperature. water-stress. weed-control. weeds

28. **Effect of nitrogen supply on carbon dioxide-induced changes in competition between rice and barnyardgrass (Echinochloa crus-galli)**
Zhu-ChunWu. Zeng-Qing. Ziska-L-H. Zhu-JianGuo. Xie-ZuBing. Liu-Gang,
Weed Science, 2008, 56 (1), pages 66-71
Abstract: As atmospheric carbon dioxide concentration ([CO2]) increases, it is anticipated that the competitive ability of C3 crops could be enhanced relative to C4 weeds in agricultural systems. However, given the different nitrogen use efficiencies of C3 and C4 plants, it is unclear whether any effect of increasing [CO2] on C3/C4 competition is nitrogen dependent. To determine the interaction of [CO2] and N availability on species growth and competitive outcomes, the growth of rice (C3 photosynthetic pathway) was examined in both monoculture and in competition with a common weed, barnyard grass (C4 photosynthetic pathway) at two levels of N supply (0.357 and 1.071 mmol N/litre) and two levels of [CO2] (ambient and ambient+200 micro mol/mol) under field conditions in eastern China. In monoculture, the biomass response of rice to elevated [CO2] depended on N supply, whereas the response of barnyard grass to elevated [CO2] was less dependent on N. Consequently, when grown in mixture, the proportion of rice biomass increased relative to that of barnyard grass under elevated [CO2] if the supply of N was adequate. However, if N was low, elevated [CO2] significantly reduced the proportion of leaf area and root biomass relative to barnyard grass biomass. Although data from this experiment confirm that competitiveness of rice could be enhanced relative to C4 weeds in response to rising [CO2] in situ, the data also indicate that such a response could be contingent on the supply of N. This suggests that, for rice cropping systems where N is in limited supply, rising atmospheric CO2 could still exacerbate competitive losses, even from C4 weeds
Other Title: Effect of nitrogen supply on carbon dioxide-induced changes in competition between rice and barnyardgrass (Echinochloa crus-galli)
Descriptors: carbon-dioxide. carbon-dioxide-enrichment. crop-weed-competition. nitrogen. rice. Weeds; China

29. **Genetic Engineering for the Poor: Golden Rice and Public Health in India**
Stein-A-J. Sachdev-H-P-S. Qaim-M,
World Development, 2008, 36 (1), pages 144-158

30. **Impact of allelochemical exuded from allelopathic rice on soil microbial community** /Kong-C-H. Wang-P. Zhao-H. Xu-X-H. Zhu-Y-D,
Soil Biology & Biochemistry, 2008, 40 (7), pages 1862-1869
Abstract: Vitamin A deficiency (VAD) affects millions of people, causing serious health problems. Golden Rice (GR), which has been genetically engineered to produce beta-carotene, is being proposed as a remedy. While this new technology has aroused controversial debates, its actual impact remains unclear. We develop a methodology for ex ante evaluation, taking into account health and nutrition details, as well as socioeconomic and policy factors. The framework is used for empirical analyses in India. Given broad public support, GR could more than halve the disease burden of VAD. Juxtaposing health benefits and overall costs suggests that GR could be very cost-effective
Other Title: Genetic Engineering for the Poor: Golden Rice and Public Health in India

Descriptors: Health Production. Economic Development: Agriculture; Natural Resources; Energy; Environment; Other Primary Products. Economic Development: Human Resources; Human Development; Income Distribution; Migration. Agricultural R&D; Agricultural Technology; Agricultural Extension Services

31. **Intercropping with aerobic rice suppressed Fusarium wilt in watermelon**
Ren-LiXuan. Su-ShiMing. Yang-XingMing. Xu-YangChun. Huang-QiWei. Shen-QiRong,
Soil Biology & Biochemistry, 2008, 40 (3), pages 834-844
Abstract: Watermelon is susceptible to Fusarium wilt in successively mono-cropped soil. Pot experiments were carried out to investigate the effect of intercropping with aerobic rice on Fusarium wilt in watermelon. The tested soil was classified as a loam soil, previously planted with watermelon and collected from Hexian county, Anhui province, China. The results obtained are listed as follows: (1) 66.7% of watermelon plants were infected with wilt disease and 44.4% died on 40 days after transplanting in mono-cropped soil, but plants were much less susceptible to infection when intercropped with rice; (2) the density of Fusarium oxysporum f. sp. niveum decreased by 91% in soil from the intercropped watermelon rhizosphere when compared with that from the mono-crop 40 days after transplanting; (3) densities of bacteria and actinomycetes increased, but fungal density decreased in rhizosphere soil from the intercrops in comparison with the mono-crop control; (4) compared to the control, the germinated Fusarium spores were decreased by 41.0% in the treatment with addition of 1.5 ml rice root exudates. Adding 20 ml of root exudates decreased Fusarium spore production by 76.4%; and (5) the activities of defense enzymes in the leaves and roots of watermelons in the intercropped system were significantly lower than those in the mono-cropped system. It is suggested that intercropping with aerobic rice alleviated Fusarium wilt in watermelon, by restraining the spore production of Fusarium and by changing the microbial communities in rhizosphere soil through the production of rice root exudates
Descriptors: aerobic-conditions. cropping-systems. cultural-control. disease-resistance. enzyme-activity. enzymes. fungal-diseases. fungal-spores. intercropping. leaves. loam-soils. microbial-flora. plant-disease-control. plant-diseases. plant-pathogenic-fungi. plant-pathogens. pot-experimentation. rhizosphere. rice. root-exudates. roots. soil-types. susceptibility. watermelons

32. **Transgenic Bt rice does not affect enzyme activities and microbial composition in the rhizosphere during crop development**
Liu-Wei. Lu-HaoHao. Wu-WeiXiang. Wei-QiKun. Chen-YingXu. Thies-J-E,
Soil Biology & Biochemistry, 2008, 40 (2), pages 475-486
Abstract: Use of transgenic crops, including those expressing the insecticidal Cry protein from Bt, is increasing at a rapid rate in worldwide. Field and laboratory studies of transgenic Bt crops have been carried out to detect the persistence and activity of the Cry protein in soil and its effect on soil microorganisms to assess their risks to environment. However, there were few studies that evaluate the seasonal effects of Bt rice on rhizosphere soil microbial communities compared to those of insecticides commonly applied in paddy soil for the control of lepidopteran insects. In this study, seasonal effects of transgenic rice expressing the Cry1Ab insecticidal protein active against lepidoperan pests and the insecticide triazophos [3-(o,o-diethyl)-1-phenyl thiophosphoryl-1,2,4-triazol] on soil enzyme activities and microbial communities were compared under field conditions. During a 2-year field

study, rhizosphere soil samples of transgenic-Bt rice (Bt), non-Bt parental rice (Ck) and non-Bt parental rice with triazophos (Ckp) applied were taken at four stages in the rice developmental cycle: seedling, booting, heading and maturing. Microbial processes were investigated by measuring different biochemical activities including those involved in C and P cycling. Denaturing gradient gel electrophoresis (DGGE) and terminal-restriction fragment length polymorphism (T-RFLP) analyses were used to compare rhizosphere microbial compositions. Some occasional and inconsistent effects of the application of triazophos on the bacterial composition in the rhizosphere soil of rice plant were found at the booting and heading stages as compared with that of transgenic-Bt rice. There were no statistically significant differences (P>0.05) in phosphatase activity, dehydrogenase activity, respiration, methanogenesis or fungal community composition in rhizosphere soil between Bt, Ck and Ckp over the rice cropping cycle. However, seasonal variations in the selected enzyme activities and microbial community composition in the rhizosphere soil of Bt, Ck and Ckp were clearly detected. These results suggested that the changes in rhizophere soil microbial community composition associated with the crop growth stage overweighed the application of triazophos and the cry1Ab gene transformation. KMD1 (Bt) rice expressing the cry1Ab gene had no measurable adverse effect on the key microbial processes or microbial community composition in rhizophere soil over 2 years of rice cropping
Other Title: Transgenic Bt rice does not affect enzyme activities and microbial composition in the rhizosphere during crop development
Descriptors: biological-activity-in-soil. enzyme-activity. insect-pests. insecticide-residues. insecticides. oxidoreductases. persistence. pest-resistance. phosphoric-monoester-hydrolases. plant-pests. polluted-soils. respiration. rhizosphere. rhizosphere-bacteria. rhizosphere-fungi. risk-assessment. seasonal-variation. soil-enzymes. soil-flora. soil-pollution. soil-types. transgenic-plants. triazophos

33. **Zero tillage impacts in India's rice-wheat systems: a review**
Erenstein-O. Vijay-Laxmi,
Soil & Tillage Research, 2008, 100 (1-2), pages 1-14
Abstract: To date, the most widely adopted resource conserving technology in the Indo-Gangetic Plains (IGP) of South Asia has been zero-tillage (ZT) wheat after rice, particularly in India. The paper reviews and synthesizes the experience with ZT in the Indian IGP. ZT wheat is particularly appropriate for rice-wheat systems in the IGP by alleviating system constraints by allowing earlier wheat planting, helping control the weed Phalaris minor, reducing production costs and saving water. ZT wheat after rice generates substantial benefits at the farm level (US$97 ha-1) through the combination of a 'yield effect' (a 5-7% yield increase, particularly due to more timely planting of wheat) and a 'cost savings effect' (US$52 ha-1, particularly tillage savings). These benefits explain the widespread interest of farmers and the rapidity of the diffusion across the Indian IGP, further aided by the wide applicability of this mechanical innovation
Descriptors: cost-benefit-analysis. crop-yield. cropping-systems. cultural-control. no-tillage. reviews. rice. weed-control. weeds. wheat

34. **Why grain yield of transplanted rice on permanent raised beds declines with time?** / Kukal-S-S. Yadvinder-Singh. Sudhir-Yadav. Humphreys-E. Amanpreet-Kaur. Thaman-S,
Soil & Tillage Research, 2008, 99 (2), pages 261-267

Abstract: Permanent raised beds are being promoted as a resource conservation technology for rice-wheat systems in Indo-Gangetic plains (IGP) to improve the water productivity of rice and wheat in addition to other benefits, as furrow irrigation can be more efficient than flood irrigation. However, several studies carried out in the NW IGP have shown rice grain yields to decrease with the increasing age of the beds. The present study was conducted on a deep alluvial loam (Ustochrept) in a farmer's field at Phillaur, Punjab, India, to identify possible reasons for the declining grain yield of rice on the permanent raised beds (37.5 cm wide alternating with 30 cm wide furrows 15 cm deep) in comparison to fresh raised beds. The beds were formed with a bed planter drawn by a 35-hp 4-wheel tractor, which was also used to direct drill wheat on the permanent beds each year, and to reshape the beds prior to each rice crop. This paper reports a study of rice root distribution and mass at the end of the vegetative stage, and soil bulk density after harvest, for transplanted rice on permanent beds (4th rice crop, 8th crop) in comparison with transplanted rice on fresh beds (1st crop). Rice grain yield declined linearly with increasing age of the permanent beds. It decreased by 19% in 2004, 45% in 2005 and 59% in 2006 from 4.64 t ha-1 in 2003. In situ exposure of root profiles on permanent and fresh beds revealed that the horizontal spread of roots on permanent beds (6 cm from the base of the plant at 18 cm depth and 12 cm at 27 cm depth) was much less than on fresh beds (12 cm at 18 cm depth and 18 cm at 27 cm depth). The root mass density in at 0-15 cm the middle of the fresh beds was 59% higher than on the permanent beds. Bulk density was significantly higher under the shoulder and side of the permanent beds to the depth of sampling (0-15 cm) than under the fresh beds at the same positions across the furrow. The decline in performance of rice on beds as the beds aged was at least partly due to compaction of the permanent beds by the tractor tyres, which had width similar to that of the top of the furrow. This hindered the spread of the roots particularly towards the beds
Descriptors: compaction. crop-yield. raised-beds. rice. roots. soil-compaction. transplanting. yield-losses

35. **Faster residue decomposition of brittle stem rice mutant due to finer breakage during threshing/** Cabiles-D-M-S. Angeles-O-R. Johnson-Beebout-S-E. Sanchez-P-B. Buresh-R-J,
Soil & Tillage Research, 2008, 98 (2), pages 211-216
Abstract: In intensive tropical rice (Oryza sativa L.) cropping systems with short fallows, it would be advantageous that rice straw decompose fast enough to facilitate land preparation and planting of the subsequent crop. The straw of a brittle stem rice mutant of IR68 was tested for more rapid decomposition compared with non-brittle IR68 straw. The hypothesis was that the brittle mutant straw would break into smaller pieces during threshing, and that both the smaller piece size and the differences in biochemical straw composition would enable more rapid decomposition. Brittle straw broke into smaller pieces than non-brittle straw during a replicated trial of three threshing methods: hand threshing, pedal threshing, and axial-flow machine threshing. In a litter bag study to determine the effect of straw piece size on decomposition rate of each straw type over 10 weeks, smaller straw pieces decomposed faster than larger pieces as indicated by changes in amount of straw and its C/N ratio over time ($P<0.05$), but there was no significant difference between straw types at the same size. It was concluded that the finer breakage of brittle straw during field operations is likely to be more important than the biochemical differences in overall residue decomposition rate

Descriptors: carbon-nitrogen-ratio. crop-residues. decomposition. mutants. rice. rice-straw. straw. threshing

36. **Proteomic analysis of rice defense response induced by probenazole**
Lin-YuZ. Chen-HuaiY. Kao-R. Chang-ShihPa. Chang-SuJei. Lai-ErhMi,
Phytochemistry, 2008, 69 (3), pages 715-728
Abstract: Here, we report the first proteomic analysis of rice defense response induced by probenazole (PBZ), an agricultural chemical that has been widely used to protect rice plants from rice blast and the bacterial blight pathogen. Two-dimensional gel electrophoresis (2-DE) was utilized to identify a total of 40 protein spots including 9 protein spots that are up-regulated by PBZ and 31 abundant protein spots. A total of 11 unique proteins from these 9 spots were identified by LC-MS/MS, and the majority of them were classified and/or possessed orthologs in defense-related functions. Five protein spots with only one protein species identified in each spot appear to be PBZ-regulated proteins. They are a putative glutathione S-transferase GSTU17, a putative phenylalanine ammonia-lyase (PAL, XP_466843), a putative caffeic acid 3-O-methyltransferase (COMT), a putative NADH-ubiquinone oxidoreductase, and a putative glucose-1-phosphate adenyltransferase. However, the other six protein species identified from the remaining four protein spots could not be conclusively described as PBZ-regulated proteins due to either the co-migration of two protein species in one spot or the presence of one protein species in two spots. Through real-time reverse transcription polymerase chain reaction (RT-PCR), it was determined that PAL (XP_466843) is likely regulated at the protein level, whereas GSTU17 and COMT were regulated at the mRNA level after PBZ application. Interestingly, the mRNA transcripts of two PAL paralogs were found to be up-regulated by PBZ. We propose that PAL, COMT, and GSTU17 are likely to confer PBZ-induced disease resistance via such functions as biosynthesis and transport of flavonoid-type phytoalexin and/or lignin biogenesis
Other Title: Proteomic analysis of rice defense response induced by probenazole
Descriptors: defence mechanisms; disease resistance; pesticides; proteomics; rice Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

37. **Quantitative analysis of auxin-regulated proteins from basal part of leaf sheaths in rice by two-dimensional difference gel electrophoresis**
Shi-Fan. Takasaki-H. Komatsu-S,
Phytochemistry, 2008, 69 (3), pages 637-646
Abstract: To identify the effects of auxin on rice root formation, proteins induced by exogenous addition of auxin to rice seedlings were analyzed by a proteomic approach. Root formation by rice seedlings was promoted by 0.45 M 2,4-dichlorophenoxyacetic acid (2,4-D) and repressed by 60 M p-chlorophenoxyisobutyric acid (PCIB). Proteins extracted from the basal part of leaf sheaths of rice seedlings treated with 2,4-D or PCIB for 48 h were labeled with Cy3 and Cy5, and separated by two-dimensional polyacrylamide gel electrophoresis. Out of nine proteins up-regulated by 2,4-D and down-regulated by PCIB, five proteins showing significant difference in abundance were used for expression analysis at the transcript abundance level. Transcript abundance of the mitochondrial complex I subunit slightly increased with 2,4-D treatment and were repressed by PCIB. The transcript abundance of EF-1beta, myosin heavy chain and mitochondrial [Mn]SOD increased with 2,4-D treatment but did not decrease with PCIB. The transcript abundance of aldehyde dehydrogenase was not

effected by 2,4-D or PCIB. These results indicate that mitochondrial complex I subunit is part of the downstream signal cascade of PCIB, whereas myosin heavy chain, mitochondrial [Mn]SOD and EF-1beta are involved in the 2,4-D signal cascade but are probably upstream of PCIB
Other Title: Quantitative analysis of auxin-regulated proteins from basal part of leaf sheaths in rice by two-dimensional difference gel electrophoresis
Descriptors: 2,4-D; auxins; electrophoresis; leaf sheaths; leaves; plant development; plant growth regulators; plant proteins; proteomics; quantitative analysis; rice; roots; seedlings Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

38. **Effects of a bile acid elicitor, cholic acid, on the biosynthesis of diterpenoid phytoalexins in suspension-cultured rice cells**
Shimizu-T. Jikumaru-Y. Okada-A. Okada-K. Koga-J. Umemura-K. Minami-E. Shibuya-N. Hasegawa-M. Kodama-O. Nojiri-H. Yamane-H,
Phytochemistry, 2008, 69 (4), p. 973-981
Abstract: An elicitor of rice defense responses was recently isolated from human feces and was identified as cholic acid (CA). Pathogen infection in rice leaves induces phytocassanes and momilactones, both of which are major diterpenoid phytoalexins in rice, whereas CA mainly induces phytocassanes. We established a high-performance liquid chromatography-electrospray ionization-tandem mass spectrometry protocol for the rapid and accurate quantification of phytocassanes and momilactones. Using this method, we showed that CA preferentially induced the formation of phytocassanes in suspension-cultured rice cells, while a fungal chitin oligosaccharide elicitor induced that of both phytocassanes and momilactones. We further investigated the effects of CA on the expression of diterpene cyclase genes involved in phytoalexin biosynthesis. CA induced the transcription of the genes OsCPS2 (OsCyc2) and OsKSL7 (OsDTC1), which are involved in phytocassane biosynthesis, to a greater extent than the genes OsCPS4 (OsCyc1) and OsKSL4, which are involved in momilactone biosynthesis. OsCPS2 was particularly strongly induced, suggesting that it is one of the main mechanisms by which CA induces high levels of phytocassanes
Other Title: Effects of a bile acid elicitor, cholic acid, on the biosynthesis of diterpenoid phytoalexins in suspension-cultured rice cells
Descriptors: analytical methods; bile acids; biosynthesis; cell cultures; cell suspensions; chitin; cholic acid; diterpenoids; fungal elicitors; gene expression; genes; HPLC; mass spectrometry; oligosaccharides; phytoalexins; rice; transcription Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

39. **Pathogenesis-related proteins in somatic hybrid rice induced by bacterial blight**
Yu-C-L. Yan-S-P. Wang-C-C. Hu-H-T. Sun-W-N. Yan-C-Q. Chen-J-P. Yang-Lin,
Phytochemistry, 2008, 69 (10), pages 1989-1996
Abstract: Rice bacterial blight, caused by Xanthomonas oryzae pv. Oryzae (Xoo), is one of the most serious rice diseases worldwide. The bacterial blight resistance trait from Oryza meyeriana, a wild rice species, was introduced into an elite japonica rice cultivar using asymmetric somatic hybridization. This study was carried out with the intention of understanding the molecular mechanism of incompatible interaction between Xoo and the stable somatic hybrids by using proteomic analyses. Proteins were extracted from leaves at 24, 48, and 72 h after Xoo inoculation and separated by 2-DE. A total of 77 protein spots changed their intensities significantly ($p<0.05$) by

more than 1.5-fold at least at one time point. Sixty-four protein spots were successfully identified by MS analysis. Among them, 51 were known to be involved in photosynthesis. Up-regulation of Rubisco large subunit (RcbL) small fragments and down-regulation of RcbL big fragments indicated that intact RcbL and RcbL big fragments degraded following Xoo attack, which was further confirmed by Western blot analysis. The differential expression of proteins related to signal transduction, antioxidant defense, photosynthesis, metabolism, and protein turnover during the Xoo infection, suggests the existence of a complex regulatory network in the somatic hybrid rice that increases resistance toward Xoo infection and damage
Other Title: Pathogenesis-related proteins in somatic hybrid rice induced by bacterial blight
Descriptors: disease resistance; gene expression; genes; genetic resistance; hybrids; plant diseases; plant pathogenic bacteria; plant pathogens; plant proteins; rice; somatic hybridization Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes; Xanthomonas oryzae; Xanthomonas; Xanthomonadaceae; Gracilicutes; bacteria; prokaryotes

40. **An antibacterial pyrazole derivative from Burkholderia glumae, a bacterial pathogen of rice** / Mitchell-R-E. Greenwood-D-R. Vijayalekshmi-Sarojin, Phytochemistry, 2008, 69 (15), pages 2704-2707
Abstract: Burkholderia glumae, a bacterial pathogen on rice, produced compounds in liquid culture that, in agar diffusion assays, gave strong inhibitory action against Erwinia amylovora, the bacterium responsible for fire blight disease of apple and pear trees. Products were isolated from culture medium by cation exchange and then purified by bioassay-guided chromatographic methods. Two major products were obtained, one of which was not active when fully purified. Each product showed a single ninhydrin-staining spot on TLC and a single HPLC peak. The non-active product was deduced from NMR, MS, and chemical data, to be the tripeptide L-alanyl-L-homoserinyl-L-aspartate. The NMR data for the active product demonstrated that it contained the same tripeptide, but functionalised at the beta-carboxyl of the C-terminal aspartate, by a moiety that provided an additional 98 mass units to the parent tripeptide. Various data led to the interpretation that this moiety was a highly unusual oxygenated pyrazole structure, and thus the bioactive product was deduced to be 3-[L-alanyl-L-homoserinyl-L-aspartyl-beta-carboxy]-4-hydroxy-5-oxopyrazo le. This compound was found to inhibit the growth of a number of different bacterial species
Other Title: An antibacterial pyrazole derivative from Burkholderia glumae, a bacterial pathogen of rice
Descriptors: antibacterial properties; apples; biological control; biological control agents; pears; peptides; plant pathogenic bacteria; plant pathogens; rice Burkholderia; Burkholderiaceae; Burkholderiales; Betaproteobacteria; Proteobacteria; Bacteria; prokaryotes; Erwinia; Enterobacteriaceae; Enterobacteriales; Gammaproteobacteria; Malus; Rosaceae; Rosales; dicotyledons; angiosperms; Spermatophyta; plants; eukaryotes; Oryza; Poaceae; Cyperales; monocotyledons; Pyrus

41. **Characterization of glutathione S-transferase of the rice leaffolder moth, *Cnaphalocrocis medinalis* (Lepidoptera: Pyralidae): Comparison of its properties of glutathione S-transferases from other lepidopteran insects**
Yamamoto-Kohji. (yamamok@agr.kyushu-u.ac.jp). Teshiba-Satosh. Aso-Yoich, Pesticide Biochemistry and Physiology, 2008, 92 (3), pages 125-128

Abstract: An enzyme that possesses the glutathione S-transferase (GST) activity was found in the rice leaffolder moth, Cnapholocrocis medinalis. The enzyme was purified to homogeneity for the first time by ammonium sulfate fractionation and affinity chromatography. The resultant enzyme revealed a single band with a molecular mass of 24 kDa by SDS-polyacrylamide gel electrophoresis under reduced conditions. When assayed with 1-chloro-2,4-dinitrobenzene, a universal substrate for GST, the purified GST had an optimum pH at 8.0, and was fairly stable at pH 3-10 and at temperatures below 50 degrees C. The enzyme was also able to conjugate glutathione to 4-hydroxynonenal, a cytotoxic lipid peroxidation product. The present GST was inhibited by fenitrothion, permethrin, and deltamethrin, suggesting that the GST could be involved in metabolizing these organophosphorus and pyrethroid insecticides.
Other Title: Characterization of glutathione S-transferase of the rice leaffolder moth, Cnaphalocrocis medinalis (Lepidoptera: Pyralidae): Comparison of its properties of glutathione S-transferases from other lepidopteran insects
Descriptors: Methods and Techniques; Enzymology (Biochemistry and Molecular Biophysics) temperature, optimum pH

42. **Effect of feeding forest foliages, rice straw and concentrate-based total mixed ration on nutrient utilization and growth in mithun (Bos frontalis)**
Prakash-B. Dhali-A. Mech-A. Khate-K. Moaakum-H. Rajkhowa-C,
Livestock Science, 2008, 117 (2-3), pages 263-269
Abstract: The study aimed to evaluate the effect of feeding Borrena hirticulata (BH), Ficus hirta (FH), rice straw (RS) and concentrate-based total mixed ration (TMR) on nutrient utilization, rumen fermentation and growth in mithun. Growing male mithun calves were randomly allotted to 2 feeding groups (6 in each), TMR1 and TMR2. The TMRs consisted of RS 300 g kg-1, concentrate 400 g kg-1 and BH 300 g kg-1 (TMR1) or FH 300 g kg-1 (TMR2) on a dry matter (DM) basis. Both TMRs were fed ad libitum to the animals for 121 d and a digestibility study was conducted during the last 7 d of the experiment. To assess rumen fermentation, rumen fluid was collected at 2 h interval for 24 h. Apparent digestibility of DM, crude protein (CP) and crude fibre (CF) did not differ significantly between the TMRs. Nevertheless, apparent digestibility of ether extract was found to be significantly ($P<0.01$) greater in TMR2 (0.59) compared to TMR1 (0.54). Body weight gain (BWG; g d-1), DM intake (kg d-1), CP intake (g d-1) and feed efficiency (kg feed kg-1 gain) were found to be significantly ($P<0.05$) greater in TMR1 (548, 5.14, 713 and 9.28) compared to TMR2 (496, 4.91, 703 and 10.03). An insignificant positive association ($r=0.35$) between DM intake and BWG, but a significant ($P<0.01$) positive association ($r=0.74$) between CP intake and BWG were evident. Rumen pH (5.71 to 7.18) and ammonia-nitrogen (8.0 to 25.0 mg/dl) did not differ significantly between the TMRs, but differed significantly ($P<0.01$) at different h post-feeding. In contrast, rumen total volatile fatty acid (42 to 105 mM) and total nitrogen (40.4 to 90.3 mg/dl) differed significantly ($P<0.05$) between the TMRs and at different h post-feeding. The study revealed that BH, FH, RS and concentrate-based TMRs may be fed to mithun for satisfactory growth
Other Title: Effect of feeding forest foliages, rice straw and concentrate-based total mixed ration on nutrient utilization and growth in mithun (Bos frontalis)
Descriptors: ammonium-nitrogen. diets. ether-extracts. feed-conversion-efficiency. feed-intake. growth. liveweight-gain. nitrogen-balance. nutrition-physiology. protein-

digestibility. protein-digestion. rice. rice-straw. rumen-digestion. rumen-fermentation. straw. volatile-fatty-acids

43. **Toxic compounds in essential oils of coriander, caraway and basil active against stored rice pests/** Lopez-Maria-D. Jordan-Maria-J. Pascual-Villalobos-Maria-J. (mjesus.pascual@carm.es),
Journal of Stored Products Research, 2008, 44 (3), pages 273-278
Abstract: Essential oils, distilled from seeds of Coriander sativum and Carum carvii and from leaves of five different varieties of Ocimum basilicum, were fractionated by column chromatography and tested in the laboratory for volatile toxicity against three stored rice pests (Sitophilus oryzae, Rhyzopertha dominica and Cryptolestes pusillus). The active fractions were analyzed by GC-MS. Coriander contained linalool (1617 ppm of-the oil) as the main product active against the three pests. Camphor-rich fractions (over 400 ppm) were very toxic to R. dominica and C pusillus. Tile caraway profile included carvone and limonene as expected but (E)-anethole, generally regarded as a minor product in the essential oil of this species, was also a major component, being present at 365 ppm. Carvone was the most effective (972 ppm) monoterpenoid against S. oryzae. In addition, (E)-anethole at 880 ppm was toxic to R. dominica while vapors of limonene (1416 ppm) and fenchone-rich (554 ppm) fractions killed adults of C. pusillus only. Three major essential oil profiles were present in the five varieties of O. basilicum analyzed: methyl eugenol/estragole, estragole and estragole/linalool chemotypes. The abundance of components had a strong influence on the outcome of the bioassays. Fractions, where combinations of products occurred with or without other minor compounds, were often more toxic than any one compound alone.
Other Title: Toxic compounds in essential oils of coriander, caraway and basil active against stored rice pests
Descriptors: Biochemistry and Molecular Biophysics; Agronomy (Agriculture); Pest Assessment Control and Management chemotype

44. **Hull characteristics as related to susceptibility of different varieties of rough rice to Rhyzopertha dominica (F.) (Coleoptera : Bostrichidae)**
Chanbang-Y. Arthur-F-H. (frank.arthur@ars.usda.gov). Wilde-G-E. Throne-J-E,
Journal of Stored Products Research, 2008, 44 (3), pages 205-212
Abstract: Rhyzopertha dominica (F.), an important pest of stored grains, causes economic damage to rough rice through physical damage to the kernel, resulting in reductions in grain quality. In this test, 28 varieties of commercial rough rice (10 long grain, 11 medium grain, and 7 short grain) were examined for solid, split and cracked hulls, hull thickness, and adult emergence from neonate R. dominica introduced on each individual variety. The percentage of solid hulls ranged from 55.5% on Koshihikari variety to 92.8% on Akita variety, and the percentages of cracked and split hulls were correlated with increased susceptibility. The Dobie index for progeny production showed Wells, Jupiter, and Pirogue varieties as the most tolerant to R. dominica, while Rico and Francis were the most susceptible. The hull thickness of rough rice varied among varieties, but the tolerant varieties appeared to have thicker hulls than the susceptible varieties. There was no difference among rice types (long-, medium-, or short grain) regarding tolerance or susceptibility to R. dominica. Results show that the characteristics of the rough rice hull are important for conferring susceptibility of individual varieties to R. dominica

Other Title: Hull characteristics as related to susceptibility of different varieties of rough rice to Rhyzopertha dominica (F.) (Coleoptera : Bostrichidae)
Descriptors: Agronomy (Agriculture); Pest Assessment Control and Management rice grain (grain product), pest susceptibility, pest tolerance, hull characteristic

45. **Structural insights into rice BGlu1 beta-glucosidase oligosaccharide hydrolysis and transglycosylation**
Chuenchor-Watchale. Pengthaisong-Salil. Robinson-Robert-C. Yuvaniyama-Jirundo. Oonanant-Worrapo. Bevan-David-R. Esen-Asi. Chen-Chun-Jun. Opassiri-Rodjan. Svasti-Jisnuso. Cairns-James-R-Ketudat. (cairns@sut.ac.th),
Journal of Molecular Biology, 2008, 377 (4), pages 1200-1215
Abstract: The structures of rice BGlu1 beta-glucosiclase, a plant beta-glucosidase active in hydrolyzing cell wall-derived oligosaccharides, and its covalent intermediate with 2-deoxy-2-fluoroglucoside have been solved at 2.2 angstrom and 1.55 angstrom resolution, respectively. The structures were similar to the known structures of other glycosyl hydrolase family 1 (GHI) beta-glucosidases, but showed several differences in the loops around the active site, which lead to an open active site with a narrow slot at the bottom, compatible with the hydrolysis of long beta-1,4-linked oligosaccharides. Though this active site structure is somewhat similar to that of the Paenibacillus polyinyxa beta-glucosidase B, which hydrolyzes similar ohgosaccharides, molecular docking studies indicate that the residues interacting with the substrate beyond the conserved -1 site are completely different, reflecting the independent evolution of plant and microbial GH1 exo-beta-glucanase/beta-glucosidases. The complex with the 2-fluoroglucoside included a glycerol molecule, which appears to be in a position to make a nucleophilic attack on the anomeric carbon in a transglycosylation reaction. The coordination of the hydroxyl groups suggests that sugars are positioned as acceptors for transglycosylation by their interactions with E176, the catalytic acid/base, and Y131, which is conserved in barley BGQ60/beta-II beta-glucosidase, that has oligosaccharide hydrolysis and transglycosylation activity similar to rice BGlu1. As the rice and barley enzymes have different preferences for cellobiose and cellotriose, residues that appeared to interact with docked oligosaccharides were mutated to those of the barley enzyme to see if the relative activities of rice BGlu1 toward these substrates could be changed to those of BGQ60. Although no single residue appeared to be responsible for these differences, 1179, N190 and N245 did appear to interact with the substrates. (C) 2008 Elsevier Ltd. All rights reserved
Other Title: Structural insights into rice BGlu1 beta-glucosidase oligosaccharide hydrolysis and transglycosylation
Descriptors: Enzymology (Biochemistry and Molecular Biophysics) enzyme-substrate interaction

46. **Pleomorphic configuration of the trimeric capsid proteins of Rice dwarf virus that allows formation of both the outer capsid and tubular crystals**
Iwasaki-K. Miyazaki-N. Hammar-L. Zhu-YaFeng. Omura-T. Wu-Bomu. Sjoborg-F. Yonekura-K. Murata-K. Namba-K. Caspar-D-L. Fujiyoshi-Y. Cheng-R-H,
Journal of Molecular Biology, 2008, 383 (1), pages 252-265
Abstract: In the double-shelled capsid of Phytoreovirus, the outer capsid attaches firmly to the 3-fold axes of the T=1 core. It then forms a T=13 lattice via lateral interactions among the P8 trimers (Wu et al., 2000, Virology 271, 18-25). Purified P8

molecules also assemble into hexagonal monolayers as well as tubular crystals. To explore the mechanisms of formation of these structures, the configurations of P8 trimers were compared and verified in particles of Rice dwarf virus and in tubular crystals (tubes) whose structure was determined by cryoelectron microscopy using helical reconstruction technique. Remarkable variations in intertrimer contacts were observed in the tubes and in the surface lattice of Rice dwarf virus capsid. Superposition of the atomic structure of P8 trimers in the structures analyzed by cryoelectron microscopy allowed us to identify groups of specific and stable interactions, some of which were preserved in the tubes and the quasi-equivalent T=13 icosahedral lattice of the virion's shell. The flexible nature of the binding between P8 trimers, created via electrostatic interactions that hold radially inward, appears to allow the outer-capsid P8 trimers to envelop the ragged surface of the core, forming the double shell of an intact viral particle
Other Title: Pleomorphic configuration of the trimeric capsid proteins of Rice dwarf virus that allows formation of both the outer capsid and tubular crystals
Descriptors: coat-proteins. plant-pathogens. plant-viruses. viral-proteins

47. **Thermochemical esterifying citric acid onto lignocellulose for enhancing methylene blue sorption capacity of rice straw**
Gonga-Renmin. (rmgong.nju@163.com). Zhong-Kedin. Hu-Yu. Chen-Jia. Zhu-Guopin, Journal of Environmental Management, 2008, 88 (4), pages 875-880
Abstract: In this paper, rice straw was esterified thermochemically with citric acid (CA) to produce potentially biodegradable cationic sorbent. The modified rice straw (MRS) and crude rice straw (CRS) were evaluated for their methylene blue (MB) removal capacity from aqueous solution. The effects Of Various experimental parameters (e.g., initial pH, sorbent dose, dye concentration, ion strength, and contact time) were examined. The ratio of MB sorbed on CRS increased as the initial pH was increased from pH 2 to 10. For MRS, the M 13 removal ratio came up to the maximum Value beyond pH 3. The 1.5 g/l or up of MRS Could almost completely remove the dye from 250 mg/l of MP solution. The ratio of MB sorbed kept above 98% over a range from 50 to 450 mg/l of MB concentration when 2.0 g/l Of MRS Was used. increase in ion strength of solution induced decline of M B sorption. The isothermal data fitted the Langmuir model. The sorption processes followed the pseudo-first-order rate kinetics. The intraparticle diffusion rate constant (k(id)) was greatly increased due to modification.
Other Title: Thermochemical esterifying citric acid onto lignocellulose for enhancing methylene blue sorption capacity of rice straw
Descriptors: Biochemistry and Molecular Biophysics; Waste Management (Sanitation) rice straw, thermochemical esterification

48. **Resistance pattern and antioxidant enzyme profiles of protoporphyrinogen oxidase (PROTOX) inhibitor-resistant transgenic rice**
Il-Jung-H. Kuk-Yong-In. (yikuk@sunchon.ac.kr).Back-Kyoungwha. Burgos-Nilda-R, Pesticide Biochemistry and Physiology, 2008, 91 (1), pages 53-65
Abstract: We quantified the resistance levels of transgenic rice plants, expressing Myxococcus xanthus protoporphyrinogen oxidase (PROTOX) in chloroplasts and mitochondria, to PROTOX inhibitors, acifluorfen, oxyfluorfen, carfentrazone-ethyl, and oxadiazon. We also determined whether active oxygen species-scavenging enzymes are involved in the resistance mechanism of transgenic rice. The transgenic rice line M4 was about >200-fold more resistant to oxyfluorfen than the wild-type

(WT). M4 was also resistant to acifluorfen, carfentrazone-ethyl, and oxadiazon, but did not show multiple resistance to imazapyr and paraquat, which have different target sites. Acifluorfen, oxyfluorfen, carfentrazone-ethyl, and oxadiazon reduced the chlorophyll content in leaves of WT, but had minimal or no effect on M4. The PROTOX inhibitors also caused significant lipid peroxidation in the treated leaves of WT rice. However, the malondialdehyde production in M4 was not affected by these herbicides. The WT rice had higher activities of superoxide dismutase, catalase, ascorbate peroxidase, and glutathione reductase than M4 after treatment with PROTOX inhibitors. A similar response was observed in all cases of antioxidant isozyme profiles analyzed. However, the induction in antioxidant activity in WT was not enough to overcome the toxic effects of a PROTOX inhibitor so the plant eventually died.
Other Title: Resistance pattern and antioxidant enzyme profiles of protoporphyrinogen oxidase (PROTOX) inhibitor-resistant transgenic rice
Descriptors: Enzymology (Biochemistry and Molecular Biophysics) resistance pattern

49. **Effects of rice straw on the speciation of cadmium (Cd) and copper (Cu) in soils**
Cui-Y-S. Du-X. Weng-L-P. Zhu-Y-G,
Geoderma, 2008, 146 (1-2), pages 370-377
Abstract: Four soils were collected from different sites of China in Lechang (LC, Guangdong province), Changsha (CS, Hunan province), Jiaxing (JX, Zhejiang province) and Hangzhou (HZ, Zhejiang province), and were spiked with Cu (50 mg kg-1) and Cd (5 mg kg-1). The effects of rice straw addition (6%) on the chemical distribution of both metal ions were studied by measuring the soluble metal ion concentrations and the free metal ion concentrations (using the Donnan membrane technique) after 1-, 3- and 6-month incubation. Results show that the addition of rice straw increased soil pH by about 0.4 pH unit on average, and increased DOC significantly in soil LC, CS and JX, but not in soil HZ. With the addition of rice straw, total soluble Cu concentration increased from 0.82 micro mol l-1 (0.26-2.4 micro mol l-1) to 1.22 micro mol l-1 (0.70-3.60 micro mol l-1), whereas total soluble Cd concentration decreased from 20 nmol l-1 (2-70 nmol l-1) to 15 nmol l-1 (2-56 nmol l-1). When rice straw was added, both free Cu2+ and Cd2+ concentrations decreased, for free Cu2+ concentration from 217 nmol l-1 (31 to 369 nmol l-1) to 124 nmol l-1 (22 to 263 nmol l-1) and for free Cd2+ concentration from 16 nmol l-1 (1-55 nmol l-1) to 12 nmol l-1 (1-43 nmol l-1). With the increase of incubation time, free Cu2+ concentration tended to increase but free Cd2+ concentration decreased. Speciation model calculations show that compared to the binding capacity of soil organic matter, the capacity of rice straw is much less important. The decrease of free metal ion concentration upon rice straw addition can be attributed mainly to the increased pH. The higher DOC content in the rice straw treatment could be the reason for higher soluble Cu concentration when rice straw was added. Adsorption to DOC is much less important for Cd than for Cu. Calculation also shows that adsorption to clay minerals plays a more important role for Cd than for Cu, which may explain the stronger ageing effects on Cd distribution
Other Title: Effects of rice straw on the speciation of cadmium (Cd) and copper (Cu) in soils

Descriptors: adsorption. aging. binding. cadmium. capacity. clay-minerals. copper. ions. metal-ions. minerals. organic-matter. rice. rice-straw. soil. soil-organic-matter. soil-pH. straw

50. **Rice marketing systems in the Philippines and Thailand: do large numbers of competitive traders ensure good performance?**
Dawe-D-C. Moya-P-F. Casiwan-C-B. Cabling-J-M,
Food Policy, 2008, 33 (5), p. 455-463 **Abstract:** Four soils were collected from different sites of China in Lechang (LC, Guangdong province), Changsha (CS, Hunan province), Jiaxing (JX, Zhejiang province) and Hangzhou (HZ, Zhejiang province), and were spiked with Cu (50 mg kg-1) and Cd (5 mg kg-1). The effects of rice straw addition (6%) on the chemical distribution of both metal ions were studied by measuring the soluble metal ion concentrations and the free metal ion concentrations (using the Donnan membrane technique) after 1-, 3- and 6-month incubation. Results show that the addition of rice straw increased soil pH by about 0.4 pH unit on average, and increased DOC significantly in soil LC, CS and JX, but not in soil HZ. With the addition of rice straw, total soluble Cu concentration increased from 0.82 micro mol l-1 (0.26-2.4 micro mol l-1) to 1.22 micro mol l-1 (0.70-3.60 micro mol l-1), whereas total soluble Cd concentration decreased from 20 nmol l-1 (2-70 nmol l-1) to 15 nmol l-1 (2-56 nmol l-1). When rice straw was added, both free Cu2+ and Cd2+ concentrations decreased, for free Cu2+ concentration from 217 nmol l-1 (31 to 369 nmol l-1) to 124 nmol l-1 (22 to 263 nmol l-1) and for free Cd2+ concentration from 16 nmol l-1 (1-55 nmol l-1) to 12 nmol l-1 (1-43 nmol l-1). With the increase of incubation time, free Cu2+ concentration tended to increase but free Cd2+ concentration decreased. Speciation model calculations show that compared to the binding capacity of soil organic matter, the capacity of rice straw is much less important. The decrease of free metal ion concentration upon rice straw addition can be attributed mainly to the increased pH. The higher DOC content in the rice straw treatment could be the reason for higher soluble Cu concentration when rice straw was added. Adsorption to DOC is much less important for Cd than for Cu. Calculation also shows that adsorption to clay minerals plays a more important role for Cd than for Cu, which may explain the stronger ageing effects on Cd distribution
Descriptors: adsorption. aging. binding. cadmium. capacity. clay-minerals. copper. ions. metal-ions. minerals. organic-matter. rice. rice-straw. soil. soil-organic-matter. soil-pH. straw

51. **Lipase-catalyzed production of solid fat stock from fractionated rice bran oil, palm stearin, and conjugated linoleic acid by response surface methodology**
Alim-M-A. Lee-J-H. Shin-J-A. Lee-Y-J. Choi-M-S. Akoh-C-C. Lee-K-T,
Food Chemistry, 2008, 106 (2), pages 712-719
Abstract: Solid fat stock was produced from the fractionated rice bran oil (solid phase, S-RBO) and palm stearin (PS) through lipase-catalyzed reaction, in which conjugated linoleic acid (CLA) was intentionally incorporated. For optimizing the reaction, response surface methodology (RSM) was employed with four reaction variables such as water activity, reaction temperature, reaction time, and mole ratio of S-RBO to PS. The predictive model was adequate due to no significant lack of fit and satisfactory level of coefficient of determination (R 2=0.95). The melting point of solid fat stock was affected by reaction time and substrate mole ratio, whereas water activity and reaction temperature had no significant effect. Based on ridge analysis,

the combination of A w (X 1; 0.32), reaction temperature (X 2; 65.3C), reaction time (X 3; 28.9 h), and substrate mole ratio (X 4; 1:1.1) was optimized for producing solid fat stock with target melting point of 43.8C. The solid fat stock (SFS) contained 39.9% palmitic, 31.3% oleic, 13.2% linoleic acid, and 10.9% CLA isomers. Solid fat contents were 23.4, 10.9, and 2.5% at 20, 30, and 40C, respectively. These results suggested that RSM can be used to optimize the lipase-catalyzed production of a solid fat stock
Other Title: Lipase-catalyzed production of solid fat stock from fractionated rice bran oil, palm stearin, and conjugated linoleic acid by response surface methodology
Descriptors: chemical composition; chemical reactions; fat; isomers; linoleic acid; mathematical models; melting point; methodology; oils; optimization; prediction; reaction time; rice bran; stearin; synthesis; temperature; triacylglycerol lipase; water activity

52. **Partial extraction method for the rapid analysis of total lipids and gamma-oryzanol contents in rice bran** / Lilitchan-S. Tangprawat-C. Aryusuk-K. Krisnangkura-S. Chokmoh-S. Krisnangkura-K,
Food Chemistry, 2008, 106 (2), pages 752-759
Abstract: Total lipids and gamma-oryzanol in rice bran were determined by a partial extraction method. The results agreed well with the conventional total extraction methods. The proposed method uses fewer hazardous organic solvents, takes a shorter extraction time and requires no special extraction apparatus. Total lipids and gamma-oryzanol in nine rice bran varieties were analysed by the developed technique. Daw Dum 5647 had the highest total lipids and gamma-oryzanol while the lowest content was found in KD XBT 313-19-1-1 and SP XBT 43-7, respectively. The adsorption coefficient (K d) of the lipids and gamma-oryzanol, between hexane and bran, at 30C are between 1.16 and 2.00 and 2.02 and 2.65, respectively (depending on the moisture content of the bran). From the K d values, it was estimated that about 92-95% of the lipids and 95-96% of the gamma-oryzanol were extracted into hexane at a 10:1 (v/w) ratio of hexane to bran. The effect of solvents on the extraction of gamma-oryzanol from rice bran was also studied. It was found that isopropanol was the most suitable solvent for extraction and determination of gamma-oryzanol in rice bran. It showed better agreement with the total extraction method
Other Title: Partial extraction method for the rapid analysis of total lipids and gamma-oryzanol contents in rice bran
Descriptors: adsorption; chemical analysis; chemical composition; determination; extraction; isopropyl alcohol; lipids; methodology; nutrient content; propionates; rice bran; solvents

53. **Gelatinization and rheological properties of rice starch/xanthan mixtures: Effects of molecular weight of xanthan and different salts**
Viturawong-Yuvare. Achayuthakan-Piyad. Suphantharika-Manop. (scmsp@mahidol.ac.th), Food Chemistry, 2008, 111 (1), pages 106-114
Abstract: Effects of molecular weight (M-w) of xanthan (XG) and salts (0.1 M NaCl or CaCl2) on the pasting, thermal, and theological properties of rice starch (RS) were studied. A series of five XG samples, having various M-w was prepared by homogenization of native XG solutions in the presence or absence of salts. The presence of salts greatly reduced the intrinsic viscosities, [eta], of all XG solutions. Rapid visco-analysis (RVA) data showed that XG addition increased the peak,

breakdown, final, and setback viscosities of RS, either in the presence or absence of salts, whereas the pasting temperatures were unaffected. Differential scanning calorimetry (DSC) demonstrated that the gelatinization temperatures of RS were unaffected by XG addition but slightly increased by CaCl2 addition, whereas the gelatinization enthalpies (Delta H) were significantly decreased by additions of XG and salts. Dynamic shear data revealed weak gel-like behaviour in all paste samples in which their rigidity was decreased by XG addition. Flow tests showed that all pastes exhibited time-dependent shear-thinning (thixotropic) with yield stress behaviour in which the hysteresis loop areas were significantly decreased by XG addition, whereas the other theological parameters varied differently among the samples, with and without added salt. In general, the effects of XG addition on the pasting and theological properties of RS were more pronounced with increasing Mw of XG and these effects depended on salts added.
Other Title: Gelatinization and rheological properties of rice starch/xanthan mixtures: Effects of molecular weight of xanthan and different salts
Descriptors: Biochemistry and Molecular Biophysics; Foods gelatinization, thermal property, rheological property, stress behavior, gel-like behavior, rice (ethnic food)

54. **Purification and identification of a novel heteropolysaccharide RBPS2a with anti-complementary activity from defatted rice bran**
Wang-L. Zhang-Hongbi. Zhang-Xiaoya. Chen-Zhengxing. (zxchen_2008@126.com),
Food Chemistry, 2008, 110 (1), pages 150-155
Abstract: A novel heteropolysaccharide RBPS2a with anti-complementary activity was obtained from defatted rice bran by hot water extraction, ethanol precipitation, and purified by gel chromatography after anion-exchange chromatography. This fraction exhibited more potent anti-complementary activity than other polysaccharide fractions. RBPS2a was eluted as a single symmetrical narrow peak on high-performance gel-permeation chromatography (HPGPC) and the average molecular weight was 90,000 Da. We found RBPS2a contained 86.7% polysaccharide and 8.7% protein. The amino acid pattern showed that RBPS2a contained large amount of glutamic acid, arginine, aspartic acid, lysine, and alanine. The molar content of the above five amino acids constituted 59.31% of the total amino acids. Gas chromatography of absolute acid hydrolysate of RBPS2a suggested that it was composed of arabinose, xylose, glucose and galactose with a molar ratio of 4:2:1:4. The Fourier-transform infrared spectra (FT-IR) and H-1, C-13 NMR spectroscopy analysis revealed that RBPS2a had a backbone consisting of beta-(1 -> 3)-linked D-galacopyranosyl residues substituted at O-2 with glycosyl residues composed of alpha-D-xylose-(1 -> 4)-alpha-D-arabinose-(1 -> and alpha-D-glucose-(1 -> 4)-alpha-D-arabinose-(1 -> linked residues. Furthermore, some of the fractions extracted and purified from defatted rice bran exhibited strong anti-complementary activity. Among these fractions, the purified polysaccharide RBPS2a had the highest activity.
Other Title: Purification and identification of a novel heteropolysaccharide RBPS2a with anti-complementary activity from defatted rice bran
Descriptors: Biochemistry and Molecular Biophysics; Foods defatted rice bran

55. **Proton NMR relaxation study of swelling and gelatinisation process in rice starch-water samples/** Ritota-Men. Gianferri-Raffaell. Bucci-Rem. Brosio-Elvino. (elvino.brosio@uniromal.it),
Food Chemistry, 2008, 110 (1), pages 14-22

Abstract: Proton transverse magnetization decay curves of rice flour starch-water samples were measured and analysed for the presence of four components in the relaxation curve. T-2 values were interpreted on the basis of the diffusive and chemical exchange model that provided evidence for extra granular bulk water and three more water populations whose relaxation rate is governed by diffusive and chemical exchange with starch components. The analysis of relaxation data provided information on dynamics of water molecules as well as on the size and dispersion of diffusive domains. Furthermore, by measuring solid to liquid ratio, transverse and longitudinal relaxation curves of starch-water mixtures at increasing temperatures - from 20 to 77 degrees C - swelling and gelatinisation processes were monitored.
Other Title: Proton NMR relaxation study of swelling and gelatinisation process in rice starch-water samples
Descriptors: Methods and Techniques; Foods rice flour, proton transverse magnetization decay curve

56. **Nutrient composition and physicochemical properties of Indian medicinal rice - Njavara** / Deepa-G. Singh-Vasudev. Naidu-K-Akhilender. (kanaidu@mailcity.com), Food Chemistry, 2008, 106 (1), pages 165-171
Abstract: Njavara, a medicinal rice, was assessed for its nutrient composition and physicochemical properties, in order to understand its therapeutic properties. Dehusked Njavara rice consisted of 73% carbohydrates, 9.5% protein, 2.5% fat, 1.4% ash and 1628 0 per 100 g of energy. Physicochemical properties and nutritive components of dehusked rice of Njavara were evaluated and compared with two commonly consumed non-medicinal rice varieties - Jyothi (red coloured) and IR 64 (brown coloured). The carbohydrates, fats, apparent amylose equivalent, fatty acid profile and triglycerides of Njavara were comparable to Jyothi and IR 64. However, Njavara rice had 16.5% higher protein, and contained higher amounts of thiamine (27-32%), riboflavin (4-25%) and niacin (2-36%) compared to the other two rice varieties. The total dietary fibre content in Njavara was found to be 34-44% higher than that of Jyothi and IR 64. Significantly higher phosphorus, potassium, magnesium, sodium and calcium levels were found in Njavara rice, compared to the other two varieties. The cooking time of dehusked Jyothi and IR 64 varieties were found to be 30 min, while Njavara needed longer time to cook, (38 min). The cooked rice of Njavara was slimy in nature, probably due to the presence of non-starch polysaccharides.
Other Title: Nutrient composition and physicochemical properties of Indian medicinal rice - Njavara
Descriptors: Biochemistry and Molecular Biophysics; Foods

57. **Geographical origin of polished rice based on multiple element and stable isotope analyses** / Suzuki-Yaeko. (suzuki-yaeko@ed.tmu.ac.jp). Chikaraishi-Yoshit. Ogawa-Nanako-O. Ohkouchi-Naohik. Korenaga-Takash,
Food Chemistry, 2008, 109 (2), pages 470-475
Abstract: We determined carbon and nitrogen contents (C and N contents) and stable carbon, nitrogen, and oxygen isotopic compositions (delta C-13, delta N-15, and delta O-18) of polished rice in order to develop a simple method to discriminate its geographical origin. As a first attempt, we examined a single cultivar, Koshihikari rice, from 14 different cultivation areas including Australia (n = 1), Japan (n = 12),

and USA (n = 1). For all rice samples, C and N contents and the isotopic compositions are consistent with those of general plant materials, being 37.2-40.0% (C content), 0.8-1.4% (N content), -27.1 to -25.4% (delta C-13), +0.4 to +9.0% (delta N-15), and +18.8 to +22.9% (delta O-18). However, its cultivated area is clearly distinguished by a pentagonal radar plot based on the elemental and isotopic compositions. Thus, the comparison of C and N contents and delta C-13, delta N-15, and delta O-18 values would potentially be useful for rapid and routine discrimination of geographical origin of the polished rice. (C) 2008 Elsevier Ltd. All rights reserved
Other Title: Geographical origin of polished rice based on multiple element and stable isotope analyses
Descriptors: Biochemistry and Molecular Biophysics; Biogeography (Population Studies); Foods geographical origin, polished rice, pentagonal radar plot

58. **Antioxidant components and properties of five long-grained rice bran extracts from commercial available cultivars in Thailand/** Chotimarkorn-Chatchawan. (chotimarkorn.c@hotmail.com). Benjakul-Soottawa. Silalai-Nattig,
Food Chemistry, 2008, 111 (3), pages 636-641
Abstract: Five varieties of long-grained rice bran, which are the most commonly cultivated varieties in Thailand, are abundant in antioxidant components. The antioxidative activity of rice bran extracts was investigated using various established in vitro systems, including 2,2'-diphenyl-1-picrylhdrazyl free radical-scavenging (DPPH,), total reducing power, ferrous ion-chelating activity and lipid peroxidation inhibition. The total phenolic and flavonoid contents, and gamma-oryzanol, tocopherol and tocotrienol isomer contents of rice bran extract were also determined by colorimetric assay and high performance liquid chromatography. The methanolic rice bran extracts produced strong results with DPPH free radical-scavenging (EC50 0.38-0.74 mg/ml), reducing power (EC50 0.10-0.53 mg/ml), ferrous ion-chelating activity (EC50 0.11-0.55 mg/ml) and inhibition of lipid peroxidation (EC50 0.14-0.57 mg/ml). Total phenolic and flavonoid contents, and gamma-oryzanol, tocopherol and tocotrienol contents of rice bran extract were in the range 2.2-3.2, 0.03-0.10, 0.56-1.08, 0.35-0.77 and 0.22-0.46 mg/g rice bran, respectively. These results indicated that the methanolic components of the long-grained rice bran extracts might potentially be natural antioxidants. (c) 2008 Elsevier Ltd. All rights reserved
Other Title: Antioxidant components and properties of five long-grained rice bran extracts from commercial available cultivars in Thailand
Descriptors: Biochemistry and Molecular Biophysics; Agronomy (Agriculture); Foods lipid peroxidation, rice bran (grain product), antioxidant component, antioxidant compartment

59. **Paste viscosity of rice starches of different amylose content and carboxymethylcellulose formed by dry heating and the physical properties of their films/** Li-Yu. Shoemaker-Charles-F. Ma-Jiangu. Shen-Xuera. Zhong-Fang. (fzhong@jiangnan.edu.cn),
Food Chemistry, 2008, 109 (3), pages 616-623
Abstract: Starch modified by combination with sodium carboxymethylcellulose (CMC) has been reported to have improved film properties. In this study, rice starches with different amylose content were heat-treated in a dry state after being impregnated with low or medium-viscosity CMC. Noticeable change was found in pasting properties of the starches after dry heat treatment with CMC. It indicated that crosslinkage occurred between the starch and CMC. The waxy starch showed

significant change in viscosity throughout pasting after dry heating with CMC, suggesting that the ester bonds were mostly formed between the hydroxyl groups in amylopectin branches of rice starch and carboxylate acid groups of CMC. Particle size also increased after heat treatment with CMC. The modified starch-based films showed improvement in the tensile strength. Both water vapor and oxygen permeability reduced for the modified starch-based films. Dynamic mechanical analysis (DMA) study showed that the values of G' of modified starch-based film were higher than those of native starch-based film over the temperature range -40 to 60 degrees C. The heating process with CMC could be used as a modification method for starch and provide desirable properties of starch-based films.
Other Title: Paste viscosity of rice starches of different amylose content and carboxymethylcellulose formed by dry heating and the physical properties of their films
Descriptors: Biochemistry and Molecular Biophysics physical property, paste viscosity

60. **Structure-viscosity relationships for rice varieties during starches from different heating** / Li-Yu. Shoemaker-Charles-F. Ma-Jiangu. Moon-Kim-Ji. Zhong-Fang. (fzhong@sytu.edu.cn),
Food Chemistry, 2008, 106 (3), pages 1105-1112
Abstract: The effects of starch particle size and leached amylose on the viscosity of rice starch dispersions and changes of short-range structure and amylose content in starch granules of different rice varieties during heating were investigated. It was found that starch granule swelling increased rice starch dispersion viscosity during heating. The viscosities of the starch dispersions during heating were principally dependent on granular volume fraction and independent of starch variety. A distinct correlation between the amount of leached amylose and swelling of starch granules was also found. High initial amylose concentrations in starch granules reduced swelling during heating, thereby reducing rice dispersion viscosities. Fourier-transform IR spectroscopy indicated that the loss of short-range order was significant when the temperature reached the pasting onset temperature. The short-range order of waxy and medium grain rice starches was higher than that of long grain rice starches before gelatinization. The loss of order of waxy and medium grain rice starches was greater than that of long grain rice starches during heating, which was due to the presence of amylose, restraining the swelling and disruption of starch granules during heating.
Other Title: Structure-viscosity relationships for rice varieties during starches from different heating
Descriptors: Biochemistry and Molecular Biophysics; Agronomy (Agriculture); Foods heating, structure-viscosity relationship

61. **Impact of parboiling conditions on Maillard precursors and indicators in long-grain rice cultivars** / Lamberts-Lieve. (Lieve.Lamberts@biw.kuleuven.be). Rombouts-In. Brijs-Kristo. Gebruers-Kur. Delcour-Jan-A,
Food Chemistry, 2008, 110 (4), pages 916-922
Abstract: The effect of steaming conditions (mild, intermediate and severe) during parboiling of five different long-grain rice cultivars (brown rice cultivars Puntal,

Cocodrie, XL8 and Jacinto, and a red rice) on rice colour, and Maillard precursors and indicators was investigated. Rice colour increased with severity of parboiling conditions. Redness increased more than yellowness when parboiling brown rice. Parboiling turned red rice black. It changed the levels of glucose, fructose, sucrose, and maltose. Losses of the non-reducing sugar, sucrose were caused by both leaching into the soaking water and enzymic conversion, rather than by thermal degradation during steaming. Concentrations of the reducing sugars, glucose and fructose, in intermediately parboiled rice were higher than those of mildly parboiled rice. After severe parboiling, glucose levels were lower than those of intermediately parboiled rice, while fructose levels were higher. These changes were ascribed to the sum of losses in the Maillard reaction (MR), formations as a result of starch degradation and isomerisation of glucose into fructose. It was clear that the epsilon-amino group of protein-bound lysine was more affected by parboiling conditions and loss in MRs, than that of free lysine. Low values of the MR indicators furosine and free 5-hydroxymethyl-2-furaldehyde (HMF) in processed brown and red rices were related to mild parboiling, whereas high furosine and low free HMF levels were indicative of rices being subjected to intermediate processing conditions. High furosine and high free HMF contents corresponded to severe hydrothermal treatments. The strong correlation ($r = 0.89$) between the free HMF levels and the increase in redness of parboiled brown rices suggested that Maillard browning was reflected more in the red than in the yellow colour.
Other Title: Impact of parboiling conditions on Maillard precursors and indicators in long-grain rice cultivars
Descriptors: Biochemistry and Molecular Biophysics; Methods and Techniques; Foods Maillard reaction, thermal degradation, steaming, parboiling condition

62. **Effects of soaking, germination and fermentation on phytic acid, total and in vitro soluble zinc in brown rice** / Liang-Jianfen. (liangjf@cau.edu.cn). Han-Bel-Zhon. Nout-M-J-Rober. Hamer-Robert-J,
Food Chemistry, 2008, 110 (4), pages 821-828
Abstract: Rice is all important staple food in Asian countries. In rural areas it is also a major source of micronutrients. Unfortunately, the bioavailability of minerals, e.g. zinc from rice, is low because it is present as all insoluble complex with food components such as phytic acid. We investigated the effects of soaking, germination and fermentation with an aim to reduce the content of phytic acid, while maintaining sufficient levels of zinc, in the expectation of increasing its bioavailability. Fermentation treatments were most effective in decreasing phytic acid (56-96% removal), followed by soaking at 10 degrees C after preheating (42-59%). Steeping of intact kernels for 24 h at 25 degrees C had the least effect oil phytic acid removal (<20%). With increased germination periods at 30 degrees C, phytic acid removal progressed from 4% to 60%. Most wet processing procedures, except soaking after wet preheating, caused a loss of dry mass and zinc (1-20%). In vitro solubility, as a percentage of total zinc in soaked rice, was significantly higher than in untreated brown rice while, in steeped brown rice, it was lower ($p < 0.05$). Fermentation and germination did not have significant effects on the solubility of zinc. The expected improvement due to lower phytic acid levels was not confirmed by increasing levels of in vitro soluble zinc. This may result from zinc complexation to other food components.

Other Title: Effects of soaking, germination and fermentation on phytic acid, total and in vitro soluble zinc in brown rice
Descriptors: Nutrition; Foods dry mass, soaking effect, germination effect, fermentation effect

63. **Influence of the correction for moisture/water content on the quality of the certification of cadmium, copper and lead mass fractions in rice**
Vassileva-Emili. Quetel-Christophe-R. (Christophe.Quetel@ec.europa.eu),
Food Chemistry, 2008, 106 (4), pages 1485-1490
Abstract: The moisture/water content of rice sample was determined by means of three different methods: oven drying, Karl Fischer titration and thermogravimetry. These results were applied for the certification of the Cd, Cu and Pb mass fractions by isotope dilution mass spectrometry, IDMS, in this rice material.Two series of measurements were carried out in parallel, first on a set of water "saturated" samples, and second on a set of "nonsaturated" samples also corrected for progressive water pick-up. The hygroscopicity correction factor at 1 min (corresponding to the addition of the IDMS spike) was conservatively taken as H-1 min = 0 ± 0.70 (k = 2) from 0.25% to 0.35% spread observed for isotherms established for 15 samples. For the first method, the following optimal sequence was established: successive drying sessions of at least 8 h in a ventilated oven at 85 ± 2 degrees C until constant mass is attained (and no more than 0.001 g difference between successive weighing). Under these conditions, it was found that the apparent moisture/water content measured with the three methods for "non-saturated" samples coincided within one standard deviation. From this agreement it is reasonable to assume that moisture in this rice material was essentially "free" water. These results also showed that the oven drying method has the potential to produce reproducible, and possibly meaningful, data providing that a reasonable temperature of drying was identified.Beside, it was found that the uncertainty on these corrections (particularly the hygroscopic effect) plays an important role for all investigated elements in "non-saturated" rice samples (up to nearly 60% in the case of Cu, 25% for Cd and 7% for Pb). The contribution of the uncertainty on the dry mass correction was found to be below 1% for the "saturated" samples. However, the principles of arranging water saturation of the samples prior to their processing introduced supplemental important technical complications and risks of sample contamination.These issues, nearly never addressed in the case of the uncertainty propagation, are particularly important to achieve comparability conditions for analytical results produced from different laboratories.
Other Title: Influence of the correction for moisture/water content on the quality of the certification of cadmium, copper and lead mass fractions in rice
Descriptors: Foods moisture content, water content, food composition, hygroscopicity

64. **Evaluation of soil quality parameters in a tropical paddy soil amended with rice residues and tree litters** / Rao-B-K-R. Siddaramappa-R,
European Journal of Soil Biology, 2008, 44 (3), pages 334-340
Abstract: Laboratory and greenhouse experiments were conducted to study the effects of applications of rice residue and Pongamia pinnata and Azadirachta indica leaf litters on biochemical properties (extraction yield of humus, composition of humus, microbial biomass carbon, activities of urease and acid phosphatase) of a

lowland rice soil under flooded conditions. Bulk soil sample collected from the Mandya paddy fields was used for the green house trials and the laboratory incubation studies. The organic materials were added at three rates - zero, 25.0 g carbon kg-1 (2.5% C) and 50.0 g carbon kg-1 dry soil (5.0% C). Results showed that tree leaf litter and rice residue at 5.0% C rate decreased instantaneous decay constant (k), there by retarded the rate of C mineralization. Carbon contents of HA increased with the rate of C added. Study of delta-log K values and C contents of humic acids revealed that greatest molecular weight of HA was in the pongamia litter treatment, followed by neem litter and rice residue. Grain and straw yields of rice crop in the pot culture study were statistically correlated to the soil quality parameters. Neem and pongamia tree litter incorporation at 2.5% C could be considered for improving soil health and crop yields of rice under flooded conditions; however, application at higher rates significantly (Pless than or equal to 0.05) lowered total dry matter production in rice, despite favorable soil health parameters such as humic yields, microbial biomass - C content and acid phosphatase and urease activity. Among different soil health parameters, microbial quotient was found to be more sensitive indicator of decline in soil quality

Other Title: Evaluation of soil quality parameters in a tropical paddy soil amended with rice residues and tree litters

Descriptors: acid-phosphatase. biochemistry. carbon. crop-residues. crop-yield. enzyme-activity. humification. humus. litter-(plant). mineralization. paddy-soils. rice. soil-amendments. soil-enzymes. soil-organic-matter. soil-types. urease

65. **Root-derived respiration and non-structural carbon of rice seedlings**
Xu-XingLiang. Kuzyakov-Y. Wanek-W. Richter-A,
European Journal of Soil Biology, 2008, 44 (1), pages 22-29

Abstract: Various methods have been suggested to separate root and microbial contributions to soil respiration. However, to date there is no ideal approach available to partition below-ground CO2 fluxes in its components although the combination of traditional methods with approaches based on isotopes seems especially promising for the future improvement of estimates. Here we provide evidence for the applicability of a new approach based on the hypothesis that root-derived (rhizomicrobial) respiration, including root respiration and CO2 derived from microbial activity in the immediate vicinity of the root, is proportional to non-structural carbon contents (sugars and organic acids) of plant tissues. We examined relationships between root-derived CO2 and non-structural carbon of rice (Oryza sativa) seedlings using 14C pulse labelling techniques, which partitioned the 14C fixed by photosynthesis into root-derived 14CO2, and 14C in sugars and organic acids of roots and shoots. After the 14C pulse 14C in both sugars and organic acids of plant tissues decreased steeply during the first 12 h, and then decreased at a lower rate during the remaining 60 h. Soil 14CO2 efflux and soil CO2 efflux strongly depended on 14C pools in non-structural carbon of the plant tissues. Based on the linear regression between root-derived respiration and total non-structural carbon (sugars and organic acids) of roots, non-rhizomicrobial respiration (SOM-derived) was estimated to be 0.25 mg C g-1 root d.w. h-1. Assuming the value was constant, root-derived respiration contributed 85-92% to bulk soil respiration

Other Title: Root-derived respiration and non-structural carbon of rice seedlings

Descriptors: biological-activity-in-soil. carbon. carbon-dioxide. loam-soils. Luvisols. microbial-activities. organic-acids. rhizosphere. rice. roots. seedlings. shoots. soil-flora. soil-organic-matter. soil-types. sugars

66. **Changes of organic acid exudation and rhizosphere pH in rice plants under chromium stress/** Zeng-Fanron. Chen-Son. Miao-Yin. Wu-Feib. Zhang-Guoping. (zhanggp@zju.edu.cn),
Environmental Pollution, 2008, 155 (2), pages 284-289
Abstract: The effect of chromium (Cr) stress on the changes of rhizosphere pH, organic acid exudation, and Cr accumulation in plants was studied using two rice genotypes differing in grain Cr accumulation. The results showed that rhizosphere pH increased with increasing level of Cr in the culture solution and with an extended time of Cr exposure. Among the six organic acids examined in this experiment, oxalic and malic acid contents were relatively higher, and had a significant positive correlation with the rhizosphere pH, indicating that they play an important role in changing rhizosphere pH. The Cr content in roots was significantly higher than that in stems and leaves. Cr accumulation in plants was significantly and positively correlated with rhizosphere pH, and the exudation of oxalic, malic and citric acids, suggesting that an increase in rhizosphere pH, and exudation of oxalic, malic and citric acid enhances Cr accumulation in rice plants. (c) 2007 Elsevier Ltd. All fights reserved
Other Title: Changes of organic acid exudation and rhizosphere pH in rice plants under chromium stress
Descriptors: Pollution Assessment Control and Management; Agronomy (Agriculture) rhizosphere pH, chromium stress, organic acid exudation

67. **Genotypic and environmental variation in chromium, cadmium and lead concentrations in rice** / Zeng-Fanron. Mao-Yin. Cheng-Wangd. Wu-Feib. Zhang-Guoping. (zhanggp@zju.edu.cn),
Environmental Pollution, 2008, 153 (2), pages 309-314
Abstract: Genotypic and environmental variation in Cr, Cd and Pb concentrations of rice grains and the interaction between these metals were investigated by using 138 rice genotypes grown in three contaminated soils. There were significant genotypic differences in the three heavy metal concentrations of rice grains, with the absolute difference among 138 genotypes in grain Cr, Cd and Pb concentrations being 24.5-, 9.1- and 23.8-folds, respectively, under the slightly contaminated soil (containing 4.61 mg kg(-1) Cr, 1.09 mg kg(-1) Cd and Pb 28.28 mg kg(-1), respectively). A highly significant interaction occurred between genotype and environment (soil type) in the heavy metal concentrations of rice grains. Cr concentration in rice grains was not correlated with Cd and Pb concentration. However, there was a significant correlation between Cd and Pb in slightly and highly contaminated soils. The results suggest the possibility to develop the rice cultivars with low Cd and Pb concentrations in grain. (C) 2007 Elsevier Ltd. All rights reserved
Other Title: Genotypic and environmental variation in chromium, cadmium and lead concentrations in rice
Descriptors: Toxicology; Agronomy (Agriculture) soil contamination, environmental variation, genotypic variation

68. **Influence of fipronil compounds and rice-cultivation land-use intensity on macroinvertebrate communities in streams of southwestern Louisiana, USA**
Mize-Scott-V. (svmize@usgs.gov). Porter-Stephen-D. Derncheck-Dennis-K,
Environmental Pollution, 2008, 152 (2), pages 491-503

Abstract: Laboratory tests of fipronil and its degradation products have revealed acute lethal toxicity at very low concentrations (LC50) of <0.5 mu g/L to selected aquatic macroinvertebrates. In streams draining basins with intensive rice cultivation in southwestern Louisiana, USA, concentrations of fipronil compounds were an order of magnitude larger than the LC50. The abundance ($p = -0.64$; $p = 0.015$) and taxa richness ($r(2) = 0.515$, $p < 0.005$) of macroinvertebrate communities declined significantly with increases in concentrations of fipronil compounds and rice-cultivation land-use intensity. Macro invertebrate community tolerance scores increased linearly ($r(2) = 0.442$, $p < 0.005$) with increases in the percentage of rice cultivation in the basins, indicating increasingly degraded stream conditions. Similarly, macroinvertebrate community-tolerance scores increased rapidly as fipronil concentrations approached about 1 mu g/L. Pesticide toxicity index determinations indicated that aquatic macroinvertebrates respond to a gradient of fipronil compounds in water although stream size and habitat cannot be ruled out as contributing influences. Published by Elsevier Ltd
Other Title: Influence of fipronil compounds and rice-cultivation land-use intensity on macroinvertebrate communities in streams of southwestern Louisiana, USA
Descriptors: Toxicology; Pollution Assessment Control and Management; Pesticides; Marine Ecology (Ecology, Environmental Sciences) taxa richness, rice-cultivation

69. **Inorganic arsenic levels in baby rice are of concern**
Meharg-Andrew-A. (a.meharg@abdn.ac.uk). Sun-Guoxi. Williams-Paul-N. Adomako-Eurek. Deacon-Clair. Zhu-Yong-Gua. Feldmann-Joer. Raab-Andre,
Environmental Pollution, 2008, 152 (3), pages 746-749
Abstract: Inorganic arsenic is a chronic exposure carcinogen. Analysis of UK baby rice revealed a median inorganic arsenic content ($n = 17$) of 0.11 mg/kg. By plotting inorganic arsenic against total arsenic, it was found that inorganic concentrations increased linearly up to 0.25 mg/kg total arsenic, then plateaued at 0.16 mg/kg at higher total arsenic concentrations. Inorganic arsenic intake by babies (4-12 months) was considered with respect to current dietary ingestion regulations. It was found that 35% of the baby rice samples analysed would be illegal for sale in China which has regulatory limit of 0.15 mg/kg inorganic arsenic. EU and US food regulations on arsenic are non-existent. When baby inorganic arsenic intake from rice was considered, median consumption (expressed as mu g/kg/d) was higher than drinking water maximum exposures predicted for adults in these regions when water intake was expressed on a bodyweight basis.
Other Title: Inorganic arsenic levels in baby rice are of concern
Descriptors: Foods food regulation, bodyweight, baby rice (grain product, baby food)

70. **Runoff of pesticides from rice fields in the Ile de Camargue (Rhone river delta, France): Field study and modeling** / Comoretto-Laetiti. Arfib-Brun. Talva-Romai. Chauvelon-Philipp. Pichaud-Mar. Chiron-Serg. Hoehener-Patrick. (hoehener@up.univ-mrs.fr),
Environmental Pollution, 2008, 151 (3), pages 486-493
Abstract: A field study on the runoff of pesticides was conducted during the cultivation period in 2004 on a hydraulically isolated rice farm of 120 ha surface with one central water outlet. Four pesticides were studied: Alphamethrin, MCPA, Oxadiazon, and Pretilachlor. Alphamethrin concentrations in runoff never exceeded 0.001 mu g L-1. The three other pesticides were found in concentrations between 5.2 and 28.2 mu g L-1 in the runoff water shortly after the application and decreased

thereafter. The data for MCPA compared reasonably well with predictions by an analytical runoff model, accounting for volatilization, degradation, leaching to groundwater, and sorption to soil. The runoff model estimated that runoff accounted for as much as 18-42% of mass loss for MCPA. Less runoff is observed and predicted for Oxadiazon and Pretilachlor. It was concluded that runoff from rice paddies carries important loads of dissolved pesticides to the wetlands in the Ile de Camargue, and that the model can be used to predict this runoff.
Other Title: Runoff of pesticides from rice fields in the Ile de Camargue (Rhone river delta, France): Field study and modeling
Descriptors: Models and Simulations (Computational Biology); Pesticides; Agronomy (Agriculture) pesticide runoff

71. **Total recovery of resources and energy from rice straw using microwave-induced pyrolysis** / Huang-Y-F. Kuan-W-H. Lo-S-L. Lin-C-F,
Bioresource Technology, 2008, 99 (17), pages 8252-8258
Abstract: This article presents the application of microwave-induced pyrolysis to total recovery of resources and energy from rice straw. The microwave power and particle size of feedstock were both key parameters affecting the performance of microwave-induced pyrolysis. Under 400-500 W microwave power, the reduction of fixed carbon in the biomass was significant. From the experimental results of specific surface area, zeta potential, and Cu2+ adsorption, the applications of solid residues in the water and wastewater treatment could be expected. The major compositions in gaseous product were H2, CO2, CO, CH4 of 55, 17, 13, 10 vol.%, respectively. The high H2 content might imply that microwave-induced pyrolysis of biomass waste has the potential to produce the H2-rich fuel gas. Alkanes, polars, and low-ringed polycyclic aromatic hydrocarbons were three primary kinds of compounds in the liquid product
Other Title: Total recovery of resources and energy from rice straw using microwave-induced pyrolysis
Descriptors: adsorption. biofuels. biogas. carbon-dioxide. carbon-monoxide. copper. electrokinetic-potential. energy-sources. gas-production. hydrogen. methane. methane-production. particle-size. pyrolysis. renewable-resources. rice. rice-straw. straw. surface-area. paddy. zeta potential

72. **Decolorization and biosorption for Congo red by system rice hull-Schizophyllum sp. F17 under solid-state condition in a continuous flow packed-bed bioreactor**
Li-XuDong. Jia-Rong,
Bioresource Technology, 2008, 99 (15), pages 6885-6892
Abstract: Synthetic dyes are important chemical pollutants from various industries. This work developed an efficient and relatively simple continuous decolorization system rice hull-Schizophyllum sp. F17 under solid-state condition in a packed-bed bioreactor, for decolorizing Congo red. In the decolorization system, two decolorization mechanisms exist, one is decolorization by Schizophyllum sp. F17, the other is biosorption by rice hull. The decolorization efficiency was greatly affected by dye concentration and hydraulic retention time (HRT), which were quantificationally analyzed and optimized through response surface methodology (RSM). A 22 full

factorial central composite design (CCD) was performed, and three second order polynomial models were generated to describe the effects of dye concentration and HRT on total decolorization (R2=0.902), decolorization by Schizophyllum sp. F17 (R2=0.866) and biosorption by rice hull (R2=0.890). Response surface contour plots were constructed to show the individual and cumulative effects of dye concentration and HRT, and the optimum values. A maximum total decolorization 89.71% and maximum decolorization by Schizophyllum sp. F17 60.44% was achieved at dye concentration 142.63 mg/L, HRT 41 h, and dye concentration 110.7 mg/L, HRT 29.4 h, respectively. Meanwhile, the role of manganese peroxidase (MnP) in the decolorization process was investigated. This study proved the feasibility of continuous mode for decolorizing synthetic dyes by white-rot fungi in solid-state fermentation bioreactors
Other Title: Decolorization and biosorption for Congo red by system rice hull-Schizophyllum sp. F17 under solid-state condition in a continuous flow packed-bed bioreactor
Descriptors: bioreactors. crop-residues. decolorization. dyes. enzyme-activity. enzymes. fermentation. industrial-effluents. industrial-wastes. rice-husks. waste-water. waste-water-treatment. waste-water-treatment-plants

73. **Production of activated carbon from bagasse and rice husk by a single-stage chemical activation method at low retention times**
Kalderis-D. Bethanis-S. Paraskeva-P. Diamadopoulos-E,
Bioresource Technology, 2008, 99 (15), pages 6809-6816
Abstract: The production of activated carbon from bagasse and rice husk by a single-stage chemical activation method in short retention times (30-60 min) was examined in this study. The raw materials were subjected to a chemical pretreatment and were fed to the reactor in the form of a paste (75% moisture). Chemicals examined were ZnCl2, NaOH and H3PO4, for temperatures of 600, 700 and 800 deg C. Of the three chemical reagents under evaluation only ZnCl2 produced activated carbons with high surface areas. BET surface areas for rice husk were up to 750 m2/g for 1:1 ZnCl2:rice husk ratio. BET surface areas for bagasse were up to 674 m2/g for 0.75:1 ZnCl2:bagasse ratio. Results were compared to regular two-stage physical activation methods
Other Title: Production of activated carbon from bagasse and rice husk by a single-stage chemical activation method at low retention times
Descriptors: activated-carbon. methodology. phosphoric-acid. pretreatment. rice-husks. sodium-hydroxide. sugarcane-bagasse. temperature. waste-water. waste-water-treatment. waste-water-treatment-plants

74. **Value-added subcritical water hydrolysate from rice bran and soybean meal**
Watchararuji-K. Goto-M. Sasaki-M. Shotipruk-A,
Bioresource Technology, 2008, 99 (14), pages 6207-6213
Abstract: New value-added product was derived from agricultural by-products: rice bran and soybean meal by means of subcritical water (SW) hydrolysis. The effect of temperature (200-220 deg C), reaction time (10-30 min), raw material-to-water weight ratio (1:5 and 2:5), was determined on the yields of protein, total amino acids, and reducing sugars in the soluble products. The suitable hydrolysis time was 30 min and the proper weight ratio of the raw material-to-water was 1:5. The reaction temperature suitable for the production of protein and amino acids was 220 deg C for raw and deoiled rice bran, 210 deg C for raw soybean meal, and 200 deg C for deoiled

soybean meal. The products were also found to have antioxidant activity as tested by ABTS.+ scavenging assay. In addition, sensory evaluation of milk added with the hydrolysis product of deoiled rice bran indicated the potential use of the product as a nutritious drink
Other Title: Value-added subcritical water hydrolysate from rice bran and soybean meal
Descriptors: amino-acids. antioxidant-properties. hydrolysates. hydrolysis. protein-content. reducing-sugars. rice-bran. sensory-evaluation. soyabeans. temperature. time

75. **Evaluation of ultra- and nanofiltration for refining soluble products from rice husk xylan** / Vegas-R. Moure-A. Dominguez-H. Parajo-J-C. Alvarez-J-R. Luque-S, Bioresource Technology, 2008, 99 (13), pages 5341-5351
Abstract: Liquors from water treatments of rice husks (containing soluble xylan-derived products) were processed with NF and UF membranes for concentrating and removing both monosaccharides and non-saccharide compounds. Among the commercial membranes assayed, the best results were achieved with the 4 kDa polymeric tubular ESP04 (PCI Membranes), and the 1 kDa ceramic monolithic Kerasep Nano (Novasep). Several trade-offs were identified both in membrane selection and in operating conditions. The ESP04 polymeric membrane provided the best fractionation, but lower recovery under comparable experimental conditions, while its fluxes were about half of those of the ceramic Kerasep Nano membrane. Increase in transmembrane pressure resulted in improved product recovery, at the expense of a lower purity. Additional data on product refining by coupling membrane processing with extraction and ion exchange are provided
Other Title: Evaluation of ultra- and nanofiltration for refining soluble products from rice husk xylan
Descriptors: hydrolysis. ion-exchange. membranes. oligosaccharides. rice

76. **Lipase catalyzed interesterification of palm stearin and rice bran oil blends for preparation of zero trans shortening with bioactive phytochemicals**
Reshma-M-V. Saritha-S-S. Balachandran-C. Arumughan-C,
Bioresource Technology, 2008, 99 (11), pages 5011-5019
Abstract: Palm stearin (PS) and rice bran oil (RBO) blends of varying proportions were subjected to enzymatic interesterification (EIE) using a 1,3 specific immobilized lipase. The interesterified blends were evaluated for their physicochemical characteristics and bioactive phytochemical contents using differential scanning calorimeter (DSC), X-ray diffraction (XRD), gas chromatography (GC) and high performance liquid chromatography (HPLC). The blends of PS and RBO in different proportions (40:60, 50:50, 60:40 and 70:30) had saturated fatty acid content and unsaturated fatty acid content in the range of 37.6-52.0% and 48.0-62.4%, respectively. The blends 40:60, 50:50 and 60:40 showed a considerable reduction in their highest melt peak temperature (TP) and solid fat content (SFC) on EIE. The interesterified blends retained bioactive phytochemicals like tocols (839-1172 ppm), sterols (4318-9647 ppm), oryzanols (3000-6800 ppm) and carotene (121-180 ppm). XRD studies demonstrated that the interesterified blends contained beta and beta ' polymorphic forms
Other Title: Lipase catalyzed interesterification of palm stearin and rice bran oil blends for preparation of zero trans shortening with bioactive phytochemicals

Descriptors: carotenes. catalytic-activity. enzyme-activity. enzymes. esterification. phytochemicals. rice-bran. saturated-fatty-acids. stearin. sterols. tocopherols. triacylglycerol-lipase. unsaturated-fatty-acids

77. **Use of rice husk for the adsorption of congo red from aqueous solution in column mode**
Han-RunPing. Ding-DanDan. Xu-YanFang. Zou-WeiHua. Wang-YuanFeng. Li-YuFei. Zou-Lina, Bioresource Technology, 2008, 99 (8), pages 2938-2946
Abstract: A continuous fixed bed study was carried out by using rice husk as a biosorbent for the removal of congo red (CR) from aqueous solution. The effects of important factors, such as the value of initial pH, existing salt, the flow rate, the influent concentration of CR and bed depth, were studied. Data confirmed that the breakthrough curves were dependent on flow rate, initial dye concentration and bed depth. Thomas, Adams-Bohart, and Yoon-Nelson models were applied to experimental data to predict the breakthrough curves using non-linear regression and to determine the characteristic parameters of the column useful for process design, while bed depth/service time analysis (BDST) model was used to express the effect of bed depth on breakthrough curves. The results showed that Thomas model was found suitable for the normal description of breakthrough curve at the experimental condition, while Adams-Bohart model was only for a initial part of dynamic behavior of the rice husk column. The data were in good agreement with BDST model. It was concluded that the rice husk column can remove CR from solution
Other Title: Use of rice husk for the adsorption of congo red from aqueous solution in column mode
Descriptors: adsorption. dyes. industrial-wastes. mathematical-models. pH. removal. rice-husks. salt. waste-water. waste-water-treatment. waste-water-treatment-plants

78. **Rice straw pulp obtained by using various methods**
Rodriguez-A. Moral-A. Serrano-L. Labidi-J. Jimenez-L,
Bioresource Technology, 2008, 99 (8), pages 2881-2886
Abstract: Rice straw was used as an alternative raw material to obtain cellulosics pulps. Pulping was done by using classics reagents as soda (with anthraquinone and parabenzoquinone as additives), potassium hydroxide and Kraft process. The holocellulose, alpha -cellulose and lignin contents of rice straw (viz. 60.7, 41.2 and 21.9 wt%, respectively) are similar to those of some woody raw materials such as pine and eucalyptus, and various non-wood materials including olive tree prunings, wheat straw and sunflower stalks. Pulping tests were conducted by using soda, soda and anthraquinone at 1 wt%, soda and parabenzoquinone at 1 wt%, potassium hydroxide and sodium sulphate (Kraft process) under two different sets of operating conditions, namely: (a) a 10 wt% reagent concentration, 170 deg C and 60 min; and (b) 15 wt% reagent, 180 deg C and 90 min. The solid/liquid ratio was 6 in both cases. Paper sheets made from pulp extracted by cooking with soda (15 wt%) and AQ (1 wt%) at 180 deg C and 90 min pulp exhibit the best drainage index, breaking length, stretch and burst index (viz. 23 deg SR, 3494 m, 3.34% and 2.51 kN/g, respectively)
Other Title: Rice straw pulp obtained by using various methods
Descriptors: cellulose. lignin. methodology. pulping. rice. rice-straw. straw

79. **Physico-chemical and microbiological analyses of fermented corn cob, rice bran and cowpea husk for use in composite rabbit feed** / Oduguwa-O-O. Edema-M-O. Ayeni-A-O,
Bioresource Technology, 2008, 99 (6), pages 1816-1820
Abstract: An experiment was conducted to evaluate the effect of fermentation on the proximate composition of corn cob, rice bran and cowpea husk for use in composite rabbit feed formulations. The test ingredients were moistened with tap water and allowed to ferment naturally at room temperature. During fermentation, samples of the fermenting materials were extracted at zero, 24 and 48 h for physico-chemical and microbiological analyses using standard procedures. The microorganisms associated with the fermenting materials were identified as Rhizopus oligosporus, Aspergillus oryzae, Aspergillus niger, Rhodotorula, Geotrichum candidum, Candida albicans, and Saccharomyces cerevisiae. Two (R. oligosporus and S. cerevisiae) out of microorganisms present were used as starter cultures to ferment the test ingredients and the fermented products were then analyzed. From the results obtained S. cerevisiae enhanced the protein and fat contents while R. oligosporus was able to degrade the fiber significantly
Other Title: Physico-chemical and microbiological analyses of fermented corn cob, rice bran and cowpea husk for use in composite rabbit feed
Descriptors: cowpeas. feed-formulation. fermentation. husks. maize-cobs. physicochemical-properties. protein-content. rice-bran. silage-making. silage-quality

80. **Co-firing coal with rice husk and bamboo and the impact on particulate matters and associated polycyclic aromatic hydrocarbon emissions**
Chao-C-Y-H. Kwong-P-C-W. Wang-J-H. Cheung-C-W. Kendall-G,
Bioresource Technology, 2008, 99 (1), pages 83-93
Abstract: The potential of co-firing rice husk and bamboo with coal was studied in a bench-scale pulverized fuel combustion reactor. Experimental parameters including biomass blending ratio in the fuel mixture, biomass grinding size, excess air ratio and relative moisture content in the biomass were investigated. Particulate Matters in the forms of PM10, PM2.1, ultra fine particles as well as the associated Polycyclic Aromatic Hydrocarbons (PAHs) emissions were evaluated. An operation range between 10% and 30% of biomass to coal ratio was found to be the optimum range in terms of minimum pollutant emissions per unit energy output. Co-combustion of coal with biomass seemed to have the effect of moving the fly-ash in PM2.1 to a larger size range, but increasing the number counts of the ultra fine particles. It was noted that the much higher volatile matter content in the biomass fuels has played a key role in improving the combustion performance in the system. However, slagging, fouling and formation of clinker could be the issues requiring attention when using biomass co-combustion in conventional boilers
Other Title: Co-firing coal with rice husk and bamboo and the impact on particulate matters and associated polycyclic aromatic hydrocarbon emissions
Descriptors: air-pollutants. air-pollution. aromatic-hydrocarbons. bamboos. bioenergy. biomass. coal. combustion. emission. equipment-performance. polycyclic-hydrocarbons. rice-husks

81. **Purification and characterization of cellulase produced by Bacillus amyoliquefaciens DL-3 utilizing rice hull** / Lee-YouJung. Kim-BoKyung. Lee-

BoHwa. Jo-KangIk. Lee-NamKyu. Chung-ChungHan. Lee-YoungChoon. Lee-JinWoo,
Bioresource Technology, 2008, 99 (2), pages 378-386
Abstract: A microorganism hydrolyzing rice hull was isolated from soil and identified as Bacillus amyloliquefaciens by analysis of 16S rDNA and partial sequences of the gyrA gene, and named as B. amyloliquefaciens DL-3. With the analysis of SDS-PAGE, the molecular weight of the purified cellulase was estimated to be 54 kDa. The purified cellulase hydrolyzed avicel, caboxymethylcellulose (CMC), cellobiose, beta -glucan and xylan, but not p-Nitrophenyl- beta -D-glucopyranoside (PNPG). Optimum temperature and pH for the CM Case activity of the purified cellulase were found to be 50 deg C and pH 7.0, respectively. The CMCase activity was inhibited by some metal ions, N-bromosuccinimide and EDTA in the order of Hg2+ > EDTA > Mn2+ > N-bromosuccinimide > Ni2+ > Pb2+ > Sr2+ > Co2+ > K+. The open reading frame of the cellulase from B. amyloliquefaciens DL-3 was found to encode a protein of 499 amino acids. The deduced amino acid sequence of the cellulase from B. amyloliquefaciens DL-3 showed high identity to cellulases from other Bacillus species, a modular structure containing a catalytic domain of the glycoside hydrolase family 5 (GH5), and a cellulose-binding module type 3 (CBM3)
Other Title: Purification and characterization of cellulase produced by Bacillus amyoliquefaciens DL-3 utilizing rice hull
Descriptors: amino-acids. carboxymethylcellulose. cellobiose. cellulase. cobalt. EDTA. enzyme-activity. enzymes. glucans. lead. manganese. mercury. nickel. potassium. rice-husks. strontium. xylan

82. **Characteristics of dairy manure composting with rice straw**
Li-XiuJin. Zhang-R-H. Pang-YunZhi,
Bioresource Technology, 2008, 99 (2), pages 359-367
Abstract: The aim of this work was to investigate the effects of aeration rate, aeration method, moisture content, and manure age on the characteristics of dairy manure composting with rice straw in terms of composting temperature, oxygen consumption rate, emission of odorous gases, and final compost property. It was found that the aeration rate of 0.25 L/min-kg VS was capable of achieving the highest composting temperature, longest retention time of high temperature, and less emission of odour gases. Except for the composting temperature reached, there was no significant difference between bottom-forced and top-diffusion aerations in terms of final compost property. The higher initial moisture content (65%) was more favorable for its higher temperature, longer retention time of high temperature, and more stable end compost obtained. Fresh manure showed better composting performance than the aged manure for its higher temperature reached in less time and less ammonia emission. Oxygen consumption rates were basically similar to those of temperatures. Most emissions of the odorous gases occurred during the first week of composting, therefore, special attention should be paid to this period of time for effective odour control
Other Title: Characteristics of dairy manure composting with rice straw
Descriptors: aeration. cattle-manure. composting. composts. dairy-wastes. emission. moisture-content. odours. oxygen. rice. rice-straw. straw. temperature

83. **Extraction of protein and amino acids from deoiled rice bran by subcritical water hydrolysis** / Sereewatthanawut-I. Prapintip-S. Watchiraruji-K. Goto-M. Sasaki-M. Shotipruk-A,
Bioresource Technology, 2008, 99 (3), pages 555-561
Abstract: This study investigated the production of value-added protein and amino acids from deoiled rice bran by hydrolysis in subcritical water (SW) in the temperature range between 100 and 220 deg C for 0-30 min. The results suggested that SW could effectively be used to hydrolyze deoiled rice bran to produce useful protein and amino acids. The amount of protein and amino acids produced are higher than those obtained by conventional alkali hydrolysis. The yields generally increased with increased temperature and hydrolysis time. However, thermal degradation of the product was observed when hydrolysis was carried out at higher temperature for extended period of time. The highest yield of protein and amino acids were 219 plus or minus 26 and 8.0 plus or minus .6 mg/g of dry bran, and were obtained at 200 deg C at hydrolysis time of 30 min. Moreover, the product obtained at 200 deg C after 30 min of hydrolysis exhibited high antioxidant activity and was shown to be suitable for use as culture medium for yeast growth
Other Title: Extraction of protein and amino acids from deoiled rice bran by subcritical water hydrolysis
Descriptors: amino-acids. antioxidants. degradation. extraction. hydrolysis. proteins. rice-bran. temperature. yeasts. yields

84. **Effects of chemical treatments of rice straw on rumen fermentation characteristics, fibrolytic enzyme activities and populations of liquid- and solid-associated ruminal microbes in vitro**
Chen-X-L. Wang-J-K. Wu-Y-M. Liu-J-X,
Animal Feed Science and Technology, 2008, 141 (1-2), pages 1-14
Abstract: This study was conducted to investigate the effects of treatment of rice straw (RS) with sodium hydroxide (SH) and ammonium bicarbonate (AB) on fermentation characteristics, fibrolytic enzyme activities and populations of liquid- and solid-associated ruminal microbes in vitro. In vitro gas test was performed to evaluate the nutritive value of the treated straw. Specific activities of fibre-degrading enzymes, namely carboxymethyl cellulase (CMCase), avicelase that catalyzes the breakdown of crystalline cellulose (Avicel) to cellobiose and xylanase were estimated from the amount of reducing sugars released from the solid-bound microbes. Total deoxyribonucleic acid (DNA) was extracted from the liquid- and solid-associated ruminal microbes, respectively, and populations of rumen microbes were determined by real-time quantitative polymerase chain reaction (PCR). Populations of total rumen fungi, Ruminococcus flavefaciens and Fibrobacter succinogenes were expressed as a proportion of total rumen bacterial 16S ribosomal deoxyribonucleic acid (rDNA). The cumulative gas production (GP) at all incubation times, potential GP and rate constant of GP were highest for SH-RS, followed by AB-RS and lowest for the untreated RS ($P<0.05$). Microbial crud protein increased with incubation time, and was higher for the treated straws than for the untreated ($P<0.05$). Both treated and untreated straws maintained a typical roughage type of fermentation with a high proportion of acetate. The SH treatment increased CMCase and avicelase activities at all incubation times. Both SH and AB treatments significantly increased xylanase activity. Rumen fungi were significantly increased with incubation time in both liquid and solid phases for SH-RS, but not affected by AB treatment. Both solid- and liquid-associated R.

flavefaciens were higher in treated straws than in the untreated, with higher solid-associated R. flavefaciens in SH-RS than in AB-RS at early incubation periods. Solid-associated F. succinogenes was lower, and liquid-associated F. succinogenes was higher in proportion of total ruminal bacterial 16S rDNA in SH-RS than in other two straws, with little difference in solid-associated F. succinogenes between untreated and AB straws. Liquid-associated F. succinogenes was lower at early incubation in AB-RS. It is inferred that chemical treatments enhance the nutritive value of RS through improving rumen fermentation and fibrolytic enzyme activities that are mainly resultant from more available substrate, and has great influences on rumen microbial distribution and populations, but their fluctuating pattern with incubation time is slightly different between two treated straws
Other Title: Effects of chemical treatments of rice straw on rumen fermentation characteristics, fibrolytic enzyme activities and populations of liquid- and solid-associated ruminal microbes in vitro
Descriptors: ammonium-bicarbonate. cellulase. chemical-treatment. crude-protein. enzyme-activity. gas-production. in-vitro. nutritive-value. rice. rice-straw. rumen-bacteria. rumen-fermentation. rumen-microorganisms. sodium-hydroxide. straw

85. **Evaluation of silicate iron slag amendment on reducing methane emission from flood water rice farming** / Ali-M-A. Oh-JuHwan. Kim-PilJoo,
Agriculture, Ecosystems & Environment, 2008, 128 (1-2), pages 21-26
Abstract: Application of electron acceptors such as ferric iron oxides and hydroxides for controlling methane (CH4) emission from wetland rice fields deserves special attention due to its dominant role over all other redox species in wetland soils. Silicate iron slag (hereafter, silicate fertilizer), a byproduct of steel industry containing electron acceptors, was applied in paddy field (Agronomy Farm, Gyeongsang National University, South Korea) at the rate of 0, 1, 2 and 4 Mg ha-1 to investigate their effects on reducing CH4 emissions from flood water rice (Oryza sativa, cv. Dongjinbyeo) farming during 2006-2007. CH4 emission rates measured by closed-chamber method decreased significantly ($p<0.05$) with increasing levels of silicate fertilizer application during rice cultivation. Soil redox potential (Eh) showed a contrasting response to CH4 emission rates. The concentrations of dissolved iron materials in percolated water, and the active and free iron oxides in soil significantly increased with the applications of silicate fertilizer, which acted as oxidizing agents and electron acceptors, and eventually suppressed CH4 emissions during the rice growing seasons. Total CH4 emission was decreased by 16-20% with 4 Mg ha-1 silicate fertilizer application and simultaneously rice grain yield was increased by 13-18%. Silicate fertilization significantly stimulated rice plant growth, especially root biomass, root volume and porosity, which might have improved rhizosphere oxygen concentration, and then partially contributed to reduce CH4 emission through enhancing methane oxidation. Therefore, silicate fertilizer could be a good soil amendment for reducing CH4 emission as well as increasing rice productivity in wetland paddy field
Other Title: Evaluation of silicate iron slag amendment on reducing methane emission from flood water rice farming
Descriptors: air-pollutants. crop-yield. emission. greenhouse-gases. growth. methane. paddy-soils. pollution-control. redox-potential. rhizosphere. rice. rice-soils. roots. silicates. slags. soil-amendments. soil-types

86. **A comparison of growth and photosynthetic characteristics of two improved rice cultivars on methane emission from rainfed agroecosystem of northeast India**
Kaushik-Das. Baruah-K-K,
Agriculture, Ecosystems & Environment, 2008, 124 (1-2), pages 105-113
Abstract: Wetland rice fields serve as an important anthropogenic source of atmospheric methane, a greenhouse gas implicated in global warming. An experiment was conducted at the North Bank Plain Zone of Assam, India, during summer rice growing season (April-July 2006) in order to elucidate the effects of morpho-physiological characteristics of rice (Oryza sativa L.) plants on methane emission from paddy fields. Two improved rice cultivars viz. Disang and Luit were grown in light textured loamy soil (Sand 28.50%, Clay 30.10%, Silt 41.40%, electrical conductivity (EC) 0.43 mmhos/100 g, cation exchange capacity (CEC) 10.20 meq 100 g-1) under rainfed condition. Higher seasonal integrated methane flux was recorded in cultivar Disang (Esif=1.38 g m-2) compared to Luit (Esif=0.96 g m-2). Both the cultivars exhibited two emission peaks; one at active vegetative growth stage and the other at panicle initiation stage of the crop. Methane emission from the cultivars was significantly regulated by crop phenology and growth. Vegetative growth in terms of leaf number and area, root volume and length and tiller number was higher in Disang. Statistical analysis of these parameters showed a positive correlation with methane emission. On the other hand, yield and all yield-attributing parameters were found to be superior in cultivar Luit. Cultivar Luit recorded higher photosynthetic rate after panicle initiation. On the other hand, Disang recorded higher rate of photosynthesis during active vegetative growth period. In Luit, maximum partitioning of photosynthates was found towards the developing panicle, whereas in cultivar Disang, photosynthates could not be allocated sufficiently towards the panicle. In Disang, maximum partitioning of photosynthates was recorded towards the vegetative parts (including root) of the rice plant. Variation in organic carbon content of soil was observed in the field planted with two cultivars. Higher soil organic carbon content was recorded in the field planted with cultivar Disang. From this, we hypothesize that in Disang, photosynthetic carbon products were utilized as substrate by methanogens in the rhizosphere leading to more production of methane. Additionally, higher vegetative growth with high methane transport capacity (MTC) may positively contribute to higher methane emission from cultivar Disang
Other Title: A comparison of growth and photosynthetic characteristics of two improved rice cultivars on methane emission from rainfed agroecosystem of northeast India
Descriptors: clay-soils. crop-growth-stage. crop-yield. cultivars. ecosystems. growth. leaf-area. leaves. loam-soils. methane. methane-production. organic-carbon. phenology. photosynthates. photosynthesis. rice. roots. silty-soils. soil-types. tillers. yield-components

87. **Plant species richness and floristic composition change along a rice-pasture sequence in subsistence farms of Brazilian Amazon, influence on the fallows biodiversity (Benfica, State of Para)** / Mitja-D. Miranda-I-de-S. Velasquez-E. Lavelle-P,
Agriculture, Ecosystems & Environment, 2008, 124 (1-2), pages 72-84
Abstract: Along the Amazonian pioneer front in the Brazilian state of Para, smallholder farmers manually clear primary rain forest every year to grow rice prior to sowing pastures that they will use for 5-20 years. Species richness and floristic

composition of the weedy species were studied in 20 plots along a farming succession, from rice fields, to 1-year-old, 4-8-year-old and over 10-year-old pastures planted to Brachiaria brizantha. In the early phases of the farming cycle reduction in the average plant total species richness in 50 m2 plots decreased from 67 to 20 species and comprised both woody and herbaceous species. The increase to 41 species further observed in mature pastures was essentially comprised of herbaceous species. Rice fields were characterised by a great floristic heterogeneity which later decreased when they were planted to pastures. PCA of plant communities ordinated plots along a gradient of increasing anthropisation that explained 23.6% of total variance. Species were classified into four ecological groups, which floristic composition and specific richness changed throughout the farming succession. Species richness and density of forest woody species decreased progressively from 32 to 7 species and from 152 to 16 individuals per 50 m2, and only a few species such as Memora allamandiflora and Poecilanthe effusa resisted pasture conditions. Pioneer/secondary woody species of the genera Cecropia and Solanum germinated out of the forest seed bank, and seven species on average were observed in rice fields and 1-year-old pastures. At later stages (>4 years) their respective species richness decreased to three species while their density decreased sharply, from 439 to 41 individuals per 50 m2. A few forest herbaceous species of the families Marantaceae and Poaceae and the fern species Adiantum argutum, which survived in rice fields (2 species per 50 m2 on average), almost disappeared in the 4-8-year-old pastures. In the early phase of the intra-farming succession, a rather stable community of six species of secondary herbaceous plants on average was established. Species richness further increased to 16 in the >10-year-old pastures with addition of species such as Desmodium axillare, Phyllanthus amarus or Cyperus compressus. In accordance with the concept of Initial Floristic Composition, floristic composition at the beginning of the intra-farming succession was determined by the floristic composition of the former forest and by the nature and intensity of the initial disturbance (deforestation and burning). Further changes in species richness, floristic composition and density in the intra-farming succession are driven by the intra-farming management
Other Title: Plant species richness and floristic composition change along a rice-pasture sequence in subsistence farms of Brazilian Amazon, influence on the fallows biodiversity (Benfica, State of Para)
Descriptors: biodiversity. botanical-composition. chronosequences. farming-systems. forests. grasslands. pastures. pioneer-species. plant-communities. plant-ecological-groups. rice. small-farms. sown-grasslands. species-diversity. species-richness. subsistence-farming. survival. tropical-rain-forests. weeds. woody-plants

88. **Exchange of carbonyl sulfide (OCS) and dimethyl sulfide (DMS) between rice paddy fields and the atmosphere in subtropical China**
Yi-ZhiGang. Wang-XinMing. Sheng-GuoYing. Fu-JiaMo,
Agriculture, Ecosystems & Environment, 2008, 123 (1-3), pages 116-124
Abstract: Carbonyl sulfide (OCS) and dimethyl sulfide (DMS) are important trace gases contributing to sulfate aerosol formation in the lower and upper atmosphere and hence greatly impacting global radiative balance. In the present study the exchange of OCS and DMS between rice (Oryza sativa L.) paddy fields and the atmosphere was studied in subtropical China from November 2004 to July 2005. OCS and DMS fluxes were compared between the planted and non-planted paddy fields, and between dry and waterlogged soils. The rice paddy fields were found to be a net sink for OCS and a source for DMS, with an uptake rate of 12.1 plus or minus 16.0 pmol m-2 s-1

for OCS and an emission rate of 25.9 plus or minus 35.2 pmol m-2 s-1 for DMS. OCS fluxes varied significantly between non-planted dry and waterlogged soils, with an uptake rate of 11.4 plus or minus 7.1 pmol m-2 s-1 for non-planted dry soils and an emission rate of 9.0 plus or minus 5.4 pmol m-2 s-1 for non-planted waterlogged soils. For DMS the variation between non-planted dry and waterlogged soils was not significant. Both OCS and DMS fluxes showed significant differences between the planted and non-planted waterlogged soils. For OCS, the planted waterlogged soil acted as a sink with an uptake rate of 29.0 plus or minus 25.7 pmol m-2, but the non-planted waterlogged soil acted as a source with an emission rate of 9.0 plus or minus 5.4 pmol m-2 s-1. For DMS, both the planted and non-planted waterlogged soils acted as sources, with an emission rate of 51.2 plus or minus 37.5 pmol m-2 s-1 for the planted waterlogged soil, which was significantly higher than that for the non-planted waterlogged soil (3.8 plus or minus 2.8 pmol m-2 s-1). OCS and DMS exchange rates differed significantly at different rice growth stages, with the highest fluxes at the jointing-booting stage. The potential factors causing the variations between the different treatments are also discussed. This work revealed that rice paddy field in subtropical China acts as a sink for OCS and an emission source for DMS as a whole and further investigation on the influence of soil microorganisms and soil redox potential on the OCS and DMS fluxes in rice paddy field are needed
Other Title: Exchange of carbonyl sulfide (OCS) and dimethyl sulfide (DMS) between rice paddy fields and the atmosphere in subtropical China
Descriptors: aerosols. atmosphere. carbonyl-sulfide. diurnal-variation. emission. methyl-sulfide. paddy-soils. redox-potential. rice. soil-air. soil-types. subtropics. waterlogging

89. **Tillage and irrigation effects on crop yields and soil properties under the rice-wheat system in the Indian Himalayas**
Bhattacharyya-R. Kundu-S. Pandey-S-C. Singh-K-P. Gupta-H-S,
Agricultural Water Management, 2008, 95 (9), pages 993-1002
Abstract: Conservation tillage systems generally improve soil organic C (SOC), plant available water capacity (PAWC), aggregation and soil water transmission. A field experiment was conducted for 4 years (2001-2002 to 2004-2005) to study tillage (conventional tillage (CT) and zero tillage (ZT)) systems. The selected irrigation treatments were at four levels (I1: pre-sowing (PS), I2: PS+active tillering (AT)/crown root initiation (CRI), I3: PS+AT/CRI+panicle initiation (PI)/flowering (FL), and I4: PS+AT/CRI+PI/FL+grain filling (GF)), applied at the critical growth stages on rice (Oryza sativa L.) and wheat (Triticum aestivum L.). Their effects on direct seeded rice productivity and soil properties (SOC and selected physical properties) after rice and wheat harvest were investigated. Soil organic C contents after rice and wheat harvest in the 0-15 cm soil depth were higher under ZT than under CT. Soil organic C increased significantly with I2 over I1 for both crops and with I4 over I2 for the wheat crop. The PAWC was significantly higher with ZT than CT. Zero tilled and frequently irrigated plots showed enhanced infiltration characteristics (infiltration rate, cumulative infiltration and sorptivity) and saturated hydraulic conductivity. Both direct seeded rice and wheat yields were not significantly different in the plots under ZT and CT. There was a significant increase in both rice and wheat yields in the plots under I2 over I1. However, water use efficiency between irrigation treatments was not significantly different. Hence, under direct seeded rice-wheat system in a sandy clay loam soil of the sub-temperate Indian

Himalayas, farmers may adopt ZT with two irrigations in each crop for optimum resource conservation
Other Title: Tillage and irrigation effects on crop yields and soil properties under the rice-wheat system in the Indian Himalayas
Descriptors: conservation-tillage. crop-yield. direct-sowing. infiltration. irrigation. no-tillage. organic-carbon. rice. saturated-hydraulic-conductivity. soil-chemical-properties. soil-depth. soil-organic-matter. soil-physical-properties. soil-properties. sorption. tillage. water-use-efficiency. wheat

90. **Ammonia volatilization from urea in rice fields with zero-drainage water management**
Li-Hua. Liang-XinQiang. Chen-YingXu. Tian-GuangMing. Zhang-ZhiJian,
Agricultural Water Management, 2008, 95 (8), pages 887-894
Abstract: Three field experiments located at Yuhang (YH), Changshu (CS), and Jiaxing (JX) Agricultural Research Stations in the Taihu region of China were conducted to elucidate ammonia volatilization (AV) during rice growing seasons through 'zero-drainage water management', combined with sound irrigation, rainfall forecasting and field drying. The experiment at each site had five N rates (0-360 kg N/ha in 90 kg increments). AV was measured by the continuous airflow enclosure method. Results show that AV was completed within 10-12 days after urea application. The peak values of AV rates after the first topdressing (AF1) at N360 treatment could reach 11.2, 9.0, and 8.5 kg N/ha day within 2-4 days at the YH, CS, and JX sites, respectively. It was only necessary to maintain a higher water level during the first 'flooding-drying' cycle after the AF1. The seasonal averages of the total AV fluxes accounted for 4.4-15.5%, 4.4-12.6%, and 4.6-10.9% of the applied urea at the YH, CS, and JX sites, respectively, suggesting that the zero-drainage water management with flooding-drying cycles was effective for controlling AV. This study also speculates that the total AV flux during the rice season was more N rates and seasons related than sites
Other Title: Ammonia volatilization from urea in rice fields with zero-drainage water management
Descriptors: ammonia. application-rates. drainage. drying-wetting-cycles. irrigation. nitrogen. rain. rice. rice-soils. soil-types. urea. volatilization. water-management
Geographic Location: China. Zhejiang

91. **Overland water and salt flows in a set of rice paddies**
Playan-E. Perez-Coveta-O. Martinez-Cob-A. Herrero-J. Garcia-Navarro-P. Latorre-B. Brufau-P. Garces-J,
Agricultural Water Management, 2008, 95 (6), pages 645-658
Abstract: Cultivation of paddy rice in semiarid areas of the world faces problems related to water scarcity. This paper aims at characterizing water use in a set of paddies located in the central Ebro basin of Spain using experimentation and computer simulation. A commercial field with six interconnected paddies, with a total area of 5.31 ha, was instrumented to measure discharge and water quality at the inflow and at the runoff outlet. The soil was classified as a Typic Calcixerept, and was characterized by a mild salinity (2.5 dS m-1) and an infiltration rate of 5.8 mm day-1. The evolution of flow depth at all paddies was recorded. Data from the 2002 rice-growing season was elaborated using a mass balance approach to estimate the infiltration rate and the evolution of discharge between paddies. Seasonal crop evapotranspiration, estimated with the surface renewal method, was 731 mm (5.1 mm

day-1), very similar to that of other summer cereals grown in the area, like corn. The irrigation input was 1874 mm, deep percolation was 830 mm and surface runoff was 372 mm. Irrigation efficiency was estimated as 41%. The quality of surface runoff water was slightly degraded due to evapoconcentration and to the contact with the soil. During the period 2001-2003, the electrical conductivity of surface runoff water was 54% higher than that of irrigation water. However, the runoff water was suitable for irrigation. A mechanistic mass balance model of inter-paddy water flow permitted to conclude that improvements in irrigation efficiency cannot be easily obtained in the experimental conditions. Since deep percolation losses more than double surface runoff losses, a reduction in irrigation discharge would not have much room for efficiency improvement. Simulations also showed that rice irrigation performance was not negatively affected by the fluctuating inflow hydrograph. These hydrographs are typical of turnouts located at the tail end of tertiary irrigation ditches. In fact, these are the sites where rice has been historically cultivated in the study area, since local soils are often saline-sodic and can only grow paddy rice taking advantage of the low salinity of the irrigation water. The low infiltration rate characteristic of these saline-sodic soils (an experimental value of 3.2 mm day-1 was obtained) combined with a reduced irrigation discharge resulted in a simulated irrigation efficiency of 60%. Paddy rice irrigation efficiency can attain reasonable values in the local saline-sodic soils, where the infiltration rate is clearly smaller than the average daily rice evapotranspiration
Other Title: Overland water and salt flows in a set of rice paddies
Descriptors: evapotranspiration. Inceptisols. infiltration. irrigation. overland-flow. paddy-soils. percolation. rice. runoff. runoff-water. saline-sodic-soils. salinity. soil-types. soil-water-movement. water-flow

92. **Global warming, rice production, and water use in China: developing a probabilistic assessment** / Tao-Fulu. Hayashi-Y. Zhang-Zhao. Sakamoto-T. Yokozawa-M,
Agricultural and Forest Meteorology, 2008, 148 (1), pages 94-110
Abstract: Uncertainties in global climate models (GCMs) and emission scenarios affect assessments of the impact of global warming as well as the communication of scientific results. Here, we developed a probabilistic technique to deal with the uncertainties and to simulate the impact of global warming on rice production and water use in China, against a global mean temperature (GMT) increase scale relative to 1961-1990 values. From 20 climate scenarios output from the Intergovernmental Panel on Climate Change Data Distribution Centre, we used Monte Carlo analysis to develop the most likely climate-change scenarios for representative stations and derived the CERES-Rice model of [Alocilja, E.C., Ritchie, R.T., 1988. Rice simulation and its use in multicriteria optimization, IBSNAT Research Report Series 01] to simulate rice production under baseline and future climate scenarios. Adaptation options such as automatic application of irrigation and fertilization were considered, although cultivars were assumed constant over the baseline and future. After assessing representative stations across China, we projected changes in rice yield, growing period, evapotranspiration, and irrigation-water use for GMT changes of 1, 2, and 3 deg C in a probabilistic way. Without consideration of CO2-fertilization effects, our results indicate that the growing period would shorten with 100% probability; yield would decrease with a probability of 90%, 100%, and 100% for GMT change of 1, 2, and 3 deg C, respectively. The median values of yield decrease ranged from 6.1% to 18.6%, 13.5% to 31.9%, and 23.6% to 40.2% for GMT changes

of 1, 2, and 3 deg C, respectively. According to the median values of the projected changes, evapotranspiration and irrigation water use would decrease in most of the investigated stations. If CO2-fertilization effects were included, the rice growing period would also be reduced with 100% probability; across the stations the median values of yield changes ranged from -10.1% to 3.3%, -16.1% to 2.5%, and -19.3% to 0.18% for GMT changes of 1, 2, and 3 deg C, respectively. Evapotranspiration and irrigation water use would decrease more and with higher probability in comparison with the simulations without consideration of CO2-fertilization effects. Our study presents a process-based probabilistic assessment of rice production and water use at different GMT increases, which is important for identifying which climate-change level is dangerous for food security
Other Title: Global warming, rice production, and water use in China: developing a probabilistic assessment
Descriptors: carbon-dioxide. climatic-change. climatic-factors. crop-yield. cultivars. evapotranspiration. fertilizers. global-warming. irrigation. Monte-Carlo-method. probability-analysis. rice. simulation-models. water-use

93. **Proteome analysis of proteins responsive to ambient and elevated ozone in rice seedlings** / Feng-YanWen. Komatsu-S. Furukawa-T. Koshiba-T. Kohno-Y, Agriculture, Ecosystems & Environment, 2008, 125 (1-4), pages 255-265
Abstract: Ozone is a major gaseous pollutant that induces crop loss. Although the physiological and morphological responses of crops to ambient ozone have been well characterized, little is known about the protein responses. We firstly investigated the protein responses in rice seedlings under ambient and elevated ozone stress by a proteome approach. Twenty proteins were differentially expressed. Expression of ribulose-1,5-bisphosphate carboxylase/oxygenase (RuBisCO) large subunit (LSU) and their 17-18 kDa fragments and RuBisCO activase were reduced by both ambient and elevated ozone. RuBisCO small subunit (SSU), large subunit fragment (37 kDa), and oxygen-evolving enhancer proteins 1 and 2 increase in expression with ambient ozone, and decreased with elevated ozone. Ambient ozone induced a slight reduction, and elevated ozone induced a significant reduction in the expression of energy metabolism proteins. Expression of the antioxidant proteins glutathione S-transferase and Mn superoxide dismutase increased upon ozone exposure, but thioredoxin peroxidase expression decreased. Three defense/stress-related proteins, pathogenesis-related (PR) class 5 protein (PR5) and two PR10 proteins OsPR10/PBZ1 and RSOsPR10, were significantly induced after 2 days exposure to elevated ozone and gradually increased during exposure period. The results not only indicate the difference in protein responses between leaves exposed to ambient and elevated ozone, but also demonstrated the highly damaging effect of elevated ozone on rice seedlings at the proteome level
Other Title: Proteome analysis of proteins responsive to ambient and elevated ozone in rice seedlings
Descriptors: air-pollutants. air-pollution. antioxidants. gene-expression. glutathione-transferase. leaves. manganese. metabolism. oxidoreductases. oxygen. oxygenases. ozone. peroxidase. proteins. proteomes. proteomics. ribulose-bisphosphate-carboxylase. rice. seedlings. stress. stress-response. superoxide-dismutase

94. **Nitrogen flow and use efficiency in production and utilization of wheat, rice, and maize in China** / Ma-WenQi. Li-JianHui. Ma-Lin. Wang-FangHao. Sisak-I. Cushman-G. Zhang-FuSuo,

Agricultural Systems, 2008, 99 (1), pages 53-63
Abstract: China has long been the world's most populous nation and faced the double challenge of ensuring its food security without causing catastrophic damage to the environment. Since the early 1960s, Chinese agricultural development has been premised on large domestic increases in nitrogen (N) fertilizer production and consumption. However, current utilization of fertilizer is far beyond optimum, with the fate of excess N largely unknown. Here, we report on N flows, losses, and use efficiency in the production and utilization of three major grain crops using data from 2004. We also use a scenario analysis to explore strategies for improving N use efficiency. Our calculations show that N use efficiency in food production and utilization is much lower than previously published estimates. Mean N surpluses of crop fields were 144 kg/ha for wheat, 184 kg/ha for rice, and 120 kg/ha for maize. We estimate that between 50% and 85% of N harvested as grain is lost for utilization by humans and animals. Fertilizer N use efficiency (FNUE) values in crop-animal system for wheat, rice, and maize were 13.4%, 11.3%, and 3.7%, respectively. This means 7.5, 8.9 and 27.1 kg of N fertilizer were required to produce 1 kg of N in food via fertilization for these three grains. Major room exists for improving the efficiency of N flow in Chinese crop systems. Our scenario analyses shows that increases in N use efficiency of fertilizer applied to cropland (RE), decreasing ratios of grain N headed to plant food processing (GUP), and increasing efficiency in animal production (ANU) would result in a marked decrease in N loss from these three crops amounting to one million ton of N, which accounted for 6% of total chemical fertilizer input. Improved N management in Chinese food production has major ramifications for global estimations of N use efficiency and environmental pollution by reactive N, particularly nitrous oxide emissions, a major anthropogenic contributor to global climate change
Other Title: Nitrogen flow and use efficiency in production and utilization of wheat, rice, and maize in China
Descriptors: climatic-change. crop-production. food-production. food-supply. maize. nitrogen. nitrogen-fertilizers. nitrous-oxide. pollution. rice. use-efficiency. wheat

95. **Disentangling the effect of environmental factors on yield and nitrogen uptake of irrigated rice in Asia** / Jing-Qi. Bouman-B. Keulen-H-van. Hengsdijk-H. Cao-WeiXing. Dai-TingBo,
Agricultural Systems, 2008, 98 (3), pages 177-188
Abstract: Rice yield is the result of the interaction between genotype (cultivar characteristics), environment (climate and soil conditions), and management. Few studies have attempted to isolate the contribution of each of these factors. Here the rice growth model ORYZA2000 was used to analyse the variation in yield, nitrogen (N) uptake, and internal N use efficiency (INUE, grain yield per unit total crop N uptake) of rice in different environments. First, ORYZA2000 was calibrated and evaluated using an empirical data set that spanned three varieties, three years, and eight locations in Asia. Next, we used the model to investigate the relative contribution of indigenous soil N and external N supply and of the weather factors temperature and radiation to observed variation in yield. With normalized root mean square errors (RMSEn) of 6-16%, ORYZA2000 satisfactorily simulated crop biomass, yield, N uptake, and INUE, that strongly varied among genotypes and locations. Environmental factors contributed differentially to yield, N uptake, and INUE, and their contributions were modified by N management. Indigenous soil N supply affected yield and INUE more strongly than weather conditions at low

fertilizer N rates, but its influence was less pronounced at higher fertilizer N rates. Under both, low and high fertilizer N rates, indigenous soil N supply affected N uptake more than weather conditions did. Temperature contributed more than radiation to the variation in yield, N uptake, and INUE. Results suggest that N fertilizer management should take into account indigenous soil N supply, while temperature is the major factor in the selection of genotypes and sowing dates in maximizing rice yield
Other Title: Disentangling the effect of environmental factors on yield and nitrogen uptake of irrigated rice in Asia
Descriptors: biomass-production. crop-yield. environmental-factors. growth-models. irrigated-farming. nitrogen. nitrogen-fertilizers. nutrient-uptake. radiation. rice. temperature. use-efficiency

96. **Modified rice cultivation in Tamil Nadu, India: yield gains and farmers' (lack of) acceptance** / Senthilkumar-K. Bindraban-P-S. Thiyagarajan-T-M. Ridder-N-de. Giller-K-E,
Agricultural Systems, 2008, 98 (2), pages 82-94
Abstract: The looming water crisis and water-intensive nature of rice cultivation are driving the search for alternative management methods to increase water productivity in rice cultivation. Experiments were conducted under on-station and on-farm conditions to compare rice production using modified methods of irrigation, planting, weeding and nutrient management with conventional methods of cultivation. Farm surveys were used to evaluate adoption of modified rice cultivation method. On-station experiments showed that, a combination of water-saving irrigation, young seedling or direct seeding, mechanical weeding and green manure application increased the rice water productivity though the largest yields were obtained for a combination of conventional irrigation, young seedling or direct seeding, mechanical weeding and green manure application. On-farm experiments demonstrated a yield advantage of 1.5 t ha-1 for the modified method over conventional method. We found, however, that yield advantages were not the sole factor driving adoption. Associated changes required in management, including the increased labour demand for modified planting, unwillingness of agricultural labourers to change practices, difficulties with modified nursery preparation and the need to replace cheaper women's labour for hand weeding with more costly men's labour for mechanical weeding, all reduced the chance of adopting the modified rice cultivation method. Risks associated with water-saving irrigation, such as uncertainty about the timing and amount of water release for irrigation affect adoption adversely as well. There was no incentive for farmers to adopt water-saving irrigation as water from reservoirs and electricity for pumping well-water are both free of charge. To date farmers continue to experiment with the modified cultivation method on a small part of their farms, but are unlikely to adopt the modified method on a large-scale unless policies governing water management are changed
Other Title: Modified rice cultivation in Tamil Nadu, India: yield gains and farmers' (lack of) acceptance
Descriptors: crop-production. crop-yield. farmers'-attitudes. irrigation. manual-weed-control. rice. tillage. weed-control. weeds

97. **Modeling water temperature in a rice paddy for agro-environmental research** Kuwagata-T. Hamasaki-T. Watanabe-T,
Agricultural and Forest Meteorology, 2008, 148 (11), pages 1754-1766

Abstract: Water temperature in rice paddies (*Oryza sativa* L.) is one of the most important factors affecting the growth and yield of rice, and also influences CH4 emission from paddy fields. We developed a simple model of the daily mean water temperature in a rice paddy. The model has two steps for evaluating the paddy water temperature. In the first step, the daily mean water temperature of a non-vegetated water surface (Tw0) is evaluated from meteorological data (air temperature, specific humidity, wind speed, solar radiation, and downward longwave radiation) by daily 24-h mean or daytime (nighttime) 12-h mean heat balance equations. The bulk heat transfer coefficient at the water surface is a key parameter for evaluating Tw0. Next, the daily mean water temperature in a rice paddy (Tw0) is evaluated by adding a correction term to Tw0. Here, the correction term is described as a function of the leaf area index (LAI), solar radiation, and wind speed, and the formula was determined empirically. The model simulated fairly well the daily mean water temperature of rice paddies with root mean square errors of 0.81-0.85 deg C. This study also demonstrated the important result that the influence of a plant canopy on water temperature depends not only on canopy density (LAI), but also on solar radiation and wind speed. Tw0 was usually lower than Tw0, but in rice paddies with LAI=0.5-1.5, Tw0 was higher than Tw0 under strong wind conditions in sunny weather. These characteristics were incorporated into the model developed in this study
Other Title: Modeling water temperature in a rice paddy for agro-environmental research
Descriptors: agricultural-meteorology. air-temperature. canopy. humidity. leaf-area-index. meteorological-factors. plant-water-relations. rice. simulation-models. solar-radiation. water-temperature. wind-speed

98. **Determination of antioxidant components in rice bran oil extracted by microwave-assisted method**
Zigoneanu-I-G. Williams-L. Xu-Z. Sabliov-C-M,
Bioresource Technology, 2008, 99 (11), pages 4910-4918
Abstract: Rice bran oil was extracted by microwave-assisted extraction with isopropanol and hexane using a solvent-to-rice bran ratio of 3:1 (w/w). The experiments were done in triplicate at 40, 60, 80, 100, and 120 deg C with a total extraction time of 15 min/sample. The oil components were separated by normal-phase HPLC and quantified with a fluorescence detector. The radical scavenging capability of the oil was tested with DPPH and was expressed as micro mol Trolox Equivalent Antioxidant Activity. The increase in total vitamin E with temperature from 40 to 120 deg C was 59.63% for isopropanol and 342.01% for hexane. Isopropanol was the best solvent for the extraction of gamma -tocopherol and gamma -tocotrienol as compared with hexane for both microwave-assisted and conventional solvent extraction. Isopropanol was better for oil yield extraction at high temperatures. Samples extracted with isopropanol at 120 deg C had higher antioxidant activity. No differences in oil yield, total vitamin E, and antioxidant activity of oil was noticed between the two methods (microwave-assisted and solvent extractions), at 40 deg C. No degradation of alpha -tocopherol was noticed during the process
Other Title: Determination of antioxidant components in rice bran oil extracted by microwave-assisted method
Descriptors: antioxidants. chemical-composition. extraction. food-analysis. heat-treatment. nutritive-value. plant-oils. rice-bran. tocopherols. tocotrienols. vitamin-E

99. **Diurnal and seasonal variation in bulk stomatal conductance of the rice canopy and its dependence on developmental stage** / Maruyama-A. Kuwagata-T,
Agricultural and Forest Meteorology, 2008, 148 (6-7), pages 1161-1173
Abstract: Bulk stomatal conductance (gS) is an important factor that expresses the effect of stomatal movements on water transfer between the plant and atmosphere at the canopy scale and is widely used as a parameter in many micrometeorological models. Diurnal and seasonal variations in gS of the rice canopy were determined using a heat transfer model based on heat flux measurements in irrigated rice fields. Season-long observations from transplanting to maturation of rice plants were conducted to obtain heat flux data in a humid temperate climate at three experimental sites with widely differing cropping seasons in Japan. A double source model was used as the heat transfer model to calculate gS. Seasonal variations in heat fluxes differed for sensible heat and latent heat. Sensible heat flux was smaller and relatively constant within the range -50 to 50 W m-2, whereas latent heat flux showed large variations from 0 to 250 W m-2 throughout the growth period. It was suggested that this would be a common pattern for paddy rice fields in all cropping seasons. Diurnal variation in gs showed a common trend in all growth periods with lower values in the morning and evening, and higher values during the midday because of its dependence on solar radiation. The relationship between absorbed solar radiation (Sabs) and gs was determined using a Jarvis-type model for each growth period. Maximum values of bulk stomatal conductance (gSmax) for saturated Sabs rapidly decreased from 0.06 to 0.02 m s-1 between the active tillering and panicle formation stages, and moderately decreased from 0.02 to 0.01 m s-1 during the ripening stage. This was considered to be due to the change in leaf chlorophyll concentration. Seasonal variation in gSmax can be commonly expressed for all cropping seasons using the function of developmental stage (PS). Using this function, the gS value can be obtained easily at a given developmental stage, which makes it possible to use micrometeorological models in relation to rice phenological development for evaluating important factors, such as water temperature and transpiration, that affect rice production
Other Title: Diurnal and seasonal variation in bulk stomatal conductance of the rice canopy and its dependence on developmental stage
Descriptors: canopy. chlorophyll. climatic-factors. developmental-stages. diurnal-activity. heat-flow. heat-transfer. leaves. panicles. rice. ripening. seasonal-variation. solar-radiation. stomata. stomatal-movement. temperature. tillering. transpiration. water-transfer

100. **Correlation changes between rice yields in North and Northwest China and ENSO from 1960 to 2004**
Zhang-TianYi. Zhu-JiAng. Yang-XiaoGuang. Zhang-XiaoYu,
Agricultural and Forest Meteorology, 2008, 148 (6-7), pages 1021-1033
Abstract: The correlations between ENSO (El Nino/Southern Oscillation) and crops in China have been recognized, but the research focusing on the causes behind the correlations still remains incomplete. In this study, we concentrate on the causal relationship between ENSO and rice yields in North and Northwest China. We found that there was an inconsistency in the observed correlation between rice yields and the occurrence of ENSO events during various periods from 1960 to 2004 in most provinces. Rice was vulnerable to El Nino events before 1980, while it seemed to benefit from the occurrence of such events following 1980. We established the reason for the change through a combination of mechanistic modeling and empirical

statistical analysis. We concluded that much of this inconsistency in yield responses to ENSO can be attributed to the development of water supply systems throughout our study region. The meteorological impacts associated with ENSO events varied with water regime. This important finding provided a key explanation into the interaction processes between ENSO climate variability and the water supply in the rice production system, and further confirmed the importance of considering interactive effects between climate variability and human adaptation practices when assessing climate change impacts on agricultural variability
Other Title: Correlation changes between rice yields in North and Northwest China and ENSO from 1960 to 2004
Descriptors: climatic-change. correlation-analysis. crop-yield. rice. statistical-analysis. water-supply

101. **Performance of Diverse Rice Genotypes Based on Seed-Set in Interspecific Hybrid Production: Implications for Plant Breeders**
Efisue-A. Ubi-B. Tongoona-P. Derera-J. Laing-M,
Journal of New Seeds, 2008, 9 (2), pages 128-144
Abstract: Interspecific hybridization is an important technique used in improving rice populations by combining desired traits from different species. However, this could be difficult due to barriers to interspecific hybridization. The objective of this study was to determine the performance of different rice species based on seed set in an interspecific hybridization program. Five Oryza glaberrima genotypes and four interspecific inbred lines were used as female (seed) parents and two improved O. sativa and two interspecific inbred lines (NERICA 2 and NERICA 3) as male (pollen) parents to generate 36 cross combinations representing the North Carolina Design II mating scheme. Four groups of crosses were made: group A (O. glaberrima × O. sativa), group B (O. glaberrima × Interspecific), group C (Interspecific × O. sativa) and group D (Interspecific × Interspecific). Groups A and B had seed-set levels of about 10%. Group D had the highest seed-set level, with a mean of 19%. The least seed-set was for group C (6% seed-set). Overall, the study indicated a serious challenge in making interspecific hybrids, because only 11% of 8031 pollinations were successful in setting seed, compared with 45% within O. glaberrima and 70% within O. sativa crosses under similar conditions. Higher sterility was observed in backcrosses involving the O. glaberrima cytoplasm as compared with single crosses. The backcrosses involving O. glaberrima cytoplasm were completely sterile with no seed-set except with the CG 14 cytoplasm
Other Title: Performance of Diverse Rice Genotypes Based on Seed-Set in Interspecific Hybrid Production: Implications for Plant Breeders
Descriptors: genotypes; interspecific-hybrids; Oryza; pollination; seed-set; sterility

102. **Indices to screen for grain yield and grain-zinc mass concentrations in aerobic rice at different soil-Zn levels**
Jiang-W. Struik-P-C. Zhao-M. Van-Keulen-H. Fan-T-Q. Stomph-T-J,
Netherlands Journal of Agricultural Science, 2008, 55 (2), pages 181-198
Abstract: Zinc is an important micronutrient for both crop growth and human nutrition. In rice production, yields are often reduced and Zn mass concentrations in the grains are often low when Zn is in short supply to the crop. This may result in malnutrition of people dependent on a rice-based diet. Plant breeding to enhance low-Zn tolerance might result in higher yields and nutritional quality but requires effective selection criteria embedded in physiological insight into the Zn husbandry of the crop

and applicable in field evaluation of advanced breeding material or in screening of existing varieties. Using existing and newly developed low-Zn tolerance indices, this study presents the results of screening experiments carried out in high- and low-Zn soils. Sixteen accessions of aerobic rice were grown under greenhouse conditions to conceptualize the indices and 14 under field conditions to validate the indices. As the differences in soil-Zn levels in these experiments did not result in differences in grain yield, literature data were used from experiments where the soil-Zn level did have an effect on grain yield, to further check the validity of the indices. Several indices were applied to evaluate the genotypic low-Zn tolerance performance in attaining (relatively) high grain yield, high grain-Zn mass concentration, or both. The results indicate that the grain-Zn mass concentration efficiency index is different from the grain yield efficiency index and that the low-Zn tolerance indices identified superior genotypes best. Amongst the indices tested, the low-Zn tolerance index for grain yield and the low-Zn tolerance index for grain-Zn mass concentration were closely correlated with grain yield and grain-Zn mass concentration, respectively. Therefore, the low-Zn tolerance index for grain yield was effective in screening for high stability and high potential of grain yield, and the low-Zn tolerance index for grain-Zn mass concentration was effective for grain-Zn mass concentration under low and high soil-Zn conditions
Other Title: Indices to screen for grain yield and grain-zinc mass concentrations in aerobic rice at different soil-Zn levels
Descriptors: breeding; low-zinc-tolerance; Oryza-sativa-L; yield-index; zinc-efficiency

103. **Effect of land use change from paddy rice cultivation to upland crop cultivation on soil carbon budget of a cropland in Japan/** Nishimura-S. Yonemura-S. Sawamoto-T. Shirato-Y. Akiyama-H. Sudo-S. Yagi-K,
Agriculture, Ecosystems & Environment, 2008, 125 (1-4), pages 9-20
Abstract: Effect of land use change from paddy rice cultivation to upland crop cultivation on soil carbon budget (SCB) was studied by comparing three types of cropping system (single cropping of paddy rice (PR), single cropping of upland rice (UR) and double cropping of soybean and wheat (SW)) in an experimental field having the same history as consecutively cultivated paddy rice fields. The carbon dioxide (CO_2) and methane (CH4) fluxes from the fields were measured continuously over 2.5 years with an automated flux monitoring system. Atmospheric CO2 was significantly absorbed during the growth periods of different crops, including all the summer crops and winter wheat. The amounts of absorbed CO2 during the summer crop growth period were highest in the PR plots and lowest in the UR plots. On the other hand, CO_2 emission was observed during the fallow period. In addition, a significantly high peak and the subsequent gradual decrease in CO_2 emission were observed after plowing the fields in autumn. Significant CH4 emission was found in only the PR plots during the submerged period. With consideration of gas flux data and the amount of carbon supplied and removed by agricultural management practices such as straw incorporation and crop harvest, the SCB in the croplands was estimated. The soil carbon budgets of the PR plots were positive (79-137 g C m-2 y-1), which indicates the accumulation of carbon in the soil. On the other hand, those of the UR and SW plots were negative (-343 to -275 g C m-2 y-1 and -361 to -256 g C m-2 season-1, respectively), which indicates significant carbon loss from the soil. The contribution of CH4 emission to SCB was small compared with that of CO_2 dynamics. Significant differences in the carbon content of the top soil between the

plots were also found after the experiment, consistent with the above SCB result. The results indicate that land use change from paddy rice cultivation to upland crop cultivation causes significant loss of carbon from cropland soil
Other Title: Effect of land use change from paddy rice cultivation to upland crop cultivation on soil carbon budget of a cropland in Japan
Descriptors: absorption. arable-land. carbon. carbon-dioxide. change. crop-production. cropping-systems. double-cropping. emission. Fluvisols. greenhouse-gases. land-use. methane. rice. rotations. soil-types. sole-cropping. soyabeans. upland-rice. wheat. winter-wheat

104. **Rice sheath blight disease resistance identified in Oryza spp. accessions**
Prasad-B. Eizenga-G-C,
Plant Disease, 2008, 92 (11), pages 1503-1509
Abstract: *Oryza* spp., wild relatives of cultivated rice (*Oryza sativa*), may contain novel resistance genes for sheath blight, caused by Rhizoctonia solani, that could be used to enhance resistance to this important disease in commercial rice. To identify resistant sources for sheath blight disease, 73 Oryza genotypes were evaluated with three different methods conducted in the greenhouse, growth chamber, or laboratory because there are significant limitations to screening wild Oryza spp. under field conditions. For the microchamber method, 4-week-old seedlings were inoculated with a potato dextrose agar plug containing mycelia, covered with a 2-liter soft drink bottle, and rated 1 week after inoculation. A detached-leaf method involved placing a potato dextrose agar plug containing mycelia on the abaxial surface of a leaf section that was cut from a 5-week-old plant and placed on moist filter paper in a petri dish under constant light, then evaluated after 72 h. For the toothpick inoculation method, toothpicks colonized with mycelia were placed in the leaf collar region of plants at the panicle initiation stage, plants were placed in a growth chamber, and disease symptoms were evaluated after 7 days. The microchamber method gave a more uniform, reproducible response, and was easier to use under greenhouse conditions. Seven Oryza spp. accessions were identified as moderately resistant with three accessions classified as O. nivara (IRGC104705, IRGC100898, and IRGC104443) and one each as O. barthii (IRGC100223), O. meridionalis (IRGC105306), O. nivara/O. sativa (IRGC100943), and O. officinalis (IRGC105979)
Other Title: Rice sheath blight disease resistance identified in Oryza spp. accessions
Descriptors: disease-resistance. genetic-resistance. genotypes. plant-diseases. plant-genetic-resources. plant-pathogenic-bacteria. plant-pathogens. rice. wild-relatives

105. **Recent Rice stripe virus epidemics in Zhejiang province, China, and experiments on sowing date, disease-yield loss relationships, and seedling susceptibility**
/Wang-H-D. Chen-J-P. Zhang-H-M. Sun-X-L. Zhu-J-L. Wang-A-G. Sheng-W-X. Adams-M-J,
Plant Disease, 2008, 92 (8), pages 1190-1196
Abstract: Rice stripe virus, transmitted by the small brown planthopper Laodelphax striatellus, has recently reemerged as a major disease in Zhejiang province, eastern China. Intensive surveys during 2003 to 2006 demonstrated how the disease has spread rapidly from the northern to central and eastern regions with increasing incidence each year. In bioassays, the highest proportions of viruliferous vectors were from regions where the disease was most severe. The greatest disease incidence was in the earliest sown plants, and substantial control could be achieved by delaying planting from late May to mid-June. In experiments where different proportions of

infected plants were established (by inoculation or varying the sowing date), average yield losses were 0.8% for every 1% increase in disease incidence. In inoculation experiments, young seedlings, particularly those at the three- to five-leaf stage, were the most susceptible, whereas less than or equal to 1% of plants inoculated at or after the elongation stage developed symptoms. Recent epidemics appear to have resulted from large populations of viruliferous vectors colonizing rice seedlings at the most susceptible stage. This is probably because of changes in cropping practice, recent warmer winters in Zhejiang province, and the development of resistance or tolerance to the insecticides widely used (triazophos, synthetic pyrethroids, and Imidacloprid)
Other Title: Recent Rice stripe virus epidemics in Zhejiang province, China, and experiments on sowing date, disease-yield loss relationships, and seedling susceptibility
Descriptors: climatic-factors. crop-growth-stage. crop-yield. cropping-systems. disease-vectors. epidemics. imidacloprid. insect-pests. insecticide-resistance. insecticides. plant-diseases. plant-pathogens. plant-pests. plant-viruses. pyrethroids. rice. sowing. susceptibility. triazophos. winter. yield-losses

106. **Soil carbon and nitrogen changes in long-term continuous lowland rice cropping**
Pampolino-M-F. Laureles-E-V. Gines-H-C. Buresh-R-J,
Soil Science Society of America Journal, 2008, 72 (3), pages 798-807
Abstract: Rice (Oryza sativa), the main staple food in Asia, is typically produced on submerged anaerobic soils, which generally have slower decomposition of soil organic matter (SOM) than aerobic soils. We sampled four long-term experiments in the Philippines, with two or three rice crops grown each year with continuous or near-continuous soil submergence, to determine the effect of fertilizer management on long-term changes in soil C and N and on C and N balances. Soils were an Aquandic Epiaquoll, an Entic Pellustert, and a Typic Pelludert; soil pH ranged from 5.9 to 6.7. After 17 to 21 years of continuous rice cultivation, the concentration of total soil organic C (SOC) and total soil N (NT) in the topsoil (0-20 cm) were greater with N-P-K fertilizer application than without fertilizer application. During 15 years of additional continuous rice cropping, topsoil SOC and NT were consistently maintained or increased regardless of N-P-K fertilizer regime. Topsoil SOC increased up to 10% in an experiment with three rice crops per year and removal of all aboveground plant biomass after each crop. Subsoil SOC and NT (20-80 cm) were not affected by fertilizer application. The N balances indicated that biological N2 fixation averaged 19 to 44 kg N ha-1 crop-1 across the four experiments. Anaerobic N mineralization (ANM) in the topsoil was maintained during 15 years of continuous rice cropping with N-P-K fertilizer application in all four experiments. The results suggest that continuous cultivation of irrigated rice with balanced fertilizer application on submerged soils maintained or slightly increased SOM and maintained soil N-supplying capacity
Other Title: Soil carbon and nitrogen changes in long-term continuous lowland rice cropping
Descriptors: anaerobic-conditions. carbon. long-term-experiments. mineralization. Mollisols. nitrogen. nitrogen-balance. NPK-fertilizers. organic-carbon. rice. soil-organic-matter. soil-pH. topsoil. Vertisols

107. **Organic amendments influence soil organic carbon pools and rice-wheat productivity**

Bidisha-Majumder. Biswapati-Mandal. Bandyopadhyay-P-K. Gangopadhyay-A. Mani-P-K. Kundu-A-L. Mazumdar-D,
Soil Science Society of America Journal, 2008, 72 (3), p.775-785
Abstract: Soil organic C (SOC) pools under long-term management practices provide information on C sequestration pathways, soil quality maintenance, and crop productivity. Farmyard manure (FYM), paddy straw (PS), and green manure (GM) along with inorganic fertilizers were used in a 19-year-old rice (Oryza sativa)-wheat (Triticum aestivum) cropping system in subtropical India (West Bengal) to evaluate their impact on SOC stock, its different pools - total organic C (Ctot); oxidizable organic C (Coc) and its four fractions of very labile (Cfrac1), labile (Cfrac2), less labile (Cfrac3), and nonlabile C (Cfrac4); microbial biomass C (Cmic); and mineralizable C (Cmin). Cropping with only N-P-K fertilizer application just maintained SOC content, while N-P-K plus organics increased SOC by 24.3% over the control, their relative efficacy being FYM > PS > GM. A minimum of 3.56 tonnes C ha-1 year-1 was required to be added as organic amendments to compensate for SOC loss from cropping. The passive (Cfrac3+Cfrac4) pool and Cmin constituted about 39 and 11.5%, respectively, of Ctot. Organics contributed toward the passive pool in the order FYM > PS > GM. Most of the pools were significantly (P=0.005) correlated with each other. Yield and sustainable yield index were strongly related with Cfrac1, Coc, Cmic, and Cmin. Results suggest Cfrac1 as a useful indicator for assessing soil health, and balanced fertilizer application with FYM as suitable management for sustaining crop productivity of the rice-wheat system
Other Title: Organic amendments influence soil organic carbon pools and rice-wheat productivity
Descriptors: carbon-sequestration. crop-production. crop-yield. farmyard-manure. green-manures. NPK-fertilizers. organic-carbon. rice. rice-straw. soil-amendments. straw. wheat

108. **Carolina foxtail (Alopecurus carolinianus): susceptibility and suitability as an alternative host to rice blast disease (Magnaporthe oryzae [formerly M. grisea])**
Jia-Y. Gealy-D. Lin-M-J. Wu-L. Black-H,
Plant Disease, 2008, 92 (4), pages 504-507
Abstract: Carolina foxtail (Alopecurus carolinianus) has not been reported to host Magnaporthe oryzae. A collection of Carolina foxtail obtained from several Arkansas locations over a 4-year period was inoculated with four races of the fungus under greenhouse conditions and, in all cases, inoculation resulted in the formation of irregular, yellow and brown lesions without obvious gray centers that are characteristic for blast on rice. Differences in these lesions were not observed among our collection. These lesions appeared to differ from typical blast lesions on inoculated rice leaves but were evident following artificial inoculation of Carolina foxtail in the greenhouse. M. oryzae races that differed in pathogenicity toward rice cultivars also displayed differences in lesion development on Carolina foxtail. The most virulent race on rice cultivars also produced lesions most rapidly on Carolina foxtail. These lesions developed more quickly on Carolina foxtail than on the most susceptible rice cultivars tested, including a susceptible California cultivar, M202. M. oryzae isolates cultured from these lesions in the infected Carolina foxtail caused typical disease symptoms of blast on inoculated rice cultivars. We suggest that Carolina foxtail is a new and previously unrecognized host for the blast pathogen
Descriptors: alternative-hosts. fungal-diseases. plant-diseases. plant-pathogenic-fungi. plant-pathogens. rice

109. **Divergence between sympatric rice- and soybean-infecting populations of Rhizoctonia solani anastomosis group-1 IA**
Assis-J-B-de. Peyer-P. Rush-M-C. Zala-M. McDonald-B-A. Ceresini-P-C,
Phytopathology, 2008, 98 (12), pages 1326-1333
Abstract: Rhizoctonia solani anastomosis group (AG)-1 IA causes soybean foliar blighting (aerial blight) and rice sheath blight diseases. Although taxonomically related within the AG-1 complex, sister populations of R. solani AG-1 IA infecting Poaceae (rice) and Fabaceae (soybean) are genetically distinct based on internal transcribed spacer rDNA. However, there is currently no information available regarding the extent of genetic differentiation and host specialization between rice- and soybean-infecting populations of R. solani AG-1 IA. We used 10 microsatellite loci to compare sympatric R. solani AG-1 IA populations infecting rice and soybeans in Louisiana and one allopatric rice-infecting population from Texas. None of the 154 multilocus genotypes found among the 223 isolates were shared among the three populations. Partitioning of genetic diversity showed significant differentiation among sympatric populations from different host species (PHI ST=0.39 to 0.41). Historical migration patterns between sympatric rice- and soybean-infecting populations from Louisiana were asymmetrical. Rice- and soybean-derived isolates of R. solani AG-1 IA were able to infect both rice and soybean, but were significantly more aggressive on their host of origin, consistent with host specialization. The soybean-infecting population from Louisiana was more clonal than the sympatric rice-infecting population. Most of the loci in the soybean-infecting populations were out of Hardy-Weinberg equilibrium (HWE), but the sympatric rice-infecting population from Louisiana was mainly in HWE. All populations presented evidence for a mixed reproductive system
Other Title: Divergence between sympatric rice- and soybean-infecting populations of Rhizoctonia solani anastomosis group-1 IA
Descriptors: DNA. genetic-diversity. genotypes. loci. microsatellites. plant-pathogenic-fungi. plant-pathogens. populations. rice. soyabeans

110. **The role of silicon in preventing appressorial penetration by the rice blast fungus**
Hayasaka-T. Fujii-H. Ishiguro-K,
Phytopathology, 2008, 98 (9), pages 1038-1044
Abstract: To test the hypothesis that silicon (Si) confers resistance against appressorial penetration of the rice blast fungus, the proportion of appressorial penetration into the leaf epidermis to total appressoria formed was compared among rice plants amended with various rates of silica gel to those plants nonamended. The amounts of Si in the youngest leaves were consistent with the amounts of silica gel applied to the rice plants. Relative Si levels on the adaxial surface of leaves as detected by energy dispersive X-ray analysis also increased with the amounts of silica gel applied. Based on light microscopic observation of the adaxial surface of rice leaves, the proportion of appressorial penetration was reduced by increasing amounts of silica gel applied and increased with the length of period after spray inoculation. Consequently, these results strongly support the hypothesis and suggest that Si in the leaf epidermis may confer resistance against appressorial penetration. Meanwhile, the number of lesions per leaf also decreased with the amount of Si applied, while only a certain part of penetrated appressoria could become sporulating susceptible lesions. This suggests that Si also confers physiological resistance against blast infection after the penetration

Other Title: The role of silicon in preventing appressorial penetration by the rice blast fungus
Descriptors: disease-resistance. fungal-diseases. induced-resistance. leaves. plant-diseases. plant-pathogenic-fungi. plant-pathogens. rice. silicon

111. **Population structure of Fusarium fujikuroi from California rice and water grass**
Carter-L-L-A. Leslie-J-F. Webster-R-K,
Phytopathology, 2008, 98 (9), pages 992-998
Abstract: The recent observance of Fusarium fujikuroi, the causal agent of Bakanae disease of rice, in California provides a unique opportunity to assess the population diversity of an introduced pathogen in a new environment. We collected 172 isolates of this pathogen between 2000 and 2003 from California rice and two from water grass (Echinochloa spp.). Pathogenicity of F. fujikuroi was demonstrated on early water grass (E. oryzoides) and barnyard grass (E. crus-galli) indicating that weed control should be part of Bakanae management programs. Both mating types and six unique amplified fragment length polymorphism haplotypes corresponding to six identified vegetative compatibility groups were detected. The two most frequently isolated haplotypes encompassed 94% of the collected isolates, suggesting that clonal reproduction dominates. Coefficients of similarity between the unique haplotypes ranged from 0.94 to 0.98, and indicate that there is very little genotypic variation in the F. fujikuroi population in California. The near fixation of the MAT-1 idiomorph (observed ratio 170 MAT-1:4 MAT-2), is consistent with a hypothesis of predominant or exclusive asexual reproduction. The low level of introduced genotypic diversity, in conjunction with the asexual reproductive strategy of this population will slow evolutionary processes, including adaptation to the California environment
Other Title: Population structure of Fusarium fujikuroi from California rice and water grass
Descriptors: adaptation. alternative-hosts. amplified-fragment-length-polymorphism. evolution. fungal-diseases. genes. genetic-analysis. genetic-diversity. genetic-markers. genetic-variation. pathogenicity. plant-diseases. plant-pathogenic-fungi. plant-pathogens. rice. weeds

112. **A fragment of the Xanthomonas oryzae pv. oryzicola harpin HpaGXooc reduces disease and increases yield of rice in extensive grower plantings**
Chen-Lei. Zhang-ShuJian. Zhang-ShaoSong. Qu-ShuPing. Ren-XiuYan. Long-JuYing. Yin-Qian. Qian-Jun. Sun-Feng. Zhang-ChunLing. Wang-LingXian. Wu-XiaoJing. Wu-TingQuan. Zhang-ZhongKai. Cheng-ZaiQuan. Hayes-M. Beer-S-V. Dong-HanSong,
Phytopathology, 2008, 98 (7), pages 792-802
Abstract: Harpins of phytopathogenic bacteria stimulate defense and plant growth in many types of plants, conferring disease resistance and enhanced yield. In a previous study, we characterized nine fragments of the harpin protein HpaGXooc from Xanthomonas oryzae pv. oryzicola for plant defense elicitation and plant growth stimulation activity relative to the intact protein. In plants grown under controlled conditions, the fragment HpaG10-42 was more active in both regards than HpaGXooc. Here, we demonstrate that the activity of HpaG10-42 in rice under field conditions significantly exceeds that of HpaGXooc, stimulating resistance to three important diseases and increasing grain yield. We carried out tests in 672 experimental plots with nine cultivars of rice planted at three locations. Application protocols were optimized by testing variations in application rate, frequency, and

timing with respect to rice growth stage. Of the concentrations (24, 24, 12, and 6 micro g/ml), and number and timing of applications (at one to four different stages of growth) tested, HpaG10-42 at 6 micro g/ml applied to plants once at nursery seedling stage and three times in the field was most effective. Bacterial blight, rice blast, and sheath blight were reduced 61.6 and 56.4, 93.6 and 76.0, and 93.2 and 55.0% in indica and japonica cultivars, respectively, relative to controls. Grain yields were 22 to 27% greater. These results are similar to results obtained with typical local management practices, including use of chemicals, to decrease disease severities and increase yield in rice. Our results demonstrate that the HpaG10-42 protein fragment can be used effectively to control diseases and increase yield of this staple food crop
Other Title: A fragment of the Xanthomonas oryzae pv. oryzicola harpin HpaGXooc reduces disease and increases yield of rice in extensive grower plantings
Descriptors: application-rates. bacterial-proteins. crop-yield. cultivars. disease-resistance. induced-resistance. plant-diseases. plant-pathogenic-bacteria. plant-pathogens. rice

113. **Genetic and functional characterization of the rice bacterial blight disease resistance gene xa5**
Iyer-Pascuzzi-A-S. Jiang-H. Huang-L. McCouch-S-R,
Phytopathology, 2008, 98 (3), pages 289-295
Abstract: Xanthomonas oryzae pv. oryzae is the causal agent of rice bacterial blight, a destructive rice disease worldwide. The gene xa5 provides race-specific resistance to X. oryzae pv. oryzae, and encodes the small subunit of transcription factor IIA. How xa5 functions in bacterial blight resistance is not well understood, and its recessive gene action is disputed. Here we show that xa5 is inherited in a completely recessive manner and the susceptible allele Xa5 is fully dominant. In accordance with this, bacterial growth in heterozygous and homozygous susceptible lines is not significantly different. Further, one allele of Xa5 is sufficient to promote disease in previously resistant plants; additional copies are not predictive of increased lesion length. Surprisingly, a resistant nearly isogenic line (NIL) of an indica variety sustains high levels of bacterial populations compared to the susceptible NIL, yet the resistant plants restrict symptom expression. In contrast, in japonica NILs, bacterial population dynamics differ in resistant and susceptible genotypes. However, both resistant indica and japonica plants delay bacterial movement down the leaf. These results support a model in which xa5-mediated recessive resistance is the result of restricted bacterial movement, but not restricted multiplication
Other Title: Genetic and functional characterization of the rice bacterial blight disease resistance gene xa5
Descriptors: disease-resistance. gene-expression. genes. genetic-transformation. genetic-variation. genotypes. plant-diseases. plant-pathogenic-bacteria. plant-pathogens. rice. transcription-factors. transgenic-plants

114. **A method for inoculation and evaluation of rice sheath blight disease**
Park-D-S. Sayler-R-J. Hong-YeonGyu. Nam-MinHee. Yang-Y-N,
Plant Disease, 2008, 92 (1), pages 25-29
Abstract: Sheath blight of rice, caused by Rhizoctonia solani, is one of the most important rice diseases worldwide; however, no rice cultivar has been found to be completely resistant to this fungus. To facilitate detailed analysis of sheath blight resistance at genetic, molecular, biochemical, and functional genomic levels, new methods were developed for effective and uniform infection and accurate evaluation

of the disease. The efficiency of R. solani infection was tested on two resistant (Tetep and Jasmine 85) and two susceptible (Chucheongbyeo, Junambyeo) cultivars using three different inoculum types (agar block, liquid cultured mycelia ball, and mycelia suspension). By covering the inoculated sheaths with aluminum foil to maintain humidity, 100% infection rate was achieved in this study. Liquid cultured mycelia balls caused significantly longer lesions (5.4 cm) than other types of inoculum, including agar block (2.4 cm) and mycelia suspension (1.6 cm). An improved method for evaluating sheath blight disease was selected by comparing two methods for evaluating disease severity among three partially resistant cultivars and five susceptible cultivars inoculated with liquid cultured mycelia balls. In addition, a new formula was developed to calculate the disease susceptibility index. Lesion length and the susceptibility index generally were correlated in each leaf, but there were discrepancies between the two evaluation methods due to differences in plant architecture among the cultivars. The susceptibility index calculated using the new formula was the most accurate method for evaluating sheath blight disease across all cultivars. The effect of heading date and panicle number also was evaluated in relation to sheath blight resistance. Cultivars with late heading dates generally were more resistant to sheath blight than those with early heading dates
Other Title: A method for inoculation and evaluation of rice sheath blight disease
Descriptors: cultivars. disease-resistance. fungal-diseases. heading-date. inoculum. methodology. mycelium. panicles. plant-diseases. plant-pathogenic-fungi. plant-pathogens. rice

115. **Analysis of flagellin perception mediated by flg22 receptor OsFLS2 in rice**
Takai-R. Isogai-A. Takayama-S. Che-FangSik,
Molecular Plant Microbe Interactions, 2008, 21 (12), pages 1635-1642
Abstract: Plants have sensitive perception systems that recognize various pathogen-derived molecules. We previously reported that rice detects flagellin from a rice-incompatible strain of gram-negative phytopathogenic bacterium, Acidovorax avenae, which induces subsequent immune responses involving cell death. The mechanism of flagellin perception in rice, however, has remained obscure. In this study, we found that flg22, a peptide derived from the flagellin N-terminus, induced weak immune responses without cell death in cultured rice cells. To elucidate the mechanism by which flg22 induced signaling in rice, we characterized OsFLS2, the rice ortholog of AtFLS2, which mediates flg22 perception. Heterologous expression of OsFLS2 functions in Arabidopsis, showing the conservation of the flg22 signaling pathway across divergent plant taxa. OsFLS2-overexpressing rice cultured cells generated stronger immune responses with the induction of cell death following stimulation with flg22 and flagellin. However, examination of the growth rate of the compatible strain in inoculated OsFLS2-overexpressing rice could not confirm bacterial growth suppression compared with wild-type rice. These results suggest that rice possesses a conserved flagellin perception system utilizing the FLS2 receptor which, when upregulated, hardly affects resistance against compatible A. avenae
Other Title: Analysis of flagellin perception mediated by flg22 receptor OsFLS2 in rice
Descriptors: cell-culture. disease-resistance. peptides. plant-pathogenic-bacteria. plant-pathogens. rice. signal-transduction

116. **ARCHIPELAGO: a dedicated resource for exploiting past, present, and future genomic data on disease resistance regulation in rice**

Vergne-E. Ballini-E. Droc-G. Tharreau-D. Notteghem-J-L. Morel-J-B,
Molecular Plant Microbe Interactions, 2008, 21 (7), pages 869-878
Abstract: Large amounts of expression data dealing with biotic stresses in rice have been produced in the past 5 years. Here, we extensively review approximately 70 publications and gather together information on more than 2,500 genes of the rice defense arsenal. This information was integrated into the OryGenesDB database. Several genes (e.g., metallothioneins and PBZ1) appear to be hallmarks of rice-pathogen interactions. Cross-referencing this information with the rice kinome highlighted some defense genes and kinases as possible central nodes of regulation. Cross referencing defense gene expression and quantitative trait loci (QTL) information identified some candidate genes for QTL. Overall, pathogenesis-related genes and disease regulators were found to be statistically associated with disease QTL. At the genomic level, we observed that some regions are richer than others and that some chromosomes (e.g., 11 and 12), which contain a lot of resistance gene analogs, have a low content of defense genes. Finally, we show that classical defense genes and defense-related genes such as resistance genes are preferentially organized in clusters. These clusters are not always coregulated and individual paralogs can show specific expression patterns. Thus, the rice defense arsenal has an ARCHIPELAGO-like genome structure at the macro and micro level. This resource opens new possibilities for marker-assisted selection and QTL cloning
Other Title: ARCHIPELAGO: a dedicated resource for exploiting past, present, and future genomic data on disease resistance regulation in rice
Descriptors: chromosomes. cluster-analysis. databases. disease-resistance. gene-expression. genes. genomics. kinases. pathogenesis. plant-pathogens. quantitative-trait-loci. rice

117. **A genome-wide meta-analysis of rice blast resistance genes and quantitative trait loci provides new insights into partial and complete resistance**
Ballini-E. Morel-J-B. Droc-G. Price-A. Courtois-B. Notteghem-J-L. Tharreau-D,
Molecular Plant Microbe Interactions, 2008, 21 (7), pages 859-868
Abstract: The completion of the genome sequences of both rice and Magnaporthe oryzae has strengthened the position of rice blast disease as a model to study plant-pathogen interactions in monocotyledons. Genetic studies of blast resistance in rice were established in Japan as early as 1917. Despite such long-term study, examples of cultivars with durable resistance are rare, partly due to our limited knowledge of resistance mechanisms. A rising number of blast resistance genes and quantitative trait loci (QTL) have been genetically described, and some have been characterized during the last 20 years. Using the rice genome sequence, can we now go a step further toward a better understanding of the genetics of blast resistance by combining all these results? Is such knowledge appropriate and sufficient to improve breeding for durable resistance? A review of bibliographic references identified 85 blast resistance genes and approximately 350 QTL, which we mapped on the rice genome. These data provide a useful update on blast resistance genes as well as new insights to help formulate hypotheses about the molecular function of blast QTL, with special emphasis on QTL for partial resistance. All these data are available from the OrygenesDB database
Other Title: A genome-wide meta-analysis of rice blast resistance genes and quantitative trait loci provides new insights into partial and complete resistance
Descriptors: cultivars. databases. disease-resistance. genes. genetic-mapping. genomics. plant-pathogenic-fungi. plant-pathogens. quantitative-trait-loci. Rice. Japan

118. **Identification of a new locus, Ptr(t), required for rice blast resistance gene Pi-ta-mediated resistance** / Jia-Y-L. Martin-R,
Molecular Plant Microbe Interactions, 2008, 21 (4), pages 396-403
Abstract: Resistance to the blast pathogen Magnaporthe oryzae is proposed to be initiated by physical binding of a putative cytoplasmic receptor encoded by a nucleotide binding site-type resistance gene, Pi-ta, to the processed elicitor encoded by the corresponding avirulence gene AVR-Pita. Here, we report the identification of a new locus, Ptr(t), that is required for Pi-ta-mediated signal recognition. A Pi-ta-expressing susceptible mutant was identified using a genetic screen. Putative mutations at Ptr(t) do not alter recognition specificity to another resistance gene, Pi-ks, in the Pi-ta homozygote, indicating that Ptr(t) is more likely specific to Pi-ta-mediated signal recognition. Genetic crosses of Pi-ta Ptr(t) and Pi-ta ptr(t) homozygotes suggest that Ptr(t) segregates as a single dominant nuclear gene. A ratio of 1:1 (resistant/susceptible) of a population of BC1 of Pi-ta Ptr(t) with pi-ta ptr(t) homozygotes indicates that Pi-ta and Ptr(t) are linked and cosegregate. Genotyping of mutants of pi-ta ptr(t) and Pi-ta Ptr(t) homozygotes using ten simple sequence repeat markers at the Pi-ta region determined that Pi-ta and Ptr(t) are located within a 9-megabase region and are of indica origin. Identification of Ptr(t) is a significant advancement in studying Pi-ta-mediated signal recognition and transduction
Other Title: Identification of a new locus, Ptr(t), required for rice blast resistance gene Pi-ta-mediated resistance
Descriptors: cultivars. disease-resistance. fungal-diseases. gene-expression. genes. genetic-variation. genotypes. loci. mutants. plant-diseases. plant-pathogenic-fungi. plant-pathogens. rice. susceptibility

119. **OsRAR1 and OsSGT1 physically interact and function in rice basal disease resistance**
Wang-YaLing. Gao-MingJun. Li-Qun. Wang-LinYou. Wang-JianJun. Jeon-JongSeong. Qu-Na. Zhang-YueLin. He-ZuHua,
Molecular Plant Microbe Interactions, 2008, 21 (3), pages 294-303
Abstract: The RAR1 and SGT1 proteins function synergistically or antagonistically in plant innate immune responses. Here, we show that the rice orthologs OsRAR1 and OsSGT1 physically interact in vivo and in yeast. They displayed conserved roles in Arabidopsis disease resistance through ectopic expression in the Arabidopsis rar1 and sgt1 mutants. Overexpression of OsRar1 and OsSGT1 in rice significantly increased basal resistance to a virulent bacterial blight Xanthomonas oryzae pv. oryzae PXO99 but not to another virulent strain DY89031, suggesting race-specific-like basal resistance conferred by OsRar1 and OsSGT1. OsRar1-OE and OsSGT1-OE plants also enhanced resistance to all four virulent blast fungal Magnaporthe oryzae races. Overexpression of the OsSGT1-green fluorescent protein (GFP) fusion most likely caused a dominant negative phenotype which led to race-specific-like basal resistance. Transgenic plants overexpressing OsSGT1-GFP show enhanced resistance to DY89031 but decreased resistance to PXO99, implying that OsSGT1 might be the target of a component required for DY89031 virulence or OsSGT1-GFP might stabilize weak resistance proteins against DY89031. Consistent with the hypothesis of the dominant negative regulation, we observed the reduced sensitivity to auxin of OsSGT1-GFP plants compared with the wild-type ones, and the curling-root phenotype in OsSGT1-OE plants. These results collectively suggest that OsRar1 and

OsSGT1 might be differentially required for rice basal disease resistance. Our current study also provides new insight into the roles of OsSGT1 in basal disease resistance
Descriptors: disease-resistance. gene-expression. genes. green-fluorescent-protein. plant-diseases. plant-pathogenic-bacteria. plant-pathogenic-fungi. plant-pathogens. plant-proteins. rice

120. **Nitrogen supply in rice-based cropping systems as affected by crop residue management**
Nguyen-Hong-Thuy. Shan-YuHua. Bijay-Singh. Kai-Rong-Wang. Zu-Cong-Cai. Yadvinder-Singh. Buresh-R-J,
Soil Science Society of America Journal, 2008, 72 (2), pages 514-523
Abstract: Concerns regarding the detrimental effects of burning crop residues on human health and the environment have increased interest in alternative uses of crop residues. We examined the in situ use of crop residue as a source of supplemental N for succeeding crops in rice (Oryza sativa)-based cropping systems at three sites during 3 years (2003-05). The experiments included a rice-wheat (Triticum aestivum) rotation at Yixing, Jiangsu Province, China; a rice-wheat rotation at Ludhiana, Punjab, India; and double-rice cropping at Taojiang, Hunan Province, China. The supply of N from crop residues was assessed in the absence of fertilizer N as the difference in total plant N between plots with and without residue. At Yixing, incorporation of wheat residue before rice significantly increased the N supply to the rice by 14 kg N ha-1 averaged across 3 years. At Ludhiana, incorporation of rice residue before wheat reduced the N supply by 3 kg N ha-1 to the wheat, but increased the N supply by 5 kg N ha-1 to the rice crop following the wheat. In all cases, the return of crop residues had no net benefit on crop yield when fertilizer N was supplied at rates sufficient to eliminate N deficiency. The incorporation of crop residues did not increase the N supply to the succeeding crop during its vegetative growth phase, but the N supply to the crop at later growth stages was often increased. Adjustments in the timing and rate of fertilizer N are probably necessary to optimally supply N to crops receiving residues
Descriptors: burning. crop-residues. crop-yield. cropping-systems. double-cropping. nitrogen. nitrogen-fertilizers. organic-amendments. rice. rotations. soil-fertility. temporal-variation. wheat

121. **Responses of two contrasting genotypes of rice to brown planthopper**
Wang-YuanYuan. Wang-XiaoLan. Yuan-HongYu. Chen-RongZhi. Zhu-Lili. He-RuiFeng. He-GuangCun,
Molecular Plant Microbe Interactions, 2008, 21 (1), pages 122-132
Abstract: Rice (Oryza sativa L.) and brown planthoppers (BPH) (Nilaparvata lugens Stal) provide an ideal system for studying molecular mechanisms involved in the interactions between plants and phloem-feeding insects. The phenotypic responses and changes in transcript profiles of seedlings representing two rice cultivars differing in resistance to the BPH were analyzed. In the BPH-compatible (susceptible) cv. MH63, BPH feeding reduced three examined plant growth parameters (leaf area expansion, height increases, and dry weight increases) and photosynthetic rates of the leaves. In the BPH-incompatible (resistant) cv. B5, BPH feeding caused slight reductions in protein and sucrose contents, but the plants maintained their photosynthetic activity and grew normally. A cDNA microarray containing 1,920 suppression subtractive hybridization clones was used to explore the transcript profiles differences in the two cultivars under control and BPH-feeding conditions. In

total, 160 unique genes were detected as being significantly affected by BPH feeding in rice plants, covering a wide range of functional categories, and there were 38 genes that showed the similar transcript pattern in both genotypes. The physiological responses and transcript profiles of plants represented in both genotypes suggested that multiple pathways might be involved in reprogramming of BPH-infested rice plants. The differences in transcript levels between the compatible and incompatible interactions revealed in this study were not only the reaction of resistance and susceptibility but also reflections of different damage rates and genotypic backgrounds of the rice cultivars
Other Title: Responses of two contrasting genotypes of rice to brown planthopper
Descriptors: chemical-composition. dry-matter. genes. insect-pests. leaf-area. pest-resistance. photosynthesis. plant-composition. plant-height. plant-pests. protein-content. rice. sucrose. transcription

122. **Conservation agriculture for rice-wheat cropping system**
Tomar-S-S,
Journal of the Indian Society of Soil Science, 2008, 56 (4), pages 358-366

123. **Comparison of the function of different water-saving rice cultivation systems in the seasonal-drought hilly region of Southern China**
Xiao-Xin. Zhao-Y. Hu-F,
Journal of Sustainable Agriculture, 2008, 32 (3), pages 463-482
Abstract: This study examines the material flow, energy flow, value flow, and ecological environmental benefits of water-saving rice cultivation systems. The results showed that the net production and economical production in the Results his only two types of water-saving rice cultivation systems were 3.10 ╫ 105 to 3.78 ╫ 105 MJ (ha¬ yr)-1 and 1.77 ╫ 105 to 1.98 ╫ 105 MJ (ha¬ yr)-1, respectively. The major input of energy was from fertilizers, which were 0.59 ╫ 105 to 0.97 ╫ 105 MJ (ha¬ yr)-1. The outputinput ratios of energy and light utilization efficiency of rice fields were 3.22 to 6.45:1 and 0.64 to 0.78, respectively. The net monetary values were $484 to $1166 (ha¬ yr)-1, and the cost-benefit ratios were 0.34 to 0.88. Higher energy conversion efficiency, light utilization efficiency, and economic efficiency were found in the water-saving irrigation double-cropping rice cultivation system and water-saving rice cultivation system of rice and rape rotation. However, the lower energy conversion efficiency and economic efficiency took place in water-saving rice cultivation system of flooddrought cultivation. The water-saving rice cultivation systems had a higher integral benefit than did the local rice cultivation system, and could significantly save water and decrease the application of fertilizer and pesticide, allowing control of agriculture non-point resource pollution
Other Title: Comparison of the function of different water-saving rice cultivation systems in the seasonal-drought hilly region of Southern China

124. **Integrated nutrient management by using target yield equations for rice-jute system in Eastern India** / Ghosh-A,
Journal of Sustainable Agriculture, 2008, 32 (1), pages 149-160
Abstract: Field studies on target yield equation (TYE)-based integrated nutrient management in rice (Oryza sativa) and jute (Corchorus capsularis) were conducted to investigate its value in achieving target yields, improving nutrient utilization and soil nutrient status. The study was conducted for 3 years consecutively during 2001 to 2003 under on-farm rainfed conditions growing rice variety Padmini in sequence with

jute variety JRO 524 during wet season (April to December). Requirement of nitrogen (N) phosphorus (P), and potassium (K) for achieving target yield of 4 t ha-1 for rice and 3 t ha-1 for jute was estimated following a soil test crop response (STCR)-based TYE. Four sets of treatments included farmyard manure (FYM) as organic source and synthetic fertilizers as chemical source applied to both rice and jute, compared with an untreated crop (no NPK) usually followed in farmers' practice. Results showed marginal deviation from specified target yield, achieving 96% of the target yield in rice and 95% in jute. Integrated nutrient management resulted in significantly higher yield of both rice (3.84 t ha-1) and jute (2.85 t ha-1), treated with 100% INM combined with 75% fertilizer NPK+25% organic N. As a result, the system productivity aggregating rice and rice equivalent yield of jute was also highest (8.97 t ha-1) with 100% INM. A benefit:cost ratio was also derived, showing a maximum of 1.04 in rice with 100% INM, compared with 0.96 with the application of fertilizer alone. Nutrient uptake and nutrient productivity were also higher in crops with 100% INM. In addition, sustained availability of soil N, P, and K (and thereby, improvement in soil nutrient balance), was pronounced more with 100% INM. Therefore, the 3-year on-farm study showed that TYE-based INM not only helped achieve near-target yields but also promoted nutrient utilization and sustainable soil NPK status
Other Title: Integrated nutrient management by using target yield equations for rice-jute system in Eastern India
Descriptors: application-rates. cost-benefit-analysis. crop-yield. equations. farmyard-manure. fertilizer-requirement-determination. jute. nitrogen-fertilizers. nutrient-uptake. phosphorus-fertilizers. potassium-fertilizers. rice. rotations. soil-fertility

125. **Performance of site-specific and real-time N management strategies in irrigated rice**
Stalin-P. Ramanathan-S. Natarajan-K. Chandrasekaran-B. Buresh-R,
Journal of the Indian Society of Soil Science, 2008, 56 (2), pages 215-221
Abstract: Field experiments were conducted during kharif and rabi seasons of 2001 and 2002 with the objective of evaluating the performance of different fertilizer N management strategies including site-specific and real-time N management, on dry matter production, N uptake, yield, yield components and N use efficiency in rice. Among the different N fertilization strategies tried. both site-specific nutrient management (SSNM) with fixed N split approach i.e., 115 ± 20 kg/ha in kharifand 140 ± 20 kg N/ha in rabi as well as real-time N management viz., leaf colour chart (LCC) with critical value 4 based N management (N applied at LCC=4) (35 kg N/ha in kharif and 30 kg N/ha in rabi when the LCC value fell below 4) registered higher dry matter production, N uptake, N use efficiency and grain yield than the other treatments. The results suggest that as a simple tool, the adoption of real-time N management viz., the LCC=4 based N management is a profitable proposition of N fertilization strategy for rice
Other Title: Performance of site-specific and real-time N management strategies in irrigated rice
Descriptors: SSNM; LCC; critical-value; dry-matter-production; N-uptake; N-use-efficiency

126. **Integrated effect of mineral fertilizers and green manure on crop yield and nutrient availability under rice-wheat cropping system in calciorthents**
Kumar-V. Prasad-R-K,
Journal of the Indian Society of Soil Science, 2008, 56 (2), pages 209-214

Abstract: A field experiment conducted on Calciorthents revealed that average biomass production of green gram [Vigna radiata (L.) Wikzek] at initiation of flowering was 1.12 t/ha whereas residual yield of green gram was 1.20 t/ha] after picking pods at full maturity stage. On an average, green gram yielded 0.55 t grain/ha. The direct and residual effects of 75% NPK + green manure on grain yield of rice and wheat were more than those through addition of 100% NPK, which indicates that green manure could easily substitute 25% NPK to each of rice and wheat crop (equivalent to 25 kg N, 6.67 kg P and 8.3 kg K/ha in rice-wheat cropping system). Green manuring and green gram residue incorporation enhanced the uptake of N, P and K by rice and wheat. The direct and residual effect of green gram residues incorporation was inferior to green manuring because of high C/N ratio of the crop residue (34.3). Significant build up of organic carbon, available N, P and K in soils was recorded under graded levels of fertilizers and also with green manure and green gram straw incorporation after the picking of pods. This study suggests that a short duration pulse crop like green gram can give dual profit by way of providing grain for sale/consumption by the farmer's family and straw as the green manure
Other Title: Integrated effect of mineral fertilizers and green manure on crop yield and nutrient availability under rice-wheat cropping system in calciorthents
Descriptors: nutritional-fertilizers; green-manure; crop-residues; calciorthents

127. **Integrated nutrient management in rice-wheat cropping system for sustainable productivity**
Singh-F. Kumar-R. Pal-S,
Journal of the Indian Society of Soil Science, 2008, 56 (2), pages 205-208
Abstract: Field studies on target yield equation (TYE)-based integrated nutrient management in rice (Oryza sativa) and jute (Corchorus capsularis) were conducted to investigate its value in achieving target yields, improving nutrient utilization and soil nutrient status. The study was conducted for 3 years consecutively during 2001 to 2003 under on-farm rainfed conditions growing rice variety Padmini in sequence with jute variety JRO 524 during wet season (April to December). Requirement of nitrogen (N) phosphorus (P), and potassium (K) for achieving target yield of 4 t ha-1 for rice and 3 t ha-1 for jute was estimated following a soil test crop response (STCR)-based TYE. Four sets of treatments included farmyard manure (FYM) as organic source and synthetic fertilizers as chemical source applied to both rice and jute, compared with an untreated crop (no NPK) usually followed in farmers' practice. Results showed marginal deviation from specified target yield, achieving 96% of the target yield in rice and 95% in jute. Integrated nutrient management resulted in significantly higher yield of both rice (3.84 t ha-1) and jute (2.85 t ha-1), treated with 100% INM combined with 75% fertilizer NPK+25% organic N. As a result, the system productivity aggregating rice and rice equivalent yield of jute was also highest (8.97 t ha-1) with 100% INM. A benefit:cost ratio was also derived, showing a maximum of 1.04 in rice with 100% INM, compared with 0.96 with the application of fertilizer alone. Nutrient uptake and nutrient productivity were also higher in crops with 100% INM. In addition, sustained availability of soil N, P, and K (and thereby, improvement in soil nutrient balance), was pronounced more with 100% INM. Therefore, the 3-year on-farm study showed that TYE-based INM not only helped achieve near-target yields but also promoted nutrient utilization and sustainable soil NPK status
Descriptors: application-rates. cost-benefit-analysis. crop-yield. equations. farmyard-manure. fertilizer-requirement-determination. jute. nitrogen-fertilizers. nutrient-

uptake. phosphorus-fertilizers. potassium-fertilizers. rice. rotations. soil-fertility. India. Orissa

128. **Diagnosis and recommendation integrated system for monitoring nutrient status of rice in lowland areas in the vicinity of Satluj River in Punjab**
Hundal-H-S. Singh-D. Singh-K. Brar-J-S,
Journal of the Indian Society of Soil Science, 2008, 56 (2), pages 198-204
Abstract: The Diagnosis and Recommendation Integrated System (DRIS) approach was employed to monitor the nutrient status ofrice crop cultivated in lowland areas in the vicinity of Satluj River in district Ludhiana. Standard reference DRIS norms were established for various nutrient ratios obtained from high yield population of rice crop and were further used to compute DRIS indices, which assessed nutrient balance and order of limitation to yield. The DRIS-derived sufficiency ranges for N, P, K, Ca, Mg and S from nutrient indexing survey ofrice plants grown on lowland areas were 1.49-2.50, 0.14-0.23, 0.57-1.11, 0.30-0.58, 0.13-0.30 and 0.14-0.26%, respectively. The limits for Fe, Mn, Zn and Cu were 64-217, 72-184, 15-24 and 3-6 mg/kg, respectively. On the basis of sufficiency ranges, 14.50, 1.78, 11.20 and 0.76% samples were low in N, P, K and S, respectively, from three hundred and ninety-three rice crop fields surveyed. In case of micronutrients, 1.53 and 2.04% samples were low in Mn and Zn, respectively. Validation experiments were carried out in the following year at some selected sites for rice crop on the basis of most required nutrient element by DRIS approach. Soil application of the most required macronutrient elements (N, P, K and S) through their respective fertilizer and micronutrients (Zn, Cu and Mn) through foliar spray of their salts changed their respective order from the most required to their lesser or the least one among the ten nutrient elements and eventually contributed to increase in grain yield of rice except Mn. The DRIS was also validated at some sites where Ca and Mg were identified as the most required nutrient elements. However, application of CaCl2 or MgCl2 at these respective locations did not contribute to increase in the grain yield of rice. Thus, DRIS approach, besides diagnosing the deficiency or identification of inadequacy of a certain nutrient element (even if all the ten nutrients are within the sufficiency range), helped in increasing rice yield by application of most required nutrient through fertilizers
Other Title: The diagnosis and recommendation integrated system for monitoring nutrient status of rice in lowland areas in the vicinity of Satluj River in Punjab
Descriptors: rice; leaf-composition; DRIS; sufficiency-ranges; validation

129. **Fertilizer N economy, soil nutrient status, water use efficiency and rice productivity with real-time nitrogen management and organic residues under irrigated and rainfed situations**
Sharma-P-K. Masand-S-S,
Journal of the Indian Society of Soil Science, 2008, 56 (2), pages 167-173
Abstract: Integrated nutrient management by combining organic and inorganic sources of plant nutrients has been found to improve and sustain soil and food productivity. A field experiment was conducted in a silty clay loam acid Alfisol to investigate the utility of lantana (Lantana spp.) biomass, an obnoxious weed, unfit as cattle feed, and growing abundantly in uncultivated areas, as an organic amendment in rice-wheat cropping system. Soil applications of the freshly-chopped lantana biomass at 15 t/ha/yr before puddling were initiated in 1999 wet season (ws). Three N management treatments (N applied at LCC=2 and LCC=3, and at recommended rate of 90 kg/ha) under two water regimes (irrigated vs rainfed) were imposed to rice in

2003. After seven rice-wheat cropping cycles (June 2006), soil organic carbon, available N, Olsen's P and exchangeable K were 1.18%, 378, 42 and 110 kg/ha, respectively, with lantana addition (M1), and 1.08%, and 323, 33 and 99 kg/ha without lantana addition (M0), as against initial values of 1.08%, and 314, 22 and 121 kg/ha. Rice grain yield (2003-2005) increased by 4-21% with M1 compared to M0, and 4-13% with LCC = 3 compared to fixed recommended dose of N (RFD). Irrigated rice produced 6% higher yield than rainfed rice. Water use efficiency (WUE) was highest under rainfed condition, with M1 and LCC=3. Nitrogen management using LCC saved 30 and 60 kg/ha fertilizer N without and with lantana addition, respectively, over RFD. Thus, real-time N management through LCC= 3 coupled with lantana biomass economized on fertilizer N, and enhanced the rice productivity and WUE under both irrigated and rainfed situations
Descriptors: fertilizer-N-economy; organic-amendment; rice-yield; water-regime; water-use-efficiency

130. **Improved rice variety adoption and its welfare impact on rural farming households in Akwa Ibom State of Nigeria**
Udoh-E-S. Omonona-B-T,
Journal of New Seeds, 2008, 9 (2), pages 156-173
Abstract: In this study cross-sectional data from 200 rice farmers were used to examine the various factors that influence the adoption of improved rice varieties distributed by the State Agricultural Development Programme (AKADEP) and its welfare impact on the farmers. The Foster, Greer and Thorbecke (FGT) class of measures was used to determine the incidence, the depth and severity of poverty among rice farming households who are adopters and non-adopters of improved rice varieties. The incidence, depth, and severity of poverty were higher among households who were non-adopters of improved rice varieties. The Tobit regression model was used to determine the factors that affect adoption and poverty. Educational attainment, access to extension agents, access to credit, access to augmented inputs, farm size, and crop yield were significant determinants of adoption of improved rice varieties. The results of the determinants of household poverty revealed that age, educational attainment, extent of commercialization and probability of adoption negatively influenced household poverty, whereas household size exerted a positive impact on the household poverty levels. The negative impact of adoption of improved rice varieties on household poverty implicitly showed improvement in households' welfare that had adopted improved rice varieties. These results generally suggest the relevance of adoption of improved rice varieties in improving the welfare of rice farming households. It also suggests relevance of human capital indices like education and extension services as drivers of poverty alleviation and dissemination of new innovations to farming households
Other Title: Improved rice variety adoption and its welfare impact on rural farming households in Akwa Ibom State of Nigeria
Descriptors: academic-achievement. age. commercialization. crop-yield. cultivars. extension. farm-inputs. farm-size. genetic-improvement. households. innovation-adoption. poverty. rice. rural-communities. welfare-economics

131. **Seed priming with polyamines improves the germination and early seedling growth in fine rice**
Muhammad-Farooq. Basra-S-M-A. Rehman-H. Hussain-M,
Journal of New Seeds, 2008, 9 (2), pages 145-155

Abstract: Pre-sowing polyamine seed treatments were employed in fine rice (Oryza sativa) to explore the possibility of improving germination and early seedling growth. Fine rice (cv. Super-basmati) seeds were soaked in 10 and 20 ppm aerated solutions of spermidine, putrescine and spermine for 48-h at 28 plus or minus 2 C. Polyamine seed treatments resulted in earlier, synchronized and enhanced germination. Improvement in shoot and root length, seedling fresh and dry weight, and root and leaf score, was also observed in seeds treated with polyamines. Seed treatment with 10 ppm putrescine solution was the most effective for most of the attributes studied
Descriptors: application-rates. leaves. polyamines. priming. putrescine. rice. roots. seed-germination. seed-treatment. seedling-growth. seedlings. seeds. shoots. soaking. spermidine. spermine

132. **Soil fertility advantages of submerged rice cropping systems: a review**
Sahrawat-K-L,
Journal of Sustainable Agriculture, 2008, 31 (3), pages 5-23
Abstract: Wetland rice production systems in Asia are making a major contribution to the global rice supply. Wetland rice cultivation is often cited as an example of a sustainable cropping system. Wetland or paddy rice growing involves land preparation by cultivating in the flooded or saturated state (puddling), followed by transplanting of seedlings in soils under submerged condition and growing of the crop until two to three weeks before harvest. In other rice-based cropping systems, the land is either dry- or flood-fallowed during the period between two crops. Afterwards, two or three crops of rice are grown in submerged soil condition. However, shortage of freshwater is becoming critical for this traditional lowland rice cultivation. Obviously, there is high potential in exploring rice cultivation under moisture regimes that save water and also increase productivity. Such a situation provides an opportunity to critically analyze the fertility benefits of submerged rice cropping systems that would help facilitate in making a practical and right choice for growing of rice in future. The objective of this paper is to highlight the underlying principles, which govern the fertility advantages to submerged rice cropping systems. The advantages of growing rice in submerged soils include a general amelioration of chemical fertility, preferential accumulation of organic matter and improved availability of major, secondary and selected micronutrients. These soil fertility advantages benefit the long-term maintenance of soil fertility and sustainability of wetland rice systems. The paper emphasizes the potential of growing wetland rice in monsoon Asia, specifically in poorly drained, waterlogging-prone areas where the water table is shallow (within 30 cm of the soil surface)
Other Title: Soil fertility advantages of submerged rice cropping systems: a review
Descriptors: cropping systems; flooding; lowland areas; nutrient availability; organic matter; puddling; reviews; rice; soil fertility; submergence; sustainability; water table; waterlogging; wetlands Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

133. **Capacity building of the vegetable and rice farmers in Bangladesh: JICA intervention**
Kamruzzaman-M. Takeya-H,
Journal of Sustainable Agriculture, 2008, 31 (3), pages 145-161
Abstract: This study examines changes in the profitability and capacity building of vegetables and rice producers in Bangladesh resulting from the intervention of a group of experts from the Japan International Cooperation Agency (JICA). JICA

worked for four years in the Comilla model project area and launched a program to improve agricultural practices and motivate local farmers to adopt innovative practices. This study examines the profitability and capacity building of these farmers using the criteria of net return, benefit cost ratio, and regression analysis. Our results show that both vegetable and rice producers in the project area experienced a significant increase in profitability compared to farmers outside the project area. Also, both vegetable and rice producers in the project area have significantly increased their capacity in terms of technical, social, human, natural and financial capital when compared to farmers outside the project area. These results indicate the positive impact of the intervention of JICA experts on the Comilla model project area
Descriptors: costs; crop production; development projects; profitability; returns; rice; technology transfer; vegetables South Asia; Asia; Least Developed Countries; Developing Countries; Commonwealth of Nations; Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

134. **Growth and toxin production of proteolytic Clostridium botulinum in aseptically steamed rice products at pH 4.6 to 6.8, packed under modified atmosphere, using a deoxidant pack**
Kimura-Bon. (kimubo@kaiyodai.ac.jp). Kimura-Ryusuk. Fukaya-Tetsuy. Sakuma-Kinv. Miya-Satok. Fujii-Tate,
Journal of Food Protection, 2008, 71 (3), pages 468-472
Abstract: Demand for aseptically steamed rice products has been increasing rapidly in Japan over the past 10 years. In our previous study, we showed that proteolytic Clostridium botulinum produce toxins in steamed rice products packaged under a modified atmosphere of <= 03% oxygen. In the present study, we examined the effect of pH to control botulism risk in steamed rice products packaged under modified atmosphere (5% CO2 and 95% N-2 as the balance) with the inclusion of a deoxidant pack to produce an oxygen concentration of <= 0.3%. A mixture of 10 strains of proteolytic C. botulinum (5 type A strains and 5 type B strains) was inoculated into steamed rice products at pH values between 4.6 and 6.8 prior to packaging. All samples were stored at 30 degrees C for 24 weeks. Samples at higher pH showed earlier starts of neurotoxin production. Neurotoxin was detected after 2 weeks of incubation in samples at pH 5.4 or above, whereas it took 4 weeks for the toxin to be detected in samples at pH 5.2 to 5.3 and 12 weeks in samples at pH 5.0 to 5.1. In samples at pH 4.9 or below, no toxin was detected during the experimental period. Apparent sample spoilage did not occur before C. botulinum produced neurotoxin in most of the samples. Based on these results, we conclude that aseptically steamed rice products must be packaged at pH 4.9 or below under modified atmosphere containing <= 0.3% oxygen, with the inclusion of a deoxidant pack
Other Title: Growth and toxin production of proteolytic Clostridium botulinum in aseptically steamed rice products at pH 4.6 to 6.8, packed under modified atmosphere, using a deoxidant pack
Descriptors: Toxicology; Development; Agronomy (Agriculture); Foods growth rate, pH range

135. **Optimum threshold of nitrogen use efficiency for sustainable rice grain yield under varying stand density and N levels in deepwater situations/** Ghosh-A,
Journal of Sustainable Agriculture, 2008, 31 (4), pages 139-148
Abstract: Field experiments were conducted during the wet seasons of 2002, 2003, and 2004 to study the influence of varying stand density and N levels on N use

efficiencies for sustainable grain yield of rice under deepwater situation. Rice variety Sarala (semi-dwarf, photo-sensitive, long duration) was directly dibble-sown during mid-May every year. Three crop stand configurations: low, normal and high-density stand were studied with four different N levels: 0, 40, 60 and 80 kg N/ha. Crops under low-density stand (450 cm2/hill) produced significantly higher yield (2.71 t/ha) than high (150 cm2/hill) and medium/normal density stand (300 cm2/hill). Studies on N application also showed progressive increase in grain yield (3.15 t/ha) with increasing N levels up to 60 kg N/ha, beyond which it showed no additional yield advantages. N uptake (47.15 kg N/ha) was higher under low-density stand and with 60 kg N/ha (51.83 kg N/ha). Low-density stand showed higher N use efficiency as estimated in agronomic N use efficiency (22.36 kg grain/kg N applied), physiologic N use efficiency (67.61 kg grain/kg N uptake) and N recovery efficiency (32.97%). They were also higher with 60 kg N/ha showing 25.89 kg grain/kg N applied, 66.92 kg grain/kg N uptake and 38.67%, respectively. Thus, the study determined the optimum thresholds of N use efficiencies for sustainable grain yield, which could be realized when plants are arranged under low stand density (450 cm2/hill) with an optimum level of 60 kg N/ha
Descriptors: application-rates. crop-yield. deep-water-rice. nitrogen-fertilizers. nutrient-uptake. plant-nutrition. rice. stand-density. sustainability. use-efficiency

136. **Haplotype diversity at the Pi-ta locus in cultivated rice and its wild relatives**
Wang-X. Jia-Y. Shu-Q-Y. Wu-D,
Phytopathology, 2008, 98 (12), pages 1305-1311
Abstract: The Pi-ta gene in rice confers resistance to races of Magnaporthe oryzae that contain AVR-Pita. Pi-ta encodes a predicted cytoplasmic receptor protein with a nucleotide-binding site and a leucine-rich domain. A panel of 51 Oryza accessions of AA genome species Oryza sativa, O. glaberrima, O. rufipogon, O. nivara, and O. barthii, and CC genome species O. officinalis were sequenced to investigate the diversity present in the exon and intron regions of the Pi-ta gene. Two major clades were identified, consisting of 16 different sequences with numerous insertion and deletions. Only one Pi-ta resistance allele was identified despite DNA sequences revealing 16 Pi-ta variants. Most differences were identified in the intron region, and obvious selection of any motif was not observed in the coding region of Pi-ta variants. Reverse-transcription polymerase chain reaction analysis of seedlings revealed that all Pi-ta variants were expressed with or without pathogen inoculation. The 15 Pi-ta variants can be translated into nine proteins highly similar to the Pi-ta protein. Resistance to M. oryzae expressing AVR-Pita correlates with alanine and susceptibility correlates with serine at position 918 of Pi-ta in most accessions examined. These data confirm that a single amino acid controlling resistance specificity underlies the evolution of resistance of Pi-ta genes in rice
Descriptors: amino-acids. correlation-analysis. disease-resistance. genes. genetic-diversity. genomes. haplotypes. leucine. loci. nucleotide-sequences. nucleotides. plant-pathogenic-fungi. plant-pathogens. reverse-transcriptase-PCR. rice. seedlings. wild-relatives

137. **The Arabidopsis AtNPR1 inversely modulates defense responses against fungal, bacterial, or viral pathogens while conferring hypersensitivity to abiotic stresses in transgenic rice**
Quilis-J. Penas-G. Messeguer-J. Brugidou-C. Segundo-B-S,
Molecular Plant Microbe Interactions, 2008, 21 (9), pages 1215-1231

Abstract: The nonexpressor of pathogenesis-related (PR) genes (NPR1) protein plays an important role in mediating defense responses activated by pathogens in Arabidopsis. In rice, a disease-resistance pathway similar to the Arabidopsis NPR1-mediated signaling pathway one has been described. Here, we show that constitutive expression of the Arabidopsis NPR1 (AtNPR1) gene in rice confers resistance against fungal and bacterial pathogens. AtNPR1 exerts its protective effects against fungal pathogens by priming the expression of salicylic acid (SA)-responsive endogenous genes, such as the PR1b, TLP (PR5), PR10, and PBZ1. However, expression of AtNPR1 in rice has negative effects on viral infections. The AtNPR1-expressing rice plants showed a higher susceptibility to infection by the Rice yellow mottle virus (RYMV) which correlated well with a misregulation of RYMV-responsive genes, including expression of the SA-regulated RNA-dependent RNA polymerase 1 gene (OsRDR1). Moreover, AtNPR1 negatively regulates the expression of genes playing a role in the plant response to salt and drought stress (rab21, salT, and dip1), which results in a higher sensitivity of AtNPR1 rice to the two types of abiotic stress. These observations suggest that AtNPR1 has both positive and negative regulatory roles in mediating defense responses against biotic and abiotic stresses
Descriptors: defence-mechanisms. disease-resistance. drought. drought-resistance. fungal-diseases. gene-expression. genes. plant-diseases. plant-pathogenic-bacteria. plant-pathogenic-fungi. plant-pathogens. plant-viruses. rice. salinity. salt-tolerance. transgenic-plants

138. **Improvement of bacterial blight resistance in rice cultivars Jyothi and IR50 via marker-assisted backcross breeding**
Bharathkumar-S. Paulraj-R-S-D. Brindha-P-V. Kavitha-S. Gnanamanickam-S-S,
Journal of Crop Improvement, 2008, 21 (1), pages 101-116
Abstract: In pathogen population analysis of 208 Xanthomonas oryzae pv. oryzae (Xoo) strains that were assembled from different parts of India, 21 pathotypes were identified on the basis of disease reactions on near-isogenic lines (NILs) and 13 pathotypes, on rice differentials. Rice cultivars, Jyothi and IR50, which are high yielding but highly prone to bacterial blight (BB) caused by pathogen populations of Xanthomonas oryzae pv. oryzae in India, were chosen. To improve the BB resistance of these two varieties, a pyramid line, NH56, containing four R-genes, Xa4, xa5, xa13, and Xa21, was selected as the R-donor based on resistance to existing pathogen population. The four R-genes were successfully transferred to cultivars through a traditional backcross method and their presence was documented with marker-aided selection (MAS). Thirty BC4F2 plants derived from JxNH56 (cv. Jyothi) and 45 BC4F2 plants derived from IR50xNH56 (cv. IR50) had all four resistance genes (Xa4, xa5, xa13, and Xa21), which should be useful resistance donors for breeding other BB-resistant elite indica varieties
Other Title: Improvement of bacterial blight resistance in rice cultivars Jyothi and IR50 via marker-assisted backcross breeding
Descriptors: artificial-selection. cultivars. disease-resistance. genetic-improvement. genetic-markers. plant-breeding. plant-diseases. plant-pathogenic-bacteria. plant-pathogens. rice

139. **The on-farm trials of the rotational prawn-rice farming in a semi-deep water area**
Lam-My-Lan. Micha-J-C. Duong-Nhut-Long. Tran-Thanh-Hai,
Journal of Applied Aquaculture, 2008, 20 (3), pages 168-183

Abstract: The on-farm trials of rotational rice-prawn farming in a semi-deep water area in the Mekong Delta of Vietnam was carried out in six rice fields (0.7-1.0 ha) to evaluate the production and economic efficiency of using low and high cost feed on prawn culture in paddies at different densities. Two stocking densities of 4 and 5 PL/m2 were investigated. Two treatments of feed types (pellets only or a combination of pellets, trash fish, and snail meat) were applied at stocking 4 PL/m2. At the treatment of 5 PL/m2, prawns were fed a combination of pellets, trash fish, and snail meat. Prawns were stocked in the mid-April and harvested in mid-November before the next dry season rice crop. Rice farming was started 3 to 5 days after prawn harvesting. By cull harvesting during the culture period, final mean weights of prawn ranged from 47.2 to 57.2 g/prawn and the male:female ratio at harvesting was 2.5:1.0. The prawn yield of treatment 5 PL/m2 was highest (630 plus or minus 22 kg/ha). Net profits in treatments using the combination of pellets, trash fish, and snail meat were 861 plus or minus 193 US$/ha to 1,019 plus or minus 25 US$/ha for the prawn crop and 1,393 plus or minus 71 US$/ha to 1,576 plus or minus 180 US$/ha for the whole system (prawn crop+dry rice crop) and significantly higher than in treatment using pellet only ($P<0.05$). Prawns fed on pellets or a combination of pellets and snail meat both offer similar results in terms of production and economics. The dry rice crop offered high cost benefit ratio (2.29-2.33) with low operating cost (414-434 USD/ha) and it made a better use in sustainable rice fields through the rotational rice-prawn system
Other Title: The on-farm trials of the rotational prawn-rice farming in a semi-deep water area
Descriptors: prawns. rice. shrimp-culture. stocking-density. stocking-rate density of stocking. paddy

140. **Induced rice resistance to blast varies as a function of Magnaporthe grisea avirulence genes** / Yasuda-N. Noguchi-M-T. Fujita-Y,
Plant Disease, 2008, 92 (8), pages 1144-1149
Abstract: Incompatibility reactions between rice and the blast fungus Magnaporthe grisea produce various degrees of lesions, from large brown flecks to small, nearly invisible lesions. We previously identified four avirulence genes (AvrPia, AvrPii, AvrPit, and Avr-Hattan3) in M. grisea isolates by genetic analysis of progeny from crosses between isolates with differing pathogenicity. Using progeny known to contain a specific avirulence gene, we demonstrated that the type of resistance lesion produced in rice by an avirulent isolate and the degree of leaf blast suppression by preinoculation with that isolate were determined by the combination of avirulence and resistance genes in the isolate and the cultivar. The degree of leaf blast suppression by preinoculation with an avirulent isolate increased with larger resistance lesions. When two genes were involved in an isolate's avirulence, lesions appeared that resembled those expected for the gene that produced the smaller lesion. The degree of leaf blast suppression by the isolate with two avirulence genes was comparable with that induced by the isolate with the avirulence gene that produced the smaller effect. The ability of specific resistance gene combinations that effectively suppress blast disease is discussed for each avirulence gene
Other Title: Induced rice resistance to blast varies as a function of Magnaporthe grisea avirulence genes
Descriptors: cultivars. disease-resistance. fungal-diseases. genes. plant-diseases. plant-pathogenic-fungi. plant-pathogens. rice

141. **A putative MAP kinase kinase kinase, MCK1, is required for cell wall integrity and pathogenicity of the rice blast fungus, Magnaporthe oryzae**
Jeon-JunHyun. ...[et al.]
Molecular Plant Microbe Interactions, 2008, 21 (5), pages 525-534
Abstract: Insertional mutagenesis of Magnaporthe oryzae led to the identification of MCK1, a pathogenicity gene predicted to encode mitogen-activated protein kinase kinase kinase (MAPKKK) homologous to BCK1 in Saccharomyces cerevisiae. Targeted disruption of MCK1 resulted in the fungus undergoing autolysis and showing hypersensitivity to cell-wall-degrading enzyme. The mck1 produced significantly reduced numbers of conidia and developed appressoria in a slightly retarded manner compared with the wild type. Appressorium of the mck1 mutant was unable to penetrate into plant tissues, thereby rendering the mutant nonpathogenic. Cytorrhysis assay and monitoring of lipid mobilization suggested that the appressorial wall was altered, presumably affecting the level of turgor pressure within appressorium. Furthermore, the mck1 mutant failed to grow inside plant tissue. Complementation of the mutated gene restored its ability to cause disease symptoms, demonstrating that MCK1 is required for fungal pathogenicity. Taken together, our results suggest that MCK1 is an MAPKKK involved in maintaining cell wall integrity of M. oryzae, and that remodeling of the cell wall in response to host environments is essential for fungal pathogenesis
Other Title: A putative MAP kinase kinase kinase, MCK1, is required for cell wall integrity and pathogenicity of the rice blast fungus, Magnaporthe oryzae
Descriptors: cell-walls. enzymes. kinases. mutagenesis. pathogenicity. plant-pathogenic-fungi. plant-pathogens

142. **Effect of high temperature on sucrose content and sucrose-cleaving enzyme activity in rice grain during the filling stage**
Tian-L. Qi-hua-L. Ohsugi-R. Yamagishi-T. Sasaki-H,
International Rice Research Notes, 2008, 32 (2), pages 48
Abstract: Dynamic changes in sucrose, fructose, and glucose contents and differences in activities of sucrose synthase, vacuolar invertase, and cell wall-bound invertase in rice grain after flowering stage were studied under natural and high temperatures by using japonica rice varieties Koshihikari and Sasanishiki. In rice grains, the sucrose synthase activity was higher than that of invertase, which was significantly correlated with starch accumulation rate, indicating that sucrose synthase played an important role in sucrose degradation and starch synthesis. Under high temperature, the significant increase in grain sucrose content without any increase in fructose and glucose contents suggested that the hightemperature treatment enhanced sucrose accumulation, while diminishing sucrose degradation in rice grains. Compared with control plants, the decrease in activities of sucrose synthase, vacuolar invertase, and cell wall-bound invertase with high temperature-treated plants indicated that the deceleration of sucrose degradation was related to the decrease in activities of sucrose synthase and invertase

143. **Photosynthetic characteristics and heterosis in transgenic hybrid rice with maize phosphoenolpyruvate carboxylase (pepc) gene**
Ji-hang-L. Xun-chao-X. Hua-qiang-Z. Li-bin-H. Kai-zheng-Z. Ping-L,
International Rice Research Notes, 2008, 32 (2), pages 47

Abstract: Three F1 hybrids derived from sterile rice lines Gang 46A, 776A, and 2480A and improved restorer line Shuhui 881 containing maize phosphoenolpyruvate carboxylase (pepc) gene were used to analyze the effect of this gene on heterosis and photosynthetic characteristics, while the F1 obtained by crossing Shuhui 881 with the three above mentioned sterile lines served as control. The dynamics of photosynthetic characteristics in leaves of three F1 lines with pepc gene and their control was determined at initial tillering, maxium tillering, elongation, initial heading, heading, maturity stages, and at other different times after the flag leaf has fully expanded. The PEPCase activities of the three F1 with pepc gene increased significantly as compared with control plants during the whole developmental stage. Moreover, net photosynthesis rate (Pn) also increased to a certain extent. The data showed that PEPCase activity was significantly correlated to Pn (correlation coefficient of 0.6081**). The photosynthetic indexes of the three F1 with pepc gene were obviously superior to the respective control in apparent quantum efficiency, light compensation point, and carboxylation efficiency, while the CO_2 compensation point was lower than that of the corresponding control. The Pn of the three F1 with pepc gene at light saturation point and CO_2 saturation point was also higher than that of control plants. In addition, the three F1 with pepc gene had an average increase of 37.10% in grain yield per plant in comparison with control plants. The results indicated that the photosynthetic characteristics of hybrid rice containing the pepc gene had been improved to some extent due to the introduction of this gene

144. **Identification of QTLs for cooking and eating quality of rice grain**
Shi-yong-S. Wei-H. Hong-xuan-L,
International Rice Research Notes, 2008, 32 (2), pages 46
Abstract: The backcross inbred line (BIL) population derived from the cross between Koshihikari (good eating and cooking quality, japonica) and Kasalath (poor quality, indica) was used to analyze QTLs for amylose content (AC), gelatinization temperature (GT), gel consistency (GC), and protein content (PC). Eight main-effect QTLs including two for AC, three for GT, two for GC, and one for PC were identified. Moreover, 27 epistatic QTL pairs, including seven for AC, five for GT, four for GC, and 11 for PC were also detected, whereas for AC and GT, one main-effect QTL with a major gene was detected, respectively. Therefore, the main-effect QTL might be more responsible for the current variation than the epistatic QTL. The results indicated that the main-effect QTL is the primary genetic basis for those traits. However, for PC, the epistatic QTL explained a much greater portion of the total variation than did main-effect QTL, suggesting that epistatic loci are the primary genetic basis for such trait. In the experiment, chromosome segment substitution lines (CSSLs) were used to confirm the reliability of the main-effect QTLs detected in the BIL population. Of the eight main=effect QTLs for four traits in BIL analysis, six were confirmed and two remained unconfirmed by CSSL analysis

145. **A rapid DNA mini-prep method for large-scale rice mutant screening**
Fu-lin-Q. He-he-W. Jie-C. Jie-yun-Z. Leung-H. Shi-hua-C,
International Rice Research Notes, 2008, 32 (2), pages 45
Abstract: A high-throughput rice DNA mini-preparation method was developed. The method is suitable for largescale mutant bank screening as well as for large mapping populations with characteristics of maintaining relatively high level of DNA purity and concentration. The extracted DNA was tested and was found suitable for regular

PCR amplification (SSR) and for Targeting Induced Local Lesion in Genome (TILLING) analysis

146. **Effect of phosphorus deficiency on leaf photosynthesis and carbohydrate partitioning in two rice genotypes with contrasting low phosphorus susceptibility**
Yong-fu-L. An-cheng-L. Hassan-M-J. Xing-hua-W,
International Rice Research Notes, 2008, 32 (2), pages 44
Abstract: To study the effect of phosphorus (P) deficiency on leaf photosynthesis and carbohydrate partitioning and to determine whether the characteristics of leaf photosynthesis and carbohydrate partitioning are related to low P tolerance in rice plants, a hydroponic culture experiment supplied with either sufficient P (10 mg/l) or deficient P (0.5 mg/l) was conducted by using two rice genotypes different in their responses to low P stress. Results showed that the plant growth of Zhenongda 454 (low P-tolerant genotype) was less affected by P deficiency compared with SanyangÆai (low P-sensitive genotype). Under P-deficient conditions, photosynthetic rates of Zhenongda 454 and SanyangÆai were decreased by 16% and 35%, respectively. Zhenongda 454 showed a higher photosynthetic rate than SanyangÆai. Phosphorus deficiency decreased stomatal conductance in both genotypes but had no significant influence on leaf internal CO_2 concentration (Ci), suggesting that the decrease in leaf photosynthetic rate of rice plants induced by P deficiency was not due to stomatal limitation. Phosphorus deficiency increased the concentration of soluble carbohydrates and sucrose in the shoots and roots of both genotypes and also markedly increased the allocation of soluble carbohydrates and sucrose to the roots. Under deficient P supply, Zhenongda 454 had higher root-shoot soluble carbohydrate content ratio and root-shoot sucrose content ratio than SanyangÆai. In addition, P deficiency increased the concentration of starch in roots for both genotypes, whereas it had no effect on the content of starch in the shoots or roots. Compared with genotype SanyangÆai, the better tolerance for low-P stress of Zhenongda 454 can be explained by the fact that it maintains a higher photosynthetic rate and a greater ability to allocate carbohydrates to the roots under P deficiency

147. **Source-sink relationship in intersubspecific hybrid rice**
Ji-hang-L. Xun-chao-X. Li-bin-H. Ping-L,
International Rice Research Notes, 2008, 32 (2), pages 43
Abstract: Three indica restorer lines (Mianhui 725, Shuhui 527, and Shuhui 881), an American rice variety Lemont, and a javanica rice variety Xiangdali were crossed with japonica Kitaake, and five F1 hybrids were obtained to study the photosynthetic and agronomic traits. The data on photosynthetic characteristics indicated that the net photosynthetic rate (Pn) of the five F1 hybrids was significantly higher than that of their parents (or one of them) under high photosynthetic flux density (PFD); the overall performance of hybrids was better than their respective parents in terms of apparent quantum yield (AQY), carboxylation efficiency (CE), and CO2 compensation point (CCP). Moreover, the photosynthetic performance of the five F1 differed due to variation in heredity and the typical indica-japonica hybrids Mianhui 725/Kitaake and Shuhui 527/Kitaake were better than the others on this aspect. The agronomic traits revealed that the five F1 exhibited different heterosis, with Shuhui 881/Kitaake having the largest sink, followed by Mianhui 725/Kitaake, Shuhui 527/Kitaake, Lemont/Kitaake, and Xiangdali/Kitaake. The production potential of indica-japonica hybrids was higher than that of the other two hybrids, which was consistent with the performance of Pn. However, the superior trait of indica-japonica

hybrids on sink size has not been fully turned into high yield because of abnormal seed setting. Therefore, attention should be paid to proper genome coordination and appropriate genetic distance to achieve super high yield

148. **Utilization of eui gene from a recessive tall rice mutant 02428h in breeding**
Cai-lin-W. Ling-Z. Zhen-Z. Ya-dong-Z,
International Rice Research Notes, 2008, 32 (2), pages 42
Abstract: To improve the panicle extrusion of photo- and thermosensitive sterile line æPeiÆai 64S by using the elongated uppermost internode (eui) gene of the wide compatibility rice mutant 02428h, a new photo- and thermosensitive sterile line P8hS characterized by elongated uppermost internode was developed by transferring the eui gene into PeiÆai 64S through three successive backcrossings. Compared with PeiÆai 64S, P8hS was 35.6 cm higher, resulting from the elongation of the uppermost and the second internodes from the top. The panicle extrusion of PeiÆai 64S was completely improved and positive effects were found on the main agronomic characters of P8hS and its hybrids when the eui gene was introduced into PeiÆai 64S

149. **Frequency and rates of zinc application under hybrid rice-wheat sequence in a mollisol of Uttarakhand/** Varshney-P. Singh-S-K. Srivastava-P-C,
Journal of the Indian Society of Soil Science, 2008, 56 (1), pages 92-98
Abstract: Field experiments were conducted on a Typic Hapludoll to evaluate the efficacy of different rates and frequency of Zinc (Zn) application on yield, zinc concentration and uptake ofhybrid rice-wheat sequence. Zinc application significantly increased the grain yield, concentration in as well as uptake by both the crops. The concentration of Zn was more in wheat grain as compared to straw while the reverse was true for rice; however, total zinc removal by hybrid rice was more than twice as compared to wheat. Application of zinc sulphate significantly increased the DTPA-extractable Zn in soil but the effect decreased with subsequent crop removal. Evaluation of different rates and frequencies of Zn clearly indicated that application of 10 kg Zn/ha to rice in the first year and 5 kg Zn/ha to rice in the second year was most economical combination to sustain the productivity of hybrid rice-wheat sequence in the tarai region of Uttarakhand
Other Title: Frequency and rates of zinc application under hybrid rice-wheat sequence in a mollisol of Uttarakhand
Descriptors: rice-wheat-sequence; zinc-sulphate; typic-hapludoll

150. **Effect of nitrogen levels on yield of and nutrient uptake by salt-tolerant rice and wheat cultivars in gypsum-amended sodic soils**
Singh-Y-P. Singh-R. Gautam-A-K,
Journal of the Indian Society of Soil Science, 2008, 56 (1), pages 86-91
Abstract: The effect of nitrogen levels on yield of and nutrient uptake by salt-tolerant rice and wheat . cultivars in a gypsum-amended sodic soil of Uttar Pradesh was studied at the Central Soil Salinity Research Institute, Regional Research station, Lucknow. The promising results reveal that the salt-tolerant rice variety CSR 13 gave 75.5% and 116.0% higher grain yield over traditional salt-tolerant variety Bejhari with 120 and 150 kg N/ha, respectively. Similarly salt-tolerant variety of wheat KRL 19 gave 13.0% higher grain yield over KRL 1-4 with 150 kg N/ha. Maximum agronomic response was found in CSR 13 with 120 kg N/ha and it decreased with the increase in N level but in traditional variety Bejhari response to N reduced drastically

with the increasing levels of N. In wheat, both the varieties responded with increasing levels of N up to 120 kg/ha. Maximum net return and benefit:cost ratio was obtained from salt-tolerant rice (CSR 13) and wheat (KRL 19) cultivars grown with 150 kg N/ha
Other Title: Effect of nitrogen levels on yield of and nutrient uptake by salt-tolerant rice and wheat cultivars in gypsum-amended sodic soils
Descriptors: nitrogen-levels; salt-tolerant-rice-and-wheat-cultivars; yield; N-uptake; N-use-efficiency

151. **Soil fertility changes after long-term application of organic manures and crop residues under rice-wheat system**
Balwinder-K. Gupta-R-K. Bhandari-A-L,
Journal of the Indian Society of Soil Science, 2008, 56 (1), pages 80-85
Abstract: A long-term field experiment on integrated management of FYM, green manure (GM) and crop residues with inorganic fertilizers in rice-wheat system is in progress at the Punjab Agricultural University, Ludhiana, since 1993. The effect of organic materials and inorganic fertilizers on soil properties and grain yield of rice and wheat was studied after 8 years of cropping cycle on a loamy sand. The incorporation of crop residues along with 50% NPK and FYM or GM contributed towards meeting 50% NPK requirement of rice. Long-term application of crop residues and organic manures increased the soil organic C content of soil. The combined use of crop residues, organic amendments and chemical fertilizers significantly increased the availability of N, P, K., Sand rnicronutrients in soil over chemical fertilizers alone
Other Title: Soil fertility changes after long-term application of organic manures and crop residues under rice-wheat system
Descriptors: crop-residues; green-manure; FYM; rice; wheat; soil-fertility

152. **Effect of feeding rice bran based diets to crossbred gilts on certain blood biochemical parameters in preweaned piglets**
Thirumurugan-P. Chhabra-A-K. Bhar-R,
Indian Veterinary Journal, 2008, 85 (11), pages 1176-1178
Abstract: The aim of this study is to find out the effect of variations in the diets of crossbred gilts (Landrace x native livestock) on certain blood biochemical parameters in preweaned piglets. Results after feeding the animals showed that organic matter and nitrogen free extract of the respective diets decreased with increase in the level of rice bran, on the other hand, ether extract, crude fibre and acid insoluble ash content and GE value of the diets increased with increase in percentage of rice bran incorporation in the diet T2 (41% rice bran) and T3 (82% rice bran). Average daily DM intake of the gilt during lactation period increased as the level of rice bran increased in the respective diet. However, DCP intake was lower in T3 then T2 group and control. Digestible energy intake was lowest in T3 group followed by T2 group and highest in control. There was no significant difference in plasma glucose, cholesterol, total protein, albumin, globulin and plasma urea value of piglets in the three treatment groups at birth. However, Plasma glucose and cholesterol was lower and plasma urea was higher in T3 group than control and T2 group. The results suggest that rice bran could be incorporated at 41% level in the diet of crossbred gilts without affecting the blood biochemical values in preweaned piglets

Other Title: Effect of feeding rice bran based diets to crossbred gilts on certain blood biochemical parameters in preweaned piglets
Descriptors: albumins. blood-sugar. cholesterol. crossbreds. diets. energy-intake. feed-formulation. gilts. globulins. Landrace. native-livestock. organic-matter. pig-feeding. piglets. rice-bran. urea

153. **Economics of pig rearing on rice bran based diets**
Thirumurugan-P. Chhabra-A-K. Bhar-R. Soren-N-M,
Indian Veterinary Journal, 2008, 85 (12), pages 1302-1305
Abstract: An experiment was conducted to optimize the level of rice bran (RB) in the diet of crossbred (Landrace x local) pigs for economic performance during growing and breeding periods. The pigs were fed a diet containing maize, wheat bran, rice bran at 35, 47 and 0% in T1; 17.5, 23.5 and 41% in T2 and 0, 0 and 82% in T3. Soyabean meal, fish meal, mineral mixture and salt were used at 10, 6, 1.5 and 0.5% respectively and vitamin AD3 was added at 15 g/quintal in all the diets. Overall performance of the pig in T3 group was very poor and total out put cost was significantly lower. Average daily feed intake, live weight gain, feed conversion efficiency, piglet weight at weaning and output cost of T2 group was comparable with control group (T1) and significantly higher than T3 group. Moreover, benefit cost ration was significantly higher in T2 than T1 and T3 The results suggest that rice bran can be included upto 41% in the diet of Indian crossbred pigs without affecting its performance
Other Title: Economics of pig rearing on rice bran based diets
Descriptors: costs. diets. fattening-performance. feed-conversion-efficiency. feed-formulation. feed-intake. finishing. liveweight-gain. maize. pig-feeding. piglets. rice-bran. wheat-bran

154. **Forestry plantations on rice bunds: farmersÆ perceptions and technology adoption**
Bargali-S-S. Singh-S-P. Shrivastava-S-K. Kolhe-S-S,
International Rice Research Notes, 2008, 32 (2), pages 40-41
Abstract: This study was conducted in Durg District, Chhattisgarh State, where about 8% of the area (0.87 million ha) is forested. The villagers collect wood products from forests for their daily needs (mainly fuel wood). This ruthless cutting of trees and shrubs to narrow the gap between supply and demand of forest products endangers biodiversity and sustainable development, thereby adversely affecting ecological restoration

155. **Benefit-cost ration in producing aromatic and nonaromatic rice genotypes in Kashmir Valley**
Parray-G-A. Shikari-A-B,
International Rice Research Notes, 2008, 32 (2), pages 38-40
Abstract: Kashmir is well known for the cultivation of a large number of aromatic as well as nonaromatic landraces, which occupy different agroecological niches. Most of the aromatic rice varieties are local landraces maintained by farmers since time immemorial (now preserved at various rice stations of the university). Some of these varieties possess not only good aroma but also elite morphological features, which are desirable under our valley conditions. Of the aromatic genotypes, Mushk Budgi and Kamad are in great demand and are highly priced, whereas nonaromatic rice varieties K-332 and Jhelum (SKAU-27) are commercially grown. Since a vast difference is

found in the yielding abilities of these aromatic and nonaromatic varieties, there is room for improving these aromatic cultivars. A study was carried out to determine the benefit-cost ratio (BCR) of producing these varieties to better identify the factors that may need to be manipulated to further improve these varieties

156. **Effects of applying all or individual management components on rice yield in rainfed uplands** / Singh-R-K. Mandal-N-P. Singh-C-V,
International Rice Research Notes, 2008, 32 (2), pages 37-38
Abstract: Direct-seeded upland rice is an important production system for the resource-poor farmers of eastern India. With the recent emphasis on improving the productivity of this important risk-prone ecosystem, a number of technological interventions have been suggested by researchers. Application of technology components as a package is required for achieving higher productivity in upland rice. Whenever a single component of the package is not applied, productivity decreases significantly. The contribution of each technology component to increasing rainfed upland rice productivity is not investigated thoroughly. In our study, we examined the contribution of the different components of technology to rainfed upland rice productivity

157. **Grain yield and yield components of rice as influenced by different crop establishment methods/** Bisht-P-S. Puniya-R. Pandey-P-C. Singh-D-K,
International Rice Research Notes, 2008, 32 (2), pages 33-34
Abstract: Conventional methods of rice transplanting have become expensive because of increasing cost of seed, fertilizer, water, and labor. A system of rice intensification (SRI), introduced from Madagascar (Uphoff 2006), and its improved form, integrated crop management (ICM), need to be further evaluated. During a national symposium on SRI held in November 2006 at ANGRAU, Hyderabad, India, farmers from Andhra Pradesh and Tamil Nadu claimed great savings in terms of seed, water, and labor with SRI. To validate these claims, an experiment was conducted to evaluate different crop establishment methods in the Tarai plain of Uttarakhand

158. **Application of herbicide lethality in hybrid rice**
Zhu-Q-S. Yang-Q-J. Zhang-D-W. Wang-S-M. Dong-J. Feng-C. Zhu-J-B,
International Rice Research Notes, 2008, 32 (2), pages 31-33
Abstract: With improved seed production technology and parental outcrossing traits, hybrid rice seed production yield has increased from hundreds of kilograms per hectare to a national average of 2.5 t haû1 during the last three decades in China. However, current seed production protocols are based on a technology established 30 years agoùfemale and male parents are separately transplanted in different rows at a certain ratio and are harvested separately. The complexity of seed production has become a limiting factor for wide-scale adoption of hybrid rice as more labor is consumed and purity control and mechanical operations are difficult

159. **A new phenotypic screen to map quantitative trait loci associated with rice tolerance for planthoppers/** Kadirvel-P. Soundararajan-R-P. Gunathilagaraj-K,
International Rice Research Notes, 2008, 32 (2), pages 28-30
Abstract: There has been a long history of attempts to design screening tests to measure plant resistance to insects since the time Painter (1951) classified plant resistance into three mechanisms: nonpreference (antixenosis), antibiosis, and tolerance. As the most important insect pests of rice (Oryza sativa L.), brown

planthopper Nilaparvata lugens (Stσl) and whitebacked planthopper Sogatella furcifera (Horvath) demanded the attention of entomologists and breeders to develop easy and reliable screening techniques to screen a large number of germplasm and breeding materials to develop cultivars with improved resistance to planthoppers (Heinrichs et al 1985). Tolerance is the most important component of resistance for breeding, but it has not been well used as the phenomenon of tolerance has not been fully understood, there is a lack of suitable techniques to identify and incorporate tolerance into an improved genetic background, and details of the genetics of tolerance have not been determined (Velusamy and Heinrichs 1986)

160. **Occurrence and distribution of the invasive rice black bugs Scotinophara spp. (Hemiptera: Pentatomidae) in the Philippines /** Barrion-A-T. Joshi-R-C. Sebastian-L-S,
International Rice Research Notes, 2008, 32 (2), pages 15-20
Abstract: Rice (*Oryza sativa* L.) is the staple diet of almost two-thirds of the worldÆs human population and food to 1,400 species of rice-feeding invertebrates (Walker 1962, Barrion and Litsinger 1987). Of the rice-feeding invertebrates, 25 species are putative major and minor pests of rice in tropical Asia. Among the putative pests, the highly cryptic and invasive rice black bugs (RBB) of the genus Scotinophara Stσl, 1867 (Pentatomidae: Podopinae) are emerging insect pests in irrigated and rainfed wetland rice fields in the Philippines. Upland rice is also prone to RBB infestation as observed recently in Landang, Datu, and Montawal in Maguindanao Province in April 2006 (AT Barrion, pers. obs.). Damage caused by the sap-feeding RBB is similar to that caused by rice stem borersùi.e., deadheart and whitehead are observed in the vegetative and reproductive growth stage, respectively (Barrion and Litsinger 1987). As a cryptic organism, limited information was known about RBB in the past (Gabriel 1975); previous damage attributed to stem borer may have been due to RBB. These pentatomid bugs are also potential vectors of plant diseases as damaged plants become stunted and leaf-feeding sites turn yellowish to dark brown, resembling a blast lesion (Lim 1975)

161. **Technologies for energy use of rice straw: a review**
Gadde-B. Menke-D. Siemers-W. Pipatmanomai-S,
International Rice Research Notes, 2008, 32 (2), pages 5-14
Abstract: Rice straw is a major field-based residue that is produced in large amounts in Asia. In fact, the total amount equaling 668 t could produce theoretically 187 gallons of bioethanol if the technology were available (Kim and Dale 2004). However, an increasing proportion of this rice straw undergoes field burning. This waste of energy seems inapt, given the high fuel prices and the great demand for reducing greenhouse gas emissions as well as air pollution. As climate change is extensively recognized as a threat to development, there is growing interest in alternative uses of field-based residues for energy applications. In contrast to the use of food crops (such as maize), the use of agricultural residues as biofuel offers a potential pathway of renewable energy that avoids risks for food security. There are primarily two types of residues from rice cultivation that have potential in terms of energyùstraw and husk. Although the technology of using rice husk is well established in many Asian countries, rice straw is, as of now, rarely used as a source of renewable energy. One of the principal reasons for the preferred use of husk is its easy procurementùthat is, it is available at the rice mill. In the case of rice straw, however, its collection is laborious and its availability is limited to harvest time. The

logistics of collection could be improved through baling, but the necessary equipment is expensive and buying it is uneconomical for most rice farmers. Thus, technologies for energy use of straw must be especially efficient to compensate for the high costs involved in straw collection. This review aims to give an overview of the available technologies for energy applications of rice straw, their development status, and the problems encountered in their use. It also provides an overview of rice straw quality as this property has an influence on technology efficiencies

162. **Soil quality assessment in rice production systems: establishing a minimum data set**
Lima-A-C-R-de. Hoogmoed-W. Brussaard-L,
Journal of Environmental Quality, 2008, 37 (2), pages 623-630
Abstract: Soil quality, as a measure of the soil's capacity to function, can be assessed by indicators based on physical, chemical, and biological properties. Here we report on the assessment of soil quality in 21 rice (Oryza sativa) fields under three rice production systems (semi-direct, pre-germinated, and conventional) on four soil textural classes in the Camaqua region of Rio Grande do Sul, Brazil. The objectives of our study were: (i) to identify soil quality indicators that discriminate both management systems and soil textural classes, (ii) to establish a minimum data set of soil quality indicators and (iii) to test whether this minimum data set is correlated with yield. Twenty-nine soil biological, chemical, and physical properties were evaluated to characterize regional soil quality. Soil quality assessment was based on factor and discriminant analysis. Bulk density, available water, and micronutrients (Cu, Zn, and Mn) were the most powerful soil properties in distinguishing among different soil textural classes. Organic matter, earthworms, micronutrients (Cu and Mn), and mean weight diameter were the most powerful soil properties in assessing differences in soil quality among the rice management systems. Manganese was the property most strongly correlated with yield (adjusted r2=0.365, P=0.001). The merits of sub-dividing samples according to texture and the linkage between soil quality indicators, soil functioning, plant performance, and soil management options are discussed in particular
Descriptors: available-water. bulk-density. copper. crop-yield. indicators. manganese. rice. soil-chemical-properties. soil-density. soil-fertility. soil-invertebrates. soil-organic-matter. soil-physical-properties. soil-texture. zinc

163. **Phenotypic characterization, genetic analysis, and molecular mapping of a new mutant gene for male sterility in rice/** Zuo-Lin. Li-Shuangchen. Chu-Mingguan. Wang-Shiqua. Deng-Qimin. Ding-Le. Zhang-Jin. Wen-Yon. Zheng-Aipin. Li-Ping. (liping@cngk.com), Genome, 2008, 51 (4), pages 303-308
Abstract: xs1 is a male-sterile rice mutant derived from a spontaneous mutation. The floret of the mutant, consisting of 6 stamens and 1 pistil, looks the same as that of the wild type except that the filaments are long and thin and the anthers are withered in white transparence. It is confirmed that xs1 is a no-pollen type of male-sterile mutant, for no pollen grains can be stained with I-2-KI solution and the anther locules are always hollow. Anther transverse sections indicate that the mutant microspores are abnormally condensed and agglomerated to form a deeply stained cluster at the late microspore stage, which results in cessation of the vacuolation process of microspores, and, therefore, the mutant forms no functional pollens for reproduction. Genetic analysis of 4 F-2 populations and 3 BC1F1 populations revealed that the mutation is controlled by a single recessive gene, termed VR1 (Vacuolation

retardation 1). Screening of 432 F-2 mutant individuals derived from the cross of xs1 x G603 with simple sequence repeat markers revealed that VR1 is located between the molecular markers RM17411 and RM5030, at distances of 0.7 and 1.5 cM, respectively, on chromosome 4. VR1 is a new male fertility controlling gene located on chromosome 4 in rice
Descriptors: Methods and Techniques; Molecular Genetics (Biochemistry and Molecular Biophysics); Population Genetics (Population Studies); Reproductive System (Reproduction) male sterility; reproductive system disease/male; diagnosis, genetics microspore stage

164. **Evaluation of rice and sugarcane SSR markers for phylogenetic and genetic diversity analyses in bamboo/** Sharma-R-K. (mrk_sharma@yahoo.com). Gupta-P. Sharma-V. Sood-A. Mohapatra-T. Ahuja-P-S,
Genome, 2008, 51 (2), pages 91-103
Abstract: Simple sequence repeat (SSR) markers are valuable tools for many purposes such as phylogenetic, fingerprinting, and molecular breeding studies. However, only a few SSR markers are known and available in bamboo species of the tropics (Bambusa spp.). Considering that grass genomes have co-evolved and share large-scale synteny, theoretically it should be possible to use the genome sequence based SSR markers of field crops such as rice (Oryza sativa) and sugarcane (Saccharum spp.) for genome analysis in bamboo. To test this, 98 mapped SSR primers representing 12 linkage groups of rice and 20 EST-derived sugarcane SSR primers were evaluated for transferability to 23 bamboo species. Of the tested markers, 44 (44.9%) rice and 15 (75%) sugarcane SSR primers showed repeatable amplification in at least one species of bamboo and thus were successfully utilized for phylogenetic and genetic diversity analyses. Transferred SSR primers revealed complex amplification patterns in bamboo, with an average of 9.62 fragments per primer, indicating a high level of polyploidy and genetic variability in bamboo. Forty-two of these primers (34 rice and 8 sugarcane SSR primers) detected an average of 2.12 unique fragments per primer and thus could be exploited for species identification. Six bamboo SSR primers exhibited cross transferability, to varying degrees, to different bamboo species. The genetic similarity coefficient indicated a high level of divergence at the species level (73%). However, a relatively low level of diversity was observed within species (25% in 20 accessions of Dendrocalamus hamiltonii). Further, cluster analysis revealed that the major grouping was in accordance with the taxonomical classification of bamboo. Thus, the rice and sugarcane SSRs can be utilized for phylogenetic and genetic diversity studies in bamboo
Descriptors: Methods and Techniques; Population Genetics (Population Studies) genome, genetic diversity, polyploidy

165. **Identification of stably expressed quantitative trait loci for cooked rice elongation in non-Basmati varieties**
166. Liu-L-L. Yan-X-Y. Jiang-L. Zhang-W-W. Wang-M-Q. Zhou-S-R. Shen-Y. Shen-YY. Liu-S-J. Chen-L-M. Wang-J-K. Wan-J-M. (wanjm@njau.edu.cn),
Genome, 2008, 51 (2), pages 104-112
Abstract: The elongation of the cooked grain determines the cooking and eating quality of Basmati rice. The identification of stable quantitative trait loci (QTLs), especially those from non-Basmati types, will extend the genetic basis of the Basmati type and facilitate the breeding of high-quality varieties. A set of recombinant inbred

lines derived from an indica x japonica hybrid was used to identify QTLs controlling the elongation ratio (ER), elongation index (EI), and water absorption (WA) of the cooked grain. Three ER QTLs on chromosomes 2, 4, and 12, two EI QTLs on chromosomes 2 and 5, and two WA QTLs on chromosomes 2 and 6 were detected. Four of these QTLs were validated using a set of established chromosome segment substitution lines. The genetic effect of qER-2 was explored in an analysis of segregating generations, using 8 newly developed simple sequence repeat markers. Two tightly linked loci (qER-2a and qER-2b) were identified on chromosome 2
Other Title: Identification of stably expressed quantitative trait loci for cooked rice elongation in non-Basmati varieties
Descriptors: Population Genetics (Population Studies) water absorption, cooked rice elongation, stably expressed quantitative trait loci, cooking/eating quality

167. **Quantitative trait loci (QTL) analysis for rice grain width and fine mapping of an identified QTL allele gw-5 in a recombination hotspot region on chromosome 5**
Wan-Xiangyua. Weng-Jianfen. Zhai-Huq. Wang-Jiankan. Lei-Caili. Liu-Xiaol. Guo-Ta. Jiang-Lin. Su-Nin. Wan-Jianmin. (wanjin@caas.net.cn),
Genetics, 2008, 179 (4), pages 2239-2252
Abstract: Rice grain width and shape play a crucial role in determining grain quality and yield. The genetic basis of rice grain width was dissected into six additive quantitative trait loci (QTI.,) and II pairs of epistatic QTL using an F-7 recombinant inbred line (RIL) population derived from a single cross between Asominori (japonica) and IR24 (indica). QTL by environment interactions were evaluated in four environments. Chromosome segment substitution lines (CSSLs) harboring the six additive effect QTL were used to evaluate gene action across eight environments. A major, stable QTL, qGW-5, consistently decreased rice grain width in both the Asominori/IR24 RIL and CSSL populations with the genetic background Asominori. By investigating the distorted segregation of phenotypic values of rice grain width and genotypes of molecular markers in BC4F2 and BC4F3 populations, qGW-5 was dissected into a single recessive gene, gw-5, which controlled both gran width and length-width ratio. gw-5 was narrowed down to a 49.7-kb genomic region with high recombination frequencies on chromosome 5 using 6781 BC4F2 individuals and 10 newly developed simple sequence repeat markers. Our results provide a basis for map-based cloning of the gw-5 gene and for marker-aided gene/QTL pyramiding in rice quality breeding
Other Title: Quantitative trait loci (QTL) analysis for rice grain width and fine mapping of an identified QTL allele gw-5 in a recombination hotspot region on chromosome 5
Descriptors: Molecular Genetics (Biochemistry and Molecular Biophysics) chromosome segment substitution line

168. **The qSD12 locus controls offspring tissue-imposed seed dormancy in rice**
Gu-Xing-You. (Xingyou.gu@sdstate.edu). Turnipseed-E-Bren. Foley-Michael-E,
Genetics, 2008, 179 (4), pages 2263-2273
Abstract: Seed component structures were grouped into maternal and offspring (embryo and endosperm) tissues to characterize a dormancy quantitative trait locus (QTL) for tissue-specific function using a marker-assisted genetic approach. The approach was devised to test if genotypic/allelic frequencies of a marker tightly linked

to the QTL deviate from Mendelian expectations in germinated and nongerminated subpopulations derived from a segregation population of partially after-ripened seeds and was applied to the dormancy QTL qSD12 and qSD7-1 in a nearly isogenic background of rice. Experimental results unambiguously demonstrated that qSD12 functions in the offspring tissue(s) and suggested that qSD7-1 may control dormancy through the maternal tissues. These experiments also provide the first solid evidence that an offspring tissue-imposed dormancy gene contributes to the segregation distortion in a mapping population developed from partially after-ripened seeds and, in part, to the germination heterogeneity of seeds from hybrid plants. Offspring and maternal tissue-imposed dormancy genes express in very early and late stages of the life cycle, respectively, and interact to provide the species with complementary adaptation strategies. The qSD12 locus was narrowed to the region of similar to 600 kbp on high-resolution map to facilitate cloning and marker-assisted selection of the major dormancy gene
Descriptors: Molecular Genetics (Biochemistry and Molecular Biophysics) quantitative trait loci, genotypic frequency, allelic freqeuncy

169. **The evolution of sex-independent transmission ratio distortion involving multiple allelic interactions at a single locus in rice**
Koide-Yohei. (ykoide@abs.agr.hokudai.ac.jp). Ikenaga-Mitsunob. Sawamura-Norik. Nishimoto-Daisuk. Matsubara-Kazuk. Onishi-Kazumits. Kanazawa-Akir. Sano-Yoshi, Genetics, 2008, 180 (1), pages 409-420
Abstract: Transmission ratio distortion (TRD) is frequently observed in inter-and intraspecific hybrids of plants, leading to a violation of Mendelian inheritance. Sex-independent TRD (siTRD) was detected in a hybrid between Asian cultivated rice and its wild ancestor. Here we examined how siTRD is controlled by the S-6 locus via a mechanism in which the S-6 allele acts as a gamete eliminator, and both the male and female gametes possessing the opposite allele (S-6(a)) are aborted only in heterozygotes (S-6/S-6(a)). Fine mapping revealed that the S-6 locus is located neaar the centromere of chromosome 6. Tescross experiments using near-isogenic lines (NILs) carrying either the S-6 or S-6(a) alleles revealed that Asian rice strains frequently harbor an additional allele (S-6(n)) the presence of which, in heterozygotic states (S-6/S-6(n) and S-6(a)/S-6(n)), does not result in siTRD. A prominent reduction in the nucleotide diversity of S-6 or S-6(a) carries relative to that of S-6(n) carries was detected in the chromosomal region. These results suggest that the two incompatible alleles (S-6/S-6(a)) arose independently from S-6(n) and established genetically discontinuous relationships between limited constituents of the Asian rice population
Descriptors: Population Genetics (Population Studies); Evolution and Adaptation; Horticulture (Agriculture) Mendelian inheritance, sex-independent transmission ratio distortion, multiple allelic interaction

170. **Dominance, Overdominance and Epistasis Condition the Heterosis in Two Heterotic Rice Hybrids/** Li-Lanzh. Lu-Kaiyan. Chen-Zhaomin. Mu-Tongmi. Hu-Zhongli. (huzhongli@whu.edu.cn). Li-Xinq,
Genetics, 2008, 180 (3), pages 1725-1742
Abstract: Two recombinant inbred (RI) populations having 194 and 222 lines each, derived, respectively, from a highly heterotic inter- (IJ) and intrasubspecific (II) hybrid, were backcrossed to their respective parents. The RI and two backcross populations along with F-1 and its two parents of each hybrid were evaluated for nine

important traits, including grain yield and eight other yield-related traits. A total of 76 quantitative trait loci (QTL) for the IJ hybrid and 41 QTL for the II hybrid were detected in the RI population, midparent heterosis of two backcross populations, and two independent sets of data by summation (L-1 + L-2) and by subtraction (L-1 - L-2) of two backcross populations (L-1 and L-2). The variance explained by each QTL ranged from 2.6 to 58.3%. In the IJ hybrid, 42% (32) of the QTL showed an additive effect, 32% (24) a partial-to-complete dominant effect, and 26% (20) an overdominant effect. In the II hybrid, 32% (13) of the QTL demonstrated an additive effect, 29% (12) a partial-to-complete dominant effect, and 39% (16) an overdominant effect. There were 195 digenic interactions detected in the IJ hybrid and 328 in the II hybrid. The variance explained by each digenic interaction ranged from 2.0 to 14.9%. These results suggest that the heterosis in these two hybrids is attributable to the orchestrated Outcome of partial-to-complete dominance, overdominance, and epistasis
Descriptors: Agronomy (Agriculture); Genetics epistasis, quantitative trait loci, digenic interaction, backcross population, variance, overdominance, yield-related trait, quantitative trait heterosis, partial-to-complete dominant effect

171. **Two Adjacent Nucleotide-Binding Site-Leucine-Rich Repeat Class Genes Are Required to Confer Pikm-Specific Rice Blast Resistance**
Ashikawa-Ikuo. (ashikawa@affrc.go.jp). Hayashi-Naga. Yamane-Hirok. Kanamori-Hiroyuk. Wu-Jianzhon. Matsumoto-Takash. Ono-Kazuk. Yano-Masahir,
Genetics, 2008, 180 (4), pages 2267-2276
Abstract: The rice blast resistance gene Pikm was cloned by a map-based cloning strategy. High-resolution genetic mapping and sequencing of the gene region in the Pikm-containing cultivar Tsuyuake narrowed down the candidate region to a 131-kb genomic interval. Sequence analysis predicted two adjacently arranged resistance-like genes, Pikm1-TS and Pikm2-TS, within this candidate region. These genes encoded proteins with a nucleotide-binding site (NBS) and leucine-rich repeats (LRRs) and were considered the most probable candidates for Pikm. However, genetic complementation analysis of transgenic lines individually carrying these two genes negated the possibility that either Pikm1-TS or Pikm2-TS alone was Pikm. Instead, it was revealed that transgenic lines carrying both of these genes expressed blast resistance. The results of the complementation analysis and an evaluation of the resistance specificity of the transgenic lines to blast isolates demonstrated that Pikm-specific resistance is conferred by cooperation of Pikm-TS and Pikm2-TS. Although these two genes are not homologous with each other, they both contain all the conserved motifs necessary for an NBS-LRR class gene to function independently as a resistance gene
Descriptors: Infection; Molecular Genetics (Biochemistry and Molecular Biophysics) rice blast; fungal disease

172. **Comparison of architecture among different cultivars of hybrid rice using a spatial light model based on 3-D digitizing/** Zheng-BangYou. Shi-LiJuan. Ma-YunTao. Deng-QiYun. Li-BaoGuo. Guo-Yan,
Functional Plant Biology, 2008, 35 (9-10), pages 900-910
Abstract: Modification of plant types (i.e. plant architecture) is an important strategy to enhance the yield potential of crops. The aims of this study were to specify rice plant types using 3-D modelling methodology. The architecture of three typical hybrid rice cultivars were measured in situ in a paddy field using a 3-D digitiser at four

development stages from the panicle initiation to the filling stage. The structural parameters of the rice canopies were calculated and their light capture and potential carbon gain were simulated based on a 3-D light model. The results confirmed that a plant type with steeper leaf angles let light penetrate more deeply with relatively uniform light distribution in the canopy at higher sun elevation angles, although this result was related to leaf area index. The variations of plant types, however, did not convert into differences of light distribution across rice varieties at lower sun elevation angles. Light use efficiency at the higher leaf area index could be enhanced by reducing mutual-shading. These results indicate that a promising approach to quantify the rice architecture in situ is to combine 3-D digitising and a 3-D light model to evaluate light interception and photosynthesis of rice plant types
Descriptors: canopy. cultivars. interception. leaf-area-index. light. mathematical-models. photosynthesis. plant-morphology. rice. solar-radiation

173. **Evidence from near-isogenic lines that root penetration increases with root diameter and bending stiffness in rice/** Clark-L-J. Price-A-H. Steele-K-A. Whalley-W-R,
Functional Plant Biology, 2008, 35 (11), pages 1163-1171
Abstract: Deep rooting can be inhibited by strong layers, although there is evidence for species and cultivar (cv.) differences in their penetration ability. Here, the availability of near-isogenic lines (NILs) in rice (Oryza sativa L.) was exploited to test the hypothesis that increased root diameter is associated with greater root bending stiffness, which leads to greater root penetration of strong layers. Wax/petrolatum discs (80% strong wax) were used as the strong layer, so that strength can be manipulated independently of water status. It was found that good root penetration was consistently associated with greater root diameter and bending stiffness, whether comparisons were made between cvs or between NILs. With NILs, this effect was seen with 'research' lines bred from recombinant inbred lines of a cross between cvs Bala and Azucena and also in improved lines developed from cv. Kalinga III by introgression of parts of the genome from Azucena. Much of the bending behaviour of roots could be explained by treating them as a simple cylinder of material. In both wax disc and sand culture systems, roots that had encountered a strong layer had lower bending stiffness than roots that had not encountered a strong layer which is a novel result and not previously reported
Descriptors: cultivars. rice. rooting. roots

174. **Assessment of genetic diversity in Venezuelan rice cultivars using simple sequence repeats markers/** Herrera-Thaura-Ghneim. (tghneim@ivic.ve). Duque-Duina-Poss. Almeida-Iris-Perez. (i.perez@inia.gob.ve). Nunez-Gelis-Torrealba. (gtorrealba@inia.gob.ve). Pieters-Alejandro-J. (apieter@ivic.ve). Martinez-Cesar-P. (c.p.martinez@ciat.cgiar.org). Tohme-Joe-M. (j.tohme@ciat.cgiar.org),
Electronic Journal of Biotechnology, 2008, 11 (5), pages 1-14
Abstract: In Venezuela, pedigree analyses indicate that the rice varieties currently under cultivation are closely related. Effective breeding programs, based on knowledge of the genetic diversity of cultivars, are needed to broaden the genetic bases of rice germplasm in the country. In this study, we used a set of 48 simple-sequence-repeat (SSR) markers to assess the genetic diversity of 11 Venezuelan rice cultivars, released by the National Rice Breeding Program between 1978 and 2007. A total of 203 alleles were detected, the number of alleles (NA) per marker ranged from 2 to 9, with an average of 4.23. The average genic diversity (H) over all SSR loci for

the 18 genotypes was 0.524, ranging from 0.105 to 0.815. Positive correlations were found between H at each locus, NA, the allele size range and the maximum number of repeats. Venezuelan cultivars showed lower H (mean = 0.37) and NA (total = 124, mean = 2.58) than the whole sample. UPGMA-cluster-analysis based on genetic distance coefficients clearly separated all the genotypes, and showed that the Venezuelan rice varieties are closely related. Molecular identification of 7 Venezuelan cultivars could be done with 9 primers pairs which produced 10 genotype-specific-alleles. Although the genetic diversity was low, SSRs proved to be an efficient tool in assessing the genetic diversity of rice genotypes. Implications of the low genetic diversity detected and relatedness of Venezuelan cultivars are discussed
Descriptors: Population Genetics (Population Studies) genotype, genetic diversity, National Rice Breeding Program

175. **Phenotyping parents of mapping populations of rice for heat tolerance during anthesis**
Jagadish-S-V-K. Craufurd-P-Q. Wheeler-T-R,
Crop Science, 2008, 48 (3), pages 1140-1146
Abstract: Seed set of rice (Oryza sativa L.) is highly sensitive to short episodes of high temperature at anthesis events that are likely to be more frequent in future climates. Breeding for tolerance is therefore an essential component of adaptation to climate variability and change. Experiments were conducted in 2003 and 2004 at optimum (30 deg C daytime) and high (35 and 38 deg C) air temperature using parents of some prominent mapping populations (i) to determine whether there were differences in the daily flowering pattern and hence a potential heat avoidance mechanism, and (ii) to identify rice genotypes having true heat tolerance during anthesis, that is, high seed set in spikelets exposed to high temperature. Rice cultivar CG14 (O. glaberrima) reached peak anthesis earlier in the morning (1.5 h after dawn) under both control (30 deg C) and high (38 deg C) temperature conditions than O. sativa genotypes (more than or equal to 3 h after dawn). Exposure to high temperature (centered on the time of peak anthesis) for 6 h reduced spikelet fertility more than exposure for 2 h, and fertility was lower at 38 deg C than at 35 deg C. Genotypic ranking for spikelet fertility at 35 and 38 deg C was highly correlated in both 2003 and 2004. Fertility was also highly correlated across years, suggesting a consistent and reproducible response of spikelet fertility to temperature. The check cultivar N22 was the most heat tolerant genotype (64-86% fertility at 38 deg C) and cultivars Azucena and Moroberekan the most susceptible (<8%)
Descriptors: climatic-change. cultivars. fertility. flowering. genetic-mapping. genotypes. heat-tolerance. phenotypes. population-genetics. rice. seed-set. spikelets. temperature

176. **Can Indonesia trust the world rice market?**
Dawe-D, Bulletin of Indonesian Economic Studies, 2008, 44 (1), pages 115-132
Abstract: Geography suggests that Indonesia will continue as a net rice importer for the foreseeable future, because it is an island nation without dominant river deltas providing abundant water and flat land suitable for rice growing. Yet policy makers remain reluctant to use the world rice market to achieve domestic food security goals for at least two reasons. First, there is concern that trade policies of other countries create a heavily distorted world market price. Second, there is fear of world market price volatility. It is argued here that distortions in the segment of the international

market relevant to Indonesia are relatively small, and that world rice prices are considerably more stable now than during the 1970s world food crisis. Thus, the fear of price distortion and volatility appears unfounded, and engaging fully with the world market is a much more viable alternative than it was 30 years ago
Descriptors: agricultural-policy. agricultural-trade. constraints. economic-viability. food-security. imports. international-trade. market-prices. rice. world-markets. Indonesia

177. **A note on rice production, consumption and import data in Indonesia**
Rosner-L-P. McCulloch-N, Bulletin of Indonesian Economic Studies, 2008, 44 (1), p. 81-92
Abstract: Debate about Indonesian rice policy has focused on estimates of production and consumption levels, and the level of imports they imply. However, Indonesian rice production and consumption data are controversial. Rice consumption as estimated from household survey data is much lower than officially reported rice production. This suggests that Indonesia is a net rice exporter, but in fact it has generally been a net importer. Some researchers argue that rice consumption data are underestimated; others contend that production is over-estimated because of inaccuracies in 'eye estimates' of harvested area. This paper reviews how rice production and consumption are measured, notes major weaknesses, and surveys attempts to reconcile consumption and production data and examine their consistency with rice import data. It concludes that rice prices are the only accurate indicator of the balance between supply and demand, and hence of the appropriate level of imports
Descriptors: agricultural-trade. crop-production. data-analysis. food-consumption. imports. international-trade. measurement. rice

178. **Indonesian rice production: policies and realities**
Simatupang-P. Timmer-C-P,
Bulletin of Indonesian Economic Studies, 2008, 44 (1), pages 65-80
Abstract: Indonesian rice production grew rapidly between 1977 and 1982, but the self-sufficiency achieved in 1984 was short-lived. Growth declined gradually from about 1982, eventually stabilising at a low rate in the late 1990s. This paper discusses factors that have influenced these outcomes over the last five decades, in an attempt to inform policy makers interested in trying to restore self-sufficiency. The earlier experience showed that self-sufficiency was technically feasible, but also that its achievement was costly, both fiscally and in economic opportunities foregone. Little appears to have changed in this regard, and recent attempts to shift this cost to consumers by raising rice prices have increased poverty. We show that increases in rice production could best be achieved by rehabilitating irrigation infrastructure and revitalising research and extension activities. However, large investments by the government in rice should not be undertaken in the absence of thorough economic cost-benefit analysis
Descriptors: agricultural-policy. crop-production. food-security. food-supply. rice Indonesia

179. **Hydration performance and physiological quality of rice seeds**
Bortolotto-R-P. Menezes-N-L-de. Garcia-D-C. Mattioni-N-M,
Bragantia, 2008, 67 (4), pages 991-996
Abstract: The relationship between the shape of the hydration curve and the physiological quality of rice seeds was studied. Six lots of seeds from cv. cultivar

IRGA 417 and 3 seed lots from cv. IRGA 422 CL were used. The seeds were subjected to a set of tests to measure the physiological potential of the lots: germination, first count germination, accelerated aging, cold test (without soil), electrical conductivity, length and dry mass of seedlings, and seedling emergence in a field in Brazil. After the evaluation of the initial quality of the lots, the hydration curve was determined. The physiological quality had significant effects on the water content of rice seeds during hydration, and seeds of lower vigour levels registered lower hydration rates and water contents compared to seeds of higher vigour levels
Descriptors: hydration. imbibition. moisture-content. rice. seed-germination. seed-moisture. seed-quality. seedling-emergence. seedling-growth. seeds. vigour. water-content. water-uptake. seed-testing

180. **Protein content and physiological quality of rice seeds**
Bortolotto-R-P. Menezes-N-L-D-de. Garcia-D-C. Mattioni-N-M,
Bragantia, 2008, 67 (2), pages 513-520
Abstract: Studies were conducted to evaluate the protein content as an aiding tool in the determination of the physiological quality of rice seeds and to correlate the results with field emergence. Six lots of rice seeds were used, i.e. 3 lots were of cultivar IRGA 417 and 3 of IRGA 422 CL, which were submitted to a set of tests to measure the following physiological qualities of the lots, i.e. germination, first count germination, accelerated aging, cold test (without soil), length and dry mass of seedlings. After determining the initial quality of the lots, a new set of tests, such as crude protein content and seedling and plant evaluations in the field were conducted. It was concluded that crude protein content is capable to identify differences between rice lots with different seed qualities and to correlate with field emergence when under adverse conditions. Therefore, it is a promising determination as an aid to conventional tests in the evaluation of the physiological potential of the rice seeds
Other Title: Teor de proteina e qualidade fisiologica de sementes de arroz
Descriptors: aging. chemical-composition. cultivars. plant-composition. protein-content. rice. seed-germination. seedlings. seeds. seed-testing

181. **Performance of upland rice to the nitrogen rates after different cover crops in no-till system/** Cazetta-D-A. Arf-O. Buzetti-S. Sa-M-E-de. Rodrigues-R-A-F,
Bragantia, 2008, 67 (2), pages 471-479
Abstract: The area cropped in no-till system has increased very fast and upland rice can be included in rotation system with other crops. Another important aspect is the adequate fertilizer application and nitrogen (N) is one of the nutrients taken in higher quantities by rice. Field studies were conducted in Mato Grosso do Sul, Brazil, during the 2001/02 and 2002/03 cropping seasons, to evaluate the performance of upland rice cv. IAC 202 through combination of covering crops such as pearl millet, grain sorghum, maize, pigeon pea, sunn hemp, velvet bean and fallow and side dressing N at zero, 25, 50, 75, 100 and 125 kg/ha. Grain sorghum was a good option to provide high dry mass and recovery for the soil surface but not for increasing productivity of rice in succession in the no-till system. The situation was inversed when pigeon pea used as cover crop. Rice productivity, in succession, in a no-till system on upland is influenced differently by N fertilizer application during the 2 years
Other Title: Desempenho do arroz de terras altas com a aplicacao de doses de nitrogenio e em sucessao as culturas de cobertura do solo em sistema de plantio direto
Descriptors: application-rates. crop-yield. maize. millets. nitrogen-fertilizers. no-tillage. pearl-millet. pigeon-peas. rice. rotations. sunn-hemp

182. **Effect of nitrogen and fungicide application at booting stage on irrigated rice crop performance/** Camargo-E-R. Marchesan-E. Rossato-T-L. Telo-G-M. Arosemena-D-R, Bragantia, 2008, 67 (1), pages 153-159
Abstract: Factors limiting rice plant growing and development caused by nutritional deficiency, especially by lack of nitrogen and diseases, affect the photosynthetic capacity and rice yield. The objective of this experiment was to evaluate the effect of the nitrogen and fungicide application on booting stage in order to verify photosynthetic area and rice yield. This work was conducted in 2005/2006 in lowland area in Santa Maria, Rio Grande do Sul, Brazil. The treatments were nitrogen rates (50, 100, and 150 kg/ha), composing the factor A, and management practices during the booting stage (supplementary application of 30 kg N/ha, fungicide application, and the combination of the previous treatments, besides check treatment), composing the factor D. The treatments were arranged in a randomized experimental block design, in a factorial scheme with four replications. The nitrogen rates promoted differentiated effects in the evaluated characteristics until booting stage (number of stem m-2, leaf area index and SPAD reading). However, there was not verified interaction among the treatments during rice grains filling. The management practices carried out on booting stage did not affect foliar area and senescence, yield and components of rice yield. The low occurrence of diseases, the efficiency of nitrogen utilization and the suitable climatic conditions for rice yield can explain the lack response to the management practices
Other Title: Influencia da aplicacao de nitrogenio e fungicida no estadio de emborrachamento sobre o desempenho agronomico do arroz irrigado
Descriptors: crop-yield. leaf-area. leaf-area-index. nitrogen-fertilizers. photosynthesis. rice. senescence

183. **Growth and developmental of red and pad rice genotypes**
Streck-N-A. Michelon-S. Kruse-N-D. Bosco-L-C. Lago-I. Marcolin-E. Paula-G-M-de. Samboranha-F-K, Bragantia, 2008, 67 (2), pages 349-360
Abstract: The characterization growth and development of red rice biotypes may help control strategies, the enhancement of competitiveness of cultivated rice with this weed and breeding programmes. Field studies were conducted in Santa Maria, Rio Grande do Sul, Brazil, during the 2004/05 growing season, with 5 sowing dates, to quantity some growth and development parameters of 2 red rice biotypes compared to irrigated genotypes. The genotypes used were IRGA 421, IRGA 416, IRGA 417, IRGA 420, BR-IRGA 409, BRS 7 TAIM, EPAGRI 109, EEA 406, a hybrid and 2 red rice biotypes (awned yellowhull-AVCAA and awned blackhull-AVCPA). The date of major developmental stages in the COUNCE scale, leaf area, panicle length, plant height, phyllochron, main culm final leaf number and tillering were measured in 5 plants per plot. Red rice biotypes usually had an intermediate developmental cycle compared to cultivated rice genotypes, with AVCAA having a longer cycle than AVCPA. Red rice biotypes had greater leaf area, greater height, greater panicle length and greater phyllochron than modern rice genotypes. Tillering of red rice varied according to the sowing date
Other Title: Comparacao de parametros de crescimento e de desenvolvimento de dois biotipos de arroz vermelho com genotipos de arroz irrigado
Descriptors: crop-yield. genotypes. growth. leaf-area. leaves. panicles. plant-height. rice. sowing-date. tillering

184. **Infectivity and ecology of Pseudomonas spp. from natural epizootics in the rice leaf folder, Cnaphalocrocis medinalis (Lepidoptera: Pyralidae) in India/** Dangar-T-K,
Biocontrol Science and Technology, 2008, 18 (3), pages 241-253
Abstract: In 2001, populations of the leaf folder (LF) (Cnaphalocrocis medinalis Guenee) reached 19-30 larvae/hill in Rabi rice (variety Lalat) fields at Choudwar, Baranga, Alani and Tangi, Orissa, India infesting 61-98% of the plants. Three bacteria viz. Pseudomonas aeruginosa (Pa1 and Pa2) and P. fluorescens (Pf) infected 62-98% of the larvae in different fields. No correlation was found among populations of the Pseudomonas spp. on the rice phyllosphere and larvae harboring the bacteria at different fields. The median lethal concentrations (LC50s; * 103 bacteria/mL) of Pa1, Pa2 and Pf were 4-4.2, 4.8-4.9 and 5.7-5.9, respectively, for the leaf piece assay and 4.8-4.9, 5-5.1 and 6.3-6.7, respectively, for the potted plant assay against second to fifth instar larvae. The median lethal times (LT50s) were 2.1-2.4, 3.2-3.5 and 5.3-6 days for the leaf piece assay, and 4-4.7, 4.7-4.9 and 6.1-6.8 days for the potted plant assay with Pa1, Pa2 and Pf, respectively. The Pa1 and Pa2 were compatible, exhibited synergistic effect and co-inoculation reduced the LC50 and LT50 as compared to inoculation with individual organisms. The Pf had no synergism with Pa1 or Pa2, and therefore, the lethal values for Pf alone or with the other bacteria were similar. Fulfillment of Koch's postulates confirmed that Pa1, Pa2 and Pf were pathogens of C. medinalis
Descriptors: biological control; biological control agents; entomopathogenic bacteria; entomopathogens; infectivity; insect pests; larvae; microbial ecology; phyllosphere; plant pests; population dynamics; rice Cnaphalocrocis; Pyralidae; Lepidoptera; insects; Hexapoda; arthropods; invertebrates; animals; eukaryotes; South Asia; Asia; Developing Countries; Commonwealth of Nations; India; Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; Pseudomonas; Pseudomonadaceae; Gracilicutes; bacteria; prokaryotes

185. **Can results from a laboratory bioassay be used as an indicator of field performance of rice cultivars with allelopathic potential against Damasonium minus (starfruit)?**
Seal-A-N. Pratley-J-E. Haig-T,
Australian Journal of Agricultural Research, 2008, 59 (2), pages 183-188
Abstract: Several weeds of rice in Australia have developed resistance to the main herbicide available for their control. Allelopathy is one phenomenon that could be incorporated into an integrated weed-management system as a supplement or alternative to synthetic herbicides. Several rice cultivars were screened both in the laboratory and the field for allelopathic potential against a major rice weed, Damasonium minus. Results from the laboratory bioassay showed that there were significant differences among cultivars in their ability to inhibit D. minus root growth. D. minus root lengths ranged from 2.0% (cv. Hungarian #1) to 32.6% (cv. Rexmont) that of the control. In the field study, significant differences existed in the D. minus dry matter grown in association with different cultivars, ranging from 4.6% (cv. Tono Brea) to 72.2% (cv. Rexmont) that of the control. Comparison between laboratory and field results indicated a strong relationship between performance in the field and in the laboratory (r2=0.713). Those cultivars ranked as allelopathic in the bioassay tended to have associated lower D. minus dry weight in the field. Eight of the top 10 allelopathic cultivars in the bioassay were among the top 10 suppressive cultivars in

the field trial. This important finding indicates that at least some of the variation in field performance of cultivars may be predicted by their performance in bioassays
Other Title: Can results from a laboratory bioassay be used as an indicator of field performance of rice cultivars with allelopathic potential against Damasonium minus (starfruit)?
Descriptors: allelopathy. cultivars. dry-matter. growth. rice. roots. Weeds. Australia

186. **Impact of nutritional conditions on yields, germination rate and shelf-life of Plectosporium alismatis conidia and chlamydospores as potential candidates for the development of a mycoherbicide of weeds in rice crops/** Cliquet-S. Zeeshan-K, Biocontrol Science and Technology, 2008, 18 (7), pages 685-695
Abstract: The effect of nutritional conditions on spore qualities was investigated in order to select which propagules, conidia or chlamydospores, would be most suitable for mycoherbicide development. Plectosporium alismatis was grown in a liquid basal medium supplemented with glucose and a mineral nitrogen source (sodium nitrate) or an organic nitrogen source (casamino acids). Conidial and chlamydospore yields, germination rate and shelf-life were compared. Two growth models were developed: on one hand, sodium nitrate added as the sole nitrogen source was partially utilised (8%), resulting in poor growth (1.770.02 mg mL-1; 61.7*105 conidia mL-1). Under these conditions, P. alismatis produced dense, melanised-like aggregates that contained chlamydospores (12.40.7*104 chlamydospores mL-1). Germination rates of chlamydospores and conidia produced under these conditions was high (80%). Twenty percent of chlamydospores were able to germinate after 4 months storage at 25C, while survival of conidia declined rapidly (<2%). When casamino acids were added to the liquid medium as the sole nitrogen source, P. alismatis produced sparser pellets resulting in high dry weights (5.370.09 mg mL-1) and high conidia numbers (9.61.5*106 conidia mL-1), while no chlamydospore were observed. The germination rate of conidia produced in casamino acids was low (3313%) after 8 h incubation and microcycle conidiation occurred. Five percent of these conidia germinated after 4 months storage. These data indicate that chlamydospores may be suitable for mycoherbicide development, provided further optimisation of yields is achieved
Descriptors: biological control; biological control agents; chlamydospores; conidia; germination; glucose; mycoherbicides; rice; sodium nitrate; storage life; weeds Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

187. **Feasibility of automatic aeration for insect pest management for rice stored in East Texas/** Arthur-F-H. Yang-Y. Wilson-L-T. Siebenmorgen-T-J, Applied Engineering in Agriculture, 2008, 24 (3), pages 345-350
Abstract: Aeration using automatic controllers was compared with manually-activated aeration (manual aeration) in bins of farm-stored rice in Nome, Texas, from 17 September 2002 through the end of the year. Manual aeration was defined as the farm owner manually activating the fans in mid-October, while automatic aeration employed activation temperatures of 23.9 deg C, 15.6 deg C, and 7.2 deg C for three discreet cooling cycles. Population development of Rhyzopertha dominica (F.), the lesser grain borer, and Sitophilus oryzae (L.), the rice weevil, was assessed by confining 20 adults of each species with 150 g of rough rice in separate cages placed at 6 different locations in the top of the rice mass. Total heat units at temperatures above 15 deg C were 150 to 300 degree days (DD) lower in bins with automatic aeration compared to manual aeration. Temperatures from 17 September through mid-

October were 8 deg C to 10 deg C less in bins with automatic aeration than in with manual aeration, and 3 deg C to 6 deg C less during the remainder of the year. The number of adult R. dominica in the cages from bins with manual aeration were 45.4 plus or minus 13.1, 114.5 plus or minus 17.7, and 223.0 plus or minus 24.8 after 5, 10, and 15 weeks, respectively, while populations in cages from bins with automatic aeration were significantly less (P<0.05); 0.8 plus or minus 0.3, 24.5 plus or minus 4.5, and 21.7 plus or minus 2.7 after 5, 10, and 15 weeks, respectively. There was no statistical difference (Pmore than or equal to 0.05) in the number of adult S. oryzae collected in cages from bins with manual versus controlled aeration after 5 weeks (11.7 plus or minus 8.1 and 0.3 plus or minus 0.3, respectively), 10 weeks (14.7 plus or minus 7.1 and 18.0 plus or minus 9.6, respectively), and 15 weeks (39.0 plus or minus 21.2 and 10.5 plus or minus 5.6, respectively). However, the variation in the data set could have masked the apparent differences in the two aeration strategies
Descriptors: aeration. heat-sums. insect-control. insect-pests. pest-control. physical-control. rice. stored-products-pests. temperature

188. **Short-term effects of wheat straw incorporation into paddy field as affected by rice transplanting time/** Ma-J. Xu-H. Han-Y. Cai-Z-C. Yagi-K,
Australian Journal of Soil Research, 2008, 46 (3), pages 281-287

189. **Rice Policy in Indonesia: A Special Issue**
McCulloch-Neil. Timmer-C-Peter, Bulletin of Indonesian Economic Studies, 2008, 44 (1), pages 33-44

190. **Genetically Modified Rice, Yields, and Pesticides: Assessing Farm-Level Productivity Effects in China** / Huang-J. Hu-R. Rozelle-S. Pray-C,
Economic Development and Cultural Change, 2008, 56 (2), pages 241-263
Abstract: Although genetically modified (GM) crops are being grown on increasing large areas in both developed and developing countries, with few minor exceptions, there has been almost no country that has commercialized a GM major food crop. One reason may be that it is unclear how the commercialization of GM crops will help poor, small farmers. The objective of this article is to report on the results of an economic analysis that uses 3 years of data from a series of quasi-experimental areas (called preproduction trials) in China's GM rice program that were carried out in the fields of small and relatively poor producers in two provinces in China. The article shows that the use of GM rice by farmers in preproduction trials allows farmers to reduce pesticide use and labor input. The effect on yields is less clear, and the findings suggest that there is very little if any yield effect. The article concludes by arguing that the commercialization of GM rice in China could have consequences that exceed the direct impacts on China's farmers and could be a key step in breaking the world's current plant biotechnology logjam
Descriptors: Economic Development: Agriculture; Natural Resources; Energy; Environment; Other Primary Products. Collectives; Communes; Agriculture. Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets. Agricultural R&D; Agricultural Technology; Agricultural Extension Services

191. **Effects of enzyme supplementation on growth, intestinal content viscosity, and digestive enzyme activities in growing pigs fed rough rice-based diet**
Wang-M-Q. Xu-Z-R. Sun-J-Y. Kim-B-G, Asian-Australasian Journal of Animal Sciences, 2008, 21 (2), pages 270-276

Abstract: The purpose of the present study was to investigate the effects of exogenous non-starch polysaccharides (NSP) enzymes on the performance, intestinal content viscosity and digestive enzyme activities of growing pigs fed a rough rice-based diet. A total of 60 crossbred barrows with an initial body weight of 35.16 kg (SD=0.82) were blocked by body weight and randomly assigned to two treatments with three replications. Each group was fed the diet based on rice with or without exogenous NSP enzymes (2 g/kg of diet). During the 70 days of the feeding trial, all pigs were given free access to feed and water. At the end of the feeding trial, six pigs from each treatment were randomly selected and slaughtered to collect intestinal digesta, intestinal mucosa and pancreas. The addition of NSP enzymes improved the average daily gain ($p<0.05$) and feed:gain ($p<0.05$) and decreased the viscosity of digesta in the jejunum ($p<0.001$) and ileum ($p<0.01$) of pigs. Supplementation of NSP enzymes increased the activities of protease ($p<0.01$), trypsin ($p<0.01$) and alpha - amylase ($p<0.05$) in duodenal contents. However, digestive enzymes in the pancreas, jejunal and ileal mucosa were unaffected by supplemental NSP enzymes ($p>0.10$). The results indicate that the addition of NSP enzymes to rough rice-based diets improved the performance of pigs, reduced viscosity and increased digestive activity in the small intestine
Descriptors: digesta. duodenum. enzyme-activity. enzymes. feed-additives. feed-conversion-efficiency. feed-supplements. growth. ileum. intestinal-mucosa. jejunum. liveweight-gain. pancreas. pig-feeding. proteinases. trypsin. viscosity

192. **Use of in vitro gas production technique to investigate interactions between rice straw, wheat straw, maize stover and alfalfa or clover**
Tang-S-X. Tayo-G-O. Tan-Z-L. Sun-Z-H. Wang-M. Ren-G-P. Han-X-F,
Asian-Australasian Journal of Animal Sciences, 2008, 21 (9), pages 1278-1285
Abstract: Measurement of gas produced during in vitro fermentation was used to investigate the fermentation characteristics and interactions of rice straw, wheat straw or maize stover mixed with alfalfa or clover at proportions of 100:0, 75:25, 50:50, 25:75 and 0:100, respectively. Cumulative gas production was recorded at 2, 4, 8, 12, 16, 24 and 48 h of incubation, and the Gompertz function was used to describe the kinetics of gas production. in vitro dry matter and organic matter disappearances (IVDMD and IVOMD) were determined after 48 h incubation. The rate of gas production of clover was higher ($p<0.05$) than that of rice straw, wheat straw, maize stover and alfalfa when straws and hays were incubated separately. Increasing the proportion of alfalfa in the straw-alfalfa mixtures increased ($p<0.05$) the rates, but not the maximum volume of gas production. However, both rate and the maximum volume of gas production were increased ($p<0.01$) as the proportions of clover increased in the straw-clover mixtures. The cumulative gas production at 48 h, IVDMD and IVOMD showed no consistent interaction effects between different mixtures of cereal straws and hays. The extent of interactive effects was affected by the types of cereal straw, legume hay and their proportions in the mixture. The appropriate combination for the mixture of rice straw or maize stover with leguminous hays was 75:25 and 25:75, respectively. The better combination occurred at a proportion of 50:50 for the mixture of wheat straw and alfalfa. We conclude that the suitable proportion of low-quality straw and high quality legume hay combination should be considered in the ration formulation system of ruminants according to the extent of positive interactive effects

Descriptors: clover-hay. clovers. dry-matter. gas-production. hay. in-vitro. legumes. lucerne. maize-stover. organic-matter. rice. rice-straw. rumen-fermentation. straw. wheat. wheat-straw. alfalfa. paddy

193. **Rice Policy in Indonesia: In This Special Issue: Notes from the Editor**
McLeod-Ross-H, Bulletin of Indonesian Economic Studies, 2008, 44 (1), pages 5-6

194. **Histological changes of tissues and cell wall of rice straw influenced by chemical pretreatments/** Wang-JiaKun. Chen-XiaoLian. Liu-JianXin. Wu-YueMing. Ye-JunAn, Asian-Australasian Journal of Animal Sciences, 2008, 21 (6), pages 824-830
Abstract: Sodium hydroxide (SH) or ammonium bicarbonate (AB) were applied to rice straw to investigate the effects on histological change of stem tissue or cell wall before and after in sacco degradation using a scanning electron microscope (SEM) and a transmission electron microscope (TEM). The SEM revealed that, the parenchyma and vascular bundles were distorted by treatment with SH at 30 or 45 g/kg straw dry matter. Faultage between phloem of large vascular bundles and parenchyma occurred with further increasing SH to 60 or 75 g/kg. The cell wall in these stem tissues was crimped when observed by TEM. However, only parenchyma and large vascular tissues were slightly distorted in AB-treated stem. For untreated and AB-treated stems, the initiation of observable ruminal degradation of cell wall was prolonged from 12 h for inner parenchyma to 24 h for sclerenchyma and to 48 h for phloem of small vascular bundles, while the outer epidermis was intact even at 72 h. For SH-treated stem, however, the cell wall from all of the investigated tissues, epidermis, small vascular bundles, sclerenchyma, and parenchyma started to be degraded at 12 h incubation. These results indicate that SH treatment contracts rice straw stem leading to an improvement in rumen degradation, and that the degradation of SH-treated stem is bilateral from inner and outer surface simultaneously
Descriptors: ammonium-bicarbonate. cell-wall-components. chemicals. degradation. electron-microscopes. morphology. rice. rice-straw. sodium-hydroxide. straw

195. **Supplementing maize or soybean hulls to cattle fed rice straw: intake, apparent digestion, in situ disappearance and ruminal dynamics**
Nguyen-Tien-Von. St-Louis-D-G. Orr-A-I. Rude-B-J,
Asian-Australasian Journal of Animal Sciences, 2008, 21 (6), pages 807-817
Abstract: Steers with ad libitum access to rice straw were assigned to four diets to evaluate the effects of maize or soybean hull supplementation on intake, in vivo digestibility, ruminal pH, VFA, ammonia-nitrogen (NH3-N) and in situ ruminal disappearance of feed nutrients by cattle consuming rice straw. Supplement treatments were: no supplement (RS); soybean meal at 0.127% BW (SBM); cracked maize at 0.415% BW plus 0.044% BW soybean meal (MAIZE); or soybean hulls at 0.415% BW plus 0.044% BW soybean meal (HULLS). The MAIZE and HULLS diets were formulated to provide approximately 4 MJ of NEm per kg of diet. Rice straw DMI was not affected ($p=0.34$) by supplement. Apparent dry matter (DM) digestibility was greater ($p<0.001$) for MAIZE and HULLS (56.6 and 60.0%, respectively) than for steers consuming SBM or RS (51.8 and 44.4%, respectively). Apparent NDF digestibility was greater ($p<0.0004$) for HULLS than MAIZE (61.7 vs. 58.0%, respectively) and apparent ADF digestibility was greater ($p<0.0008$) for HULLS than MAIZE (61.1 vs. 49.2%, respectively). There was no difference in apparent hemicellulose digestibility ($p=0.43$). Analysis of ruminal fluid collected 0, 2, 4, 6, and 8 h post-feeding revealed ammonia-nitrogen was greatest ($p<0.05$) for steers

on SBM and HULLS diets at 2 h (24.08 and 22.57 mg/dl, respectively) and total volatile fatty acids was greatest ($p<0.05$) for HULLS at 4 h (230 mM/L). In situ disappearance, measured at 0, 2, 4, 6, 8, 16 and 24 h, indicated that SBM, MAIZE and HULLS tended to enhance the digestibility of DM and fiber components of rice straw. In situ disappearance of rice straw DM was greatest for SBM and/or HULLS from 4 to 24 h ($p=0.03$). Rice straw NDF and ADF disappearance was enhanced by supplementation from 16 to 24 h ($p<0.02$). Rice straw DM, NDF and ADF disappearances at 24 h were similar for MAIZE and HULLS treatments. When feeding cattle rice straw diets, energy and protein-based supplements are essential. This study showed that fiber-based supplements are just as, if not more, effective as starch-based supplements in rice straw utilization. This study shows that soybean hulls, in spite of their high fiber content, are as efficient as maize for supplementing rice straw primarily because fiber in soybean hulls is highly digestible as shown by in vivo digestibility and in situ disappearance
Descriptors: ammonium-nitrogen. diets. digestibility. feed-intake. hemicelluloses. husks. maize. pH. rice. rice-straw. rumen-digestion. soyabeans. steers. straw. supplementary-feeding. volatile-fatty-acids
Identifiers: ammonia nitrogen. bullocks. corn. digestion in rumen. hulls. hydrogen ion concentration. paddy. potential of hydrogen. soybeans

196. **Effect of storage time on the rancidity and metabolizable energy of rice polishing in poultry**
Pasha-T-N. Khattak-F-M. Khan-D-R. Jabbar-M-A,
Asian-Australasian Journal of Animal Sciences, 2008, 21 (3), pages 420-425
Abstract: The storage office polishing (RP) with and without addition of antioxidant for sixteen weeks and its effect on rancidity and metabolizable energy values during the summer season was determined. Fifteen Single Comb White Leghorn cockerels of approximately uniform age and weight were procured and kept in metabolic cages under standard feeding and management practices. Five force feeding trials were conducted. In the first trial, fresh RP with 0 weeks of storage (diet 1 and 2) was used followed by four feeding trials with 4 (diet 3, 4), 8 (diet 5, 6), 12 (diet 7, 8), and 16 (diet 9, 10) weeks of storage of RP. The same birds were used in all trails. The birds were fasted for a period of 21 h, followed by force feeding of 20 g of RP with and without antioxidant for all storage periods. The control/fasting group was also maintained to measure endogenous fecal losses. Excreta were collected after 48 h for the determination of AME and TME values of RP. Along with the biological trials, laboratory assay of the RP stored with and without antioxidant was conducted to measure the extent of rancidity in terms of Thiobarbituric acid value (TBA). The TBA values were affected ($p<0.05$) by storage period and the values increased when the storage period increased from 4 to 16 weeks. However, the TBA values were significantly reduced ($p<0.05$) when RP was stored after addition of antioxidant when compared with the values obtained from RP stored without antioxidant (diet 3 vs. 4, 5 vs. 6, 7 vs. 8, and 9 vs. 10). The AME MJ/kg and TME MJ/kg values of RP were neither affected by increase in storage period nor addition of antioxidant. The findings of this study revealed that there was no effect of rancidity and storage time on the nutritive value, AME or TME of RP in poultry. However, TBA values were increased with the increase in storage period
Descriptors: metabolizable-energy. nutritive-value. poultry. rancidity. rice-polishings. storage

197. **Energy requirement of different weed management practices for aerobic rice in India**
Chaudhary-V-P. Pandey-D-K. Sharma-S-K, AMA,
Agricultural Mechanization in Asia, Africa and Latin America, 2008, 39 (2), pages 39-46
Abstract: An analysis of the energy requirements for the rice (Oryza sativa L.) was conducted at the Research farm of Project Directorate for Cropping Systems research, Modipuram, Meerut during the year of 2000-01 to 2003-04. Selected weed management practices: hand weeding twice, herbicides+one hand weeding, criss-cross sowing+one hand weeding, criss-cross sowing+herbicides+one hand weeding, unweeded check were subjected to aerobic rice crop to assess the energy use, out put energy obtained and net return of energy. Results revealed that the total input energy utilization in rice varied from 31,230.6 MJ/ha to 32,252.3 MJ/ha in unweeded check and criss-cross+herbicides+hand weeding, respectively. The energy use by irrigation represented the major part of total energy use, accounting about 47.6 percent followed by fertilizers about 32 percent in all treatments, whereas, machinery consumed from 11.5 to 12.5 percent of total input energy. Total amount of energy use in weed management varied from 1.18 to 2.88 percent of the total input energy. Hand weeding twice was more energy consuming than other treatments. This was followed by herbicides+hand weeding once as well as criss-cross sowing+herbicides+hand weeding once. The energy utilization for weed management was slightly higher in traditional seedbed as compared with stale seedbed. The output energy in criss-cross sowing+herbicides+hand weeding once was from 83 to 89 percent higher than unweeded, 55 percent higher than criss-cross sowing+hand weeding once, from 9 to 13 percent higher than hand weeding twice and 4 percent higher than herbicides+hand weeding once. The net return energy, among five treatments, was found to be significantly high in criss-cross sowing+herbicides+hand weeding once (i.e. 51,043.5 MJ/ha in stale seedbed and 44,363.7 MJ/ha in traditional seedbed) than other treatments, which was statistically at par with treatment herbicides+hand weeding once (i.e. 47,789.6 MJ/ha in stale seedbed and 44,847.2 MJ/ha in traditional seedbed). This was followed by hand weeding twice (i.e. 40,806.6 MJ/ha in stale seedbed and 37,591.5 MJ/ha in traditional seedbed) and criss-cross sowing+hand weeding once (i.e. 6,214.9 MJ/ha in stale seedbed and 1,534.2 MJ/ha in traditional seedbed) which had significant difference in the same seedbed preparation. However, the unweeded treatment gave negative net return energy. So, without weed management, practices adopted will not able to get output energy
Other Title: Energy requirement of different weed management practices for aerobic rice in India
Descriptors: chemical-control. energy-consumption. energy-requirements. manual-weed-control. rice. sowing. weed-control

198. **Development and evaluation of anaerobic type sprouted rice drum seeder and to ascertain the physiological load on the operator/** Devnani-R-S, AMA,
Agricultural Mechanization in Asia, Africa and Latin America, 2008, 39 (2), pages 23-33
Abstract: A number of pre-germinated rice seeders have been developed and recommended as an alternative technology to the rice farmers who are practicing manual transplanting of rice seedlings. The studies conducted on drum seeders have proven that there is no difference in the yield levels as compared to transplanted rice.

The wet seeding technology reduced the labor, water and the crop maturity period. The cost of drum seeders reported in India were in the range of Rs.2500-3000 during 2001. The physiological load on the operator for wet seeding operation with eight, six and four row drum seeders was reported as extremely heavy field work. These units required two workers to operate in fields. Therefore, the project to refine the design of pregerminated rice seeder of anaerobic type by making it light weight and easy to manouevre in small plots was taken. Based on theoretical analysis of two row drum seeders with 20 cm row spacing, the drum seeder was designed for seeding rates varying from 60-200 kg/ha. The cost of drum seeder was estimated as Rs.750/-. The developed seeder was evaluated for field performance on four varieties namely IR-36, Vandna, Krishna Hamsa and Kalinga-III. The seeding rates varied from 125-215 kg/ha and the high plant stand was achieved. The crop yield levels reported were for IR-36 4.07 tons/ha, Vandana 2.82 tons/ha, Krishna Hamsa 3.73 tons/ha and Kalinga-III 4.06 tons/ha. The operating load on the worker was measured in terms of increase in heart beat rate. The operator was allowed to work at different speeds and his heart beat rate was monitored. The operator covered the maximum area of 352 sqm/h by seeder but at the end of 30 minutes of operation his heart beat rate reached to 155-165 beats/min. The allowable heart beat rate increase of 40 beats/min was achieved with a field coverage of 198.9 sqm/hour. Thus, the developed two-row drum seeder was easily operated for anaerobic sowing of small plots at a field capacity of 199 sqm/h in backward walking mode of operation
Other Title: Development and evaluation of anaerobic type sprouted rice drum seeder and to ascertain the physiological load on the operator
Descriptors: costs. crop-yield. drills. labour. operating-range. rice. row-spacing. sowing. sowing-rates. transplanting. varieties

199. **Responses of upland NERICA rice to nitrogen and phosphorus in forest agroecosystems**
Oikeh-S-O. Nwilene-F. Diatta-S. Osiname-O. Toure-A. Okeleye-K-A,
Agronomy Journal, 2008, 100 (3), pages 735-741
Abstract: New Rice for Africa (NERICA) cultivars are widely adopted interspecific crosses between Oryza sativa and O. glaberrima but their responses to fertilizer was not known. In 2004 and 2005, four released NERICAs (NERICA 1, 2, 3, 6) under two levels of phosphorus (0 and 2.6 g m-2) and four of nitrogen (0, 3, 6, and 12 g m-2) were evaluated on an acid Typic Haplustult at Ikenne (6 deg 54'N, 3 deg 42'E) in the Nigerian forest agroecosystem. In 2004, averaged over N levels, NERICA 3 attained physiological maturity most quickly (92 days after seeding [DAS]) at 2.6 g P m-2. But under drought stress (2005), although NERICA 3 was the first to initiate panicles (49 DAS) and to reach midflowering (73 DAS), maturity was delayed until 100 to 101 DAS with or without P. Also, in 2005, NERICA 6 took a much longer time to mature (110-111 DAS) than the other cultivars. Therefore, NERICAs 3 and 6 were the least suitable cultivars for low-input, drought-prone environments. At low N of 3 g m-2 and zero P, paddy yield was highest in NERICA 1. With application of 12 g N m-2, NERICA 1 also yielded 20 to 41% more than the others, implying that it had a potential for tolerance to low N and was the most N-responsive among the cultivars evaluated under limited P. Moderate levels of N (6 g m-2) and P (2.6 g m-2) are recommended for NERICAs in smallholder low-input production systems
Descriptors: agroforestry-systems. application-rates. crop-yield. cultivars. drought. drought-resistance. flowering. maturity. nitrogen. nitrogen-fertilizers. panicles.

phosphorus. phosphorus-fertilizers. plant-water-relations. rice. soil-types. Ultisols. upland-rice. water-stress

200. **Postanthesis moderate wetting drying improves both quality and quantity of rice yield**
Zhang-Hao. Zhang-ShenFeng. Yang-JianChang. Zhang-JianHua. Wang-ZhiQin, Agronomy Journal, 2008, 100 (3), pages 726-734
Abstract: A major challenge in rice (Oryza sativa L.) production in China is to cope with a declining availability of fresh water without compromising grain yield and grain quality. This study was designed to determine if alternate wetting and moderate soil drying during grain filling could maintain grain yield and grain quality. Two rice cultivars, Zhendao 88 (japonica) and Shanyou 63 (indica), were field-grown at Yangzhou, China. Three irrigation treatments, alternate wetting and moderate soil drying (WMD, rewatered when soil water potential reached -25 kPa at 15-20 cm depth), alternate wetting and severe soil drying (WSD, rewatered when soil water potential reached -50 kPa), and conventional irrigation (CI, continuously flooded), were conducted from 6 d after heading to harvestable maturity. Root oxidation activity, the photosynthetic rate of the flag leaf, and activities of key enzymes in sucrose-to-starch conversion in grains during the late grain-filling stage were significantly increased under WMD, whereas they were significantly reduced under WSD. The grain yield was increased by 9.3 to 9.5% under WMD, while it was reduced by 7.5 to 7.8% under WSD, when compared with that under CI. Water applied to WMD was 44% and to WSD was 25% of the amount applied to CI. The WMD significantly improved milling, appearance, and cooking qualities, while WSD decreased these qualities. We conclude that a moderate wetting drying regime during the grain-filling phase of rice holds great promise to both increase yield quantity and quality and also could save precious fresh water resources
Descriptors: cooking-quality. crop-quality. crop-yield. drying. drying-wetting-cycles. enzymes. flag-leaf. irrigation. milling-quality. oxidation. photosynthesis. rice. roots. soil-water-potential. starch. sucrose

201. **Rice growth, grain yield, and floodwater nutrient dynamics as affected by nutrient placement method and rate/** Vibhu-Kapoor. Singh-U. Patil-S-K. Magre-H. Shrivastava-L-K. Mishra-V-N. Das-R-O. Samadhiya-V-K. Sanabria-J. Diamond-R, Agronomy Journal, 2008, 100 (3), pages 526-536
Abstract: The loss of major nutrients can be high in rice (Oryza sativa L.) fields, particularly rainfed rice, where water flowing from field to field during periods of high rainfall not only reduces the nutrient use efficiencies but also has the potential for environmental degradation. We examined the influence of deep point placement of N, P, and K briquettes compared to broadcast incorporation of N, P, and K on floodwater nutrient loads after fertilizer application and on the performance of wet season rice in a Vertisol. Broadcast application of N as urea resulted in an average 10 times higher amounts of ammonium N in floodwater compared to deep placement of urea briquette. The broadcast application of single superphosphate resulted in 67 times higher amounts of P in floodwater than plots receiving deep placed P. The floodwater NH4+-N and P content in the deep placement treatments were negligible - similar to floodwater N and P content without fertilizer application. The floodwater K amounts were also significantly lower with deep placed N-P-K briquettes. Significantly higher grain and straw yields, total N, P, and K uptake, and N and P use efficiencies were observed with deep placement of N-P-K compared to broadcast

application of N-P-K. Deep placed N-P briquettes gave significantly higher grain yield, straw biomass, total P and K uptake, apparent P recovery, and agronomic N and P use efficiencies when plant spacing was reduced from 20 by 20 cm to 20 by 10 cm. Closer plant spacing led to better utilization of P and K and provided opportunities for deep placement of N-P or N-P-K briquettes in soils with low available P. Combining site specific characteristics (high soil pH, low percolation rate, high rainfall and surface runoffs) with plant spacing and N-P-K briquettes prepared based on site-specific nutrient requirements offers potential for higher yields, improved fertilizer use efficiency, balanced fertilization, and reduced nutrient losses
Descriptors: ammonium-nitrogen. biomass. briquettes. broadcasting. crop-yield. deep-placement. growth. nitrogen. nitrogen-fertilizers. nutrient-uptake. percolation. phosphorus. phosphorus-fertilizers. potassium. potassium-fertilizers. rain. rice. rice-straw. runoff. soil-pH. soil-water-movement. spacing. straw. superphosphate. urea. use-efficiency

202. **Simulating leaf appearance in rice**
Streck-N-A. Bosco-L-C. Lago-I, Agronomy Journal, 2008, 100 (3), pages 490-501
Abstract: Most rice (Oryza sativa L.) simulation models assume that only temperature affects leaf appearance rate (LAR). This assumption ignores results from controlled environment studies that show that LAR in rice is not constant with time (calendar days) under constant temperature. The Streck model, which takes into account age effects on LAR, improved the prediction of leaf appearance in winter wheat (Triticum aestivum L.) cultivars compared with the Wang and Engel (WE) model and the phyllochron model but has not been evaluated in rice. The objective of this study was to adapt and evaluate the Streck model to simulate main stem LAR and leaf number in rice. A 4-yr experiment with several sowing dates from 2003-2004 to 2006-2007 was performed at Santa Maria, RS, Brazil. Seven rice cultivars were used: IRGA 421, IRGA 420, IRGA 417, IRGA 416, BRS 7 (TAIM), BR-IRGA 409, and EPAGRI 109. Plants were grown in 12-L pots during the 4 yr, and in a paddy rice field during the 2006-2007 growing season. Coefficients necessary to run the Streck model, the WE model, and the phyllochron model were estimated with data from five sowing dates of the 2003-2004 growing season and the models were evaluated with independent data from the other three growing seasons. Predictions of the main stem leaf number, represented by the Haun Stage (HS), were better with the Streck model. The RMSE was 0.7, 1.0, and 1.8 leaves, for the Streck model, the WE model, and the phyllochron model, respectively
Descriptors: cultivars. estimation. growth. leaves. plant-development. prediction. rice. simulation. simulation-models. sowing-date. stems

203. **Predicting rice yield response to midseason nitrogen with plant area measurements**
Stevens-G. Wrather-A. Rhine-M. Vories-E. Dunn-D, Agronomy Journal, 2008, 100 (2), pages 387-392
Abstract: A simple method is needed to aid farmers with midseason nitrogen (MSN) decisions in dry-seeded, delayed flood rice (Oryza sativa L.). This study was conducted to develop thresholds using visual and digital image measurements for predicting rice yield response to MSN. 'Francis' and 'Cheniere' rice were drill seeded on 19-cm row spacing from 2004 to 2006 on silt loam and clay soils at Glennonville and Portageville, MO. Preflood N (PFN) was applied at rates of 0, 39, 78, 118, and

157 kg urea-N ha-1 with and without two MSN applications of 34 kg N ha-1 at panicle differentiation (R1) and at R1+7d. Plant area observations were made 1 to 2 d before R1. In each plot, a yardstick was floated on floodwater positioned between two center rows. Visible inch numbers were counted while standing above the rows. A number was not counted when rice leaves obstructed the view of one or more digits in the whole number. Plant height was measured, and digital images of canopy were analyzed to determine percent green pixels. Highest rice yields on both soils were most often achieved with 78 kg N ha-1 with MSN or 118 kg N ha-1 without MSN. The PFN significantly affected visible yardstick numbers, plant height, and percent green pixels. Height was the least reliable indicator of rice N status. Using regression analysis, no rice yield increase from MSN was produced when fewer than 13 yardstick numbers were showing or more than 64% of image pixels were green
Descriptors: crop-yield. imagery. nitrogen-fertilizers. plant-height. rice. yield-forecasting

204. **Sequence analysis of DSSAT to select optimum strategy of crop residue and nitrogen for sustainable rice-wheat rotation/** Sarkar-R. Sandipta-Kar, Agronomy Journal, 2008, 100 (1), pages 87-97
Abstract: Weather variability affects the production of most cropping systems, and rice (Oryza sativa L.)-wheat (Triticum aestivum L.) rotation is not an exception. Integrating weather forecasts with soil fertility management options is one way to combat the production decrease by anticipating weather variability along with sustaining the soil environment. Sequence analysis of DSSAT3.5 was used to select the best combination of crop residue and N application rate for sustainable production of rice-wheat rotation under generated weather. CERES-Rice and CERES-Wheat of DSSAT3.5 were calibrated and validated for rice and wheat crops. Weather generator SIMMETEO was used to generate the weather variables of 30 future years. The variables generated by SIMMETEO, which closely matched with actual weather variables, were used for yield prediction by the sequence analysis program driver. The regression analysis showed a strong relationship between generated rainfall values and predicted yield. The different crop residue levels and N rates were compared for transplanted rice-wheat (T) and direct seeded rice-wheat (D) rotation under 10 yr of generated weather scenario. The sequence analysis of DSSAT predicted the combination of wheat crop residue with 100 kg N ha-1 for rice and rice residue with 80 kg N ha-1 for wheat provided stable yield for both T and D rotation. These combinations of crop residues and N rates were also predicted best for stable rotations under 30 yr of generated weather
Descriptors: application-rates. crop-residues. crop-yield. nitrogen-fertilizers. rain. regression-analysis. relative-humidity. rice. rotations. sustainability. temperature. weather. wheat. wind-speed. yield-forecasting

205. **The ecologically optimum application of nitrogen in wheat season of rice-wheat cropping system/** Liang-X-Q. Li-H. He-M-M. Chen-Y-X. Tian-G-M. Xu-S-Y, Agronomy Journal, 2008, 100 (1), pages 67-72
Abstract: Because excessive application of N fertilizer for crop production leads to environmental pollution and low N utility efficiency, a better understanding of the effects of N application rates on crop yields and NO3-N leaching is required for developing optimum ecological N management that reduces NO3-N leaching while keeping crop yield. Field experiments at two sites in the Taihu region of China were conducted to study the ecologically optimum application of N in wheat (Triticum

aestivum L.) season of rice (Oryza sativa L.)-wheat cropping system. The experiment at either site had five N rates on wheat (0-360 kg N ha-1 in 90-kg increments) and NO3-N in leachate were collected by wedge-shaped fiberglass wick lysimeters. At either site, the N-wheat yield quadratic response curve was fitted quite well and a significantly linear relationship between N rates and seasonal NO3-N masses in leachate was also found. The calculated economically optimum N rate for wheat was more site related than depending on changing growing conditions from year to year, while the ecologically optimum N rate was significantly different both at sites and growing conditions (P=0.01). The results suggest that applying the ecologically optimum N rates of 120-180 kg N ha-1 to wheat is beneficial for maximally reducing NO3-N leaching loss but minimally decreasing yield
Descriptors: application-rates. crop-yield. leaching. nitrate-nitrogen. nitrogen-fertilizers. rice. wheat

206. **The use of safety devices in adoption of agro-chemicals by rice farmers in Obafemi-Owode Local Government Area of Ogun State/** Kuponiyi-F-A. Adewale-J-G,
African Journal of Food, Agriculture, Nutrition and Development, 2008, 8 (4), pages 427-440
Abstract: Studies were conducted to assess the knowledge and use of rice agrochemicals and also the knowledge and use of safety devices and methods attached to the proper application of the chemicals among rice farmers of Obafemi-Owode Local Government Area (LGA) of Ogun, Nigeria. The multi-stage random sampling technique was used to select the respondents for this study. The list of rice farmers in the study area who were registered with the Agricultural Development Zonal office was procured and the functioning ones among them determined by preliminary field tour. A total of 127 functioning farmers were finally randomly selected and data procured from them through the administration of validated structured interview schedule. About two-thirds of the farmers were not more than 50 years old, 87% were married, while 66% were literate. About 86% were full-time small-scale rice farmers (69% growing less than 2.6 ha), while only 48.8% of these had fortnightly contact with agricultural extension agents. Most of the farmers (72.4%) were land secure, while about half relied solely on hired labour. The knowledge level of agrochemicals and their level of use were moderately high. About 41% of them depended on extension agents as major sources of information about rice agrochemicals. Other major sources were salesmen of agrochemicals, rice merchants, radio and television. However, the knowledge level and actual use of safety devices and methods were low. Age and educational level were significantly related to the knowledge of safety devices and methods used in the application of rice agrochemicals. The literacy level of farmers need to be raised, while extension agents need to intensify their visit and campaign on the use of rice agrochemicals, particularly the safety devices and methods attached to the application of the chemicals
Descriptors: age; agricultural chemicals; extension; extension agents; extension education; farmers' attitudes; literacy; rice; safety West Africa; Africa South of Sahara; Africa; Developing Countries; ACP Countries; Commonwealth of Nations; Anglophone Africa; Oryza; Poaceae; Cyperales; monocotyledons; angiosperms; Spermatophyta; plants; eukaryotes

207. **Characterization and greenhouse evaluation of Brazilian calcined nonapatite phosphate rocks for rice**
Francisco-E-A-B. Chien-S-H. Prochnow-L-I. Austin-E-R. Toledo-M-C-M. Taylor-R-W, Agronomy Journal, 2008, 100 (3), pages 819-829
Abstract: Little information is available on the agronomic effectiveness of calcined nonapatite phosphate rock (PR) sources containing crandallite minerals in the form of Ca-Fe-Al-P for flooded and upland rice (Oryza sativa L.). We conducted laboratory and greenhouse studies to (i) characterize the mineralogical composition, (ii) investigate the solubility and dissolution behavior, and (iii) evaluate the agronomic effectiveness of two nonapatite PR sources (Juquia and Sapucaia) from Brazil and compared them with (i) a highly reactive Gafsa PR (Tunisia) containing apatite in the form of Ca-P and (ii) a reference water-soluble triple superphosphate (TSP) for flooded and upland rice. After calcination at 500 deg C for 4 h, the solubility of Juquia PR and Sapucaia PR in neutral ammonium citrate (NAC) significantly increased from almost nil to a maximum of 39.3 and 114 g P kg-1, respectively. X-ray diffraction showed that crystalline crandallite mineral was transformed to an amophorus form after calcination. The solubility behavior of the two calcined PR sources followed the same trend as Gafsa PR, that is, P release decreased with increasing equilibrium pH in the 0.01 M KCl solution (pH 3.0-8.0). At pH 3, the solubility followed: Gafsa PR > calcined Sapucaia PR > calcined Juquia PR. No P release was detected from any of the PR sources at pH more than or equal to 5.0 in the solution, indicating the Ca-P characteristic of the Ca-Fe-Al-P mineral controlled P dissolution of the calcined PR. Without calcination, both Juquia PR and Sapucaia PR were totally ineffective for upland rice grown on a Hiwassee clay loam (fine, kaolinitic, thermic Rhodic Kanhapludult) with pH 5.4 whereas a significant P response was observed with the calcined PR samples. For flooded rice grown on Hiwassee soil, the calcined Juquia PR and Sapucaia PR were 66 and 72%, respectively, as effective as TSP in increasing rice grain yield whereas Gafsa PR was ineffective. For upland rice grown on the unlimed soil, Gafsa PR was as effective as TSP in increasing rice grain yield whereas calcined Juquia PR and Sapucaia PR were 89 and 83% of TSP. The effectiveness of Gafsa PR was reduced to 0% after the soil was limed to pH 7.0 whereas the two calcined PR sources were reduced to 49% of TSP. Soil available P extracted by iron oxide impregnated filter paper (Pi test) or anion-exchange resin after rice harvest correlated well with P uptake by rice grain for flooded and upland rice
Descriptors: apatite. calcination. chemical-composition. clay-loam-soils. crop-yield. liming. mineralogy. nonclay-minerals. phosphorus. rice. rock-phosphate. soil-pH. soil-types. Ultisols. upland-rice

208. **Field application of modified low cost dryer for rice seed drying - a case study in West Java and Central Java, Indonesia/** Rachmat-R. Lubis-S. Rickman-J-F. Nagraha-S. Gummert-M. Sudaryono. Thahir-R, AMA,
Agricultural Mechanization in Asia, Africa and Latin America, 2008, 39 (1), pages 46-48
Abstract: An overview has been given of the research and development in rice handling and processing that was carried out as a case study at the farmer level in West Java and Central Java, Indonesia. The objective of this research was to improve the efficiency and profitability of rice seed processing. Attempts were made to improve rice seed quality at the farmer level by focusing on the drying with the modified IRRI low cost dryer (LCD). The measurement parameters were moisture

content, sound seed, and germination rate. Results indicated that seed drying by LCD had significant quality with normal seedling (95.0-97.0%), sound seed (98.7-99.4%) and insect infestation (0-9%)
Descriptors: air-temperature. driers. drying. efficiency. handling. humidity. moisture-content. profitability. rice. seed-germination. seed-quality. Seeds

209. **Evaluation, constraints and acceptability of different types of vertical conveyer reaper for harvesting rice in coastal Orissa, India/** Parida-B-C, AMA, Agricultural Mechanization in Asia, Africa and Latin America, 2008, 39 (1), pages 29-32
Abstract: One vertical conveyer reaper mounted on a tractor and three different makes of self propelled reaper were evaluated for harvesting rice in CRRI farm and nearby farmers' fields in coastal districts of Orissa, India. The average field capacity for the tractor operated reaper was 0.34 ha/h whereas the average field capacity for a self-propelled reaper was 0.19 ha/h. The grain loss was less than 0.5% and was admissible. The manpower requirement for the reaper was 59-61 h/ha while that for manual harvesting was 240 h/ha. The cost of harvesting was cheaper. However, the predicament of land situation, approach road, and standing water at the time of harvesting stands in the way of acceptability of the machine. However, the availability of the machine and easy and quick availability of spare parts is a must for large scale acceptance of the reaper windrower
Descriptors: coastal-areas. farm-machinery. farmers'-attitudes. harvesters. harvesting. labour. mechanization. operating-costs. rice. tractors

210. **Engineering the application of grain protectants on F1 hybrid rice seeds: the Philippine-HRCP experience** / Orge-R-F. Abon-J-E-O, AMA, Agricultural Mechanization in Asia, Africa and Latin America, 2008, 39 (4), pages 55-62
Abstract: In 2002, when the commercialization of the hybrid rice technology in the Philippines started and was carried out nationwide through the Hybrid Rice Commercialization Program (HRCP), quality deterioration of stored and distributed F1 hybrid rice seeds due to storage pest infestation was a widely experienced problem. In order to prevent further seed quality losses, the Philippine Rice Research Institute (PhilRice), at that time being the agency in charge of the procurement, storage and distribution of the hybrid rice seeds nationwide, decided to treat the seeds with grain protectants (insecticides) prior to storage starting with the 2003 dry season harvest. Although there were available information on the right kind and amount of insecticide that could effectively control such kind of pest infestation, the urgent problem encountered at hand was how to accurately and uniformly apply the inescticide solution to the seeds at a recommended low volume application of 1-2 liters per ton of seeds. Low volume application was necessary since a significant increase in the seed moisture content could be another threat in maintaining the quality of the seeds. At that time, there was no locally availably technology developed and marketed for the purpose. The need was urgent and there was not much time availble to come up with a seed treatment technology that could be used by the HRCP. This paper presents the experiences and the process of developing a low cost seed treating machine as a prompt answer to a serious need of the Program

211. **A simple spectral index using reflectance of 735 nm to assess nitrogen status of rice canopy** / Lee-YuhJyuan. Yang-ChwenMing. Chang-KuoWei. Shen-Yuan,

Agronomy Journal, 2008, 100 (1), pages 205-212
Abstract: Spatial distribution of canopy N status is the primary information needed for precision management of N fertilizer. This study demonstrated the feasibility of a simple spectral index (SI) using the first derivative of canopy reflectance spectrum at 735 nm (dR/d lambda |735) to assess N concentration of rice (Oryza sativa L.) plants, and then validated the applicability of a simplified imaging system based on the derived spectral model from the dR/d lambda |735 relationship in mapping canopy N status within field. Results showed that values of dR/d lambda |735 were linearly related to plant N concentrations measured at the panicle formation stage. The leaf N accumulation per unit ground area was better fitted than other ratio-based SIs, such as simple ratio vegetation index (SRVI), normalized difference vegetation index (NDVI), R810/R560, and (R1100-R660)/(R1100+R660), and remained valid when pooling more data from different cropping seasons in varied years and locations. A simplified imaging system was assembled and mounted on a mobile lifter and a helicopter to take spectral imageries for mapping canopy N status within fields. Results indicated that the imaging system was able to provide field maps of canopy N status with reasonable accuracy (r=0.465-0.912, root mean standard error [RMSE]=0.100-0.550) from both remote sensing platforms
Descriptors: canopy. image-analysis. leaves. nitrogen-content. precision-agriculture. reflectance. remote-sensing. rice. spatial-distribution. spectral-data