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C20 Extension

001. Singh, D.; Dhillon, D.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Extn. Edn.). Communication behaviour of agricultural development officers of Punjab. Annals of Biology (India). (Jun 2006) v. 22(1) p. 67-74 KEYWORDS: AGRICULTURAL WARMING; SERIES; INFORMATION RETRIEVAL; PUNJAB; EXTENSION ACTIVITIES.

The present study was undertaken in six randomly selected districts of Punjab to analyse the communication behaviour of Agricultural Development Officers in terms of information input, processing and output. All the ADOs in position from the selected districts were taken as respondents. The data were collected from them with the help of distributed questionnaire approach during the monthly meetings held at district headquarters. Majority of the respondents attended training programmes, consulted farm literature, attended expert lectures, farmer fairs and consulted university scientists for getting latest agricultural information. Very few respondents frequently listened the farm radio broadcasts and viewed farm telecasts. Majority of the respondents evaluated the information before its dissemination to farmers against their past experience discussed with colleagues, laid out demonstrations, discussed with subject matter specialists and considered socio-economic conditions of area. Majority of the respondents stored the information by getting it photocopied, maintained subject-wise files, memorized the information and recorded in their diaries. The various information transformation methods used by the respondents included translation of information into local languages, writing features for newspaper/magazines, prepared leafletslhandouts for distribution among farmers and wrote success stories of progressive farmers. The information output of behaviour of the respondents revealed that on an average one respondent met 305 farmers, attended 65 office calls, organized 32 group meetings, 74 field visits, one exhibition, four method demonstrations, two result demonstrations and six field days and training camps and delivered 22 lectures.

E11 Land Economics and Policies

002. RAO, VENKATA B.V.(Bangalore, Karnataka (India). Land use planning for small farmers: Socio-Economic and Environment Perspectives. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 379-383 KEYWORDS: SOCIOECONOMIC ENVIRONMENT; LAND USE.

E20 Organization, Administration and Management of Agricultural Entreprises or Farms

003. Rampal, V.K.; Gill, L.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Extn. Edn.). Innovativeness scale towards contract farming. Annals of Biology (India). (Jun 2006) v. 22(1) p. 59-62 KEYWORDS: FARMING SYSTEMS; INNOVATION ADOPTION.

Punjab government has started contract farming scheme from rabi season 2002-03. Under this scheme, the area is being shifted from rice and wheat to other high valued crops. Fanners entering new contract farming ventures should be prepared to balance the prospect of higher returns with the possibility of greater risk. In present study, innovativeness was measured as the degree to which an individual was relatively earlier in adopting new ideas as compared to other members of the social &ystem. The Likert method or method of summated ratings of scale construction was adopted for Constructuion of innovativeness scale. As a basis for rejecting statements in the method of summated jngs. We used item analysis. Any t-value equal to or greater than 1.75 has been included in final ale. There are IO statements which had t-value equal to or greater than 1.75. The reliability coefficient IS determined by using Speannan Brown Fonnula to be 0.87. The intrinsic validity was determined be 0.93. It concluded that the measuring scales used in the investigation were sufficiently reliable nd valid as well.

004. Rampal, V.K.; Gill, L.S. (Punjab Agricultural University, Ludhiana (India). (Dept. of Extn. Edn.). Economic motivation scale towards contract farming. Annals of Biology (India). (Jun 2006) v. 22(1) p. 63-66 KEYWORDS: FARMING SYSTEM.

Punjab government has started contract farming scheme from rabi season of 2002-03. Under this scheme, the area is being shifted from rice and wheat to other high valued crops. Farmers entering new contract farming ventures should be prepared to balance the prospect of higher returns with the possibility of greater risk. In present study, economic motivation was the occupational success in terms of profit maximization and relative value individual placed on economic ends. The Likert method or method of summated ratings of scale construction was adopted for construction of economic motivation scale. As a basis for rejecting statements in the method of summated ratings, we used item analysis. Any t-value equal to or greater than 1.75 has been included in final scale. There are eight statements which had t-value equal to or greater than 1.75. The reliability coefficient was determined by using Spearman Brown Formula to be 0.87. The intrinsic validity was determined to be 0.93. It concluded that the measuring scales used in the investigation were sufficiently reliable and valid as well.

E80 Home Economics, Industries and Crafts

005. Kumar, A. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Centre of Food Science and Technology); Singh, A.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Biochemistry); Singh, R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Centre of Food Science and Technology). Instantization of black gram (Vigna mungo L.) and efficacies of different cooking methods. Annals of Biology (India). (Jun 2006) v. 22(1) p. 79-84 KEYWORDS: INSTANTIZING; VIGNA MUNGO; COOKING.

The attempts were made for development of process for fast cooking of black gram. Black gram (whole) grains were soaked in distilled water and salt solution (1.5 percent sodium bicarbonate, 0.5 percent sodium carbonate and 0.75 percent citric acid) for 12 h. After soaking, the samples of grains were cooked by different types of methods i. e. microwave cooking, steam cooking, pressure-cooking and vat cooking. After that, samples were dried in cabinet and fluidized bed dryers at 60°C. The effects of the main processing steps on the chemical compositions, sensory quality, cooking time and physicochemical

characteristics have been areas of research. The results indicated that water soaked whole black gram dhal showed significant lower cooking time in comparison with salt soaked grains. Cabinet drying was found best suited for drying of pre-cooked dhal. During processing, treatments showed perceived amount of decrease in fats, proteins, ash content and phytic acid. After the culmination of instantization process, the samples were analyzed for different parameters. Steam pre cooked, black gram dhal had less cooking time, better hardness, less disperson and high hydration. Thus, water soaking, steam pre-cooking and cabinet drying were concluded as best treatments for development of quick cooking whole black gram dhal.

006. Kharmra, K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). (Dept. of Clothing and Textiles); Deepak, D. (Government Polytechnic, Hisar (India). Effect of enzyme treatment on weight loss of denim. Annals of Biology (India). (Jun 2006) v. 22(1) p. 85-87 KEYWORDS: ENZYMES; CELLULASE.

Cellulase enzyme treatment was given to two qualities of denim i. e. 100 percent cotton denim (light weight denim and heavy weight denim) and blended cotton denim (synthetic denim) and effect on weight loss was observed. It was seen that it was increasing with the increase in concentration and time period. After a certain concentration it was increasing slightly.

007. Deepak, D. (Government Polytechnic, Hisar (India); Khamra, K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). (Dept. of Clothing and Textiles). Effect of enzyme treatment on colour fading of denim. Annals of Biology (India). (Jun 2006) v. 22(1) p. 89-91 KEYWORDS: ENZYME; CELLULASE.

Cellulase enzyme treatment was given to two qualities of denim i. e. 100 percent cotton denim (light weight denim and heavy weight denim) and blended cotton denim (synthetic denim) and effect on colour fading was observed. It was seen that it was decreasing with the increase in concentration and time period. After a certain concentration it was increasing slightly.

F01 Crop Husbandry

008. Kang, B.S.; Sidhu, B.S. (Krishi Vigyan Kendra, Nawanshar, (India)). Studies on growing off-season chilli nursery under polyhouse. Annals of Biology (India). (Jun 2006) v. 22(1) p. 39-41 KEYWORDS: CHILLIES; SOWING; TRANSPLANTING; VIGOUR.

Chilli nursery growing during winter under Polyhouse (size 24' x 13' x 6) made of UV stabilized low density polythene film of 200 microns (800 gauge) thickness was compared with the other two methods, namely, Polycover and No-cover. Under each of the three methods, sowing was done on 25 October, 15 November, 30 November and 1 February during 1997-98, 1998-99 and 1999-2000 seasons. The results revealed that nursery grown under 'polyhouse reached transplantable stage in significantly less number of days compared with the other two methods. Also polyhouse technique gave more number of transplants per unit area and the crop growth from it gave higher early and total fruit yield. A similar trend was observed for all the dates of sowing.

009. Kang, B.S. (Krishi Vigyan Kendra, Nawanshahr (India)). Comparative studies on direct seeding and transplanting method of growing cabbage. Annals of Biology (India). (Jun 2006) v. 22(1) p. 43-45 KEYWORDS: SEED; TRANSPLANTING; CABBAGE.

Direct seeding on ridge and on flat of cabbage variety 'Golden Acre' was compared with conventionally followed transplanting technique. Under each of the two methods of growing cabbage, the sowing was done during the first week of October, during 1998-99, 1999-2000 and 2000-01 seasons. The results revealed that direct seeding on ridges gave higher marketable yield and higher head weight compared with transplanting of 30 days old seedlings either on ridges or on flat. Economics of cultIvation worked out was also in favour of the direct seeding method.

010. Medida, S.K.; Singh, D.; Singh, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agrometeorology). Effect of sowing dates on agrometeorological indices of soybean (Glycine max (L.) Merrill). Annals of Biology (India). (Jun 2006) v. 22(1) p. 49-51 KEYWORDS: SOWING DATE; SOWING DEPTH; GLYCINE MAX.

A field experiment was conducted to study the influence of weather on thermal heat requirement for different phenophases on growth of soybean during kharif 2004 at Research Farm, CCS Haryana Agncultural University, Hisar. Treatments consisted of three dates of sowing (30 May, 24 June and 30 June) with four varieties (SH-40, DS-9814, PK-416 and PS-l 042). Experiment was laid out in a split plot design with four replications. Results revealed that different dates of sowing had an effect on phenological stages. Growing degree days (GDD) consumed by the crop to reach physiological matunty was higher in first date of sown crop. Among the cultivars, HUE and RUE were highest in PK -416 for dry matter production as well as seed yield.

011. Rana, K.S.; Shivran, R.K.; Kumar, A. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effect of moisture-conservation practices on productivity and water use in maize (Zea mays)-based intercropping systems under rainfed conditions. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 24-26 KEYWORDS: ZEA MAYS; INTERCROPPING; PHASEOLUS RADIATUS; WATER USE; EFFICIENCY; FARMYARD MANURE; PRODUCTIVITY.

A field experiment was carried out during the rainy season (kharif) of 2001 and 2002 to study the relative moisture utilization by maize (Zea mays L.) grown in a mixed or in a soie situation. The maize equivalent was higher in maize paired row (40/80 cm) + 2 rows of mung bean (Phaseo/us radiatus L.) than the sale maize crop. An increase in water-use efficiency (WUE) was observed in intercropping systems. The water-use efficiency was the highest (10.14 maize equivalent use/ha/mm) in maize paried row (40/80 cm) + 2 rows of mung bean. Growth, yield attributes and yield as well as maize equivalent were significantly improved with farmyard manure (FYM) + dust mulch + straw mulch treatment over no mulch. Among the moisture-conservation practices, higher WUE was recorded under FYM+dust mulch + straw mulch, closely followed by Kaolin + dust mulch + straw mulch.

012. Rathore, V.S. (Central Arid Zone Research Institute, Bikaner (India). Regional Research Stn.); Singh, P. (Banaras Hindu University, Varanasi (India); Gautam, R.C. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Productivity and water-use efficiency of rainfed pearlmillet (Pennisetum glaucum) as influenced by planting patterns and integrated nutrient management. Indian Journal of Agronomy (India). (Mar 2006) v.

51(1) p. 46-48 KEYWORDS: PLANTING; PENNISETUM; FERTILIZERS; PRODUCTIVITY; WATER USE.

A field experiment was conducted during the rainy (kharif) seasons of 2001 and 2002 a the Indian Agricultural Research Institute, New Delhi, to study the effect of planting patterns and nutrient management on growth, yieid attributes, yield, nutrient uptake and water-use efficiency of rainfed pearmillet [Pennlsetum glaucum (L.) R. Br. Emend. Stuntz.]. Modified planting patterns, viz. ridge and furrow (RF), paired row (PR) and paired rows + intercrop (PR+1 system), recorded significantly higher growth, yield, nutrient uptake and water-use efficiency of pearimillet than uniform row (UR) system of pianting. The maximum grain yield and water-use efficiency (WUE) were recorded with PR system of planting. Nutrient management caused remarkable improvement in growth, yield attributes, yield, nutrient uptake and water-use efficiency of pearlmillet. The performance of nutrient management treatments in term of grain yield and WUE followed the order of recommended dose of fertilizer (RDF"1/2 RDF + Azosplrillum + phosphorus-solubilizing bacteria (PSB) 112 RDF + Azospirillum 1/2 RDF + PSB 1/2 RDF control.

013. Misra, A. (Sugarcane Breeding Institute, Karnal (India) Retional Centre); Tripathi, B.K. (Sugarcane Breeding Institute, Coimbatore (India). Feasibility of mechanical harvesting of sugarcane (Saccharum spp. hybrid). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 65-67 KEYWORDS: HARVESTING; MECHANICAL METHODS; SACCHARUM; INTERCROPPING; ONION.SPACING.

A field experiment was conducted at the Farm of Regional Centre, Sugarcane Breeding Institute, Karnai, during 1998-99 and 1999-2000, to find out the feasibility of growing sugarcane at row spacing of 150 em required for mechanical harvesting by austoft harvester. Planting of 172,144 buds/ha in paired rows of 40 : 110 em, conventional row spacing of 75 em with selts placed along the rows and wide row spacing of 150 em with selts placed across the rows (at equal seed rates in all the cases) gave at par cane yield/ha. Intercropping at wheat (Triticum aestivum L. emend. Fiori & Paol.), Indian mustard [Brassica juncea (L.) Czernj. & Casson], coriander (Coriandrum sativum L.) and onion (Allium cepa L.) reduced the cane yieid by 17.2, 7.5, 6.9 and 2.0 percent, respectiveiy, than sale sugarcane, but the significant reduction was recorded with wheat only. Maximum net monetary return of Rs 108,470/ha was obtained from onion + sugarcane system, with higher benefit: cost ratio of 2.90. Based on cane-equivalent yield/ha, closer row spacing of 75 em with selts placed along the rows recorded comparable cane yield to row spacing of 150 em coupled with selts pi aced across the rows (2 budded selts) with onion as an intercrop in both the cases. Thus, mechanical harvesting with austoft harvester is feasible by planting sugarcane at 150 em spacing by adopting seed rate of 172,144 buds/ha with onion as an intercrop without any economic loss to the growers.

014. Gill, M.S. (Project Directorate for Cropping Systems Research, Modipuram (India); Kumar, A.; Kumar, P. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy and Agrometeorology). Growth and yield of rice (Oryza sativa) cultivars under various methods and times of sowing. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 123-127 KEYWORDS: ORYZA SATIVA; SOWING DATE; YIELD; TRANSPLANTING; DIRECT SOWING; YIELD; GROWTH.

A field investigation was carried out during the rainy season (kharif) 2001 and 2002 at the Punjab Agricultural University, Ludhiana, to establish the agronomic management practices

for direct-~eeded rice (Oryza sativa L.) in ioamy sand soils. The treatments included 2 methods of sowing (direct sowing and transplanting), 3 times of sowing (1 June, 10 June and 20 June – the corresponding transplanting on each date, was made 25 days after sowing) and 4 cultivars ('PR 111', 'PR 115', 'PR 116' and 'IR 64'). The rainfall received during crop season (June to October) of first year was 847 mm and 332.7 mm during second year. Dry-matter accumulation, leaf-area index, effective tillers etc. under direct seeding were significantly more than transplanted rice. The productivity under direct-seeded paddy accrued was = 53 q/ha (during first year 65 q/ha while in second year 40 q/ha) in loamy sand soil. The direct-seeded crop matured 10 days earlier than transplanted crop. The water productivity in direct-seeded rice ranged between 0.40 and 0.46 kg grain/m irrigation water, while under transplanting, it varied between 0.29 and 0.39 kg grain/m irrigation water clearly showing the more water-use efficiency. The maximum productivity was obtained when direct-seeded crop was raised on 10 June and short-duration, early-maturing 'PR 115' variety excelled other medium- and long-duration varieties in all growth and yield determinants.

015. Singh, S.S.; Prasad, L.K.; Upadhaya, A. (Indian Council of Agricultural Research-Research Complex for Eastern Region, Patna (India). Root growth, yield and economics of wheat (Triticum aestivum) as affected by irrigation and tillage practices in South Bihar. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 131-134 KEYWORDS: TRITICUM AESTIVUM; BIHAR; TILLAGE; IRRIGATION; ROOTS; YIELD; AGRICULTURAL ECONOMICS.

A field experiment was carried out during 3 winter seasons from 2000-01 to 2002-03 at Patna, to find out effect of tillage practices, viz. zero tillage, bed planting and conventional, and irrigation levels, viz. 3, 5, 7 and 9 em depth on rooting behaviour, yield and economics of wheat [(Triticum aestivum (L.) emend. Fiori & Paol] in Ustipsamment soils. Root characters like area (10.5 em') and length (48.1 em) were highest in bed planting, followed by conventional and zero tillage at tillering as well as flowering stages. Highest grain yield of 36.6 q/ha was obtained in zero tillage, followed by conventional tillage (34.1 q/ha) and bed planting (31.5 q/ha). Irrigation at 7 em water depth resulted in maximum grain (34.2 qIha) and straw yields. Highest water-use efficiency (375 kglha-cm) was recorded with bed planting. A significant positive linear relationship was observed between irrgation depths and root growth and grain yieid.

016. Singh, M.; Devi, K.S. (Central Agricultural University, Imphal (India). College of Agriculture). Profitability of nipping in cultivation of pea (Pisum sativum)-an indigenous agro-technique in Manipur. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 206-208 KEYWORDS: PISUM SATIVUM; CROP MANAGEMENT; MANIPUR.

A field experiment was conducted during the winter (rab/) seasons of 2002-03 and 2003-04 at the experimental field of Agronomy, College of Agriculture, Central Agricultural University, Imphal, to evaluate the profitability of nipping in Makhyatmubi pea (Pisum sativum sub sp. arvensis L.) cultivation. There were 8 treatments nipping at 15, 20, 25, 30, 35, 40 and 45 -days after sowing and a without nipping (control). Among different treatment combinations, nipping at 30 days after sowing (T4) produced significantly higher number of branches/plant, podsi plant, seed and stover yield than control. The highest net return (Rs 13, 799.5/ha) was obtained from the treatment T4 and followed by that at 35 days (T5) Rs 13,759.5/ha. While lowest net return of Rs 5254.9/ha was observed in the control.

017. Singh, T.; Dahiya, K.S.; Sidhu, M.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy and Agrometeorology). Effect of genotype, seedling age and row spacing on performance of transplanted African mustard (Brassica carinata) under late sown conditions. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 221-224 KEYWORDS: BRASSICA CARINATA; SOWING DATE; SPACING; PLANT PROPAGATION; LUDHIANA; TRANSPLANTATION; GENOTYPES.

A field experiment was conducted during the winter (rabi) seasons of 2001-02 and 2002-03 at Ludhiana, to evaluate the performance of transplanted African mustard (Brassica carinata A. Braun) under late sown conditions. Genotype 'PC 5-17' gave 5 percent higher seed yield than 'PC 5'. Leaf-area index, secondary branches/plant siliquae/plant, oil content, oil yield and net returns were significantly more in genotype 'PC 5-17' compared to 'PC 5'. The row spacing of 20, 30 and 40 cm resulted in similar seed yield during both the years. Transplanting of 45 days old seedlings resulted in 34.5 percent higher seed yield than direct seeding. Transplanting of seedlings of 30 and 60 days age also gave 27.8 and 33.5 percent respectively higher seed yield than direct seeding. Leaf-area index, number of primary and secondary branches/plant, siliquae/plant, oil yield, protein yield and net returns were significantly higher in transplanted crop than direct-seeded ones.

018. Tuteja, S.S.; Lakpale, R.; Singh, A.P.; Tripathi, R.S. (Indira Gandhi Agricultural University, Raipur (India). Dept. of Agronomy). Effect of harvesting intervals on herbage, oil yield and economics of different varieties of Japanese mint (Mentha arvensis). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 245-246 KEYWORDS: ECONOMICS; YIELD; OIL; METHA ARVENSIS.

A field experiment was conducted at Research Farm of the Indira Gandhi Agricultural University, Raipur, from mid-January to the last week of August during 2001 and 2002, to find out the effect of harvesting intervals on herbage and oil productivity of different varieties of Japanese mint (Mentha arvensis L.) under Chhatlisgarh condition. 'Himalaya' variety gave significantly higher mean herbage, oil yield and net returns when it was harvested at 120 days after planting and 75 days after first harvest. In case of 'Koshi' variety, the maximum herbage and oil yields and net returns were obtained when it was harvested at 110 days after planting and 75 days after first harvest.

019. Ghosh, P.; Gupta, K.; Mukhopadhyay, R. (University of Burdwan, Burdwan (India). Dept. of Botany). Impact of seasons on some biochemical parameters in three adiantoid ferns. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 152-159 KEYWORDS: PHTNOLIC COMP0UNDS; ADIANTUM; BIOCHEMISTRY; SEASONS; SEASONAL VARIATION.

Chlorophylls, carbohydrates, carotenoids, total free amino acids, total free phenols, and total free proline were measured in different parts of Adiantum capillus-veneris L., Adiantum incisum Forssk and Adiantum lunulatum Burm. f. in summer (April - June), rainy (July - October) and winter (November February) seasons. Among the three species, A. incisum contains the highest amount of these metabolites. Significant differences of primary and secondary metabolites were observed in different parts of the same species. Seasonal impacts on the change of quantity of the metabolites were distinctly evident. Relative water content of the leaf tissue was more in winter in all the species, maximum being in A. lunulatum. Rainy season was found to be the best time for harvest of raw materials for herbal drug purpose as phenol content was found to be highest in this season.

020. Mathew, T. (Bhabha Atomic Research Centre, Mumbai (India). Molecular Biology Div.); Pandey, D.P. (Bhabha Atomic Research Centre, Mumbai (India). Nuclear Agriculture and Biotechnology Div.). Protection of groundnut plants from water stress by chlorflurenol and cycocel. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 209-212 KEYWORDS: GROUNDNUT; CHLORFLURENOL.

Presoaking of Groundnut seeds (Arachis hypogaea L.) in solutions of chlorflurenol (CFL) and cycocel (CCC) resulted in higher yield under drought conditions. Studies on drought indices like relative water content (RWC), proline accumulation and transpiration supported the antitranspirant action of these chemicals.

021. Saha, B.; De, B.K.; Mandal, A.K. (University of Calcutta, Kolkata (India). Dept. of Seed Science and Technology). Seed treatments for improved storability and field performance of gram (Cicer arietinum L.). Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 314-320 KEYWORDS: GRAM; CICER ARIETINUM; SEED TREATMENTS; YIELDS; VIGOUR; GERMINABILITY; STORABILITY; PERFORMANCES.

Pre-storage dry treatments of freshly harvested Bengal gram seed (high-vigour) with calcium hypochlorite (common bleaching powder, 2 g I kg of seed), iodinated calcium carbonate (30 mg iodine impregnated with 3 g of calcium carbonate, 3 g I kg of seed), alcohols such as methanol and isopropanol (1 ml each of methanol and isopropanol mixed with 3 g of calcium carbonate 3 g I kg of seed) and wet treatments such as moisture equilibration-drying (hydrated o:ver saturated atmosphere for 24 h followed by drying back to its original moisture content) significantly improved post-storage germinability over untreated control. The treated seeds also showed significant increase in yield and its attributes per unit area over control. The refrigerated control (seeds kept in the refrigerator after harvest) which was taken as a reference treatment has shown better results in improving storability and field performance over control and other treatments. Physiological and biochemical studies on treated seeds showed greater membrane integrity as measured by reduced leakage of electrolytes, sugars and amino acids over untreated control. Dehydrogenase enzyme activity was significantly higher in the treated seeds than the control. The dry and wet treated seeds also showed lower lipid peroxide formation than the control. On the basis of present findings, dry treatments of seeds with calcium hypochlorite and iodinated calcium carbonate and wet treatments such as moisture equilibration-drying in freshly harvested Bengal gram seeds (high-vigour) are suggested for improved storability and field performance.

F02 Plant Propagation

022. Pandey, D.; Bose, B. (Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology). Influence of pre-sowing seed treatment with nitrate salts and different sowing dates on performance of mustard. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 261-265 KEYWORDS: MUSTARD; BRASSICA JUNCEA; SEED TREATMENT; SOWING DATE; SEEDS; GROWTH PARAMETERS.

Mustard (Brassica juncea L. Czern and Coss) seeds were soaked for 24 h either in solution of nitrate salts [(Mg(N03)2' Ca(N03)2 and KN03)] or in distilled water and sown in field at three different dates of its cropping season. The parameters like plant height, number of leaves per plant, leaf area, leaf area index and net assimilation rate were found to increase with nitrate treatments in comparison to distilled water soaked and control (seeds directly

sown in field without any prior treatment) sets. Among nitrates, Mg(N03) 2 showed better results followed by KN03 and Ca(N03)2 treatments. The plants raised from first date of sowing showed maximum plant height and leaf area but the mean number of leaves per plant and leaf area index were highest in plants with second date of sowing. Net assimilation rate was found best in the plants of third date of sowing. However,the plants raised from second date of sowing showed higher values for most of the parameters in comparison with others. Data regarding yield and yield attributes like pods plant_1 pod weight plant-1 pod length, seed pod-I, seed plant and test weight were increased in nitrate treated sets and in timely sown crops. However nitrate treatment to seeds showed an improvement in overcoming the late sown stress in mustard.

023. Agnihotri, R.K. (Govind Ballabh Pant Institute of Himalayan Environment and Development, Almora (India); Palni, L.M.S. (Government of Uttranchal, State Biotechnology Programme, Pantnagar (India); Pandey, D.K. (National Research Centre for Weed Science, Jabalpur (India). Screening of landraces of rice under cultivation in Kumaun Himalaya for salinity stress during germination and early seedling growth. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 266-272 KEYWORDS: RICE; ORYZA SATIVA; GERMINATION; LANDRACES; HIMALAYA REGION; SALINITY STRESS.

Thirty landraces of rice (Oryza sativa L.) along with an introduced variety VL-206 were screened for seed germination and seedling growth under salinity stress (0.10, 0.15 and 0.20 M NaCl). Among the landraces, Saunji showed maximum germination (90 percent) even at the highest salinity level (0.20 M NaCl) and was considered most tolerant to salinity stress. The maximum reduction in seed germination was found in Syaudhan (36 percent) when exposed to 0.20 M NaCI. Early seedling growth in different landraces varied with the salinity level. Increasing the NaCI concentration from 0.10 M to 0.20 M led to a significant reduction in root and seedling (shoot) growth, irrespective of the landrace in comparison to control. The results revealed that a valuable source of rice germplasm, in the form of landraces, is still being maintained through cultivation in remotely located villages in Kumaun region of Indian Central Himalaya, which may be useful for introgression of salinity resistant genes for the development of stress tolerant varieties.

024. Singh, S. (Mahrashi Dayanand University, Rohtak (India). Biochemistry Lab.); Mishra, S.N. (Mahrashi Dayanand University, Rohtak (India). Plant Biochemistry and Molecular Biology Research Lab.); Pundir, C.S. (Mahrashi Dayanand University, Rohtak (India). Biochemistry Lab.). A correlative analysis of oxalatge degradation and early nitrate assimilation in grain sorghum growth under sodium chloride stress. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 295-299 KEYWORDS: SORGHUM; SORGHUM VULGARE; OXIDASE; OXALATE; SODIUM; NITROGEN; GRAINS.

Seedlings of grain sorghum (Sorghum vulgare Var. CSH-14) were grown upto 10 days in Hoaglanif's solution with different levels of NaCI (0, 20, 50 and 100 mM). The changes in oxalate degradation through oxalate oxidase (OXO) and the activities of enzymes of nitrate assimilation pathway, viz. nitrate reductase (NR) and nitrite reductase (NiR) were examined in leaves. The activity of oxalate oxidase correlated statistically with the activities of the enzymes of nitrate assimilation suggesting thereby a possible link between oxalate oxidation and nitrate assimilation. The degradation of oxalate by oxalate oxidase increased with increasing level of NaCI upto 50 mM concentration with increasing production of HzOz in leaves. Activities of nitrate reductase and nitrite reductase were suppressed by NaCi salinity,

showing a significant negative correlation with oxalate degradation. This shows that oxalate degradation and nitrate assimilation in grain sorghum are simultaneously affected by salt stress.

F03 Seed Production and Processing

025. Richa; Sharma, M.L.; Bala, N. (Punjab University, Chandigarh (India). Dept. of Botany). Endogenous levels of plant growth substances in seeds in five bamboo species in relation to seed viability. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 358-363 KEYWORDS: POLANT GROWTH SUBSTANCES; BAMBOO; THYRSOSTACHYS SIAMENSIS; DENDROCALAMUS STRICTUS; ABSCISSIC ACID; SEEDS; SEED VIABILITY.

Endogenous levels of auxins and ABA in seeds is found to be one of the major factors related to the loss in seed viability in stored bamboo seeds. This was examined during storage for one year, under controlled conditions, in 5 bamboo species by means of various viability tests. Endogenous levels of putative free indole acetic acid (IAA) and free and bound abscissic acid (ABA) were measured in freshly harvested seeds and in seeds stored for one year. In freshly harvested seeds, free IAA levels were higher in all species in comparison to one-year-old seeds. Seeds of Thyrsostachys siamensis showed highest viability (G percent 76.6) and maximum content of IAA (2.90 JIg got fw) while the seeds of Dendrocalamus strictus showed lowest viability (G percent 5.53) and lowest content of IAA (2.07 JIg got fw). Same pattern of IAA was observed in seeds stored for one year but the IAA levels were found to be reduced and so did the viability across all species. The free and bound ABA levels in freshly harvested seeds were maximum in D. strictus, with lowest viability. After one year, the amount of free ABA increased by about 58 percent while the bound ABA was found to be reduced by 78 percent in this species.

026. Kasim, W.A. (Tanta University, Tanta (Egypt). Botany Dept.). Amino acid and protein profiles of Vicia faba salt-stressed seedlings grown from thermally-stressed seeds. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 364-372 KEYWORDS: AMINO ACIDS; SEEDS; VICIA FABA; PROTEINS; QUALITY; ACIDS; GERMINATION.

Seeds of Vicia faba L. cv Giza 843 were subjected to 4°C, 25°C (control) and 40 °C for 48 h before sowing in clay-loam soil and the seedlings were irrigated with water (control) or 0.1 M NaCI for 35 days (d). Germination percentage, length and fresh and dry weights of 10-d and 35-d old seedlings decreased with the rise of presowing temperature; the decrease was greater when thermal and salinity stresses were combined. In the 10-d-old seedlings, thermal and/or salinity stresses enhanced the assembly of free amino acids into members of the heat shock proteins families Hspl00, Hsp60 and sHsp, which exhausted the free amino acid pool to the point of almost total depletion. The sHsps seem to stabilize the stressdenatured enzymes and structural proteins, thus preparing them for subsequent refolding by members of the Hsp60 and Hspl00 families so that they regain their functional conformations, which might have in turn led to the observed improvement in the germination percentage and in seedling growth. In 35-d-old seedlings, fewer Hsps were synthesized leading to greater accumulation of eight amino acids (proline, glutamic acid, glycine, alanine, methionine, phenylalanine, lysine, arginine) to act as osmoregulators. The strategy for combatiag abiotic stress seems age-dependent.

027. Bhattacharya, M.; Sen, A. (North Bengal University, Siliguri (India). Dept. of Botany). Rapid In vitro multiplication of disease free Zingiber officinale Rosc. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 379-384 KEYWORDS: IN VITRO; REGENERATION; GINGER; ZINGIBER OFFICINALE; CYTOKININ; DISEASES; PLANT REGENERATION.

Ginger belonging to the family Zingiberaceae is a rhizomatous medicinal spice. Biotechnological improvement of ginger is important due to its lack of flowering and seed set. Direct in vitro regeneration of disease-free plantlets was achieved through tissue culture. Different media supplemenre'rwitJi different concentrations and combinations of cytokinins were studied. Murashige and Skoog media supplemented with 4 mg/l benzyl amino purine (BAP) provided the best regeneration compared to kinetin (kn) and zeatin (Zn) when they were used alone. Combination of 4 mg/l BAP and 3 mg/l Kn resulted in maximum number of shoots. Profuse rooting was observed in the same media. Hardenings of the healthy plantlets were done in mixture of garden soil and sand in the proportion of 1:1. Ninety four per cent of the plantlets survived hardening and all the plantlets got established in the field. Diagnostic tests- rhizome pieces were transferred to PDA to observe fungal growth on the medium, visual observations on the presence of ginger yellows symptoms and detection of the number of rotted rhizomes after storage on river sand were performed to detect the presence or absence of the pathogen in tissue culture-derived clones. Comparative studies of in vitro regenerated and conventional planting materials were performed in field. Superiority of the in vitro plantlets was established.

028. Sarma, M.; Handique, G.K.; Handique, A.K. (Gauhati University, Guwahati (India). Dept. of Biotechnology). Toxic heavy metals stress in paddy : metal accumulation profile and development of a novel stress protein in seed. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 227-233 KEYWORDS: HEAVY METALS; PADDY; ORYZA SATIVA; STRESS; PROTEINS.

Impact of toxic heavy metals lead, mercury and cadmium have been studied in paddy with respect to their impact on harvest index, metal accumulation in grain and plant body and seed protein profile. All the three metals brought about significant decline in harvest index. Lead treatment resulted in 8.85 to 14.06 percent decline in harvest index compared to control. Mercury also showed similar effect, but cadmium treatment caused 14.29 to 25.0 percent decline in harvest index. For all the three metals accumulation was highest in roots, ranging from 53.0 to 56.0 percent for lead, 47.0 to 54.0 percent for mercury and 66.0 to 69.0 percent for cadmium. Following roots, accumulation was in descending order in stem, leaf sheath, grain and leaf. In grains, accumulation was 7.0 to 8.9.percent for lead, 10.0 to 11.0 percent for mercury and 6.0 to 8.0 percent for cadmium, clearly indicating the possible health hazard. Seed protein profile analysed through SDS-PAGE revealed elimination of a high molecular weight protein (- 120) for mercury and cadmium treatment generated a novel 66.5 kDa stress protein.

029. Ghosh, M.K.; Das, B.K.; Misra, A.K.; Das, C.; Mukherjee, P.K.; Urs, S.R. (Central Sericultural Research and Training Institute, Berhampore (India). Physio-biochemical evaluation of some improved mulberry varieties in the gangetic alluvial soils under irrigated conditions. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 246-252 KEYWORDS: MULBERRY; LEAF YIELD; NITRATE REDUCTASE ACTIVITY; PROTEIN; PHOTOSYNTHESIS; ALLUVIAL SOILS; PHYSIOCHEMICAL PROPERTIES.

Ten improved mulberry varieties, viz. VI, C1730, C2016, C2017, Anantha, RF8-175, Thallaghatapura, Vishala, 81 and 81635 were evaluated for physiological and biochemical parameters under irrigated conditions in the alluvial soils of Gangetic plains of West Bengal as per zonal schedule. Leaf area, leaf fresh weight, percent moisture content and moisture retention capacity were found to vary significantly among the varieties tested. Moreover, net photosynthetic rate, transpiration rate, physiological water use efficiency, stomatal conductance and biochemical parameters, viz. total chlorophyll, total soluble sugar, nitrate reductase activity, total soluble protein and phenol content also showed significant variation among the tested varieties. Among the varieties 81635 was recorded to have higher leaf area (305.70 cm2), leaf yield (0.520 kg/plant/crop), fresh leaf weight (4.92 g), net photosynthetic rate (14.66 Jlmol CO2 m2 S-I), nitrate reductase activity (13.25 Jlmol N02- h-I g-l fw.), chlorophyll content (2.13 mg g-l fw.), total soluble sugar (48.44 mg g-l fw.) and total soluble protein (39.63 mg g-l fw.) were also higher in 81635 showing its superiority over other tested varieties. The studies suggested that 81635 can be commercially exploited for cultivation under irrigated conditions in the Gangetic alluvial soils of West Bengal.

F04 Fertilizing

030. Poonia, B.S. (RBS College, Agra (India). (Dept. of Agronomy); Shanwal, A.V. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science); Rajput, O.P. (RBS College, Agra (India). Dept. of Agronomy); Singh, J. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science); Dharamveer (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Pathology). Effect of sulphur fertilization, phosphorus solubilizing micro-organism (PSM) and growth regulators on groundnut (Arachis hypogaea L.). Annals of Biology (India). (Jun 2006) v. 22(1) p. 19-22 KEYWORDS: YIELD COMPONENTS; YIELD; FORECASTING; ARACHIS HYPOGAEA.

A field experiment was conducted at B. B. D. Govt. College Agriculture Farm, Chimanpura (Shahpura), Jaipur during 1997 and 1998 in sandy loam soils, low in agreegation, poor in N, medium in P, rich in K and pH between 7.5 to7.7. The application of sulphur and PSM significantly increased the yield attributes and yield of groundnut except number ofkemels/pod. Foliar spray of growth regulators (NAA and 2, 4-D) also significantly increased the yield attributes and yield of the crop except number of nodules/plant.

031. Singh, H.; Singh, G. (Amar Singh College, Bulandshahr (India). Dept. of Agricultural Chemistry and Soil Science). Effect of phosphorus and sulphur on yield, content and uptake of nutrient by garlic. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 48-50 KEYWORDS: PHOSPHORUS; SULPHUR; YIELD; NUTRIENT UPTAKE; GARLIC; SOIL FERTILITY; FERTILIZING.

Results of a field experiment revealed that yield of garlic increased with increasing phosphorus levels upto 120 kg ha-l, however, no significant difference was noted between 80 and 120 kg P20S ha-l. Bulb yield also increased significantly upto 40 kg S ha-l. Combined appHcation of P and S was found better than their individual application. Higher the amount of phosphorus and sulphur applied, higher was the concentration and uptake of these two elements in bulbs.

032. Chaudhary, S.K.; Thakur, S.K.; Thakur, R.B. (Rajendra Agricultural University, Samastipur (India). Dept. of Agronomy). Effect of sources and methods of nitrogen applicaiton on

growth, yield and N uptake of transplanted lowland rice (Oryza sativa) and their residual effect on secceeding wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 1-2 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM; NITROGEN; FERTILIZER; FERTILIZER APPLICATION; RESIDUAL EFFECTS.

A field experiment was conducted during 1998-2000 on silty-clay soil at University research farm, Pusa (Bihar), to evalua1e the relative efficiency of few slow-release N fertilizers, viz. prilled urea (PU), Mussoorie rock phosphate-coated urea (MRPU), nimin-coated urea (NGU) and large granulated urea (LGU) with basal and split application in transplanted lowland rice (Oryza sativa L.) and their effect on succeeding wheat (Triticum aestivum L. emend. Fiori & Paol.). Modified urea fertilizers exhibited their superiority by recording significantly higher value of all the yield-contributing characters, nitrogen uptake and significantly higher grain yield than prilled urea, irrespective of their methods of application. Maximum grain and straw yields of wheat were recorded under NGU which was significantly superior to the control and prilled urea and comparable with other sources of N.

033. Verma, A.; Nepalia, V.; Kanthaliya, P.C. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Effect of integrated nutrient supply on growth, yield and nutrient uptake by maize (Zea mays)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 3-6 KEYWORDS: ZEA MAYS; TRITICUM AESTIVUM; FERTILIZER; NUTRIENT UPTAKE; YIELDS.

A long-term fertilizer experiment initiated in 1997 at Instructional Farm of the Rajasthan College of Agriculture, Udaipur, was selected for this investigation during 2000-01 and 2001--{)2, to evaluate the etlect of integrated nutrient supply on productivity and nutrient uptake of maize (Zea mays L.)-wheat (Triticum aestivum L. emend. Fiori & Paol.) cropping system. Maximum plant height and leaf-area index (LAI) of maize were observed by applying 150 percent NPK, while dry matter was found maximum with 100 percent NPK + FYM 10 tonnes/ha. The results of both these treatments were at par in all growth parameters. Highest maize grain and stover yields were obtained by applying 150 percent NPK, though the resuits were at par with those obtained with 100 percent NPK + FYM 10 tonnes/ha. Application of 100 percent NPK + FYM 10 tonnes/ha showed highest values of growth parameters and grain yield of wheat, while maximum straw yield was recorded with 150 percent NPK. However, these 2 treatments were found at par. The balanced and integrated nutrient supply to maize and wheat showed significantly higher uptake of primary nutrients.

034. Gawai, P.P. (Rubber Board, Thane (India). Regional Res. Stn.); Pawar, V.S. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Water Management Project). Integrated nutrient management in sorghum (Sorghum bicolor)-chickpea (Cicer arietinum) cropping sequence under irrigated conditions. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 17-20 KEYWORDS: SORGHUM BICOLOR; CICER ARIETINUM; SEQUENCIAL CROPPING; FARMYARD MANURE; BIOFERTILIZERS; INORGANIC FERTILIZERS; YIELDS.

A field experiment was conducted during 2001-{)2 and 2002-{)3 at Rahuri, Maharashtra, to study the effect of integrated nutrient management in sorghum [Sorghum bicolor (L.) Moench]-chickpea (Cicer arietinum L.) cropping sequence under irrigation. Application of 75 percent recommended dose of fertilizer (RDF) + farmyard manure (FYM) + biofertilizer [Azospirillum and phosphate-solubilizing bacteria (PSB)] gave significantly higher plant height, dry mater, yield attributes and grain and fodder yields of sorghum, and was on a par

with application of 100 percent RDF through inorganics alone showing 25 percent saving of nutrients. The residual effect of application of 5 tonnes FYM/ha to preceding sorghum resulted in significantly higher growth, 'yield attributes and yield of chickpea owing to 100 percent RDF to chickpea and at par with that of 50 percent RDF showing 50 percent saving of nutrients. The net monetary returns and benefit: cost (B : C) ratio of a sequence were significantly higher owing to 100 percent RDF which were at par with that of 75 percent RDF + FYM + biofertilizer. The fertilizer levels to chickpea showed the highest net monetary owing to 100 percent RDF and highest B : C ratio owing to 50 percent RDF. Significantly higher nutrient balance was recorded because of 75 percent RDF + FYM + biofertilizers applied to sorghum and 100 percent RDF applied to chickpea.

035. Kachroo, D.; Razdan, R. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Div. of Agronomy). Growth, nutrient uptake and yield of wheat (Triticum aestivum) as influenced by biofertilizers and nitrogen. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 37-39 KEYWORDS: TRITICUM AESTIVUM; BIOFERTILIZERS; NITROGEN FERTILIZERS; NUTRIENT UPTAKE; YIELDS.

A field experiment was conducted during the winter season of 1999-2000 and 2000-01 at research farm, Sher-e-Kashmir University of Agricultural Sciences and Technology, R.S. Pura, Jammu, to study the effect of biofertilizers and nitrogen levels on growth, yield attributes, yield and nitroigen-use efficiency of 'PBW 343' wheat (Triticum aestivum L. emend. Fiori & Paol). Combined inoculation of Azotobacter + Azospirillum in 1 : 1 ratio increased the growth, yield attributes and yield significantly. The nitrogen-use efficiency values also were higher. Each unit increase in N level led to significant increase in growth, yieid-attributing characters and yield of wheat. The maximum grain yield (53.55 q/ha) was recorded with highest N level. The nitrogen-use efficiency (NUE), apparent N recovery (percent), nitrogen-efficiency ratio (NER) and physiological efficiency index of absorbed nitrogen (PEIN) were higher up to 80 kg N/ha and thereafter decreased with increasing N level.

036. Roy, D.K.; Singh, B.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Effect of level and time of nitrogen application with and without vermicompost on yield, yield attributes and quality and malt barley (Hordeum vulgare). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 40-42 KEYWORDS: HORDEUM VULGARE; NITROGEN FERTILIZER; COMPOSTING; OLIGOCHAETA; YIELDSNUTRIENT UPTAKE.

A field experiment was conducted during the winter (rab/) season of 1998-99 and 1999-2000 at Hisar, to determine the impact of N fertilizer applied at different growth stages, with and without vermicompost on yield components, grain yield and malting quality of barley (Hordeum vulgare L., s.I.) in the first trial and to study the effect of different levels of nitrogen and phosphorus with and without vermicomposf on yield and nutrient uptake by barley in the second. Nitrogen application significantly enhanced the grain and straw yields up to 90 kg N/ha. All the yield components, grain yield and nutrient uptake attained their maximum value with 10 tonnes/ha vermicompost. The grain and malt quality of barley was also influenced significantly with the application of vermicompost and nitrogen levels. The result indicated that N fertilizer strategies for malting barley should ensure reiatively small amount of available one-third N at sowing for crop establishment and initial tiller development. Additional one-third N would then be applied at first irrigation (35 days alter

sowing) and one-third N at flowering (70 days). The highest grain yield and nutrient uptake were recorded with N'OP30 level of fertility.

037. Kar, P.P.; Barik, K.C.; Mahapatra, P.K.; Garnayak, L.M.; Rath, B.S.; Bastia, D.K.; Khanda, C.M. (Orissa University of Agriculture and Technology, Bhubaneswar (India). Dept. of Agronomy). Effect of planting geometry and nitrogen on yield, economics and nitrogen uptake of sweet corn (Zea mays). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 43-45 KEYWORDS: ZEA MAYS; SPACING; NITROGEN FERTILIZERS; NUTRIENT UPTAKE; YIELD.

A field experiment was conducted during rainy seasons of 2002 and 2003 at Central Research Station, QUAT, Bhubaneshwar to study the effect of planting geometry and nitrogen on sweet corn (Zea mays L.) cv 'Madhuri'. Twenty treatment combinations, comprising four spacings (45 cm x 30 cm, 45 cm x 20 cm, 60 cm x 30 cm and 60 cm x 20 cm) allotted to the main plots and five nitrogen levels (0, 20, 40, 60 and 80 kg/ha) to the subplots, were tested in split-plot design with three replications. The spacing of 60 cm x 20 cm significantly increased the number of prime cobs (54,108/ha), green-cob yield (9.21 tonnes/ha), nitrogen uptake (53.62 kg/ha), protein yield (174.35 kg/ha) and accrued highest net return (Rs 48,571/ha) and benefit: cost ratio (3.55), followed by 45 cm x 30 cm spacing. Application of 80 kg N/ha produced significantly highest number of prime cobs (62,328/ha), green-cob yield (9.80 tonnes/ha), length (17.5 cm) and girth (16.7 cm) of cobs, green-forage yieid (17.35 t/ha), total N uptake (91.2 kg/ha) and protein yield (280.8 kg/ha). Significantly highest net returns (Rs 61,532/ha) and benefit: cost ratio (3.76) were realized with 80 kg N/ha, followed by 60 and 40 kg N/ha.

038. Kumar, A. (Birsa Agricultural University, Pakur (India); Prasad, S. (Rajendra Agricultural University, Bhagalpur (India); Kumar, S.B. (Birsa Agricultural University, Ranchi (India). Dept. of Soil Science). Effect of boron and sulphur on performance of gram (Cicer arietinum). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 57-59 KEYWORDS: CICER ARIETINUM; SULPHUR FERTILIZERS; BORON; YIELDS.

An experiment was conducted during 2001-02 and 2002-03 to study the effect of boron and sulphur on the growth and yield of gram (Gicer arietinum L.). A combined dose of 10 kg borax + 30 kg sulphar/ha gave significantly maximum average seed yield (15.98 q/ha), which out yielded ather treatments except the application of 0.25 percent boric acid (thrice) + 30 kg sulphur/ha. Single application of boron gave higher yield than of sulphur. Pods/plant, and 100-seed weight were also significantly higher under combined application of boron and sulphur. Net return was maximum (Rs 21 ,082/ha) under 10 kg borax + 30 kg sulphur/ha. Boron concentration and uptake increased significantly under combined application than the control or single application of these two elements.

039. Kumar, A.; Kushwaha, H.S. (Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot (India). Dept. of Agronomy). Response of pigeonpea (Cajanus cajan) to sources and levels of phosphorus under rainfed condition. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 60-62 KEYWORDS: CAJANUS CAJAN; PHOSPHATE FERTILIZERS; PRODUCTIVITY; NUTRIENT UPTAKE; RAINFED FARMING.

A field experiment was conducted during rainy seasons of 1999 and 2000 to study the effect of sources and levels f phosphorus on productivity of pigeonpea [Cajanus cajan (L.) Millsp.]. Application of single superphosphate (SSP) produced significantly higher nodules/plant, dry weight of nodules/plant and pods/plant than that of diammonium

phosphate (OAP). Application of SSP increased the seed yield, total P uptake and net returns over their respective OAP respectively by 6.1 percent, 0.53 kg p,o,/ha and Rs 913/ha. Phosphorus application increased the nodules/plant, dry weight of nodules/plant, pods/plant, seed yield, total P uptake and net returns significantly. Seed yield and net returns increased significantly with P levels up to 40 kg P ,O,/ha, giving 52.4 and 18.3 percent and Rs 6,757 and Rs 3,002lha more over the control and 20 kg p,o, respectively. Returns/Re invested was recorded more under 60 and 80 kg P,O,lha (Rs 2.76). followed by 40 kg P,O,lha (Rs 2.66). The agronomic P-use efficiency (APUE) and apparent P recovery were higher in SSP; however, these were recorded more at lower level of P and decreased with increase in P level. The physiological efficiency of phosphorus (PEP) and phosphorus use efficiency (PUE) were calculated more in OAP. However, PEP increased with increase in P level.

040. Kumar, N.; Singh, S.; Singh, V. (Raja Balwant Singh College, Bichpuri (India). Dept. of Agricultural Chemistry and Soil Science). Effect of iron and sulphur levels on yield, oil content and their uptake by Indian mustard (Brassica juncea). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 63-64 KEYWORDS: BRASSICA JUNCEA; SULPHUR FERTILIZERS; MICRO NUTRIENT FERTILIZERS; NUTRIENT UPTAKE.

A field experiment was conducted during winter seasons (rabi) of 1999-2000 and 2000-01 to study the effect of graded levels of iron and sulphur on Indian mustard [Brassica juncea (L.) Czernj. & Cosson]. Indian mustard responded significantly to the application of Fe and S. The seed and stover yields increased linearly up to 20 kg Fe/ha and 40 kg S/ha. The seed yield (17.72 q/ha) at 20 kg Fe/ha was 12.4 percent higher than that obtained in the control. Similarly, application of 40 kg S/ha gave the highest seed yield (18.37 g/ha), which was 28.1 percent more in comparison with that of the control. The uptake of Fe and S significantly increased up to 40 kg S/ha and 40 kg Fe/ha, and at 60 kg S/ha and 20 kg Fe/ha respectively. Oil content increased significantly with Fe and S addition. The added Fe and S were utilized maximum under application of the lowest levels of Fe and S.

041. Nehara, K.C. (Agricultural Research Station, Sriganganagar (India); Kumawat, P.D. (S.K.N. College of Agriculture, Jobner (India); Singh, B.P. (Dr. B.R. Ambedkar University, R.B.S. College, Bichpuri (India). Response of fenugreek (Trigonella foenum0graecum) to phosphorus, sulphur and plant-growth regulators under semi-arid eastern plains zone of Rajasthan. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 73-76 KEYWORDS: TRIGONELLA FOENUM GRAECUM; PHOSPHATE FERTILIZERS; SULPHUR FERTILIZERS; PLANT GROWTH SUBSTANCES; RAJASTHAN; SEMI ARID ZONES.

A field experiment was conducted during winter seasons (rabi) of 2001-02 and 2002-03 on a loamy sand soil of Jobner in Rajasthan, to study the response of fenugreek (frigonella foenum-graecum L.) under different levels of phosphours (0, 25 and 50 kg P ,O,lha), sulphur (0, 25 and 50 kg S/ha) and plant-growth regulators (control, Tricontanol2 ppm, naphthaline acetic acid 20 ppm and etheophon 100 ppm). An increase in P level up to 50 kg P ,D,lha and sulphur up to 50 kg S/ha significantly increased the yield-attributing characters; the seed, straw and biological yields; and the net returns of fenugreek. The N, P and S contents of fenugreek in seed and straw and their total uptake increased significantly with increase in the level of applied phosphorus and sulphur up to 50 kg/ha, except the P and S content in seed and straw, where significant increase was recorded only up to 25 kg P ,D,lha and 25 kg

S/ha. Among different growth-regulators, the application of NAA 20 ppm proved significantly better than the control, tricontanol and etheophon.

042. Gupta, A.; Sharma, V.K.; Sharma, G.D.; Chopra, P. (Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya, Palampur (India). Dept. of Agronomy). Effect of biofertilizer and phosphorus levels on yield attributes, yield and quality of urdbean (Vigna mungo). Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 142-144 KEYWORDS: VIGNA MUNGO; BIOFERTILIZERS; PHOSPHATE FERTILIZERS; YIELD; QUALITY; SEED; INOCULATION.

A field investigation was conducted at farmer's field during the rainy seasons of 2000 and 2001 to study the effect of bio-fertilizer inoculation and phosphorus fertilization on yield and quality of the cuitivars of urdbean (Vigna mungo (L.) Hepper] 'UG 218' urdbean produced significantly higher pods/plants, 1,000-seed weight, seed yield as well as straw yieid over other 2 varieties. However, the protein content was higher in the seeds of 'Type 9'. The practice of seed inoculation with phosphorus-solubilising bacteria showed a significant increase in seed yield and its attributes as well as protein content and Nand P uptake over uninoculated treatment. Response of crop to phosphorus fertilization was significant up to 60 kg P2,05/ha for seed and straw yields. Phosphorus application aiso resulted in significant increase in seed protein content and Nand P uptake in seed and straw.

043. Dutta, D.; Mondal, S.S. (Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Response of summer groundnut (Arachis hypogaea) to moisture stress, organic manure and fertilizer with and without gypsum under lateritic soil of West Bengal. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 145-148 KEYWORDS: ARACHIS HYPOGAEA; WEST BENGAL; ORGANIC FERTILIZERS; FARMYARD MANURE; FERRA SOILS.

Response of groundnut (Arachis hypogaea L.) cv 'TAG 24' to moisture stress and application of organic manure (FYM) and fertilizer with and without gypsum was studied during the summer seasons of 2002 and 2003 at the Regional Research Station, B.C.K.V., Jhargram (West Bengal) under acid lateritic soils. Pooledanalysis of data Indicated that moisture stress at vegetative stage (10-30 days after sowing) gave 33.53 percent higher pod yield than that at flowering stage (30-50 DAS), but this moisture stress at vegetative stage was on a par with no moisture stress for pod yield, yield attributes, oil content and nutrient uptake. The highest use of water was recorded with no moisture-stress treatment. Maximum water-use efficiency (WUE) was obtained under moisture stress during vegetative stage. Organic manuring with farmyard manure 7.5 tonnes/ha resulted in better yield attributes, yield, oil content, nutrient uptake and WUE than the control. Recommended dose of fertilizer (RDF), i.e. 30 kg N/ha, 60 kg p,o,lha and 40 kg K,o/ha when applied with gypsum 500 kg/ha significantly increased the pod yield, showing an increase of 17.19 and 11.54 percent over 100 percent and 125 percent RDF alone respectively. However, both 100 percent and 125 percent RDF were at par with or without gypsum application. Nutrient uptake and oil content were also influenced with increase in fertilizer level in combination with gypsum. Benefit cost ratio was found higher with moisture stress at vegetative stage and application of 7.5 tonnes FYM/ha or 100 percent RDF + 500 kg gypsum/ha respectively.

044. Ram, T.; Mir, M.S. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Kargil (India). Regional Agricultural Res. Sub-station). Effect of integrated management on yield and yield-attributing characters of wheat (Triticum aestivum). Indian Journal of

Agronomy (India). (Sep 2006) v. 51(3) p. 189-192 KEYWORDS: TRITICUM AESTIVUM; FARMYARD MANURE; INORGANIC FERTILIZERS; YIELDS; NITROGEN.

A field experiment was conducted during the rainy (kharif) season of 2002 and 2003 to study the effect of different levels of organic manure (FYM) and inorganic fertilizers with different biofertilizer strains on wheat (Triticum aestivum L. emend. Fiori & Paol.). Application of 10 tonnes FYM + 120 kg N/ha significantly increased plant height, effective tillers/m row length, grains/spike, grain and straw yields over the control and 10 tonnes FYM + 100 kg N/ha during both the years. Both biofertilizers, Le. Azospirillum and Azotobacter, significantly enhanced all the growth parameters and grain and straw yields over the control. Combined application of Azospirillum + Azotobacter showed significant improvement over their individual application.

045. Pandey, I.B.; Dwivedi, D.K.; Prakash, S.C. (Rajendra Agricultural University, Samastipur (India). Dept. of Agronomy). Impact of method and levels of fertilizer application and weed management on nutrient economy and yield of wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 193-198 KEYWORDS: TRITICUM AESTIVUM; FERTILIZER APPLICATION; WEED CONTROL; HERBICIDES; YIELDS.

A field experiment was conducted during the winter (rabi) seasons of 2002-03 and 2003-04 at Pusa, Bihar, to study the impact of fertilizer and weed-management practices on nutrient economy and yield of wheat (Triticum aestivum L. emend. Fiori & Paol.). Placement of fertilizers significantly reduced weed dry biomass, NPK depletion by weed and increased yield attributes, grain and straw yields, net return, net return/rupee investment and NPK uptake by crop than broadcast method of fertilizer. Application of 125 percent of the recommended dose of fertilizer (150:75:50 kg N:P:K/ha) recorded significantly higher weed dry biomass, grain and straw yields, net return and NPK uptake by crop than recommended (120:60:40 kg N:P:K/ha) and 75 percent of the recommended dose of fertilizer (90:45:30 kg N:P:K/ha). However, net return/rupee investment increased significantly only up to recommended dose of fertilizer. Hand-weeding recorded significantly higher plant height, leaf-area index, tillers/m2, grains/ear, grain and straw yields than mixture of 2,4-D + isoproturon, but was at par with those recorded under sulfosulfuron. Sulfosulfuron recorded lowest weed population, weed dry biomass, NPK depletion by weed and highest weed-control efficiency. Placement of recommended dose of fertilizer resulted in significantly higher grain yield than broadcast of 125 percent of the recommended dose of fertilizer, Similarly, recommended dose of fertilizer under weed-control treatments recorded significantly higher grain yield than 125 percent of recommended dose of fertilizer under weedy check. Weed-control treatments also recorded higher protein content in grain.

046. Saha, M.; Mondal, S.S. (Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept. of Agronomy). Influence of integrated plant nutrient supply on growth, productivity and quality of baby corn (Zea mays) in Indo-Gangetic plains. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 202-205 KEYWORDS: ZEA MAYS; ORGANIC FERTILIZERS; FARMYARD MANURE; INORGANIC FERTILIZERS; SOIL FERTILITY; QUALITY; PRODUCTION.

A field experiment was conducted during 2004 and 2005 on sandy clay-loam soil of university research farm, Kalyani, on baby corn (Zea mays L.). Combined application of organic sources of nutrients, viz. neem seed powder 1.5 tonnes/ha or karanj-cake L. 1.25 tonnes/ha, farmyard manure 7.5 tonnes/ha, commercial formulation of pelleted form of organic manures 0.75 tonnes/ha and organic manure rich with humus 1.8 tonnes/ ha along

with 75 percent recommended dose of NPK fertilizer (RDF), were effective in increasing the standard corn yield by 6.20 percent -40.53 percent over the control (100 percent RDF). The biomax (pelleted form of organic manure) proved most effective in increasing the dehusked corn yield (30.32 percent) and standard yield (40.53 perecent) over the control. Application of organics along with chemical fertilizer improved the yield attributes, quality parameter of protein content of corn over the control. Judicious application of organic manure along with inorganic fertilizer improved fertility status of the soil (N, P, K and organic C). The maximum net return, benefit: cost ratio and removal of nutrient by baby corn (67.68, 13.88 and 90.02 kg/ha of N, P and K respectively) was obtained when the crop management was done with 75 percent RDF + pelleted form of organic manure.

047. Piri, I.; Sharma, S.N. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effect of levels and sources of sulphur on yield attributes, yield and quality of Indian mustard (Brassica juncea). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 217-220 KEYWORDS: BRASSICA JUNCEA; SULPHUR FERTILIZERS; YIELDS; YIELD COMPONENTS; SANDY SOILS.

A field experiment was carried out during the winter season of 2003-04 and 2004-05 at the Indian Agricultural Research Institute, New Delhi, to study the effect of 4 levels (0, 15, 30 and 45 kg S/ha) and 2 sources (gypsum and cosavet) of sulphur on yield attributes, yield and quality of Indian mustard [Brassica juncea (L.) Czernj. & Cosson]. Yield attributes, seed and straw yields, oil content and oil yield, and sulphur content and uptake in both seed and straw increased significantly with increasing level of sulphur up to highest level of 45 kg S/ha. Application of 15, 30 and 45 kg S/ha increased the seed yield over the control by 9, 16 and 23 percent; oil yield by 13, 22 and 33 percent; and sulphur uptake by 25, 48 and 65 percent, respectively. Sources of sulphur did not differ significantly with regard to yield and sulphur uptake but cosavet recorded significantly higher sulphur-use efficiency and sulphuruptake efficiency than gypsum.

048. Singh, S.P.; Kushwah, V.S. (Central Potato Research Station, Gwalior (India). Effect of integrated use of organic and inorganic sources of nutrients on potato (Solanum tuberosum) production. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 236-238 KEYWORDS: SOLANUM TUBEROSUM; ORGANIC FERTILIZERS; FARMYARD MANURE; NPK FERTILIZERS; YIELDS; ECONOMICS.

A field experiment was conducted at Central Potato Research Station, Gwalior during winter seasons (rabl) of 2001-02 and 2002-03 to study the effect of organic and inorganic sources of nutrients on potato (Solanum tuberosum L.) production. The treatments included 25, 50, 75 and 100 percent doses of NPK with and without organic manures (farmyard manure and Nadep compost 0 tonnes/ha). Application of 100 percent NPK + 30 tonnes FYM/ha resulted in significantly higher tuber yield of 456 q/ha compared with that of other treatments except 100 percent NPK + 30 tonnes Nadep/ha and 75 percent NPK + 30 tonnes FYM/ha. The effect of organic manures (FYM and Nadep compost) in combination with inorganic fertilizers was more pronounced compared with that of organic manures alone. However, FYM was found more effective than Nadep compost in producing higher tuber yield. Maximum net return of Rs 63,627/ha was also obtained from 100 percent NPK + 30 tonnes FYM/ha. However, benefit: cost ratio was almost same under 75 percent NPK with 30 tonnes/ha FYM or Nadep compost and 100 percent NPK with 30 tonnes/ha FYM or Nadep compost.

049. Bhunia, S.R.; Chaudhan, R.P.S.; Yadav, B.S.; Bhati, A.S. (Rajasthan Agricultural University, Sriganganagar (India). Agricultural Res. Stn.). Effect of phosphorus, irrigation and Rhizobium on productivity, water use and nutrient uptake in fenugreek (Tribonella foenum-graecum). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 239-241 KEYWORDS: PHOSPHORUS; TRITONELLA FOENUM GRAECUM; IRRIGATION; RHIZOBIUM.

An experiment was conducted during winter season of 2001-2004 for consecutive 3 years at Sriganganagar in Rajasthan to study the effect of phosphorus, irrigation and Rhizobium inoculation on seed, economics, water use and nutrient uptake of fenugreek (Trigonella foneum-graecum L.). Application of 40 kg P p/ha significantly increased the yield attributes, viz. branches/plant, pods/plant, pod length, seeds/pod and test weight and finally the yield (8.08 q/ha) over 20 kg PPs. Phosphorus 40 kg pp/ha gave the highest mean benefit: cost ratio (1.47) in comparison with 20 (1.38) and 60 kg pp/ha (1.42). The highest P-use efficiency (35.95 kg/kg P20s) was recorded at 20 kg P2O/ha, and further increase in P decreased the P-use efficiency. An increase m P level, increased the consumptive use but had no effect on water-use efficiency. Highest level of P 20S led to greater extraction of moisture from lower depth of rhizosphere. Application of P increased the N, P and K uptake up to 40 kg P p/ha. IW:CPE ratio of 0.8 significantly increased the yield (10.20 q/ha), benefit: cost ratio (1.81), consumptive water use (291.9 mm) and nutrient uptake compared to IW : CPE ratio of 0.4 and 0.6. Higher yield attributes as well as higher seed (8.14 q/ha) and stover yields (17.36 q/ha) were recorded with Rhizobium inoculation than with uninoculated crop. Higher water use (244.8 mm), water-use efficiency (3.2 kg/ha-mm) and nutrient uptake (N 31.6, P 5.5 and K 37.9 kg/ha) were also recorded with the inoculated crop.

050. Patel, P.C.; Kotecha, A.V. (Anand Agricultural University, Anand (India). Main Forage Res. Stn.). Effect of phosphorus and potassium on growth characters, forage yield, nutrient uptake and quality of lucerne (Medicago sativa). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 242-244 KEYWORDS: MEDICAGO SATIVA; PHOSPHATE FERTILIZER; POTASH FERTILIZER; NUTRIENT UPTAKE; YIELDS; QUALITY.

A field experiment was conducted on well-drained sandy loam soils during the winter, summer and rainy (kharif) seasons of 2003-04 to study the nutritional requirement of major nutrients (P, K) for lucerne (Medicago sativa L.) crop. Application of 300 kg Kp/ha significantly increased the green-forage, dry-matter and crude-protein yields by 17.2, 13.3 and 17.6 percent, respectively over the control (50 kg Kp/ha), whereas the application of 150 kg Kp/ha significantly increased the green-forage yield only compared with the control in cumulative yield of 12 cuts. Both the lucerne varieties ('GAUL 1', 'AL 3') were more responsive to higher levels of potassium. Application of 75 kg P p/ha along with 300 kg Kp/ha to lucerne variety 'AL 3' recorded significantly highest dry-matter yield and maximum uptake of N, P and K, whereas the highest crude-protein yield and the maximum uptake of N and K were obtained with combined application of 75 kg pp/ha and 300 kg Kp/ha to variety 'GAUL 1'. Application of 50 kg P Ps + 300 kg Kp/ha to 'GAUL l' showed the maximum net return and net incremental cost: benefit ratio, followed by application of 75 kg pp/ha + 300 kg Kp/ha to variety 'AL 3'.

051. Srivastav, M. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Response of paclobutrazol in selected bioassays. Indian Journal of Plant Physiology

(India). (Jul-Sep 2006) v. 11(3) p. 223-226 KEYWORDS: PACLOBUTRAZOL; LETTUCE; CULTAR; COTYLEDON; CORN ROOT; ZEA MAYS; PLANT DISEASES; GIBBERELLIC ACID; BIOASSAYS.

Present investigation was carried out to analyse the response of varying concentrations of paclobutrazol in plant tissues. Evidences were produced by examining the interactio,n of gibberellic acid (GA3) and paclobutrazol (PBZ) in lettuce hypocotyl bioassay and 6-benzyl aminopurine (BAP) and paclobutrazol in radish cotyledon enlargement test that paclobutrazol counteracts gibberellins activity when applied exogenously. It also favoured radish cotyledon enlargement at low concentration without counteracting BAP action. Paclobutrazol slightly increased radish cotyledon growth at low concentration (up to 0.01 ppm) and could not counteract the growth caused by 1.0 ppm BAP at its 0.001 to 1.0 ppm concentrations suggesting independent effect of paclobutrazol to that of BAP. Furthermore, the activity of paclobutrazol was tested in corn root curvature test and it was found that PBZ concentrations from 0.001 to 10.0 ppm linearly increased the percentage of corn roots showing more than 90° curvature.

052. Sharma-Nadu, P.; Sumesh, K.V.; Lohot, V.D.; Ghildiyal, M.C. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology). High temperature effect on grain growth in wheat cultivars : an evaluation of responses. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 239-245 KEYWORDS: WHEATS; TRITICUM AESTIVUM; GROWTH; HEAT SUSCEPTIBILITY; TOLERANCES; TEMPERATURE; YIELD COMPONENTS; YIELDS.

Wheat (Triticum aestivum L) cvs. DL 153-2, C306, HD 2329 and WH 542 were grown under normal (27 November) and late (28 December) sown conditions. In an another experiment these wheat cultivafs, except that HD 2285 replaced C306, were grown under normal sowing and at anthesis stage were transferred to control and heated open top chambers (OTCs). Under late sowing, wheat cultivars were exposed to mean maximum temperature upto 3.6°C higher than normal sowing, whereas, under heated orcs, mean maximum temperature was 3.2°C higher than control OTCs, during grain growth period. In spite of more or less similar increase in temperature during grain growth period by late sowing and in orcs experiment, the magnitude of responses were different. All the cultivars showed a decrease in yield by late sowing and decrease was greater than OTCs experiment wherein the significant decrease in yield under elevated temperature (ET) was observed only in two cultivars. The main effect of high temperature in orcs appeared to be on grain size, whereas, in late sowing experiment, different yield components including grain growth rate were differentially affected in different cultivars. Nonetheless, the varietal pattern of susceptibility remained more or less same in late sowing and OTCs experiments. DL 153-2, C306 and HD2285 were relatively heat stress tolerant for grain growth and yield compared to HD 2329 and WHS42. The present study further emphasized that late sowing of wheat by end of December can bring down the grain yield by 30-40 percent compared to November sowing. The late sowing of wheat being generally practiced because of prevalence of rice-wheat cropping system could, therefore, be one of the reasons for overall decline in wheat productivity. It appears that from late sowing experiment, one may not be able to analyse precisely the effect of high temperature experienced exclusively during post anthesis period. By late sowing, pre-anthesis phenological events determining potential yield components would also be affected which were then carried over to grain growth phase and influenced the grain growth and yield.

053. Bhat, S.A. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Div. of Olericulture); Khan, F.A. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Div. of Post Harvest Technology); Khan, M.I. (Indira Gandhi Agricultural University, Ranpur (India). Dept. of Plant Physiology). Effect of nitrogen and phosphorus on growth, nutrient conent, seed yield and quality of mustard. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 281-286 KEYWORDS: MUSTARD; BRASSICA JUNCEA; GROWTH; NITROGEN; PHOSPHORUS; QUALITY; YIELDS; NUTRIENT CONTENTS.

A pot experiment was conducted to study the effect of three levels of nitrogen and phosphorus combinations, i.e. N60 P 30 kg ha-I, Nso P 40 kg ha-1 and N100 P 50 kg ha-1 on growth, yield and quality of two cultivars of mustard (Brassica juncea). The data revealed that cultivar Pusa Bold gave higher plant height, leaf number, leaf area, number primary branches and plant dry weight than Kranti. Application of higher dose of NP fertilizers, i.e. N100 Pso kg ha-1 proved significantly better in improving all these parameters. Higher fertilizer dose also resulted in a significant increase in number of siliqua plant-I, length of siliqua and number of seeds siliqua-1, which consequently resulted in a marked increase in harvest index and seed yield of both the cultivars. N100 Pso kg ha-1 also resulted in an over all increase in leaf N, P and K contents and seed protein content. Oil content was found to be decreased with increased dose of NP fertilizers, however, extent of decrease in seed oil content was lower than increase in seed yield and thus total edible oil production was still higher with higher fertilizer dose as compared to the normal recommended dose.

054. Paul, V. (Central Potato Research Institute, Modipuram (India); Ezekiel, R. (Central Potato Research Institute, Shimla (India). Sprout supressiohn of potato tubers stored at 18oC by pre-and post-harvest application of sub-lethal doses of glyphosate. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 300-305 KEYWORDS: SOLANUM TUBEROSUM; SPOUTING; SUBLETHAL DOSE; TUBER CROPS; TUBER; POTATO; GLYPHOSATE.

Glyphosate was tried at three concentrations for suppressing the sprout growth of potato (Solanum tuberosum L.) tubers in two cultivars differing in dormancy duration. Single pre-harvest foliar spray of glyphosate [0.833 kg (a.i.) ha-1] at 70 days after planting was effective in suppressing the sprout growth with no adverse effect on tuber number and yield. The reduction in sprout growth was 74 percent in Kufri Jyoti and 85 percent in Kufri Bahar. Higher concentrations of glyphosate resulted in abnormal sprouts with cauliflower like appearance and increased incidence of cracking in larger tubers (75 g), especially in variety Kufri Jyoti that showed 30 percent of this incidence. Post-harvest application of glyphosate reduced sprout growth by 81 percent and 78 percent in Kufri Jyoti and Kufri Bahar respectively.

F06 Irrigation

055. Kumar, A.; Sharma, P.C.; Batra, L. (Central Soil Salinity Research Institute, Karnal (India). Effect of alkali irrigation and gypsum doses on yield and chemical composition of oat (Avena sativa) varieties in an alkali soil. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 70-72 KEYWORDS: AVENA SATIVA; IRRIGATION; CALCIUM FERTILIZERS; ALKALI SOIL; YIELDS.

A field experiment was conducted during the winter (rabi) seasons of 2002-2003 and 2003-2004 at Kamal, to study the effect of gypsum application on 5 varieties of oat (Avena sativa L.) in a moderately alkali soil (pH 9.3) using alkali water (RSC 8.6 me/litre) irrigation.

The yield of oat was not significantly influenced owing to gypsum application; however variation in yield was recorded amongst the varieties. Highest yield was observed in variety 'HJ 8' followed by 'OS 7'. On an average, 'HJ 8' and 'OS 7' varieties registered 16.2 percent and 8.3 percent higher yield, respectively, than 'Kent', a popular variety. Higher yield of 'HJ 8' may be attributed to its tall and broad leaves compared with remaining varieties. However, 'OS 6' variety showed the maximum tillers. Gypsum application did not influence chemical composition of oat. Varieties 'Kent', 'HJ 8' and 'OL 9' showed similar crude protein that was significantly greater than the remaining 2 varieties. 'Kent' and 'OL 9' varieties accumulated significantly lower sodium percentage than the other varieties evaluated. Application of gypsum at each level enhanced the chlorophyll content of oat. Varieties 'HJ 8' and 'OS 7' also showed significantly higher total chlorophyll content, indicating their better tissue tolerance inspite of their greater sodium content.

056. Gormus, O. (Cukurova University, Adana (Turkey). Dept. of Field Crops). Effect of mepiquat chloride and boron on irrigated cotton (Gossypium hirsutum) in Turkey. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 149-151 KEYWORDS: GOSSYPIUM HIRSUTUM; MEPIQUAT; BORON; YIELD; TURKEY; FOLIAR APPLICATION.

A field study was conducted from 2003 to 2004 to evaluate effects of foliar application of Mepiquat chloride and boron on growth and yield of upland cotton (Gossypium hirsutum L.). Mepiquat chloride 0.15litre/ha significantly reduced plant height, number of main stem nodes and nodes to first fruiting branch compared to the control. Plants treated with Mepiquat chloride at first flowering and 2 weeks after first flower stage and boron 0.15 litre/ha at first flowering and and 4 weeks after first flowering resulted in significantly highest number of open bolls and seed-cotton yield. All foliar B applications applied either at 2 weeks and 4 weeks after first flower resulted in similar but higher yields than the control. Neither Mepiquat chloride nor B affected gin turnout.

057. Malayini, P.; Raja, R.; Kumar, A.A. (Central Institute for Cotton Research, Coimbatore (India). Regional Station). Evapo-transpiration based scheduling of irrigation through drip for cotton (Gossypium hirsutum). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 232-235 KEYWORDS: GOSSYPIUM HIRSUTUM; IRRIGATION SCHEDULING; TRICKLE IRRIGATION; WATER USE EFFICIENCY.

A field experiment was conducted during the winter season of 2001-02 and 2002-03 and summer season of 2002 and 2003 at Coimbatore, to find out the water requirement and water saving due to irrigation scheduling based on evapotranspiration (ET) through drip system compared to conventional irrigation for upland cotton (Gossypium hirsutum L.) crop. Scheduling of irrigation through drip at 0.8 Etc (crop evapotranspiration) was on a par with 1.0 Etc through drip. The total water requirement was 426.5 mm for winter crop and 467.3 mm for summer crop at 0.8 Etc compared to 902.8 mm and 1,002 mm, respectively, for conventional irrigation. The yield enhancement due to drip system during summer was 28.9, 44.5 and 61.5 percent, respectively, at 0.6, 0.8 and 1.0 Etc, while the yield enhancement was negligible during winter, as it coincided with heavy effective rainfall of 238 mm.

058. Pushpalatha, P.; Singh, A.; Srivastava, G.C. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology). Effect of 1-methylcyclopropene on ripening and associated parameters in tomato fruits. Indian Journal of Plant Physiology (India). (Jul-Sep

2006) v. 11(3) p. 234-238 KEYWORDS: TOMATO; LYCOPERSICON ESCULENTUM; RIPENING; POLYGAQLACTURONASE; METHYLCYCLOPROPENE.

Tomato (Lycopersicon esculentum Mill.) cv. Pusa Ruby and Pusa Gaurav fruits were harvested at mature green stage and exposed to I-MCP evolved from ethylbloc at concentrations of If..l.lJl and 5f..1.l/ I for 4 hours, at 28:t2°C. The fruits were then stored at room temperature (28:t rC). The treatment of 5f..1.In of I-MCP delayed ripening by four days in both the varieties. Respiration rate, chlorophyll, Iycopene, carotenoid contents and polygalacturonase activity were determined in mature green fruits just before treatment and at half ripe and full ripe stages. I-MCP treatment not only delayed Iycopene accumulation but also significantly reduced its magnitude. However, total carotenoids content was enhanced by I-MCP treatment. Polygalacturonase activity was highly inhibited by I-MCP at half ripe stage, but did not affect it at full ripe stage. The results imply that I-MCP could be effective in delaying the ripening process in tomato fruits under tropical condition.

059. Chauhan, R.S.; Nautiyal, M.C. (Hemwati Nandan Bhauguna Garhwal University, Garhwal (India). High Altitude Plant Physiology Research Centre). Survival of Nardostachys jatamansi DC.- An endangered medicinal herb at three different altitudes. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 273-280 KEYWORDS: MEDICINAL PLANTS; NARDOSTACHYS JATAMANSI; PLANT SURVIVAL; ALTITUDES; CULTIVATION; VEGETATIVE PROPAGATION.

Propagation of Nardostachys jatamansi through vegetative propagation as well as seedlings (60, 90 and 180 days old) transplantation methods was carried out for three consecutive growth seasons and survival percentage of transplanted plants was analyzed at three different altitudes, i.e. natural habitat (3600 m), middle altitude (2200 m) and lower altitude, (1800 m). Plant survival percentage varied with altitude and treatments and was minimum in 60 days old seedlings and maximum in vegetatively propagated plants under various treatments. Seedlings (90 and 180 days old) and vegetatively propagated plants showed better ability to survive as compared to 60 days old seedlings under similar treatments. No seedling mortality was recorded during third growth season at 2200 m and 3600 m, whereas total plant mortality was observed at 1800 m in all the treatments. Transplantation during the month of May in raised beds with farm yard manure (FYM) treatment at 3600 m and plain beds with FYM treatment _at 2200 m are suitable for better survival of the species.

F07 Soil Cultivation

060. Goswami, S.B.; Saha, S. (Bidhan Chandra Krishi Viswavidyalaya, Gayespur (India). All India Coordinated Research Project on Water Manatgement). Effect of organic and inorganic mulches on soil moisture conservaton, weed suppression and yield of elephant foot yam (Amorphophallus paeniifolius). Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 154-156 KEYWORDS: AMORPHOPHALLUS; MULCHES; WEED CONTROL; YIELDS; SOIL WATER CONTENT.

A field investigation on elephant-foot yam (Amorphophallus paeoniifolius Blume) was carried out during the pre-rainy and rainy seasons (kharif of 2001 and 2002 with various mulch materials, viz. transparent polythene, black polythene, wheat straw, paddy straw, banana leaf, water hyacinth (Eichhornia crassipes) and cowpea (Vigna sp.) as cover crop.

Black polythene, paddy straw and water hyacinth recorded significantly higher yields (50.2-52.8 tonnes/ha), which was 7.1-28.8 percent more than that of no-mulch control. Black polythene recorded the highest weed-control efficiency (92.1 percent). Mulches conserved the soil moisture by 26.3 to 29.7 percent in the soil (0-30 cm). Organic and inorganic mulches were on a par with each other in maintaining the soil-moisture status. Higher benefit: cost (B:C) ratio (3.12-3.38) was observed under application of organic mulch compared with that of inorganic or synthetic mulches (1.88-2.09).

F08 Cropping Patterns and Systems

061. Kumar, Y.P. (Acharya N.G. Ranga Agricultural University, Palem (India). Regional Agricultural Research Stn.); Rao, M.S. (Acharya N.G. Ranga Agricultural University, Hyderabad (India). Dept. of Soil Science and Agricultural University). Oil content, oil yield and seasonal water use of sunflower (Helianthus annuus L.) as influenced by tillage, irrigation and nutrient levels in rice-sunflower sequence. Annals of Biology (India). (Jun 2006) v. 22(1) p. 1-6 KEYWORDS: HELIANTHUS ANNUUS; TILLAGE; SOIL CHEMICOPHYSICAL PROPERTIES; FERTILIZER COMBINATIONS.

Field experiments were conducted during post rainy season of 200 1-02 and 2002-03 on sandy clay loam soil in rice fallows at University Research Farm, Rajendranagar, Hyderabad. The soil was low in available nitrogen and phosphorus and medium in available potassium. Three tillage practices constituting deep and shallow primary tillage in combination with rotavator (power tiller and tractor drawn) or cultivator as secondary tillage, three soil water regimes constituting of scheduling of irrigations at IW/CPE of 0.6,0.8 and 1.0 and three levels offertilizers (75, 100 and 125 PERCENT RDF) were evaluated in split-split plot design. Higher the intensity ofland preparation with tractor drawn implements (disc plough once+rotavator once), frequently irrigated plots (IWI CPE=I.O) and 25 PERCENT higher than the recommended level (125 percent RDF) recorded higher oil content, seed and oil yield and seasonal water use by crop. The interaction ofthese combinations also recorded significantly higher oil yield during both the years.

062. Magar, S.S. (Dr. Bala Saheb Sawant Konkan Krishi Vidyapeeth, Dapoli (India). Organic farming : technical feasibility, economic viability and social acceptance. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 374-378 KEYWORDS: ORGANIC AGRICULTURE; ORGANIC AMENDMENTS; FARM YARD MANURE; ORGANIC COMPOUNDS; ORGANIC SOILS; ORGANIC FERTILIZERS.

063. Mondal, A.K.; Jalali, V.K.; Pareek, N.; Wali, O. (Sher-e-Kashmir University of Agricultural Science and Technology, Jammu (India). (Div. of Soil Science and Agricultural Chemistry). Phosphorus adsorption characteristics of subtropical soils in Jammu region. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 467-468 KEYWORDS: SOIL CONSERVATION; SOIL CHEMISTRY; SOIL CLASSIFICATION; SOIL GENESIS; JAMMU; PHOSPHORUS.

064. Mina, B.L.; Singh, S. (Indian Agricultural Research Institute, New Delhi (India). (Div. of Soil Science and Agricultural Chemistry). Influence of integrated use of FYM and fertilizer phosphorus on phosphorus dynamics in soybean - wheat sequence. Annals of Agricultural

Research (India). (Mar 2005) v. 26(1) p. 40-44 KEYWORDS: CROPPING SYSTEMS; FARMYARD MANURE; PHOSPHORUS; FERTILIZER.

Field experiments were conducted at IARI, New Delhi in sandy loam, Typic, Haplustep to study the effect of integrated P supply on P dynamics in soybean-wheat sequence. The results revealed that Olsen's extractable P, different inorganic P fractions and organic P at the harvest of soybean were increased with increasing levels of P from 20 to 80 kg PzOs ha-l applied through either with FYM or DAP. The maximum increase in different P fractions was noticed at 80 kg PzOs ha-llevel applied in 1:1 ratio of FYM and DAP combination to soybean. The olsen's extractable P fraction was significantly higher with DAP than with FYM: At the end of soybean-wheat sequence Fe-P and organic P were decreased at lower levels but were increased at higher levels, while Al-P fraction was higher only at higher levels as compared to their initial concentration before sowing the soybean. Saloid-P, reductant soluble-P and Ca-P showed an accumulation at the harvest of wheat.

065. Singh, S.N. (Indian Institute of Sugarcane Research, Lucknow (India); Singh, S.C.; Singh, S.B. (Uttar Pradesh Council of Sugarcane Research, Shahjahanpur (India). Potantially of growing potato as inter/sequential crop with the widely adopted rice-sugarcane cropping system. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 18-20 KEYWORDS: CROPPING SYSTEMS; MUSTARD VARIETIES; SUGARCANE; RICE; YIELD; POTATO; WHEAT; GROWTH.

Field studies were undertaken for two consecutive seasons (2000-2002 and 2001-20(3) at the Research Farm ofD,Pi Council of Sugarcane Research, shahjahanpur (D.P.) to study the potentially of growing potato as inter/sequential crop with rice-sugarcane cropping system. Results showed that sequential cropping of potato under rice-potato-spring cane cropping system produced significantly higher cane yield (109.03 t/ha) to the tune of 16.87, 20.32 and 26.62 as compared to rice-fallow-spring cane, rice-mustard-spring cane and rice-wheat-late spring cane crop sequences, respectively. Further, after rice harvest, intercropping of potato (one row) with sugarcane planted in skipped rice rows produced the significantly highest cane yield of 116.55 t/ha (6.90 percent higher than rice-potato-spring cane crop sequence) followed by rice-sugarcane + potato cropping system (95.49 t/ha). Yields of rice, wheat, mustard and potato as inter/sequential crops were almost normal in different cropping system. Quality of cane was un-affected due to different treatments in the study.

066. Kler, D.S.; Walia, S.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy and Agrometeorology). Organic, integrated and chemical farming in wheat (Triticum aestivum) under maize (Zea mays)-wheat cropping system. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 6-9 KEYWORDS: ORGANIC FERTILIZERS; TRITICUM AESTIVUM; ZEA MAYS; FARMYARD MANURE; YIELDS; SEQUENTIAL CROPPING.

A field experiment with organic vs chemical farming with maize (Zea mays L.)-wheat (Triticum aestivum L. emend. Fiori & paol.) system was initiated during 1996-97. On the same field, the investigation was expanded to organic (pure), integrated (partial) and chemical farming systems during winter seasons of 2001-02 and 200203 and was conducted at the experimental farm, Ludhiana, on sandy-loam irrigated soil. In maize-wheat sequence, on an average M,o-M,o-RI [FYM 20 tonnes/ha each to maize and wheat and incorporation of residues (RI)], M20,-M20,-GM, RI (GM-green manuring before maize), Rec.-GM-RI (Rec.-recommended chemical fertilizers) and Rec.-GM-RO (RO-residue removed); pure and partial organic farming treatments gave 12.4, 8.3, 8.0 and 5.9 percent higher wheat grain yield than

the Rec. treatment. M20,-M,o-RI and M20,-M20,-GM-RI (pure organic), Rec.-GMRI and Rec.-GM-RO (partial organic) treatments produced significantly higher plant height, dry-matter accumulation, leaf-area index, PARI (percent), effective tillers/m', ear length, number of grains/ear and recorded higher root density and SPAD readings and also showed less canopy and soil temperature as compared to Rec. treatments.

067. Mahala, H.L.; Shaktawat, M.S.; Shivran, R.K. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). (Dept. of Agronomy). Direct and residual effects of sources and levels of phosphorus and farmyard manure in maize (Zea mays)-mustard (Brassica juncea) cropping sequence. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 10-13 KEYWORDS: ZEA MAYS; BRASSICA JUNCEA; SEQUENTIAL CROPPING; PHOSPHATE FERTILIZERS; FARMYARD MANURE; RESIDUAL EFFECTS.

A field experiment was conducted during rainy (kharif) and winter (rabi) seasons of 2001-02 and 2002-03 to evaluate the direct and residual effects of sources and levels of phosphorus and farmyard manure (FYM) applied in maize (Zea mays L.) on the succeeding Indian mustard [Brassica juncea (L.) Czernj & Cosson]. Phosphorus application through single superphosphate (SSP) recorded the maximum grain and stover yields of maize and were on a par with that of Udaipur rock phosphate (URP) +SSP (1;1). Application of URP + phosphate-solubilizing bacteria (PSB) recorded the highest availabie P after maize harvest. Grain and stover yields of maize signiftcantly Increased up to 60 kg P ,Os/ha, whereas the available Nand P status of the soil after maize harvest increased up to 80 kg P ,D,fha. FYM also significantly improved the grain and stover yields as well as the availability of Nand P in the soil after maize harvest. Residual effect of P sources was found equally effective in improving the yield and nutrient uptake of mustard. Residual effect of URP+PSB recorded the highest available P in the soil after mustard harvest. Residual effect of increasing P levels up to 80 kg P ,D,fha significantly increased the seed and straw yields, nutrient uptake and the available Nand P status of soil after mustard harvest. Residual effect of FYM also had a significant positive impact on these aspects of mustard crop as well as on the available N and P in soil.

068. Jamwal, J.S. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Bari-Brahmana (India). Dryland Research Substation). Effect of integrated nutrient management in maize (Zea mays) on succeeding winter crops under rainfed conditions. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 14-16 KEYWORDS: ZEA MAYS; FARMYARD MANURE; RESIDUAL EFFECTS; BRASSICA NAPUS; CICER ARIETINUM; NPK FERTILIZERS; SOPIL FERTILITY.

A field experiment was conducted during rainy (kharif) and winter (rabi) seasons of 1998-99 and 1999-2000 at Dryland Research Substation, Rakh Dhiansar. Bari-Brahmana to evaluate the residual effect of integrated nutrient management in maize (Zea mays L) on succeeding gobhi sarson (Brassica napus L) and chickpea (Cicer arietinum L), Application of recommended dose of NPK (60:40:20 kg/ha) + 20 kg ZnSO,lha during kharif significantly increased the grain yield of maize as well as the succeeding crops of gobhi sarson and chickpea, Application of farmyard manure (FYM) significantly increased the available N, P and K status of the soil after maize harvest. Available P status of the soil after the harvest of gobhi sarson and chickpea also increased significantly due to the residual effect of FYM and fertility levels.

069. Varughese, K. (Kerala Agricultural University, Karamana (India). Cropping Systems Res. Centre). Production potential of high value cropping systems in coastal ecosystem. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 21-23 KEYWORDS: CROPPING SYSTEMS; ORYZA SATIVA; MUSA PARADISIACA; PRODUCTIVITY; CLIMATE; COASTS.

An experiment was conducted during 2001-02 and 2002-03 at the Cropping Systems Research Centre of Kerala Agriculturai University, Karamana, to study the production potential and economics of new cropping systems. The highest production potential and net income were obtained by rice (Oryza sativa L.), banana (Musa paradisiaca) followed by rice-rice-okra [Abe/moschus esculentus (L.) Moench] cropping systems. The nutrient management above the present package of practices (POP) recommendations also increased net income in all the cropping systems included in the study. However, the highest benefit: cost ratio was obtained in rice-ricegreen manure crop dhaincha [Sesbania cannabina (Retz.) Pers.] cropping system.

070. Kumar, R.; Ali, M.; Arya, R.L.; Mishra, J.P. (Indian Institute of Pulses Research, Kanpur (India). Enhancing productivity and profitability of chickpea (Cicer arietinum) + Indian mustard (Brassica juncea) intercropping system. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 27-30 KEYWORDS: CICER ARIETINUM; BRASSICA JUNCEA; INTERCROPPING; PRODUCTIVITY; GENOTYPES.

A field experiment was carried out during 1998-99 to 2000-01 at the Indian Institute of Pulses Research, Kanpur, to study the genotypic compatibility in kabuli chickpea (Cicer arietinum L) and Indian mustard [Brassica juncea (l.) Czernj. & Casson] in chickpea + Indian mustard intercropping system. Sole crop of chickpea cv. 'BG 1003' recorded significantly highest growth and yield attributes than the other genotypes of chickpea. Among the various intercropping systems, 'BG 1003' chickpea + 'Vardan' Indian mustard recorded significantly highest growth and yield attributes of chickpea and Indian mustard than the other intercropping systems. However, highest 1 DO-seed weight of chickpea was recorded in chickpea 'KAK 2' in chickpea + 'Vardan' Indian mustard intercropping system at 6:2 row ratio. Yield reduction of chickpea was recorded higher in Indian mustard genotypes of 'Varuna' than 'Vardan'. Significantly higher chickpea-equivalent yield, land-equivalent ratio (LER), net returns and benefit: cost ratio (B:C ratio) were recorded in 'BG 1003' + 'Vardan' intercropping system than the other intercropping system. Higher seed yield of component crops in intercropping system showed complimentary relationship which resulted in higher chickpea-equivalent yield.

071. Rana, N.S.; Kumar, S.; Saini, S.K.; Panwar, G.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy) . Production potential and profitability of autumn sugarcane-based intercropping systems as influenced by intercrops and row spacing. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 31-33 KEYWORDS: INTERCROPPING; SPACING; PRODUCTIVITY; SUGARCANE; YIELD; BRASSICA JUNCEA; BRASSICA NAPUS; PROFITABILITY.

A field experiment was conducted during 2000-2002 at Pantnagar, Uttaranchal, to study the feasibility of various intercrops with autumn sugarcane. Treatments comprising 12 combinations, 6 cropping systems, viz. sole sugarcane, sugarcane + lentiJ/mustard/maize/rajmash/rapeseed, as intercrop and 2 row spacings for sugarcane planting, viz. 75 em, and 90 em were tested in randomized block design. All the intercrops except maize, reduced cane yield attributed to decline in number of millable canes. Mean

reduction in cane yield was 8.7 percent with lentil, 14.8 percent with mustard, 13.3 percent with rajmash and 8.7 percent with rapeseed. Sugarcane planted at 90 cm spacing produced 9.5 percent higher cane yield than that at 75 em. Sugarcane + maize gave the highest mean cane-equivalent yield (200.6 tonnes/ha) being 52.5, 45.4, 55.7, 50.0 and 48.6 percent higher than sole sugarcane and its intercropping with lentil, mustard, rajmash and rapeseed, respectively. Sugarcane intercropped with maize gave highest net return of Rs 124,874/ha followed by sugarcane alone (Rs 71,145) as against Rs 62,104; 65,067; 67,138 and 69,040 with intercropping of mustard, rajmash, rapeseed and lentil respectively. Row spacing for sugarcane of 90 em gave higher cane equivalent yield and monetary return over 75 cm.

072. Ram, M.; Om, H.; Dhiman, S.D.; Mandal, D.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Rice Res. Stn.). Productivity and economics of rice (Oryza sativa)-wheat (Triticum aestivum) cropping system as affected by establishment methods and tillage practices. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 77-80 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM; PRODUCTIVITY; ECONOMICS; TILLAGE; DIRECT SOWING; TRANSPLANTING.

A field experiment was conducted during 2001-02 and 2002-03 on clay loam soil at Rice Research Station, Kaul, Haryana, to evaluate 4 methods of crop establishment and tillage practices in rice (Oryza sativa L.), viz. transplanting, direct seeding in puddled soil by drum seeder, direct seeding in friable soil by seed drill and direct seeding by zero-till drill; and 3 methods in succeeding wheat (Triticum aestivum L. emend. Fiori & Paol.) crop, viz. sowing with zero-liil drill, sowing with rotavator drill and conventional sowing, for getting higher productivity and profitability of irrigated rice-wheat system. Manual transplanting of rice gave significantly higher grain yield of rice (70.8 q/ha), followed by direct seeding of rice in puddled soil (58.0 q/ha), whereas the lowest yield was obtained with dry seeding by seed drill or zero-till drill. The wheat sown after dry seeding of rice yielded significantly higher (48.4-49.6 q/ha) than when sown after transplanted (46.3 q/ha) or direct-seeded puddled rice (45.3 q/ha). In wheat, sowing by rotavator drill (reduced tillage) or by zero-till drill (zero tillage) gave significantly higher grain yield (47.4 and 49.6 q/ha respectively) than by conventional method (45.2 q/ha). Transplanting in rice and sowing by rotavator in succeeding wheat resulted in the highest total productivity and profitability of the rice-wheat system.

073. Singh, V. (Raja Balwant Singh College, Bichpuri (India). Dept. of Agricultural Chemistry and Soil Science). Productivity and economics of rice (Oryza sativa) - wheat (Triticum aestivum) cropping system under integrated nutrient supply system in recently reclaimed sodic soil. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 81-84 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM; NUTRIENT UPTAKE; ORGANIC FERTILIZERS; FARMYARD MANURE; SOIL FERTILITY; SODIC SOIL.

A field experiment was conducted during the rainy and winter seasons of 2001-04 to study the influence of integrated nutrient-supply system, comprising inorganic fertilizers and organic manures on the soil-fertility status, productivity and economics of rice (Oryza sativa L.)-wheat (Triticum aestivum L. emend. Fiori & Paol.) cropping system. Three organic manures 10 tonnes/ha, viz. farmyard manure (FYM), Sesbania canabina (Retz.) Pers. (dhaincha) and cut rice straw were added at 50 and 100 percent of the recommended doses of NPK fertilizers. The green-manure dhaincha [Sesbania cannabina (Retz.) Pers. syn, S. aculeata] applied with 100 percent of recommended dose of NPK fertilizers gave the

maximum yield of rice as well as wheat crop. This treatment also gave the highest net return and benefit: cost ratio and produced significantly higher biomass in terms of riceequivalent yield. The total uptake of N, P, K and Zn by both the crops increased significanlly with the application of fertilizers or their combined use with organic manures. Among the organic manures the overall performance of green-manure was the best, followed by farmyard manure and cut rice straw. Application of farmyard manure and cut rice straw as well as green-manuring in rice and wheat significanlly improved the available N, P, K and Zn status of the soil.

074. Singh, G.; Singh, O.P.; Singh, R.G.; Mehta, R.K.; Kumar, V.; Singh, R.P. (Narendra Deva University of Agriculture and Technology, Bahraich (India). Crop Res. Stn.). Effect of integrated nutrient management on yield and nutrient uptake of rice (Oryza sativa)-wheat (Triticum aestivum) cropping system in lowlands of eastern Uttar Pradesh. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 85-88 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM; UTTAR PRADESH; NUTRIENT UPTAKE; INORGANIC FERTILIZERS; FARMYARD MANURE; ORGANIC FERTILIZERS.

A field experiment was conducted during 1999-2002 at Crop Research Station, Ghaghraghat, Bahraich to study the effect of integrated nutrient supply on yield, yield attributes, nutrient uptake and economics of rice (Oryza sativa L.)-wheat [Triticum aestivum (L.) emend. Fiori & PaoL] cropping system and soil fertility. Application of 25 percent recommended dose of N (RON) through pressmud and the rest 75 percent NPK through inorganic fertilizers to both crops increased the grain yield of rice and wheat by 51.1 and 56.2 percent respectively over no NPK treatment. Addition of zinc with 100 percent of recommended NPK through inorganic fertilizers gave higher grain and straw yields of both rice and wheat over 100 percent of recommended NPK alone. The rice-equivalent yield and total uptake of N, P and K by rice-wheat system were highest with 25 percent RON through pressmud + 75 percent ROF through inorganic fertilizers, followed by 50 percent RON through pressmud + 50 percent RON through inorganic fertilizers. The net income and benefit: cost ratios were also highest with 25 percent of recommended N through pressmud and the rest 75 percent NPK through inorganic fertilizer. The content of organic carbon and available phosphorus in soil improved in all integrated nutrient-management practices than its initial soil status. The value of potassium, bulk density, pH and electrical conductivity decreased in all the integrated nutrient-management practices compared with its initial soil status.

075. Sharma, S.K.; Pandey, D.K.; Gangwar, K.S.; Tomar, O.K. (Project Directorate for Cropping Systems Research, Modipuram (India). Production potential and economic analysis of direct-sown ricde (Oryza sativa)-wheat (Ttiticum aestivum) system as influenced by rice varieties, nutrient management and weed control measures. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 89-92 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM; WEED CONTROL; VARIETIES; DIRECT SOWING; SULPHUR FERTILIZERS.

A field experiment was conducted during rainy (kharif) and winter (rabi) seasons of 1999-2000 and 2000-01 at Modipuram in Meerut district to identify the most suitable rice (Ol}'za sativa L.) variety for direct seeding under unpuddled conditions, and also to study the effect of sulphur and weed-control measures on rice-wheat (Triticum aestivum L. emend. Fiori & Paolo] system. Rice varieties 'ORRH l' and 'Jaya' recorded mean yields of 71.5 and 66.7 q/ha respectively, which were significantly higher than of 'PAC SOS' (50 q/ha) and 'Pusa Sasmati'

(45.S q/ ha). Application of sulphur 30 kglha and weed control did not influence the productivity of both the crops. However, application of isoproturon 1.25 kg/ha + 2, 4-0 O.S kg/ha significantly affected the mean yield (49.3 q/ha) of wheat than hand-weeding (47.4 q/ha). Rice 'Jaya' - wheat (Rs. 39,094/ha) and rice 'ORRH 1'wheat (Rs 3S,S2S/ha) system gave significantly higher net returns than rice 'Pusa Sasmati 1'-wheat (Rs 37,7521 ha) and rice 'PAC SOS'-wheat (Rs 33,S71/ha) systems.

076. Korwar, G.R.; Pratibha, G.; Ravi, V.; Kumar, D.P. (Central Research Institute for Dryland Agriculture, Hyderabad (India). Performance of castor (Ricinus communis) and greengram (Vigna radiata) in agroforestry systems in semi-arid tropics. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 112-115 KEYWORDS: RICINUS COMMUNIS; VIGNA RADIATA; INTERCROPPING; AGROFORESTRY; SEMIARID CLIMATE.

A 3-year study was conducted at the Central Research Institute for Dryland Agriculture, Hyderabad, during in rainy seasons of 2002, 2003 and 2004, to evaluate the influence of 3 agroforestry tree species, viz amla (Emblica officina/is Gaertn.), tamarind (Tamarindus indicus L.) and (Acacia Senegal Willd.) on the growth and yield of castor (Ricinus communis L.) and greengram [Vigna radiata (L.) Wilczek] under rainfed conditions. The yields of arable intercrops were significantly influenced by the trees. Maximum reduction was observed with A. senegal and the minimum with am/a. With increase in age of trees, more reduction in arable crop yield was observed. Pooled over years, the grain yield of greengram was similar in sale crop and as intercrop with the 3 tree species. But in castor sale crop was superior to intercropping with tree species. Among the tree species, castor intercroped with alma and tamarind being at par were superior to A. senegal. Economic analysis showed the superiority of agroforestry systems over sale crop systems.

077. Giri, A.N.; Deshmukh, M.N.; Gore, S.B. (Marathwada Agricultural University, Parbhani (India). Cotton Res. Scheme). Nutrient management in cotton (Gossypium hirsutum)-based cropping systems. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 116-118 KEYWORDS: GOSSYPIUM HIRSUTUM; INTERCROPPING; SOYBEANS; URD; NUTRIENTS.

A field experiment was conducted on clayey soils during the rainy seasons of 1999-2003 at Parbhani, to study nutrient management in cotton (Grossypium hirsutum L.)-based intercropping systems. Sale cotton recorded significantly higher seed-cotton yield than cotton + blackgram (Phaseo/us mungo L.) and cotton + soybean [G/ycine max (L.) Merr.] intercropping systems. However, highest and significant cotton-equivalent yields were recorded in cotton + blackgram intercropping, followed by cotton + soybean than sale crop of cotton. Further, yield of seed cotton, intercrop and cotton equivalent were enhanced significantly with every higher fertilizer level and highest values were recorded with 100 percent recommended dose of fertilizer (RDF). The performance of cotton + blackgram (1:1) with 100 percent RDF was better than all the treatments for cotton-equivalent yield and net monetary returns. The uptake of NPK by cotton was significantly more under sale cotton and cotton intercropped with blackgram than the cotton intercropped with soybean. Application of 100 percent RDF recorded significantly higher NPK uptake by cotton than 75 percent and 50 percent RDF.

078. Kumar, A.; Sharma, P.C.; Batra, L. (Central Soil Salinity Research Institute, Karnal (India). Comparative performandce of sole and intercrop of oat (Avena sativa) and Persian clover (Trifolium resupinatum) under alkali water irrigation. Indian Journal of Agronomy (India).

(Jun 2006) v. 51(2) p. 119-122 KEYWORDS: AVENA SATIVA; INTERCROPPING; TRIFOLIUM RESUPINATUM; GYPSUM; IRRIGATION.

A field experiment was conducted during the winter (rabi) seasons 2002-03 and 2003-04 to study the performance of sale and intercrop of oat (Avena sativa L.) and Persian clover or shaftal (Trifolium resupinatum L.) under alkali water irrigation. Application of gypsum 2 tonneslha significantly enhanced the green forage yield in all the cuts and total yield over no-gypsum treatment. Sale crop of Persian clover (95.7 tonneslha) gave significantly higher total green forage yield than oat (45.4 tonneslha). The yield of Persian clover was significantly improved in the first cut when grown in association with oat at different ratios. Higher green forage yieid per day was obtained when oat was harvested for 1 cut only at 75 days than Persian clover and its mixtures. Application of gypsum improved the crude protein and calcium content of crops. Persian clover alone showed significantly higher concentration of N (crude protein), Na, Ca, Mg and P, while in oat only the K concentration was higher. Further, there was significant increase in the K content and decrease in Na content of Persian clover when grown in association with oat in different ratios.

079. Kumar, S.; Singh, R.C.; Kadian, V.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Response of dhaincha (Sesbania aculeata) genotypes to sowing dates and row spacing. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 152-153 KEYWORDS: SESBANIA BISPINOSA; SOWING DATE; SPACING; GENOTYPE; YIELD.

A field study was carried out at Research Farm of CCS HAU at Hisar during rainy seasons (kharif) of 2002 and 2003 to evaluate the performance of new dhaincha [Sesbania aculeata (L.) Walp.) genotypes for seed production in relation to sowing dates and row spacing. The crop sown on 20 June gave significantly higher seed yield (13.2 and 17.1 qIha during 2002 and 2003 respectively) of dhaincha compared with that sown on 10 July (11.2 and 10.7 q/ha). Genotype 'DH l' (13.3 and 15.5 q/ha) significantly outyielded 'Ses ND 3' (11.2 and 14.4 qI ha during 2002 and 2003) in respect of grain yield. Wider row spacing of 45 (12.6 and 15.6 q/ha) and 60 cm (12.9 and 15.8 q/ha) gave significantly more yield than that of 30 cm (11.2 and 13.3 q/ha).

080. Maiti, S.; Saha, M.; Banerjee, H.; Pal, S. (Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). (Dept. of Agronomy). Integrated nutrient management under hybrid rice-(Oryza sativa) hybrid rice cropping sequence. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 157-159 KEYWORDS: NUTRIENTS; ORYZA SATIVA; NUTRIENT UPTAKE; RICE; FARMYARD MANURE; GROWTH; YIELDS; ORGANIC FERTILIZERS; INORGANIC FERTILIZERS.

A field experiment was conducted during both rainy (kharif) (2002 and 2003) and summer (boro) seasons (2003 and 2004) at the Regional Research Station, New Alluvial Zone, to study the effect of organic and inorganic sources of plant nutrients applied singly and in combination on rainy season hybrid rice (Oryza sativa L.) and their residual effect on the succeeding summer season hybrid rice, receiving recommended doses of fertilizers. Growth attributes, yield components and grain yields increased with the increase in doses of chemical fertilizers alone as well as in combination with 5 tonnes FYM/ha in both the rainy seasons. Similar trend of result was observed in boro also. In hybrid rice-hybrid rice cropping system, the application of 125 percent recommended doses of fertilizer along with 5 tonnes FYM/ha during rainy season followed by 100 percent recommended doses of fertilizer during summer season gave higher grain yield (12.0 tonnes/ha), net return (Rs 15,848/ha)

and return/Re investment (Rs 1.34) compared with that of 100 percent recommended doses of fertilizer in both the seasons (10.45 tonnesl ha) grain yield, Rs 10,004/ha net return and Rs 1.23 return/Re investment. The status of organic carbon, nitrogen, phosphorus and potassium in the soil increased over the initial values after four consecutive croppings where FYM was applied in the rainy season.

081. Gupta, V.; Sharma, R.S.; Vishwakarma, S.K. (Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). (Dept. of Agronomy). Long-term effect of integrated nutrient management on yield sustainability and soil fertility of rice (Oryza sativa) - wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 160-164 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM; CROPPING SYSTEM; FARMYARD MANURE; GREEN MANURES; YIELDS; NPK FERTILIZERS.

A long-term experiment was conducted on integrated nutrient management in rice (Oryza sativa)-wheat (Triticum aestivum L. emend. Fiori & paol.) system at Jabalpur (Madhya Pradesh) since rainy (kharif) season 1987-88 to maintain the sustainable and high grain yields of this system without degradation of soil health under irrigated production system. The present paper deals with the studies conducted during the 2002-03 and 2003-04. Substituion of 50 percent N by green leaf manuring with sunnhemp (Grata/aria juncea L.) attained highest system productivity (33.12 kg grain/haJday). While determining the sustainability yield index (SYI), the value was also maximum with 50 percent NPK + 50 percent N through green manuring with sunnhemp to rice, followed by 100 percent NPK to wheat. Maximum soil available nitrogen, phosphorus, potassium, sulphur and zinc, and minimum bulk density were noticed with substitution of 50 peercent N by green manure. However, the pH value and EC were almost constant in all the treatments. Integrated use of 50 pewrcent NPK and 50 percent N through green manuring of sunnhemp to rice followed by 100 percent NPK to wheat also fetched the maximum net monetary returns (Rs 34,403/ha/year) with the benefit: cost ratio 2.40.

082. Jain, N.K. (Rajasthan Agricultural University, Udaipur (India). Rajasthan College of Agriculture); Dahama, A.K. (Rajasthan Agricultural University, Bikaner (India). Institute of Agri-Business Management). Direct and residual effects of phosphorus and zinc fertilization on productivity of wheat (Triticum aestivum)-pearl millet (Pennisetum glaucum) cropping system. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 165-169 KEYWORDS: TRITICUM AESTIVUM; PENNISETUM GLAUCUM; PHOSPHATE; FERTILIZER; MICRONUTRIENT FERTILIZERS; YIELDS; CROPPING SYSTEMS; RESIDUAL EFFECTS.

A field experiment, carried out from winter 2001-02 to rainy season 2003 at Navgaon (Alwar) on sandy loam soil revealed that application of 60 kg P p/ha significantly improved the growth and yield attributes as well as grain (43.95 q/ha) and straw yield (68.61 q/ha), harvest index (39.13 percent), protein content (10.72 percent) and P uptake (40.92 kg/ha) by wheat [Triticum aestivum (L.) emend. Fiori & Paol.] over no-use of P (control), while Zn uptake increased only up to 30 kg P p/ha and thereafter decreased significantly. Agronomic efficiency decreased up to 90 kg P p/ha. Recovery of P was higher at 60 kg P p/ha (21.63 percent) and thereafter decreased sharply. Similarly, application of 6 kg Zn/ha significantly increased all the growth anQ yield attributes (except test weight), protein content and Zn uptake by wheat over no-use of Zn (control). Application of graded levels of zinc up to 9 kg Zn/ha, remained at par with12 kg Zn/ha, significantly increased Zn uptake by wheat crop over other levels. Application of 6 kg Zn/ha increased the grain and straw yields by 19.4 and

16.8 percent over the no-use of Zn (control). Agronomic efficiency (115.3 kg/kg) and apparent Zn recovery (1.87 percent) were also higher at 6 kg Zn/ha. Available P status of soil increased and Zn status decreased significantly with the increase in phosphorus level up to 90 kg pp/ha. However, P status decreased and Zn status increased significantly with the increase in zinc level up to 12 kg Zn/ ha. Application of 60 kg P p/ha and 6-9 kg Zn/ha to whe?t significantly improved the growth and yield attributes, yield, protein content and P uptake in succeeding pearl millet [Pennisetum glaucum (L.) R. Br. emend. Stuntz] over control, while application of P 90 kg pp/ha decreased Zn and zinc 12 kg Zn/ha improved Zn uptake by pearl millet significantly over lower levels.

083. Roul, P.K. (Orissa University of Agriculture and Technology, Sambalpur (India). College of Agriculture); Sarawgi, S.K.; Shrivastav, G.K.; Kumar, D. (Indira Gandhi Agricultural University, Raipur (India). Effect of intregrated nitrogen management techniques on productivity, nitrogen uptake, N-use efficiency, economics and energetics of rice (Oryza sativa)-Indian mustard (Brassica juncea) sequence. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 170-173 KEYWORDS: ORYZA SATIVA; BRASSICA JUNCEA; SEQUENCIAL CROPPING; NUTRIENT UPTAKE; NITROGEN FERTILIZERS; FARMYARD MANURE; ECONOMICS; COST ANALYSIS.

A field study was conducted during 2000-01 and 2001-02 at the Indira Gandhi Agricultural University, Rair to evaluate the productivity, N uptake, N-use efficiency, economics and energetics of rice (Oryza sativa L.)-Ind mustard [Brassica juncea (L.) Czern. & Coss.] cropping system under different nitrogen management techniqu The total productivity of the cropping system in terms of rice-yield equivalent was the highest under 100 percent recc mended dose of nitrogen (RON) blended with FYM applied in rainy (kharif) (113.28 q/ha) and winter (rab/) seas((102.12 q/ha). The N uptake and N-use efficiency for rice and Indian mustard crops were also higher under 10' RON blended with FYM. Highest net returns and benefit: cost ratio were also observed under 100 percent RON blenc with FYM applied in rainy and also in winter season. This treatment could bring in 31.9 and 3.8 percent higher net turns over 100 percent RON when applied in rainy season and winter season respectively. The 100 percent RON belnded v FYM applied in rainy or winter season showed the higher energy output values and application of this treatmen rainy season also recorded the highest energy-use efficiency and output input ratio. However, in winter energy-l efficiency and output: input ratio under this treatment were low.

084. Padhi, A.K.; Panigrahi, R.K. (Orissa University of Agriculture and Technology, Berhampur (India). Agricultural Res. Stn.). Effect of intercrop and crop geometry on productivity, economics, energetics and soil-fertility status of maize (Zea mays)-based intercropping systems. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 174-177 KEYWORDS: INTERCROPPING; ZEA MAYS; URD; SOIL; FERTILITY; PRODUCTIVITY; ECONOMICS; SOYBEANS.

A field experiment was conduced during the rainy seasons of 2003 and 2004 at Kalimela, Orissa, to study the effect of intercrops and crop geometry on productivity, economics, energetics and soil-fertility status of maize (Zea mays L.)-based intercropping systems under rainfed condition. Intercrop blackgram (Phaseo/us mungo L.) followed by soybean [G/ycine max (L). Merr.] was found better than groundnut (Arachis hypogaea L.), whereas the row ratio 1:1, followed by 2:2 proved better than 2:1 with respect to productivity, economics and energy output. Maize with soybean and blackgram with maize significantly recorded he highest maize-grain equivalent yield of 25.7 and 11.8q/ha at 1:1 row ratio respectively.

Among various intercropping systems, maize+blackgram at 1:1 row ratio significantly achieved the maximum maize-grain equivalent yield (37.5 q/ha), land-equivalent ratio (1.68), area-time equivalent ratio (1.61), monetary advantage index (9,102), net return (Rs 1 0,511/ha), return/ rupee invested (1.84) and energy output (144.2, 1000 MJ/ha) compared to sole maize and blackgram. Maize+soybean at 1:1 row ratio closely followed this system on the above aspects. Grbundnut proved compatible, remunerative and less competitive with maize at 2:2 ratio rather than at 1:1 and 2:1 row ratios. Intercropping increased available soil N and decreased both soil P and K compared to initial and available soil N, P and K content after sole maize at both the systems of sowing. Available soil N, P and K content varied with the kind of intercrops. However, maize+soybean followed by maize+blackgram recorded the highest available soil N at 1:1 row ratio and available soil P and Kat 2:1 row ratio among various intercropping systems.

085. Meena, O.P. (Krishi Vigyan Kendra, Jaisalmer (India); Gaur, B.L.; Singh, P. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Agronomy). Effect of row ratio and fertility levels on productivity, economics and nutrient uptake in maize (Zea mays) + soybean (Glycine max) intercropping system. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 178-182 KEYWORDS: INTERCROPPING; MAIZE; SOYBEAN; ZEA MAYS; YIELDS; NUTRIENT UPTAKE; SOIL FERTILITY.

A field experiment was conducted during the rainy seasons of 2003 and 2004 at Udaipur, to study the effect of row ratios and fertility levels on maize (Zea mays L.) + soybean [Glycine max (L.) Merr.] inercropping system in south Rajasthan. The highest maize-equivalent yield was observed with 2:2 maize + soybean intercropping sown at 30 at 30 cm distance with each other. Application of 75 percent recommended dose of fertilizer (RDF) to maize (90 kg N/ha and 40 kg P/ha) and 50 percent to soybean (60 kg N/ha and 40 kg P/ha) significantly increased their respective yields, maize-equivalent yield, net returns and benefit: cost ratios over 50 percent RDF in maize and no fertilizer in soybean. The nutrient uptake by maize was highest with 1:1 ratio, while by soybean it was with 3:3 ratios. Increasing levels of fertility to maize and soybean up to 100 percent recommended dose increased the total nutrient uptake significantly over 75 and 50 percent in the both crops in intercropping system.

086. Sudhakar, P.C.; Singh, J.P.; Singh, Y. (Banaras Hindu University, Varanasi (India). Dept. of Agronomy); Singh, R. (Udai Pratap Autonomous College, Varanasi (India). Dept. of Agronomy). Effect of graded fertility levels and silicon sources on crop yield, uptake and nutrient use efficiency in rice (Oryza sativa). Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 186-188 KEYWORDS: ORYZA SATIVA; NUTRIENT UPTAKE; SOIL FERTILITY; YIELDS; SILICON; GROWTH.

A field experiment was conducted during the rainy seasons of 2001 and 2002 on sandy clay-loam soil (Ustochrept), to assess the influence of graded fertility levels and silicon sources on yield and nutrient uptake by rice (Oryza sativa L.). Graded fertility levels up to 160-80-80-32-0.75 kg N-PPs-Kp-S-Zn-EDTA/ha significantly increased grain and straw yields of rice. Similarly, all the yield-attributing characters were also significantly Increased up to same (F) fertility level but it remained at par with F4 fertility (200-100-100-40-1.0 kg/ha) level. On the other hand, the highest nutrient uptake was associated with the highest fertility level of 200-100-100-40-1.00 kg N-P2Os-K2O-S-Zn EDTA/ha. Among silicon sources, basic slag was superior to other sources as well as the control for yield and nutrients uptake.

087. Piri, I.; Sharma, S.N. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Physiological analysis of growth and yield of indian mustard as affected by irrigation and sulphur. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 253-260 KEYWORDS: MUSTARD; BRASSICA; IRRIGATION; PHYSIOCHEMICAL PROPERTIES; SULPHUR; NITROGEN; PHYSIOLOGICAL CHARACTERS.

The present study was carried out during rabi seasons of 2003-04 and 2004-05 to find out the effect of irrigation and sulphur on growth and yield characters of Indian mustard. The results revealed that application of two irrigations at 45 DAS and 90 DAS significantly increased plant height, dry matter accumulation, relative growth rate and secondary branches/plant over one irrigation. However, effects of one irrigation and two irrigations were at par on leaf area index, net assimilation rate and primary brauches/plant but recorded significantly higher values of above physiological parameters over no irrigation in both the years. Seed yield of mustard increased significantly with increasing levels of irrigation. Application of sulphur also significantly increased the plant height, dry matter accumulation, LAI, RGR, NAR, primary and secondary branches per plant and seed yield of Indian mustard. The significant response was observed up to 45 kg S/ha.

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088. Chhonkar, V. (Guru Jambheshwar University, Hisar (India). Dept. of Biotechnology); Sood, D.R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Biochemistry); Siwach, P.; Rani, M. (Guru Jambheshwar University, Hisar (India). Dept. of Biotechnology). Fatty acid composition of some promising genotypes of garlic (Allium sativum L.). Annals of Biology (India). (Jun 2006) v. 22(1) p. 23-26 KEYWORDS: ALLIUM SATIVUM; GENOTYPES; FATTY ACIDS.

Ten genotypes of garlic (Allium sativum L.), five at four stages of bulb development and five at maturity were analyzed for fatty acid composition. During bulb development of HG 1, HG 6, HG 17, HG 19 and G 1 garlic evinced that linoleic acid contributed more than 48 percent of the total fatty acids, while stearic acid contributed the least (0.50 percent). Palmitic or oleic acid was found to be second major fatty acid depending upon genotype and developmental stage. Total unsaturated fatty acids ranged from 70.40 to 85.40 percent during bulb development and HG 17 and G 1 showed a regular increasing trend, whereas total saturated fatty acid varied from 14.60 to 29.70 percent. At maturity, the cloves arranged in outer rings of G 282 G I Yamuna Safed, G 41 Agrifound White, G 50 Yamuna Safed and G 313 Agrifound Parvati garlic genotypes contained higher concentration of palmitic, stearic and total saturated fatty acids as compared to cloves arranged in inner rings. Total unsaturated fatty acids and unsaturated/saturated fatty acids ratio decreased in general from inner to outer rings of cloves of garlic.

089. Kapur-Ghai, J. (Punjab Agricultural University, Ludhiana (India). Dept. of Zoology and Fisheries). Comparative susceptibility of various cucurbits to infestation with two-spotted spider mite, Tetranychus urticae under laboratory conditions. Annals of Biology (India). (Jun 2006) v. 22(1) p. 27-29 KEYWORDS: CUCURBITS; DISEASE RESISTANCE; PEST RESISTANCE; TETRANYCHIDAE.

Comparative susceptibility of 12 different cucurbits to infestation with two-spotted red spider mite, Tetranychus urticae was investigated by studying three parameters viz., feeding

preference, oviposition and avoidance. Each parameter indicated varied preference. Feeding preference indicated water melon, bottle gourd, ash gourd, summer squash and squash melon to be the most preferred, wanga and wild melon the least preferred cucurbits. Regarding oviposition, the highest number of eggs was recorded on musk melon, water melon and least on bitter gourd, wanga and wild melon. Avoidance studies indicated bottle gourd, water melon, squash melon to be the most preferred and long melon, wanga and bitter gourd the least preferred. Based on cumulative results of the three parameters, it can be concluded that T. urticae has highest preference for water melon, bottle gourd, summer squash and squash melon. Whereas wanga, wild melon and bitter gourd are the least preferred and the remaining cucurbits included in the present study exhibited moderate preference.

090. Singh, S.B. (Sardar Vallabh Bhai Patel University of Agriculture and Technology, Ujhani (India). Res. Stn.). Genetic variability and character association in groundnut (Arachis hypogaea). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 1-4 KEYWORDS: GENEIC DISORDERS; GENETIC VARIABILITY; HERITABILITY; CORRELATION; ARACHIS HYPOGAEA.

Genetic variability, heritability, genetic advance and correlation coefficient were studied in 163 genotypes of groundnut for different characters. High heritability and high percentage of genetic advance were recorded for number of pods and pod yield/plant, which indicate that there were more number of additive factors for these characters and improvement in yield could be brought about by selection based on phenotypic observations. Number of pods/plant and lOO-kernel weight expressed highly significant and positive phenotypic genetic association with pod yield/plant.

091. Pandya, N. (National Research Centre for Soybean, Indore (India); Chouhan, G.S.; Nepalia, V. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Agronomy). Production potential and energy budgeting of soybean (Glycine max) varieties influenced by weed-management practices under different crop geometries. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 209-212 KEYWORDS: GLYCINE MAX; WEED CONTROL; AGRICULTURAL ECONOMICS; PRODUCTION POSSIBILITIES.

A study was undertaken during the rainy season of 2001 and 2002 on clay loam alkaline soil at Udaipur (Rajasthan) to evaluate effect of weed control on production potential and energy budgeting of soybean [Glycine max (L.) Merr.] varieties grown in different crop geometris. Variety 'JS 335' recorded the maximum seed yield, additional net returns, energy gain and energy-use efficiency (EUE) compared with 'NRC 37' and 'JS 7105'. There were no significant differences in density of grassy and broad-leaf weeds at 40, 60 days after sowing and at harvest among the varieties. Crop geometry could not affect the weed as well as crop parameters. All the weed-control treatments resulted in significant reduction in density of grassy weeds and helped in significant enhancement in soybean yield. Two hand-weedings 20 and 40 days after sowing and pre-emergence (PE) application of clomazone 1.0 kg/ha + hand-weeding at 40 days after sowing treatments registered around 88 percent weedcontrol efficiency in controlling grassy as well as brod leaf weeds. Higher seed yield, additional net returns, energy gain and EUE were recorded with 2 hand-weedings, followed by clomazone 1.0 kg/ha PE + hand-weeding at 40 days after sowing.

092. Gupta, S.C.; Panwar, J.D.S. (Rajasthan Agricultural University, Jaipur (India). Agricultural Research Stn.). Morpho-physiological effects of thermal and moisture stress on chicikpea genotypes. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 213-216 KEYWORDS: LEAF AREA; CHICKPEA; GENOTYPES; MOISTURE CONTENT.

Effect of higher temperature (5:f:2°C above ambient) on some physiological parameters under moisture stress and non-stress conditions was studied in five chickpea genotypes grown in loamy sand deep soils. There was significant negative correlation between stress grain yield and membrane injury at 50 percent flowering (r= -0.5269), 20 days after flowering (DAF) (r= - 0.6890), 40DAF (r= -0.8698) and specific leaf area (SLA) (r= - 0.4829) at the podding stage. The genotype RSG 143-1 yielded 18.3q/ha having minimum membrane injury at the above stages and SLA. This genotype also had low floweJ' drop, higher number of filled pods, late senescence and higher harvest index under the stress. Its tolerance to thermal and moisture stress was shown by the lowest thermal (0.19) and drought (0.57) susceptibility indices. It is suggested that better membrane stability and low SLA may help a genotype in maintaining more filled pods and higher grain yield under the stress conditions.

093. Aditya, T.L. (Bangladesh Rice Research Institute, Gazipur (Bangladesh). Div. of Plant Breeding); Baker, D.A. (University of London, Ashford, Kent (United Kingdom). Dept. of Agricultural Sciences). Selection of salt tolerant somaclones from indica rice through continuous In vitro and Ex vitro sodium chloride stress. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 349-357 KEYWORDS: SALT TOLERANCE; COMMAN SALT; SOMACLONES; RICE; ORYZA SATIVA.

This study aimed at the selection of salt tolerant somaclones from four Bangladeshi indica rice genotypes through in vitro and ex vitro NaCl stress applied through step wise and non-step wise methods. Callogenesis was initiated under four different levels of non-step wise NaCI stress (50, 100, 150 and 200 mM) and subsequent plant regeneration was observed under same levels of NaCI stress. Among the four genotypes Binnatoa and IR51491-AC5-4 produced fertile somatic embryos with relatively high NaCI (150 mM) stress. BRRI dhan29 and BRR! Dhan 40 produced fertile somatic embryos only from 50 and 100 mM NaCI stress'conditions. Ex vitro (glass house) step-wise NaCI stress was applied to in vitro selected somaclones at the seedling (50, 100, 150 and 200 mM) and following booting stages with simultaneous acclimatization. Satisfactory seedling survival was observed for all genotypes up to 150 mM NaCI stress. Advanced flowering was observed mostly for all the genotypes when stress was applied at the seedling stage compared with combined stress at both seedling and booting stages. Fertile SCI generations were observed for genotype IR51491~AC5-4 and Binnatoa up to 200 mM NaCI stress applied at the seedling and both seedling and booting stages. Information on transmission of somaclonal variation to sexual progeny is required for further exploitation of potentially useful variants.

094. Agrawal, V.; Yadav, A. (University of Delhi, Delhi (India). (Dept. of Botany). Efficient in vitro regeneration protocol from difference ex plants in a drought tolerant variety BGD72 of Cicer arietinum L. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 421-426 KEYWORDS: IN VITRO REGENERATION; BA; CHICKEPA; GRAM; CICER ARIETINUM.

Chickpea, commonly kno\vn as gram is extensively cultivated as one of the most important winter crop throughout India, especially in northern states. Incidentally, it suffers from both biotic and abiotic stresses causing low productivity. In vitro plantlet regeneration protocol has been developed employing seed and seedling explants for improving the crop

through biotechnological manipulations. The three explant types - seed, embryonal axis and nodal segment (excised from 30-d-old seedling) were cultured on Murashige and Skoog's basal m~dium supplemented with various growth regulators, i.e. N6benzyladenine (BA), kinetin (Kn), a-naphthaleneacetic acid (NAA), indole-3-butyric acid (IBA) and indole-3-acetic acid (IAA) alone or in combination. Of the explants tried, the seed explants elicited best morphogenic response in terms of multiple shoots production. BA at 5 J.lM proved optimum for eliciting an average of 3.7 :t 1.2 shoots in 50 percent cultures in seeds whereas for embryonal axis 100 percent cultures induced an average of 3.1 :t 0.2 shoots on the same level in 30 d. However for nodal explants, 2.5 J.lM BA showed better response and an average of 3.25 :t 0.38 shoots per explants was induced in 91.7 percent cultures. For induction of roots, MS (1J2) + 5 J.lM IBA proved best where 72.5 percent shoots developed an average of 18.10:t 1.37 roots within 20 d. The pJantJets have been hardened and transferred to soH.

095. Talukdar, A. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics); Zhang, G.Q. (South China Agricultural University, Guangzhou (Peoples Republic of China). 3-S lines and molecular tagging of the gene for purple apiculus in rice (Oryza sativa L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 271-274 KEYWORDS: RICE; ORYZA SATIVA; GENETIC MAPS; ANTHOCYANIN; PIGMENTS.

Anthocyanin pigments leads to production of purple apiculus in rice (Oryza sativa L.). Proper understanding of anthocyanin pathway may lead to the development of a powerful tool in rice genetics and molecular biology. SSR marker-assisted molecular backcrossing approach was utilized to develop single segment substitution lines (3-S Lines) of Hua Jing Xian 74 with substitution segment from Lian Jian 33. The gene for purple apiculus was mapped on distal end of chromosome 6 and was found to be closely linked with RM 253 (O.2cM), PSM 349 (1.5 cM) and PSM 425 (3.8 cM), respectively. The 3-S Lines which contained only one substitution segment of chromosome from Lian Jian 33 on the genome of Hua Jing Xian 74 appeared as a viable alternative population for mapping of the gene (s) in rice.

096. Sharma, T.R. (Chaudhary Swaran Kumar Himachal Pradesh Agricultural University, Palampur (India). Advanced Centre of Hill Bioresources and Biotechnology); Rana, J.C. (National Bureau of Plant Genetic Resources, Shimla (India). Regional Stn.); Sharma, R.; Rathour, R. (Chaudhary Swaran Kumar Himachal Pradesh Agricultural University, Palampur (India). Advanced Centre of Hill Bioresources and Biotechnology); Sharma, P.N. (Chaudhary Swaran Kumar Himachal Pradesh Agricultural University, Palampur (India). Dept. of Plant Pathology). Genetic diversity analysis of exotic and Indian accessions of common bean (Phaseolus vulgaris L.) using RAPD markers. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 275-278 KEYWORDS: KIDNEY BEANS; PHASEOLUS VULGARIS; GENETIC VARIATION; GENETIC MARKERS.

Genetic diversity of forty-six common bean (Phaseolus vulgaris L.) accessions of diverse geographical origin was studied using RAPD markers. Four out of the twenty primers screened showed polymorphism across present set of genotypes. A total of 43 DNA amplicons were scored using these 4 primers. Seventy-seven per cent of the amplification products showed polymorphism, indicating fair amount of variation at the DNA level among these accessions. The genotypes shared 59 percent genetic similarity among themselves. Cluster analysis delineated the genotypes into four groups. Twenty accessions from United

States clustered in two separate groups, which possibly correspond to two well established phaseolus gene pools. Some of the accessions showed promise against the widely prevalent races of Colletotrichum lindemuthianum. Morphological variation for seed colour, shape and size showed no correspondence with molecular diversity.

097. Dongre, A.B.; Bhandarkar, M.R.; Parkhi, V.T. (Central Institute for Cotton Research, Nagpur (India). Genetic analysis of wild species in support of evolutionary changes of the genus Gossypium through ISSR markers. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 279-282 KEYWORDS: COTTON; GOSSYPIUM; GENETIC VARIATION; GENETIC MARKERS.

Twenty-two wild species of Gossypium belonging to seven genomic groups were studied using Inter Simple Sequence Repeat (ISSR) markers to establish phylogenetic relationship within the genus. Among 25 ISSR primers used, 19 were found to be scorable on agarose gel of which 88 percent were polymorphic. Genome specific and unique markers were observed in this study. In support of the evolutionary study, 3 major clusters were found in the dendrogram, one composed of A and B genome species and the other composed of D, AD and C genome species. E, F and G genome species were placed 2ut side the major cluster at the end of dendrogram.o1'hese results suggested that ISSR-PCR markers are potentially useful in establishing genetic relationship, genome specificity and genetic basis of evolution among the wild species of genus Gossypium.

098. Premchandran, M.N.; Arvinth, S.; Lalitha, R. (Sugarcane Breeding Institute, Coimbatore (India). Crop Improvement Div.). Chloroplast DNA polymorphism in psbC-trnS and trnL intron segments differentiate Saccharum and Erianthus. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 283-286 KEYWORDS: SUGARCANE; SACCHARUM; CROSS BREEDING; ERIANTHUS; CHLOROPLAST; GENETIC POLYMORPHISM; GENETIC DISTANCE.

Broaddening of the genetic base of sugarcane (Saccharum pp. hybrid) is done using wild related species Saccharum, ntaneum and Erianthus arundinaceus. Intergeneric crosses of Saccharum with E. arundinaceus as female made and putative hybrids were clonally maintained polymorphism in the chloroplast DNA segments psbC--trnS and trnL intron amplified by polymerase chain action and fragmented with restriction enzymes Haelll fd Ta, respectively could differentiate the Saccharum and Erianthus cytoplasm. One E. arundinaceus (2n = 60) X S. spontaneum (2n = 64) hybrid with chromosome number 2n = 62 was found to have Erianthus cytoplasm, which is a first report.

099. Naik, V.G.; Dandin, S.B. (Central Sericultural Research and Training Institute, Mysore (India). Molecular Biology Lab.). Identification of duplicate collections in the mulberry (Morus spp.) germplasm using RAPD analysis. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 287-292 KEYWORDS: MULBERRY; MORUS; GERMPLASM COLLECTION; GENE BANKS; GENETIC MARKERS.

Mulberry (Morus spp.) is the only source of food for the domesticated silkworm; Bombyx mori L. Large numbers of mulberry germ plasm have been conserved in the field ne banks, many of which are suspected to be duplicates. PCR based markers like RAPDs are neutral to environmental effects and can be efficiently utilized along with passport and morphological data for identification of duplicate collection in a gene bank. A close examination passport and morphological data became a basis for identification of four suspected group of

duplicates along with a closely related genotype of suspected duplicate Group I. Two sets of true duplicates (Mysore Local andV-1) were used as controls. A total of 31 random primers were used for PCR amplification, generating 357 markers which, 228 (63.9 percent) were polymorphic. The DNA marker profiles of true duplicates were identical demonstrating the reliability of the technique. The closely related genotype IRFS.135 was discriminated from the suspected duplicate Group I (Anantha and RFS-175) with a similarity of 94.4 perent. Group I, II, and IV were unambiguously confirmed duplicate sets and clustered at 100 percent similarity within the group. But the suspected duplicate collection in the Group III ccomprising of Kousen and Xuan-10 were discrimInated by 12 primers and 16 markers. The result obtained from the study predicted a minimum requirement of 100 markers . or 9 primers for detection of at least one difference for discrimination of closely related collections.

100. Sarial, A.K. (Chaudhary Charan Singh Haryana Agricultural University, Kaul (India). College of Agriculture); Singh, V.P.; Ram, K. (Indian Agricultural Research Institute, New Delhi (India). (Div. of Genetics). Heterotic potential of basmati fertility restorers for grain yield and its components in rice (Oryza sativa L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 293-298 KEYWORDS: BASMATI RICE; ORYZA SATIVA; HETEROSIS; FERTILITY; YIELD COMPONENTS.

Basmati rice (Oryza sativa L.) which is characterized with long slender superfine grain, exquisite aroma and high volume expansion resulting from linear cooked kernel elongation with minimum breadthwise swelling is an internationally traded commodity. It's yields are as low as one third of non-basmati rice. A study was undertaken to evaluate the heterotic potential of basmati fertility restorers for grain yield and its components, phonological and morphological traits. Forty-five improved germ plasm lines of aromatic and non-aromatic rices were test crossed with four cytoplasmic male sterile (CMS) lines viz., IR 5 8025 A, IR 62829A, PMS 10A and PMS 3 A of wild abortive cytosterile source to identify fertility restorers with bas mati background. Eighty-four hybrids derived from 4 CMS lines and 21 restorers were evaluated in a randomised block design (RBD) for heterosis. Observations were recorded for grain yield and its components, phenological and morphological traits. Analysis of variance revealed significant differences (p 0.01) among hybrids for all traits. Five of the basmati restorers having fertility restoration 80 percent produced hybrids with heterobeltiosis ranging from 20.64 to 150.66 percent and superiority over check ranging from 15.17 to 284.55 percent. Hybrids were superior to their parents for grain yield per plant, biological yield per plant, days to 50 percent flowering, number of effective tillers per plant and number of primaries per panicle indicated substantial heterosis. However, superiority of parents over hybrids for harvest index, 1000 grain weight and days to maturity revealed negative heterosis. Hybrid IR 58025A x Basmati 385 re1orded the highest (56.26 g) grain yield per plant. The resforers Basmati 385 and HKR 241 were found heterotic with all four CMS lines. Based on yield performance and heterosis promising hybrids of basmati restorers identified were PMS 3A x P1031-8-5-1 (early), IR 58025A x Basmati 385, IR 62829A x Basmati 385, IR 62829A x HKR 241 (medium) and PMS 3A x HKR 241 (late). Heterosis in grain yield was due to concomitant heterosis in one or more major yield components. Hybrids exhibiting higher grain yield also combined heterosis for semi-dwarf plant type and reduced total growth duration. As the restorers were tall and late in maturity, to develop semi-dwarf, high yielding basmati hybrids fitting into multiple cropping system it is

suggested to use stiff stem dwarf and early maturing bas mati CMS lines as and when available.

101. Tomar, S.M.S.; Nair, S.K.; Singh, R.; Vinod; Singh, B. (Indian Agricultural Research Institute, New Delhi (India). (Div. of Genetics). Genetic analysis of stem solidness in wheat (Triticum aestivum L.)_. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 299-302 KEYWORDS: WHEAT; TRITICUM AESTIVUM; GENETIC INHERITANCE; STEMS.

Inheritance of stem solidness was studied in common wheat using three crosses involving a solid stemmed genotype Selection 1093-1 and hollow stemmed stocks, HD 2667, NP 12 and selection 111. The internodes of two F1 hybrids were solid completely filled with pith, while one hybrid produced internodes with partially filled pith. Stem solidness in selection 1093-1 is a dominant trait inherited monogenically. However, incomplete dominance of solidness was also recorded in the cross Sel. 1093-1 x Sel. 111. The presence of an epistatic gene for hollowness over gene governing solidness of stem reported to be present in D genome of hollow stemmed cultivars is negated. Differences in means between solid and hollow stemmed true breeding and segregating F3 families were non-significant. However, significant mean difference in grain number/main spike were noted in true breeding solid and hollow families, whereas in segregating families the two means did not differ significantly. It is presumed that significant differences in grain number/main spike in true breeding solid and hollow families may be due to inadvertent selection which favored high grain number in hollow families. The identification of single gene governing solidness of culm may be a useful marker trait for genetic studies and in breeding for saw fly resistance since solidness of culm does not affect agronomic traits. The gene symbol Sc is proposed for solidness of culm in wheat.

102. Thi, N.N.; Shah, M.A. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Plant Breeding and Genetics)_. Early generation selection for yield and heat tolerance in bread wheat (Triticum aestivum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 303-307 KEYWORDS: SOFT WHEAT; TRITICUM AESTIVUM; SELECTION; YIELDS; HEAT TOLERANCE.

Thirteen families (F2 crosses) each with 5 progenies were grown in compact family block design with three replications in two environments normal sowing (E1) and very late sowing (E2) environments at Udaipur. Data recorded for grain yield, its twelve component traits and seven heat tolerant parameters were analysed to identify superior crosses and their progenies for yield and heat tolerance so as to exploit these for getting desirable sergeants in advanced generations. The analysis of variance revealed significant differences among the families for grain yield and all other traits in both the environments. However, the variations among the progenies -within a family varied from character to character and environment to environment. In normal sowing environment, C12 family was the best among the eight families depicting significantly higher grain yield than the standard check. While in E2 late sown environment, C1 could be considered as one of the best family for yield and other attributes. Of heat tolerance traits, the family C6 proved its worthiness. Based on the per se performance and estimation of variability parameters, C12P2' C11P5 and C13P5 were most promising progenies for normal conditions, while C1P3' C1Pl' C6P4' CaP1 and C4P5 were promising for very late sown conditions. Selection from these families in advanced generations could provide desirable segregants for high yield and heat tolerance.

103. Yadav, O.P. (Central Arid Zone Research Institute, Jodhpur (India). Heterosis in crosses between landrances and elite exotic populations of pearlmillet [Pennisetum glaucum (L.) R. Br.] in arid zone environments. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 308-311 KEYWORDS: PEARLMILLET; PENNISETUM GLAUCUM; CROSSBREEDS; HETEROSIS.

Stress-adapted landraces of pearl millet [Pennisetum glaucum (L.) R. Sr.] are prevalently grown in the drought prone regions of northwestern India. This stlJdy evaluated 12 crosses between selected land races and elite composites along with 7 parental populations for two years in arid zone environments. There was significant genetic variation among test entries which was due to variation due to parental populations, crosses and 'parent vs. cross'. Landraces and elite exotic composites represe-nted two contrasting, but complementary, groups of genetic material. Landraces produced the greatest amount of biomass and stover yield with lowest harvest index while elite composites had the lowest biomass and stover yield with highest harvest index. Crosses produced almost as high biomass as land races but their better partitioning resulted into highest grain yield in them. Manifestation of heterosis in crosses varied for different characters. Grain yield was the most heterotic trait with mean heterosis of 17 percent and other traits viz., days to flowering, plant height, panicle length and harvest index were far less heterotic with mean heterosis ranging between 2-4 percent. Data indicated that significant heterosis for total biomass is very critical in order to obtain simultaneously improvement in both grain and stover yields. The expression of grain yield heterosis in the best crosses was realized through differential expression of heterosis in various yield-contributing traits.

104. Singh, V.V.; Ramakrishna, K.; Arya, R.K. (Rajasthan Agricultural University, Jobner (India). Dept. of Plant Breeding and Genetics). Induced chemical mutagenesis in cowpea [Vigna unguiculata (L.) Walp.]. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 312-315 KEYWORDS: COWPEAS; VIGNA UNGUICULATA; INDUCED MUTATION.

A mutagenesis programme was carried out using three chemical mutagens viz., EMS, MMS and SA on two varieties of cowpea [Vigna unguiculata (L.) Walp.] namely, RC 19 and RC101. The M1 generation was raised only from higher doses of the mutagens which adversely affected their survival. In M2 generation, a widespectrum of macromutations were observed in the prog~nies of both the varieties including few seed color mutants. The MMS treatment was found most effective and efficient as well. Several M2 progenies of the two cowpea varieties were significantly superior to their respective parents for seed yield per plant. A considerable number of. M2 progenies were consistently superior to their parents in Ms generation also.

105. Dixit, G.P.; Katiyar, P.K. (Indian Institute of Pulses Research, Kanpur (India). Div. of Crop Improvement). Genetic base of Indian fieldpea (Pisum sativum L.) varieties and breeding lines. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 316-318 KEYWORDS: PEAS; PISUM SATIVUM; GENETIC INHERITANCE.

The Pedigree of 33 field pea (Pisum sativum L.) varieties released in India were traced back to 26 ancestors. Out of these 26 ancestors, three ancestors contributed 49 percent of the genetic .base. T 163 was the most frequently used parent followed by EC 109196 and T

10. In the recent breeding programme also, these three ancestors contributed 51 percent of the genetic base. In other words, it may be concluded that more than 50 percent of fieldpea varieties and breeding lines developed in India are more or less related due to presence of a single ancestor T 163 in their pedigree. Extensive use of few ancestors led towards genetic erosion and narrowing of genetic base in fieldpea.

106. Kumar, D.; Mahata, P.; Lakshman, S.S.; Mandi, S. (Central Research Institute for Jute and Allied Fibres, Barrackpore (India). (Div. of Crop Improvement). Morphological characterization of jute (Corchorus olitorius L.) and C. capsularis L.) varieties and their application for DUS testing. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 319-323 KEYWORDS: JUTE; CORCHORUS OLITORIUS; GENETIC DISTANCE.

In the present regime of Intellectual Property Rights, the distinctness of a candidate variety from all other varieties is the first basis of the triad of the DUS for granting protection of Plant Breeder's rights. Keeping this in view, twenty seven varieties of jute (Corchorus o/itorius L. and C. capsularis L.) including 20 released or notified and 7 varieties of common knowledge were characterized for three years using 16 qualitative morphological characteristics to establish distinctness among the varieties. Among them, 10 characters in C. capsularis were found mono-morphic and 6 characters were dimorphic where as in C. olitorius 2 characters were mono-morphic, 8 characters were dimorphic and 6 charaters were polymorphic between varieties indicating their potential for varietal characterization. No intra-varietal variation was observed for any of the characteristics. The expression of each character in all varieties was similar for three consecutive years confirming the stability of varieties. No character could identify all the varieties individually. On the basis of 16 qualitative characteristics identity and distinctness of few varieties viz., Bidhan rupali, JRO 878, Chinsurah green, JRO 66, JRO 7835 and JRO 36E in olitorius and Padma and D-154 in capsularis could be established individually and remaining varieties could be classified into two or more groups. The candidate variety, Bidhan rupali, was distinct from all other olitorius varieties and the candidate variety, JRC 321, was similar to UPC-94. Hence, to meet - DUS criteria as identification of jute varieties, some of the distinct morphological characters in coalition with biochemical or molecular characters may be necessary.

107. Devi, P.S.; Jalali, S.K.; Venkatesan, T. (Project Directorate of Biological Control, Bangalore (India). Inheritance of insecticides tolerance in resistant colonies of Trichogramma chilonis Ishii (Hymenoptera: Trichogrammatidae). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 324-326 KEYWORDS: TRICHOGRAMMA CHILONIS; GENETIC INHERITANCE; PESTICIDE RESISTANCE.

Resistant (R) strains of the egg parasitoid Trichogramma chilonis Ishii were developed against the three new insecticides viz., indoxacarb, spinosad and tebufenozide through 40 cycles of selection in the laboratory selection pressures. The resistant factor observed was 8.7, 4.8 and 2.4 folds in resistant strain over susceptible strain of T. chilonis for indoxacarb, spinosad and tebufenozide, respectively. Mode of inheritance of insecticides tolerance studied 'using respective resistant 'R' and susceptible'S' strains of T. chilonis. The degree of dominance (D) of indoxacarb tolerance was incomplete recessive for tolerant females and semi dominant for tolerant males. For spinosad, dominance levels were semi dominant for resistant females and incomplete recessive for resistant males. For tebufenozide, resistance was governed by semi dominant gene for resistant females and incomplete recessive gene

for resistant males. The backcrossing of F 1 progeny with tolerant parent indicated that strong resistance gene was coded by the coordination of genes already present in indoxacarb male genotype, for both spinosad and tebufehozide R female.

108. Tejaswini; Dhananjaya, M.V. (Indian Institute of Horticultural Research, Bangalore (India). Div. of Ornamental Crops). Genetic diversity and parental selection for hybridisation in rose (Rosa hybrida). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 329-331 KEYWORDS: ROSE; ROSA HYBRIDA; GENETIC VARIATION; SELECTION.

The present study was conducted to analyse the potential of existing rose (Rosa hybrida) germplsm collection. Existence of wide variability in stalk length (16.86cm. to 103.17cm) and keeping quality (2.7 to 7 days) indicated the possibility of utilizing the germplasm to develop better cut flower varieties through recombination. All the varieties having stalk length of 42.36 cm or above and with keeping quality of 4.74 days or more were considered under selected group. Varieties of this selected group as well as distinct colour groups were analysed for their divergence. Based on the cluster centre values and distance between the clusters, clusters were identified for hybridization in rose breeding programme.

109. Datta, D.; Prashar, M.; Bhardwaj, S.C. (Directorate of Wheat Research, Shimla (India). Regional Stn.). Pyramiding of leaf rust resistance genes Lr9 and Lr24 through molecular marker assisted selection in wheat (Triticum aestivum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 332-334 KEYWORDS: WHEAT; TRITUCM AESTIVUM; DISEASE RESISTANCE; RUSTS; PUCCINIA RECONDITA; GENETIC MARKERS.

110. Pradhan, S.K.; Bose, L.K. (Central Rice Research Institute, Cuttack (India). Crop Improvement Div.); Mani, S.C. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding). Basmati type restorers and maintainers for two cytosterile lines of rice (Oryza sativa L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 335-336 KEYWORDS: RICE; ORYZA SATIVA; HYBRIDS; BASMATI.

111. Sood, B.C.; Khajuria, V. (Chaudhary Sawarn Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). (Dept. of Plant Breeding and Genetics). Genetic and anatomical characterization of land races of maize (Zea mays L.) for lodging and yield related traits. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 337-338 KEYWORDS: MAIZE; ZEA MAYS; GENETIC DISTANCE; YIELD COMPONENTS.

112. Murugan, R.; Nirmalakumari, A. (Tamil Nadu Agricultural University, Coimbatore (India). Centre for Plant Breeding and Genetics). Genetic divergence in foxtail millet [Setaria italica (L.) Beauv.]. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 339-340 KEYWORDS: MILLETS; SETARIA ITALICA; GENETIC DIVERGENCE.

113. Gupta, A.J. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). (Div. of Olericulture); Singh, Y.V. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Vegetable Science). Genetic divergence in garden pea (Pisum sativum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 341-342 KEYWORDS: GENETIC DIVERGENCE; PEAS; PISUM SATIVUM.

114. Nimbalkar, C.A.; Baviskar, A.P.; Bajaj, V.H. (National Agricultural Research Project, Pune (India). AMMI approach for seed yield and stability of french bean (Phaseolus vulgaris L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 343-344 KEYWORDS: FRENCH BEANS; PHASEOLUS VULGARIS; YIELD COMPONENTS; GENETIC STABILITY.

115. Shukla, S.K.; Mahajan, V. (Vivekananda Parvitya Krishi Anusandhan Sansthan, Almora (India); Majumdar, N.D. (Indian Institute Pulses Research, Kanpur (India); Tiwari, V. (Directorate of Wheat Research, Karnal (India); Prasad, S.V.S. (Indian Agricultural Research Institute, Indore (India). Regional Stn.); Gupta, H.S. (Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Evaluation of rajmash (Phaseolus vulgaris L.) genotypes in mid-altitudes of North-Western Himalayas. Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 345-346 KEYWORDS: RAJMASH; PHASEOLUS VULGLARIS; GENETIC DISTANCE.

116. Doule, R.B. (Vasantdata Sugar Institute, Pune (India); Balasundaram, N. (Sugarcane Breeding Institute, Coimbatore (India). Relative efficiency of cane characters in selection for cane yield in sugarcane (Saccharum spp. hybrid). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 347-348 KEYWORDS: SUGARCANE; SACCHARUM; SELECTION; YIELD COMPONENTS.

117. Trivedi, A.P. (National Research Centre for Medicinal and Aromatic Plants, Anand (India); Dhumal, K.N.; Lawande, K.E. (University of Pune, Pune (India). (Dept. of Botany). Genetic variability, correlation and path analysis study in storage life of onion (Allium cepa L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 349-350 KEYWORDS: ONION; ALLIUM CEPA; GENETIC; GENETIC VARIATION; KEEPING QUALITY.

118. Suneetha, Y.; Patel, J.S.; Kathiria, K.B.; Bhanvadia, A.S.; Kathiria, P.K.; Patel, N.B.; Srinivas, T. (Gujarat Agricultural University, Anand (India). Stability analysis for yield and quality in brinjal (Solanum melongena L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 351-352 KEYWORDS: BRINJAL; SOLANUM MELONGENA; GENETIC STABILITY; YIELD COMPONENTS.

119. Thombre, M.V.; Deshmukh, S.U. Ajeet Seed Limited, Aurangabad (India). Isolation of genetic male sterile mutant in okra (Abelmoschus esculentus (L.) Moench). Indian Journal of Genetics and Plant Breeding (India). (Nov 2006) v. 66(4) p. 353-354 KEYWORDS: OKRA; ABELMOSCHUS ESCULENTUS; ISOLATION; MALE INFERTILITY.

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120. Kumar, D.R.; Rathore, T.R. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Soil Science). Effect of chemically enriced pressmud compost on the yield and nutrient uptake by rapeseed (Brassica campestris L. Var. Toria). Annals of Agricultural Research (India). (Dec 2004) v. 25(4) p. 563-566 KEYWORDS: FERTILIZER; SULPHUR FERTILIZER; YIELD; NUTRIENT UPTAKE; BRASSICA CAMPESTRIS.

The greenpous,f experiments was conducted to evaluate the effect of chemically enriched pressmud compost on growth and yield of rapeseed crop. In the green house

experiment conducted during rabi season of 2001 withErapeseed crop, the grade with highest enrichment (GS) was found superior in increasing plant growth, yield as weU as NPK uptake by the plant due to increased availability of nutrients. All the enriched grades (G2' G3' G4) were superior over the unenricheq grade G-1 in supporting plant growth, yield as well as N, P, K uptake. Among the levels of compost/fertilizer treatments, the plant growth, yield as well as N, P, K uptake were maximum with the treatment of 100 percent or recommeJlded dose supplied through chemical fertilizers (Tl) followed by the treatments of enriched ompost supl'lewented, with chemical fertilizers (T 2' T 3' T4) as compared to the 100 percent of recommended dose supplied through enriched pressml1d compqst alone (Ts).

121. Kumar, K.A.K.; Ravi, V.; Patil, B.C.; Chetti, M.B. (University of Agricultural Sciences, Dharwad (India). (Agricultural Res. Stn.). Influence of plant growth regulators on morpho-physiological traits and yield attributes in hybrid cotton (DHH-11). Annals of Biology (India). (Jun 2006) v. 22(1) p. 53-58 KEYWORDS: YIELD; PLANT GROWTH SUBSTANCES; GOSSYPIUM HIRSUTUM; PHOTOSYNTHESIS; TRANSPIRATION.

Plant growth regulators allow for manipulation of physiological processes in cotton growth and development. Application of growth retardants at earlier stages (45 DAS) drastically affected the plant growth and seed cotton yield as compared to any other treatment. NAA (20 ppm) recorded maximum plant height, more number of main stem nodes and higher number of sympodia as compared 10 untreated control. Foliar application of NAA (20 ppm) at 120 DAS recorded higher rate of pholosynthesis, stomatal conductance and transpiration, whereas high total chlorophyll content was observed in growth retardant treatments as compared to control. Significant variation was observed among the treatments with regard to dry matter production and its distribution. NAA (20 ppm) recorded significantly higher number of bolls per plant, boll weight and seed cotton yield followed by MC (50 ppm) sprayed at 90 DAS over untreated control.

122. Pandey, N.; Pathak, G.C. (University of Lucknow, Lucknow (India). (Botany Dept.). Nickel alters antioxidative defense and water status in green gram. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 113-118 KEYWORDS: VIGNA RADIATA; ANTIOXIDANTS; DEFENSE MECHANISM; WATER DEPREVATION.

Green gram [Vigna radiata (L.) wikzek] plants exposed to excess nickel (10, 100 and 200 flM) under glass-house conditions were quantified for selected parameters of oxidative stress and water deficit. Supply of excess nickel for 72 h induced chlorosis of young leaves, the effect being most pronounced at 200 flM Ni supply. Excess supply of nickel showed enhanced accumulation of antioxidants ascorbate and dehydroascorbate and decrease in the activity of catalase in th~ leaves, leading to accumulation of hydrogen peroxide. The aCtivity of ascorbate peroxidase, peroxidase, gluathione reductase and SOD showed an increase. The effe~t on the enzyme activities varied with the level and duration of Ni supply. Leaves of plants supplied excess Nj showed decrease in water pdtential ('I'L) and relative water content (RWC) and an increase in proline. Results observed indicate that excess supply of nickel interferes with plant water relations and induces oxidative stress.

123. Devendra, S.; Shankar, S.K.; Mulimani, V.H. (Gulberga University, Gulberga (India). (Dept. of Biochemistry). Reduction of raffinose oligosaccharides in red gram flour by microbial a-galactosidase. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2)

p. 123-129 KEYWORDS: ASPERGILLUS ORYZAE; GALATOSE; STACHYOSE; BIOCHEMISTRY; REDUCTION; RAFFINOSE.

The effect of crude a-galactosidase from Aspergillus oryzae, Gibberella fujikuroi and Lactobacillus brevis in reducing the raffinose, stachyose and v~rbascose content in red gram flour was studied. The optimum pH for a-galactosidase was found to be 4.8 for A. oryzae, 5.0 for G. fujikuroi and L. brevis, while the optimum temperature of enzyme activity was 55°C for A. oryzae, 60°C for G. fujikuroi and 40°C for L. brevis. The specific activities of a-galactosidase from A. oryzae, G. fujikuroi and L. brevis were 1.54, 0.73 and 0.93 unit mg-1 protein respectively. These enzymes were thermostable when incubated at temperature ranges of 40-60°C for A. oryzae, 40-65°C for G. fujikuroi and 35-45°C for L. brevis. The optimum conditions for removing the raffinose, stachyose and verbascose were obtained by incubating red gram flour with SO ml of crude microbial a-galactosidase extract (0.67, 0~55 and 0.67 units mP for A. oryzae, G. fujikuroi and L. brevis respectively) for 3 hr at the optimum conditions of each strain. Crude A. oryzae and G. fujikuroi a-galactosidase reduced the raffinose oligosaccharide content in red gram flour by 100 percent, while crude a-galactosidase treatment from L. brevis reduced the raffinose content by 70.20 percent, stachyose 58.14 percent and verbascose by 71.56 percent.

124. Singh, R.; Dhingra, H.R.; Goyal, S.C. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). (Dept. of Botany and Plant Physiology). Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 130-135 KEYWORDS: BIOCHEMISTRY; CALLOS; SHOOTS; CHLOROPHYCEAE; CHLOROPHYTUM BORIVILANUM.

Biochemical changes leading to shoot regeneration during in vitro culture of callus derived from bud pedicel of Chlorophytum borivilianum on MS medium (Murashige and Skoog, 1962) supplemented with 1.0 mg/l BAP + 1.0 mg/l NAA were investigated. Starch content and reducing sugars were high in the control callus, which further increased significantly in shoot differentiating cultures. Contents of total soluble sugars, free amino acids, total soluble proteins and total phenols were lower in the former and increased in the shoot differentiating cultures. The activities of enzymes like a-amylase, acid-protease, acid-phosphatase and peroxidase increased up to appearance of green patches (8-12 day) and reached a peak on 16th day of inoculation that coincided with the appearance of shoots. Conversely, the acid invertase activity decreased till the appearance of shoots.

125. Kaushal, K.; Nath, A.K.; Sharma, D.R. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). (Dept. of Biochemistry). Establishment of callus cultures and plant regeneration in strawberry (Fragaria xananassa Duch.) CV. Chandler . Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 136-144 KEYWORDS: BIOCHEMISTRY; REGENERATION; GROWTH; PLANT; CALLUS; FRAGARIA XANANASSA; MICROPROPAGATION; PLANT PHYSIOLOGY.

Leaf, petiole and stipule explants of strawberry were treated for the establishment of callus cultures, but callus initiation could be obtained only in leaf and petiole explants. The maximum callus induction percentage (88.89 percent) was recorded in MS medium containing 0.5 mg/l BAP + 0.75 mg/l NAA. Callus obtained from both leaf and petiole explants was light green, friable and compact. Regeneration was difficult to achieve. A total of 93 different combinations of growth regulators were tried. Callus differentiated into shoots after transfer to MS medium supplemented with 2 mg/l BAP+ 0.25 mg/l NAA + 0.5 mg/l kinetin. The regeneration percentage was higher in petiolar callus (83.33 percent) as

compared with the leaf-derived callus (81.67 percent). Well developed shoots in both leaf and petiolar calli obtained after 50-55 days were transferred to multiplication medium containing 0.5 mg/l BAP + 0.5 mg/l kinetin and 1.0 mg/l GA3. Rooting was done in MS half strength + 1.0 mg/l IBA and 0.2 mg/l activated charcoal. Once the root system was fully developed, the plantlets after washing were kept in 0.5 percent bavistin for 15-20 minutes and were planted in pre-sterilised mixture of soil: FYM (1:1) filled to two third of the capacity and rest filled with sterilised sand. Plantlets were hardened and then transferred to field.

126. Garg, B.K.; Burman, U.; Kathju, S. (Central Arid Zone Research Institute, Jodhpur (India). (Div. of Soil-Water-Plant Relationships). Alleviation of salinity stress effects on photosynthesis, nitrogen metabolism and yield of Indian mustard by nitrogen fertilization. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 145-151 KEYWORDS: BIOCHEMISTRYT; SALINITY; PHOTOSYNTHESIS; NITROGEN METABOLISHM; YIELD; PLANT PHYSIOLOGY; NUTRITION; NITROGEN FERTILIZERS; MUSTARD.

A study was undertaken to explore the possible alleviation of detrimental effects of salinity on growth, photosynthesis and nitrogen metabolism of Indian mustard through nitrogen fertilization. Experimental plants grown at two levels of nitrogen (0 and 60 kg ha-l) were irrigated with waters having 0.2, 5 and 10 dS m-l EC at weekly intervals from 20 DAS till maturity. Nitrogen application led to significant increase in the concentrations of N, P and K and a decrease in Na concentration in the shoot tissue, under varying salinity levels, both at vegetative and flowering stages. Observations on contents of total chlorophyll, soluble protein, free amino acids, starch, total soluble sugars, nitrate reductase activity and net photosynthetic rates at vegetative and flowering stages revealed adverse effects of salinity on photosynthesis and leaf nitrogen metabolism. However, nitrogen fertilized plants displayed higher photosynthesis and more efficient N metabolism under all levels of salinity at both the growth stages. This led to significant improvement in leaf area development, plant growth and seed yield under salt stress. It was found that seed yield of N fertilized plants even under highest salinity level was comparable with that of non-saline control plants grown without N application. Results indicated that improvement of soil nitrogen status through N application favorably modulated photosynthetic efficiency and carbohydrate metabolism of salt stressed plants besides positive effects on N metabolism which contributed to better performance of plants both under control and salinity stress.

127. Kumar, P. (Govind Ballabh Pant University of Agriculture and Technology, Ranichauri (India). (Dept. of Basic Science); Deshmukh, P.S.; Sairam, R.K.; Kushwaha, S.R.; Singh, T.P. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology). Biochemical and phenological evaluation of chickpea genotypes differing in drought tolerance. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 166-171 KEYWORDS: PROLINES; SEEDS; YIELDS; CHICKPEAS; DROUGHT; GENOTYPES; OSMOTIC PRESSURE; SOLUBILIZATION.

Field experiment was conducted to study the mechanism of moisture stress tolerance during flowering and grain filling stages in chickpea genotypes, and its impact on seed yield. Eight chickpea genotypes (four tolerant and four susceptible) of different adaptations were taken for the study. Soil moisture extraction pattern showed that chickpea crop drew soil moisture from deeper root zone upto O-cm depth. Greater accumulation of solutes like sugar, soluble proteins and proline content was observed under moisture stress condition at

105 DAS. However, at the later stage of crop growth (125 DAS) under rainfed condition, the soluble protein and soluble sugar contents decreased below the irrigatedcontrol plants, while proline content was slightly higher than control plants. Under rainfed condition greater accumulation of solutes occurred at comparatively higher osmotic potential at 105 DAS than at 125 DAS, when plants showed much lower osmotic potential. Susceptible chickpea genotypes showed reduced grain filling duration (11-14 days) and greater reduction in seed yield as compared to tolerant genotypes. Thus, it can be concluded that chickpea genotypes have osmoregulation as mechanism of drought tolerance at lower osmotic potential.

128. Kundu, B.S.; Nandal, K.; Tiwari, M.; Tomar, M. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). (Dept. of Microbiology). Establishment and influence of phosphate solubilizing bacteria on pearl millet.Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 201-205 KEYWORDS: BACTEERIAL TOXINS; BACTERIAL PESTICIDES; PEARLMILLET; BACTERIA; BACTERIAL SPASES.

Two Phosphate solubilizing bacterial isolates and their lacZ marked transconjugants were checked for their establishment in the rhizosphere and response on pearlmillet under pot house condition. Seed bacterization showedestablishment of PSB in the rhizosphere up to 60 days after sowing. The counts were slightly higher in inoculated treatments compared to uninoculated control. Application of rock phosphate and phosphatic fertilizers increased the biomass by 35-50 per cent over control. The P-uptake also improved with soil amendments and seed inoculation at both stages of sampling.

129. Vijayalakshmi, D.; Bangarusamy, U. (Tamil Nadu Agricultural University, Coimbatore (India). (Dept. of Crop Physiology). Salicylic acid as a selective gametocide in a thermosensitive genic malesterile rice. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 206-208 KEYWORDS: GERMINATION; RICE; SALICYLIC ACID.

Thermosensitive genic male sterility (TGMS) is a genic male sterility expression regulated by certain temperature conditions. This male sterility system is considered more efficient than CMS (cytoplasmic male sterility) system for hybrid rice breeding because CMS lines require specific maintainer and restorer line. So an attempt was made to identify a suitable chemical that can induce complete sterility without affecting the female organs in a stable TGMS line, TS 29 even when the temperature drops below the critical sterility temperature. Salicylic acid at 800 ppm at third and fifth stages of panicle development was found to effect near complete pollen sterility in TS 29 without affecting the female fertility. The fluorescent microscopic studies showed that the pollen from the restorer line (MDD 5) reached the ovule of TS 29, and the histological studies also showed the entry of the pollen tube into the ovule of TS29 provin2 the selective sterilitv of the chemical.

130. Mishra, S.N.; Dixit, S. (Maharashi Dayanand University, Rohtak (India). Dept. of Biosciencesw); Choudhary, D. (University of Connecticut Health Centre, Farmington (United States of America). Dept. of Pharmacology). Responses ofplants to heavy ions irradiation. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 333-348 KEYWORDS: IRRADIATION; IONS; HEAVY METALS; MUTATIONS; PLANT GROWTH REGULATORS.

Heavy ion radiations (HIR), feature of the outer space environment limiting life during space mission was evaluated for responses in algae, fungi and dormant seeds. The results obtained mostly are elusive due to unequivocal irradiation doses and microgravity /

weightlessness in space. Hence, HIR simulated experiments on earth are performed to understand precisely growth and developmental changes in plants by the operation of heavy ion accelerators at various institutes around the world. Seeds exposed to various heavy ions have shown inhibition in germination and morphological abnormalities in seedlings. Plants tumorous growth, chromosomal aberration and certain mutations due to DNA break and or missrepair or transposition is also observed. These might hamper cellular activity leading to lethality. Additionally, the experiments suggest that prolonged exposure of seed! seedling to HIR during space flight or during simulated experiments may cause differential biological effects. Plant differential responses could be attributed to heavy ion irradiation dose, plant species and its physiological state. It is tempted to suggest that heavy ions/charged particles with specific dose might activate or modify certain processes which might result into few useful plant characters. The heavy ion potential to generate mutants because of localized deposition and/or hitting the molecule in exposed plant tissues make sense to consider it as an alternative tool either for conventional breeding or for genetic modulation in a way to improve the growth and yield of crop plants or to develop stress tolerant strains for farming, in changed agro-climatic conditions. The bystander effect (induced response in cells other than targeted one) in plants is yet to be examined as in animal system. Our understanding of fundamental mechanisms of changing plant system exposed to HIR is still incomplete. More detailed studies on plant physio-chemical regulation, radiation induced mutation, kinetics of DNA repair under heavy ion exposure and microgravity may help in drawing strategies for terrafarming. The variation in radio-sensitivity of plants further gives strong note to perform extensive experiments at molecular level for requisite focus of character and screening of plants for space mission.

131. Banerjee, M.; Rai, R.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy); Srivastava, G.C. (Indian Agricultural Research Institute, New Delhi (India). (Div. of Plant Physiology); Maiti, D. (Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences); Dhar, S. (Indian Agricultural Research Institute, New Delhi (India). (Div. of Agronomy). Influence of nitrogen and phosphate solubilizing bacteria and phosphorus sources on growth, Chlorophyll and yield of maize. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 373-378 KEYWORDS: NITROGEN; PHOSPHORUS; FERTILIZERS; MAIZE; ZEA MAYS; CHLOROPHYLLS; GROWTH ATTRIBUTES; PHOSPHATIC SOURCES.

Field experiments were conducted during kharif seasons of 2002 and 2003 at Indian Agricultural Research Institute, New Delhi to study the effect of different phosphatic fertilizers and biofertilizers on growth attributes and chlorophyll content of maize. Different doseS-of phosphatic sources (single super phosphate and rock phosphate with and without PSB and V AM) were applied either without nitrogen or in combination with nitrogen fertilizer. The treatments N120P60 gave the highest leaf area and dry matter/ plant during both the years and in second year it was at par with N120SSP3oV AM. In case leaf area index (LAI), highest values were associated with N120P60 at 40 DAS in 2002 and 2003. In second year it was statistically at par with N120SSP3oV ANi at 40 and 80 DAS. At knee high stage of maize, the highest chlorophyll content of 1.03 mg/g and 1.10 mg/g fresh weight were recorded in N120SSP30V AM and N120RP30V AM in 2002 and 2003 respectively. The treatments N120SSP3oV AM and N120RP30PSB were statistically at par in both the years.

132. Pratibha; Gupta, R.K. (Govind Ballabh Pant University of Agriculture and Technology). Dept. of Environmental Sciences). Interactive effect of pesticide and SO2 on maize plants. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 397-400 KEYWORDS: PESTICIDES; MAIZE; ZEA MAYS; SULPHURDIOXIDE; PROLINE; PROTEINS.

Effects of three different pesticides 1m free proline content, total soluble proteins and nitrate reductase activity in 8°2 fumigated and non-fumigated maize plants (CM-124xCM-128) were studied under pot conditions. Total free proline content reduced in response to all the three pesticides used, while total soluble proteins and nitrate reductase activity increased. Protein content and NRA decreased in 8°2 fumigated plants over unfumigated control, while free proline content increased. Pesticide treated plants revealed lesser effect of 8°2 fumigation than the untreated plants. Thus pesticides reduced the effect of 8°2 fumigation in maize plants.

133. Bera, A.K. (Bidhan Chandra Krishi Viswavidyalaya, Nadia (India). Dept. of Plant Physiology); Patti, M.K.; Ghanti, P. (Bidhan Chandra Krishi Viswavidyalaya, Nadia (India). Dept. of Vegetable Crops). Effect of pre-sown electrical stimulus of seed on growth and yield of ridge gourd (Luffa acutangula Roxb.) and snake gourd (Trichosanthes anguina L.). Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 291-294 KEYWORDS: RIDGE GOURD; SNAKE GOURD; LUFFA ACUTANGULA; TRICHOSANTHES ANGUINA; STIMULUS; YIELDS; GROWTH; YIELD COMPONENTS.

Pre-sowing electric current treatment of seed has been recognized as an innovative tool for yield improvement in field crops. Different intensities of electrical stimulus (0, 50, 100, 150, 200 mA and 0, 100, 200, and 300 mA) were applied to the seeds of ridge gourd and snake gourd respectively for three minutes before sowing. It was observed that electrical stimulus influences different growth and yield parameters in these crops. 150mA intensity electrical stimulus for three minutes duration was found to be optimum for increasing yield in ridge gourd. But, improvement of yield in snake gourd was achieved when seeds were treated with 200 mA of electrical stimulus for three minutes.

134. Jain, R.; Srivastava, S. (Indian Institute of Sugarcane Research, Lucknow (India). Effect of cadmium on growth, mineral composition and enzyme activity of sugarcane. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 306-309 KEYWORDS: CADMIUM; CATALASE; NUTRIENTS; PEROXIDASE; SUGARCANE; SACHHARUM; HYBRIDS; ENZYMES; MINERAL COMPOSITION.

An attempt has been made to study the effect of differential levels of Cd (0, 5, 10, 100, 200 ppm Cd as cadmium chloride) on growth, cell division, chlorophyll content, and activity of catalase and peroxidase enzymes, foliar anatomical characters and essential nutrient contents in sugarcane (Sachharum sp. hybrids CoLk 8102 and CoJ 64) planted under soil pot culture conditions. Very low levels of Cd (5 and 10 ppm) decreased most of the growth attributes studied, viz. leaf number, leaf area, plant height, leaf width,fresh and dry weight of different plant parts, reduction being more with an increase in Cd supply. In variety CoLk 8102, the depression was 45, 51 and 71 percent in leaf number, plant height and leaf area respectively whereas CoJ 64 exhibited 18, 11 and 15 percent depression at 200 ppm Cd supply. Cytological studies indicated steady decline in mitotic index with increasing Cd dose in both the varieties. Chlorophyll a and b and soluble protein contents decreased with an increase in Cd supply in both the varieties. Peroxidase activity was found high while catalase activity was low in Cd supplied plants. Foliar anatomical studie-s indicated marked reduction

in number of minor veins of L TM leaves but the major veins were not affected due to Cd addition in growth medium. Essential nutrients, viz. P, Fe, Mn, Cu and Zn determined in different plant parts revealed lower content of P, Fe, Mn Cu and Zn in leaves and higher content of Fe and P in root tissue at higher Cd levels (100 and 200 ppm Cd). Results obtained indicated that high dosages of Cd (100 and 200 ppm Cd) exerted significant inhibitory effect on shoot and root growth, cell division coupled with changes in mineral composition, activity of catalase and peroxidase enzymes which in turn resulted in reduction in biomass yield of sugarcane. Both the varieties were affected due to excess Cd, effect being less pronounced in variety CoJ 64 in terms of lower decrease in 2rowth attributes.

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135. Kumar, Y.P. (Acharya N.G. Ranga Agricultural University, Palem (India). Regional Agricultural Research Stn.); Reddy, M.S. (Acharya N.G. Ranga Agricultural University, Hyderabad (India). Dept. of Soil Science and Agricultural Chemistry). Conjunctive use of castor cake and nitrogen levels on micro nutrient uptake and economics of carrot (Daucus carota L.). Annals of Biology (India). (Jun 2006) v. 22(1) p. 7-11 KEYWORDS: BEAVERS; DAUCUS CAROTA; NITROGEN; NUTRIENT UPTAKE; FERTILIZING.

A field experiment was conducted during rabi season of 1999-2000 in sandy loam soil at College Fann, College of Agriculture, Rajendranagar, Hyderabad to study the influence offour levfls of castor cake (0, 2, 4 and 6 tlha) and three levels of recommended dose of nitrogen (0, 50 and 100 percent RDN) 01 micro nutrient uptake and economics of carrot. With increase in the castor cake and nitrogen levels uptake of micro nutrients increased (Zn, Cu, Fe and Mn) at all the crop growth stages. At harvest, application of 6 t/ha castor cake recorded higher uptake of Zn (457.97 glha), Cu (158.04 glha), Fe (990.80 glha) and Mn (704.29 glha). Similarly, application of 100 percent RDN resulted in 54.8, 66.65,61.7 and 67.45 percent increase in Zn, Fe, Cu and Mn uptake, respectiJ;ly, over control (NJ. Interaction of 6 t/ha castor cake and 100 percent recommended level of nitrogen recorded higher uptake of nutrients. Highest net returns were recorded with combined application of 4 t/ha castor cake+ 1 00 percent RD1i (Rs. 485501ha) followed by 6 tlha castor I cake+ 100 percent RDN (Rs. 45950/ha) over control (CoNo).

136. Singh, A.; Singh, N.P. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). (Dept. of Agronomy). Direct and residual effects of organic and inorganic sources of nutrients under urdbean (Vigna mungo)-wheat (Triticum aestivum) cropping sequence in foot-hills of Uttranchal. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 97-99 KEYWORDS: VIGNA MUNGO; TRITICUM AESTIVUM; UTTRANCHAL; ORGANIC FERTILIZER; INORGANIC FERTILIZER; RESIDUAL EFFECTS; SEQUENCIAL CROPPING.

A field experiment was conducted during 2002-03 to 2003-04 at pantnagar, to study the direct and residual effects of organic and inorganic sources of nutrients under urdbean [Vigna mungo (L.) Hepper]-wheat (Triticum aestivum L. emend. Fiori & paol.) cropping sequence. Plant height in urdbean varied significantly with the application of farmyard manure 5 tonnes/ha and phosphorus 40 kg P2O5/ha over their respective control. Farmyard manure 5 tonnes/ha also resulted in significantly higher number of pods/plant, grain and biological yields than no-farmyard manure application. However 20 and 40 kg P2O5/ha, being at par, recorded significantly higher grain yield than the control. Yield attributes, yield and harvest index in wheat were not influenced by improved because the residual effect of

farmyard manure and phosphorus applied to urdbean, whereas 75 and 100 percent of recommended level, being at par, resulted in significantly higher values of yield attributes and yield compared to 50 percent of recommended level. On economic point of view, 75 percent of recommended fertilizer level resulted in the highest net return and also gave at par wheat-grain-equivalent yield to 100 percent of recommended level. Total nutrient uptake of the system and soil-nutrient status after urdbean-wheat sequence also increased significantly because of the direct and residual sources of nurients.

137. Kumar, A.; Singh, B.P. (Raja Balwant Singh College, Bichpuri (India). Dept. of Agronomy). Effect of row ratio and phosphorus level on performance of chickpea (Cicer arietinum)-Indian mustard (Brassica juncea) intercropping. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 100-102 KEYWORDS: CICER ARIETINUM; BRASSICA JUNCEA; PHOSPHATE FERTILIZERS; INTERCROPPING.

A field experiment was conducted during winter seasons (rab/) of 2000-01 and 2001-02 at Agricultural Research Farm to find out the effect of row ratios (4:2, 6:2 and 8:2) and phosphorus levels (30, 60 and 90 kg P,o,! ha) on chickpea or gram (Gicer arietinum L.) + Indian mustard [Brassica juncea (L.) Czernj. & Cosson] intercropping on growth, yield attributes, yield, yield assessment and monetary returns as well as P uptake under dryland conditions in semi-arid region of central Uttar Pradesh. The highest land-equivalent ratio (LER), area x time equivalency ratio (ATER), effective yield total (EYT), net return and benefit: cost ratio were obtained at 6:2 row ratio. Among the phosphorus levels tried, 60 kg P,o,/ha was found most economic. P uptake was significantly higher at 60 kg P,O,/ha in comparison with 30 kg P,o,/ha. Net return was also highest, i.e. Rs 22,042.90 and 20,182.04/ha at 6:2 row ratio and 60 kg p,o,/ha respectively.

138. Dutta, D. (Bidhan Chandra Krishi Viswavidyalaya, Birbhum (India). Regional Res. Sub-station); Bandhopadhyay, P. (Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). (Dept. of Agronomy). Production potential of intercropping of groundnut (Arachis hypogaea) with pigeonpea (Cajanus cajan) and maize (Zea mays) under various row proportions in rainfed alfisols of West Bengal. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 103-106 KEYWORDS: ARACHIS HYPOGAEA; CAJANUS CAJAN; ZEA MAYS; INTER CROPPING; WEST BENGAL; PRODUCTION POSSIBILITIES; SPACING; YIELDS.

A field experiment was conducted during the rainy (kharif) seasons of 2002 and 2003 at Jhargram, West Bengal, to evaluate the production potential and economic feasibility of intercropping of ground nut (Arachis hypogaea l.) with pigeon pea [Cajanus cajan (l.) Millsp.] and maize (Zea mays l.) under 6 row proportions (3:1, 4:1,5:1,3:2,4:2 and 5:2). Groundnut yield was reduced by 8-35 percent due to intercropping and yields of pigeonpea and maize were inversely proportional to groundnut row number. Yield components of main and intercrops were also decreased in intercropping systems. Among the intercropping systems, groundnut with pigeon pea in 5:2 row proportion or with maize in 4:2 row proportion was most remunerative in respect of net return and benefit cost ratio. These 2 intercropping systems showed high competitive ratios, land-equivalent ratio and monetary advantage among all intercropping systems.

139. Srivastava, R.K.; Bohra, J.S. (Banaras Hindu University, Varanasi (India). (Dept. of Agronomy). Performance of wheat (Triticum aestivum) + Indian mustard (Brassica juncea) intercropping in relation to row ratio, Indian mustard variety and fertility levels. Indian

Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 107-111 KEYWORDS: TRITICUM AESTIVUM; BRASSICA JUNCEA; INTERCROPPING; SOIL FERTILITY; SPACING; VARIETIES; YIELDS.

A field experiment was conducted during the winter seasons of 1999-2000 and 2000-2001 at Varanasi, Uttar Pradesh, to evaluate the effect of varying row ratio, Indian mustard [Brassica juncea (L.) Zemj. & Cosson] variety and fertility levels on yield potential, competitive function and economics of wheat + Indian mustard intercropping. Association of wheat with Indian mustard under 5:1 row ratio was found more sustainable, as it accounted for higher value in terms of land-equivalent ratio (LER) and relative crowding coefficient (1.690) and was economicaily more remunerative. For association with wheat, Indian mustard var. 'Sanjucta Asesh' proved economicaily viable than 'Vardan' with a minimum depression in yield and yield attributes of wheat. To achieve higher yield advantage and efficient resource utilization, an application of 100 percent recommended dose of fertilizer to both the component crops was found imperative. Though performance of wheat was better in its sole stand, Indian mustard varieties thrived better in intercropping treatments to their solid stands.

140. Bhatt, R.K.; Tiwari, H.S.; Vandana; Misra, L.P. (Indian Grassland and Fodder Research Institute, Jhansi (India). Photosynthesis and shade tolerance in tropical range grasses and legumes. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 172-177 KEYWORDS: GRASSES; LEGUMES; PHOTOSYNTHESIS; CHLOROPHYLL; LIGHT REQUIREMENTS; SHADE; STOMATAL TRANSPIRATION; WATER USE.

Seventeen tropical grasses (Bothriochloa bladhii, Brachiaria mutica, Brachiaria decumbens, Brachiaria brizantha, Cenchrus ciliaris, Cenchrus setiger, Chloris gayana, Chrysopogon fulvus, Dichanthium annulatum, Heteropogon contortus, Panicum maximum cv. IGFRI, Panicum maximum cv. PGG 289, Paspalum notatum, Panicum antidotale, Pennisetum polystachyon, Setaria sphacelata, Tri-specific Hybrid (TSH) [(Pennisetum americanum x P. purpureeum) x P. squamulatum] and two legumes [Stylosanthes hamata (Caribbean stylo), and Macroptilium atropurpureum] were studied for their physiological attributes under different light intensities in rain-fed semi-arid conditions. Rate of photosynthesis (P N) and stomatal conductance (Cs) decreased with decreasing light intensity and reached the minimum level under high shading (25 percent light intensity). TSH, P. antidotale, P. maximum and S. sphacelata maintained the highest P Nand Cs under shade followed by B. mutica, P. polystachyon and C. ciliaris indicating their adaptation to shade. In legumes, S. hamata maintained higher P N than M. atropurpureum under moderate shading (50 percent) and can be grown with trees having sparse canopies in tree-crop inter-cropping systems. Transpiration rate (T R) at 25 percent light intensity was half that in full sunlight. TSH, B. mutica, P. maximum, P. antidotale, S. sphacelata, P. polystachyon and S. hamata relatively maintained higher carboxylation efficiency and water-use efficiency (WUE) under shade followed by C. ciliaris, C. setiger, C. fulvus and B. bladhii. Chlorophyll content (a + b) was maximum under 50-75 percent shadin~ in most of the species.

141. Goyal, D.; Bhadauria, S.; Kumar, A. (Raja Balwant Singh College, Agra (India). Dept. of Botany). A protocol for in vitro propagation of ber (Ziziphus jujuba). Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 178-181 KEYWORDS: ZIZIPHUS JUJUBA; PROPAGATION; IN VITRO CULTURE.

A protocol for micropropagation of Ziziphus jujuba was developed by using nodal explants in different media compositions. Various morphogenic responses of explants have been observed by using different media, viz. MS, Bs and N6. MS basal medium was found to be the best among them for shoot proliferation (93.75 percent). Shoot development was initiated within a week. No callus development was observed. In order to enhance the shoot regenerative potential, explants were cultured on MS medium supplemented with various cytokinins, viz. BAP, kinetin and TDZ. MS medium supplemented with BAP (1.78 JIM) was found to be ideal for shoot development. Among various auxins used, 2.69 JIM NAA proved to be the best to induce healthy roots with minimum callused thickening, resulting in maximum survival of plants (80 percent) in the field.

142. Goswami, S.B.; Sarkar, S.; Mallick, S. (Bidhan Chandra Krishi Viswavidyalaya, Nadia (India). Dept. of Agricultural Meteorology and Physics). Crop growth and fruiting characteristics of brinjal as influenced by gravity drip irrigation. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 190-194 KEYWORDS: WATER USE; YIELDS; TRICKLE IRRIGATION; GROWTH; SOLANUM NIGRUM.

The results of experiment on low cost gravity drip irrigation in winter brinjal crop (cv. Muktakeshi) revealed that maximum plant height, leaves and flowers were recorded with surface irrigation and 100 percent ETo I Etc treatments. Drip irrigated plant became stunted and leaf numbers and flowers per plant decreased with water supply at lower replenishment of ETc Branching of plant was more under dripirrigated crop. Higher moisture supply widened flower to fruit ratio (1: 5.4 - 5.6). Reduced water supply by 80 and 60 percent ETc caused early flowering and improved flower to fruiting ratio, but reduced the flower number and fruit size. The maximum fruit yield (162.8 - 176.8 q ha-1) was obtained with increased water supply but reduced water supply did not hamper yield significantly. Drip irrigation with fertigation was noticed superior in fruit yield over surface method of water supply. Drip irrigation saved 37 - 49 percent water over surface irrigation.

143. Debnath, S.; Duttaray, S.K.; Mitra, S.K. (Bidhan Chandra Krishi Viswavidyalaya, Nadia (India). (Dept. of Fruits and Orchard Management). Relationship of leaf position and CO2 assimulation with fruit growth in litchi. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 195-200 KEYWORDS: LITCHI CHINENSIS; GROWTH; ANABOLISM; FRUITS; PHOTOSYNTHESIS.

An experiment was conducted on 22-years old 'Bombai' litchi (Litchi chinensis Sonn.) trees to study the retention and development of fruit in relation to assimilate supply. One week after fruit set, bearing panicles were manually adjusted to achieve leaf/fruit ratio of 0 to 6 by careful removal of leaf or fruit or both, on girdled as well as ungirdled branches. The results suggested that four leaves behind the panicle essentially supported retention and development of a litchi fruit. However, on ungirdled, defoliated (leaf:fruit=O) branches the developing fruits showed ability to draw resources from rest of the tree's carbon balance. The leaves just behind the fruit cluster were more effective for supplying assimilates to developing fruit than those which were old and away from fruits.

144. Garg, B.K.; Khan, H.A.; Kavia, Z.D. (Central Arid Zone Resarch Institute, Jodhpur (India). Effect of senna stems treatments on growth, net photosynthesis nitrogen metabolism and yield of pearl millet. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p.

385-390 KEYWORDS: PEARLMILLET; PENNISETUM GLAUCUM; SENNA STEM; SENNA EXTRACT; PHOTOSYNTHESIS; CHLOROFORM; NITROGEN; METABOLISM.

Effects of senna stems 2.5 and 5.0 t ha-1 and their extracts in chloroform and water were studied on pearl millet [Pennisetum gJaucum (L..) Br. Cv. HHB-67] under rainfed condition. Application of senna stems and their extracts significantly wcreased leaf area, grain yield and dry matter production of pearl millet. Maximum favourable effects on plant growth and grain yield were observed with the application of water extract of senna stems. Leaf metabolites (viz. total chlorophyll, soluble protein, free amino acids), nitrate reductase activity and net photosynthetic rate at vegetative and flowering stages were significantly improved with the application of senna stems) and their extracts in water and chloroform. Water extract of senna stems had maximum beneficial effects on leaf metabolites, nitrate reductace activity and photosynthetic efficiency. The results indicate a possibility of presence of growth promoting substance in senna .stem because such dramatic increase within a short time can not be attributed to senna residue effects only. The occurrence of triacontanol in senna stems alongwith other nutrients and unknown factors might have contributed towards their positive effects on growth and metabolism of pearl millet.

145. Sudhakar, P.; Latha, P.; Babitha, M.; Prasanthi, L.; Reddy, P.V. (Acharya N.G. Ranga Agricultural University, Tirupati (India). Regional Agricultural Research Stn.). Physiological traits contributing to grain yields under drought in black gram and green gram. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 391-396 KEYWORDS: URD; MUNG; BEANS; BLACKGRAM; GREENGRAM; CHLOROPHYLLS; DROUGHT; LEAF AREA; SPAD; MOISTURE STRESS.

Ten genotypes each of black gram and green gram were evaluated for traits contributing to water use efficiency in a field experiment conduced during Rabi, 2004-05. Under terminal moisture stress conditIons there was a significant reduction of SCMR (SP AD chlorophyll meter reading) and SLA (specific leaf area) both in black gram and green gram genotypes. Black gram genotypes PBG 107, LBG 20 and MBG 207, and green gram genotypes MGG 336 and MGG 351 showed higher SCMR and lower SLA under stress. Significant inverse relationship (r=0.73, P0.05) was observed between SLA and SCMR in black gram genotypes while no correlation was observed in green gram genotypes. Significant positive relationships were observed between seed yield and SCMR both in black gram and green gram under moisture stress indicating that SCMR could be used as a screening tool for grain yield under drought conditions.

146. Bhattacharya, A.; Nagar, P.K. (Institute of Himalayan Bioresource Technology, Palampur (India). Div. of Biotechnology). Changes in endogenous cytokinin activity during seed development in tea. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 287-290 KEYWORDS: TEA; CAMELLIA SINENSIS; CYTOKININ ACTIVITY; DEVELOPMENT STAGES; SEEDS; ENDOGENOUS.

The role of endogenous cytokinin activity was examined in tea seed during development that was divided into 6 stages. Cytokinin activity similar to zeatin (Z), zeatin ribosides (ZR) and iso-pentyl adenine (IPA) increased with advance in seed growth. Cytokinin activities (especially of Z and ZR) continued to increase from the liquid endosperm stage (i. e. stage 6) when histo-differentiation occurred to finally rise to a maximum at stage 8 or the early embryo maturation stage during which 90 percent of the endosperm was consumed by the growing embryos. Later, cytokinin activity similar to Z and ZR decreased from stage 9 (late

embryo maturation stage). Although cytokinin activities declined during full maturity (stage 10), yet maximum activity was still detected in the form of cytokinin glucosides at this period.

147. Khanna, P.K. (Shri Mata Vaishno Devi University, Udhampur (India). School of Biotechnology); Kumar, A.; Ahuja, A.; Kaul, M.K. (Central Scientific and Industrial Research, Jammu (India). Biodiversity and Applied Botany Div.). Seed protein characterization for morphotype identification in Withania somnifera (L.) Dunal. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 321-324 KEYWORDS: ASHWAGANDHA; MEDICINAL PLANTS; INDIAN GINSENG; PROTEIN POLYMORPHISM; ELECTROPHORESIS; WITHANIA SOMNIFERA; IDENTIFICATION.

Characterization of five promising morphotypes, viz. AGB (Ashwagandha germplasm bank) -002, AGB-009, AGB-015, AGB-025 and AGB-030 of Withania somnifera have been made on the basis of seed protein profiles. SDS-PAGE of different morphotypes, revealed variation in number, width and intensity of bands. The molecular weight of protein bands by SDS-PAGE obtained varied between 29.0 to 97.5 kD (Kilo-dalton) in seeds of all morphotypes. There was morphotype specificity in electrophoretic pattern of seed protein. The observations revealed that seed protein polymorphism provides a useful information regarding variability among morphotypes under investigation. This offers a useful and rapidly performed adjunct to traditional morphological methods of identification in Withania somnifera.

148. Nair, A.S. (University of Kerala, Trivandrum (India). Dept. of Environmental Sciences); Abraham, T.K. (Tropical Botanic Garden and Research Institute, Trivandrum (India); Jaya, D.S. (University of Kerala, Trivandrum (India). Dept. of Environmental Sciences). Morphological and physiological changes in cowpea (Vigna unguiculata L.) subjected to water deficit. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 325-328 KEYWORDS: CHLOROPHYLL; PROLINE; COWPEA; VIGNA UNGUICULATA; WATER STRESS; MORPHOLOGICAL; PHYSIOLOGICAL PROPERTIES.

The present study deals with the changes in morphological characteristics and physiological parameters in two varieties (Vigna unguiculata L. cv Pusakomal and Vigna unguiculata L. cv Kanakamony) of mature cowpea plants subjected to water stress. The colour and total number of leaves, specific leaf area, shoot length, chlorophyll content and relative water content in both varieties of plants subjected to water stress showed a significant decrease than its corresponding controls, while the root spread and the proline content in the water stressed plants showed a significant increase. The changes in above mentioned parameters showed that kanakamony variety is much tolerant to water stress compared to Pusakomal variety.

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149. Parihar, C.M.; Kaushik, M.K.; Palsaniya, D.R. (Rajasthan College of Agriculture, Udaipur (India). (Dept. of Agronomy). Effect of varieties, plant density and phosphorus levels on growth and yield of clusterbean (Cyamopsis tetragonoloba (L.) Taub). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 5-7 KEYWORDS: PLANT POPULATION; CYAMOPSIS TETRAGONOLOBA; PHOSPHORUS; GROWTH; YIELDS.

A field experiment comprising two varieties (RGC-936 and RGC-1003), three plant density 2.22/ 3.33 a.nd4.44 lac ha-1) andfourlevels of phosphorus (0/ 20/ 40 and 60 kg P20S ha-1) was conducted on clay loam soil 'at Instructional Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan) during kharif, 2002. The variety RGC-936 recorded significantly higher plant height, branches/plant, dry matter accumulation/plant, pods/plant, seeds/pod, seed yield (16.67 q ha-1), haulmyield (41.53q ha-1 and biological yield (58.21 q ha-1) compared to RGC 1003. Plant density (2.22 lac ha-1) recorded statistically higher growth and yield attributes compared to plant density of 3.33 and 4.44 la ha-1, while, seed haulm and biological yield were highest with plant density of 3.33 lac ha-1 over 2.22 and 4.44 lac ha1. Application of 40 kg P20S ha-1 being at par with 60 kg P20S ha-1 and significantly increased plant height: branches/plant, dry matter accumulation/plant, Fods/plant, seeds pod, seed, haulm and biologIcal YIeld q ha-1 over control and 20 kg P20S ha-. The growth attrIbutes, YIeld attrIbutes, grain yield, haulm yield and biological yield significantly increased with 40 kg P20S ha-1.

150. Kumar, R. (Indian Institute of Pulses Research, Kanpur (India); Arya, R.L. (Central Tobacco Research Institute, Cooch Behar (India). Res. Stn.); Mishra, J.P. (Indian Institute of Pulses Research, Kanpur (India). Effect of seed printing and tillage management on productivity of chickpea (Cicer arietinum) genotypes under rainfed conditions. Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 54-56 KEYWORDS: CICER ARIETINUM; SEED TREATMENT; TILLAGE; GENOTYPESA.

A field experiment was undertaken during 1998-99 to 2000-01 at the Indian Institute of Pulses Research, Kanpur, to study the effect of seed soaking and tillage management on growth, yield and yield attributes of chickpea (Cicer arietinum L.) genotypes under rainfed conditions. Significantly higher grain and straw yields of chickpea were obtained with compact (double cross planking) tillage than normal (single cross planking) tillage. Soaking of seeds in 5 percent solution of KCI for 12 hr increased the' grain and straw yields of chickpea over without soaking of seeds (control). Chickpea cv 'KWR 108' recorded significantly higher seed and straw yields than 'Pant G 114'. Highest net return and benefit: cost ratio of chickpea was recorded in compact tillage soaking of seeds in 5 percent solution of KCI for 12 hr and chickpea cv. 'KWR 108'.

151. Reager, M.L.; Sharma, S.K.; Yadav, R.S. (Rajasthan Agriculture University, Bikaner (India). Dept. of Agronomy). Yield attributes, yield and nutrient uptake of Indian mustard (Brassica juncea) as influenced by nitrogen levels and its split application in arid western Rajasthan. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 213-216 KEYWORDS: BRASSICA JUNCEA; NUTRIENT UPTAKE; NITROGEN FERTILIZERS; SPLIT DRESSING; YIELDS; RAJASTHAN; YIELDS; COMPONENTS.

A field experiment was conduced during the winter season of 2002-03 and 2003-04, to find out the effect of nitrogen levels and its split application on yield attributes and yield of Indian mustard [Brassica juncea (L.) Czernj. & Casson]. Application of increasing levels of nitrogen from 40 to 100 kg/ha significantly enhanced siliquae/plant, seeds/siliqua, siliqua length, test weight, seed yield and NPK uptake of Indian mustard. However, significant increase in stover and biological yields was recorded up to 120 kg N/ha. Further, application of one-third N as basal + one-third at first irrigation + one-third at second irrigation being statistically at par with half basal + one-fourth at first irrigation + one-fourth at second irrigation brought a substantial improvement in siliquae/plant, seeds/siliqua, siliqua length,

test weight, seed, stover and biological yield and NPK uptake compared to 2 equal splits, viz. half at basal + half at first irrigation, DAP basal + half of rest at first irrigation + half rest at second irrigation and 100 percent basal.

152. Das, S.; Ghosh, S.; Basu, P.S. (Burdwan University, Burdwan (India). Dept. of Botany). Effect of dikegulac on flowering, fruit setting and development of Cucumis sativus L.. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 119-122 KEYWORDS: DIKEGULAC; CUCUMIS SATIVUS; FLOWERING; PLANT FLOWERING SUBSTANCES.

Foliar application of dikegulac sodium (2, 3:4-6-di-O-isppropylidene – x L-xylo-2-hexalofuranosate) had promotive effect on flowering, fruit setting and fruit development of Cucumis sativus. It suppressed male owering and promoted female flowers. Dikegulac at 50mgl-l increased the length and girth of the fruits 46.3 percent and 81.5 percent respectively. With the same concentration, the weight of the fruits was increased 38.8 percent. Dikegulac (50mg J-l) also improved the quality of the developing fruits by increasing the contents of insoluble carbohydrate and ascorbic acid in the fruits at 15 days of age.

153. Bera, A.K. (Bidhan Chandra Krishi Viswavidyalaya, West Bengal (India). Dept. of Plant Physiology); Pati, M.K. (Bidhan Chandra Krishi Viswavidyalaya, West Bengal (India). Dept. of Vegetable Crops); Bera, A. (University of Calcutta, Kolkata (India). Institute of Agricultural Science). Brassinolide ameliorates adverse effects of salt stress on germination and seedling growth of rice. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 182-189 KEYWORDS: BRASINOSTROIDS; GROWTH; GERMINATION; RICE; SALINITYSALTS.

Rice in general is a salt sensitive crop. Seeds of two cultivars, viz. Kamini (salt susceptible) and Pusa 2-21 (salt tolerant) were allowed to germinate and grow in glass distilled water (control), 150 mM and 300 mM NaCl solutions, 4 J.1M brassinolide solution, 150 mM and 300 mM NaCl solutions supplemented with 4 J.1M brassinolide. Seed germination, seedling growth and hydrolytic enzymes (amylase and protease) associated with seedling development were adversely affected by NaCl salt stress. Reduction in DNA, RNA and soluble proteins and increase in peroxidase and free proline in rice seedlings were observed with increasing levels of salt stress. The effect was more conspicuous in Kamini than Pusa 2-21. Brassinolide, a steroidal component of plant origin was found to counter the adverse effect of salt stress irrespective of tolerant (kamini) and susceptible (pusa 2-21) cultivars. Ameliorative effects of brassinolide were associated with increase in the levels of nucleic acids, soluble proteins, peroxidase and free proline content under salt stress.

154. Shah, S.H.; Samiullah (Aligarh Muslim University, Aligarh (India). Dept. of Botany). Effect of photohormones on growth, and yield of black cumin (Nigella sativa L.). Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 217-221 KEYWORDS: GROWTH; PHOTOHORMONES; YIELDS; NIGELLA SATIVA; GIBBERELLIC ACID.

A pot trial was carried out to study the effect of foliar spray of 0 (de-ionized water), 10-6, 10-5 and 10-4 M each of gibberellic acid (GA3) or Kinetin (KIN) at 40 days after sowing (vegetative stage) on growth and yield of black cumin (Nigella sativa L.). GA3 application at 10-5 M concentration was found to be more effective than KIN in promoting shoot length, plant dry weight, leaf number, leaf area and branch number observed 70 days after sowing (DAS). Application of 10-5 M GA3 resulted in more capsule number, seed yield and seed yield merit, which, was found increased by 43.33, 43.85 and 53.62 percent respectively.

155. Singh, A.L.; Chaudhary, V. (National Research Centre for Groundnut, Junagarh (India). Macronutrient requirement of groundnut : effects on growth and yield components. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 401-409 KEYWORDS: NUTRIENTS; CHLOROPHYLLS; GROUNDNUT; TRANSPIRATION; FRUITS; DRY MATTER CONTENT.

A series of sand culture pot experiments were conducted to find out the optimum concentration of N, P, K, Ca, and S, in the nutrient solution, for growing groundnut with maximum growth and yield by taking each macronutFient in the range of 2-200 ppm. The observations on plant height, dry matter production, and podding at 20, 40, 60 days after emergence (DAE) and at harvest, chlorophyll content and transpiration at 40 and 70 DAE, flowering from 25-70 DAE and finally pod and haulm yields, at harvest showed that increasing the macronutrients levels, in the nutrients solution, increased these parameters significantly up to a certain level only which was optimum dose for that parameter. The number of flowers produced during the first two weeks (25-40 DAE) of its flowering increased significantly up to 10 ppm of N, P, K, and Sand 20 ppm of Ca, but the number of pods at harvest increased up to SO ppm of Nand 20 ppm of P, K, Ca and S. The pod yield and dry matter, chlorophyll, flowering, podding and transpiratio at either of the stages, however, increased up to 20 ppm of P and S and SO ppm of N, K, and Ca and further increase in the levels of these macro-nutrients did not increase these parameters any more significantly. The macro nutrient levels of SO ppm of N, K, and Ca, and 20 ppm of P and S, in nutrient solution, are being recommended for growing groundnut in nutrient culture.

156. Bai, K.V.K.; Rajagopal, V.; Kumar, S.N. (Central Plantation Crops Research Institute, Kasargod (India). Div. of Plant Physiology, Biochemistry and Post Harvest Technology). Chlorophyll fluorescence transients with response to leaf water status in coconut. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 410-414 KEYWORDS: CHLOROPHYLLS; FLURESCENCE; COCONUTS; DROUGHT STRESS; PERENNIAL CROPS.

Leaf water potential (PleaC) and chlorophyll fluorescence (ChI. F) transients were determined in coconut seedlings in the field under intermittent irrigated (non-stress) and un-irrigated (stress) conditions stress was imposed by withholding irrigation to the seedlings. With Feduction in '¥Iea~ associated with the increase in soil water deficit as well as micrometeorological variables, the ChI. F traits showed variation. Re-irrigation of the seedlings, although showed recovery of the leaf water status, did not show recovery to the PS II system as revealed by ChI. F values. The reduction in various fluorescence derived ratios viz, Fv/Fm and Fm/Fo as wel1 as t1/2 (the half rise time from Fo to Fm) implied the blockage of electron flow on the waterside of the PS II and damage to the photochemical apparatus with stress. Observations during different treatment periods clearly revealed that in coconut PS II is highly sensitive to agro-meteorological variables and prolonged drought lead to permanent damage to photosynthetic apparatus. Henee, maintenance of water status of both soil and leaf is highly crucial to protect the PS II system in coconut seedlings during summer months.

157. Jessykutty, P.C.; Jayachandran, B.K.; Asan, B. (Kerala Agricultural University, Thiruvananthapuram (India). College of Agriculture). Influence of oil palm shade on the physiology of Galanga. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 415-420 KEYWORDS: ELAEIS GUINEENSIS; OLEORESIN; ESSENTIAL OILS; STOMATA; CHLOROPHYLLS.

A study on the influence of different oil palm shade conditions on growth and physiology of galanga (Kaempferia galanga L.), grown as an intercrop, showed that it could perform well under shade. The highest P AR ~as recorded in plants under open condition and the values decreased with increasing shade levels. Specific leaf weight, leaf water potential and stomatal conductance decreased with shade while there was an increase in chlorophyll content. Dry matter production was significantly higher in the intercropped plants. The highest yield was under young palms closely followed by medium and mature palms. Volatile oil content was the highest under young palms while oleoresin, under open condition. The results clearly depict the adaptability of galangal under different oil palm shade conditions.

158. Anand, A.; Nagarajan, S.; Pathak, P.C. (Indian Agricultural Research Institute, New Delhi (India). Nuclear Research Lab.). Effect of high temperature on hydrogen peroxide scavenging enzymes during reproductive phase in aromatic rice cultivars. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 427-431 KEYWORDS: HYDROGEN PEROXIDE; RICE; ORYZA SATIVA; ENZYMES; CATALASE; HEAT.

The inductive response of HzOz scavenging enzymes was studied in leaves of aromatic rice when the plants were exposed to elevated temperature 55 days after transplanting (DAT). High temperature stress preferentially enhanced the activities of ascorbate peroxidase (APX) and non specific peroxidase (POX). Catalase (CAT) activity decreased with continuous exposure to heat stress although it was higher than control upto 15 days of stress (DAS) treatment. Thereafter, plants under normal temperature showed increased catalase activity as they experienced the stressful condition generated by shift towards reproductive stage. Hence our results suggest that (a) peroxidase enzymes detoxify HzOz under high temperature (b) catalase enzyme scavenges HzOz when the plant shifts from vegetative to reproductive stage.

159. Suseelan, K.N.; Salaskar, D.A. (Bhabha Atomic Research Centre, Mumbai (India). Nuclear Agriculture and Biotechnology Div.); Suvarna, S.; Udas, A. (Bhabha Atomic Research Centre, Mumbai (India). Analytical Chemistry Div.); Bhagwat, A. (Bhabha Atomic Research Centre, Mumbai (India). Nuclear Agriculture and Biochemistry Div.). Uptake of mercury, cadmium, uranium and zinc by Mimosa pudica. Indian Journal of Plant Physiology (India). (Oct-Dec 2006) v. 11(4) p. 432-436 KEYWORDS: MIMOSA PUDICA; MERCURY; CADMIUM; URANIUM; ZINC; HEAVY METALS.

Efficiency of uptake of known pollutant heavy metals Hg, Cd, U and Zn by Mimosa pudica, a non-consumable wild plant species, was evaluated. Various concentrations of heavy metals ranging from 1. 10, 1-20, 5-20 and 50-200 mM were used and maximum uptake by the roots at 10, 20, 10 and 100 IJ.M recorded for Hg, Cd, U, and Zn, respectively. The translocation of metals from root to stem (48 percent) and leaves (8 percent) was highest for Zn, as compared to others. U showed only 35 percent translocation to stem, where as Cd and Hg translocation -to both stem and leaves, was negligible. The results indicated differential uptake for different metals by Mimosa pudica. The roots showed maximum uptake capacity for heavy metals, implying the possible utility of Mimosa pudica for rhizofiltration.

160. Yadav, N.; Mahla, S.C.; Yadav, V.K. (Rajasthan Agricultural University, Jaipur (India). Agricultural Research Stn.). Reversal of salinity stress effects on morpho-physiological

parameters of mothbean seedlings by growth regulators. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 310-313 KEYWORDS: MOTHBEANS; GIBBERELLIC ACID; INDOLE ACETIC ACID; SALINITY STRESS; GROWTH REGULATORS; MORPHOPHYSIOLOGICAL PROPERTIES.

Two genotypes of mothbean IPCMO-912 and FMM-96 were germinated in petriplates. The treatment included 0.5percent NaCI with and without 100 ppm GAJIAA in Hoagland solution. Hoagland solution alone acted as control. Morphological parameters and water relation parameters were recorded on 7 and 12 days old seedlings. Salinity decreased the root length, shoot length, seedling fresh weight and dry weight but increased the root-shoot ratio. Hormonal treatment alleviated the adverse effect of salinity on seedling growth (length and weight) to some extent in both the genotypes. Salinity also decreased leaf water potential, osmotic potential and turgor potential and the decrease was greater in FMM-96 than in IPCMO912. Application of the hormones reversed the salinity induced fall in water potential, osmotic potential and turgor potential in the two genotypes. However, genotype FMM-96 responded more to these hormones compared to IPCMO-912.

F63 Plant Physiology - Reproduction

161. Mehta, S.K.; Tripathi, N.N.; Kumar, R.; Chhabra, M.L. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). (Dept. of Plant Pathology) . Influence of olight and temperature on induction of Pycnidia and germination of Pycnidiospores. Annals of Biology (India). (Jun 2006) v. 22(1) p. 31-34 KEYWORDS: TEMPERATURE; MACROPHOMINA PHASEOLINA; LIGHT; GERMINATION.

The maximum pycnidia of R. bataticola appeared at 20°C (20.3/cm2 surface area). Among the three isolates, the maximum pycnidia were produced by the isolate okr-II on cowpea stem at 20°C under 12 h light and 12 h darkness conditions and the maximum pycnidiospores germination (100 percent) occurred at 20 and 25°C at 3 h light exposure. The induction of pycnidia and germination of pycnidiospores decreased with the increase in temperature beyond 20 and 25°C, respectively. The pycnidia production decreased significantly when the exposure to light was increased or decreased from 12 h. Germination of pycnidiospores started within 1 h at 20°C temperature and completed within 3 h, whereas it started within 6-8 h and completed within 12 h in darkness conditions.

162. Bhat, Z.A.; Wani, M.S.; Wani, W.M. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Fruit Research Sub Station, Srinagar (India). Evaluation of newly introduced apple cultivars for their vegetative characteristics. Annals of Biology (India). (Jun 2006) v. 22(1) p. 47-48 KEYWORDS: VEGETATION; APPLE.

An experiment was conducted to study the performance of 10 apple cultivars during the year 200405 under high altitude conditions of Pahnoo Shopian (1800 masl) with respect to various vegetative characteristics viz., plant height, number of branches, stem girth and tree spread. Maximum plant height (254.00 cm) was found in Vance Delicious followed by Tydemans Early Worcester (226.00 cm) and least in Mollies Delicious (126.00 cm). Regarding number of branches, spread and stem girth, maximum values were observed in Spartan (48.00), Golden Spur (10.67) and Vance Delicious (95.50), respectively.

H10 Pests of Plants

163. Aryak, S.; Pawar, A.D. (Central Integrated Peswt Management Center, Port Blair (India). Success of rice IPM demonstrations in Andaman and Nicobar Islands. Annals of Agricultural Research (India). (Dec 2004) v. 25(4) p. 558-562 KEYWORDS: INTEGRATED PEST MANAGEMENT; PEST MITES; RICE; PEST CONTROL; PESTS OF SMALL RUMINANTS; POST HARVEST CONTROL.

Significant and consistent success of Integrated Pest Management (lPM) Programme in rice crop was In Andaman and Nicobar Islands. Throughout the study from 1996-97 to 2000-2001, the t population never crossed the Economic Threshold level (ETL) in IPM farmer's fields. A in insecticide use ranging from 2.2 to 100 per cent resulted In 3.6 to 54.3 per cent increase yield in lPM-fields. Crop benefit and natural enemies' population were higher in lPM-fields to non-IPM fields.

H20 Plant Diseases

164. Gorawar, M.M.; Hegde, Y.R.; Kulkarni, S.; Kalappanvar, I.K. (University of Agricultural Sciences, Dharwad (India). (Dept. of Plant Pathology). Cultural studies on Alternaria alternata (Fr.) Keissler causing leaf blight of turmeric. Annals of Biology (India). (Jun 2006) v. 22(1) p. 35-48 KEYWORDS: TURMERIC; ALTERNARIA ALTERNATA; FUNGAL DISEASES.

Turmeric is an ancient and sacred spice crop of India. Cultural studies were undertaken on Alternaria alterllata causing leaf blight of turmeric. Among 10 solid media evaluated, radial growth of A. alterllala was maximum on potato dextrose and Richards's agar, while maximum sporulation was observed in host leaf extract agar. Among 10 liquid media, Richards's broth supported maximum growth of the fungus.

H50 Miscellaneous Plant Disorders

165. Das, R.; Jain, V.; Arvind, S.; Barman, M.; Srivastava, G.C. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology). Kinetics of nitrate uptake system in wheat genotypes. Indian Journal of Plant Physiology (India). (Apr-Jun 2006) v. 11(2) p. 160-165 KEYWORDS: WHEAT; GENOTYPES; NITRATES; KINETIN; NITROGEN FERTILIZERS; NITROGEN FIXATION.

The nitrate uptake kinetics (C min' K m' and V max) were studied in two cultivars ofv wheat differing in the level of activity of enzyme nitrate reductase. The uptake kinetics especially Km and V max depend on the concentration of nitrate in rhizosphere. At low range of external nitrate concentration uptake system follows Michaelis-Menten saturation kinetics, while at high external nitrate concentration, the nitrate uptake system follows linear kinetics. The uptake system did not show any saturation at least up to 10mM external nitrate. Lineweaver-Burk plot transformation of the uptake data at low nitrate concentration, the Km and V max of HD 2285 (high nitrate reductase activity-HNR) and HD 1981 (low nitrate reductase activity-LNR) were found to be 0.186 and 0.725 mM, and 0.17 and 0.798 mmol g-l fro wt. hot, respectively. The Cmin was calculated by estimating the accumulation of tissue nitrate and found to be 0.9 and 1.5 mM. At low range (0.05-0.5), the rate of nitrate uptake was higher in LNR genotype and at high external nitrate concentration, the uptake of nitrate was more in HNR genotype.

166. Singh, S.N.; Tiwari, U.S. (Chandra Sekhar Azad University of Agriculture and Technology, Kanpur (India). Dept. of Crop Physiology). Sodium potassium ratio as an index to sodicity

tolerance of tomato. Indian Journal of Plant Physiology (India). (Jul-Sep 2006) v. 11(3) p. 329-332 KEYWORDS: SALTTOLERANCE; TOMATO; SODIUM; POTASSIUM; RATIO.

Eight varietieslhybrids of tomato were tested at Dilipnagar Research Farm, Kanpur at 18.0, 26.0, 14.0 and 11.6 ESP levels during 2000-01 and 36.5, 25.3, 13.5 and 11.2 ESP levels during 2001-02. These ESP levels were obtained by adding different doses of gypsum, i.e. 00 percent GR, 66 percent GR and 33 percent GR in alkali soil. In control, gypsum was not applied. Salt tolerant variety Angoorlata produced significantly higher fruit yield and characterized by lower Na/K ratio, than other varieties I hybrids of tomato that were tested.

H60 Weeds and Weed Control

167. Giri, A.N.; Deshmukh, M.N.; Gore, S.B. (Marathwada Agricultural University, Parbhani (India). Cotton Res. Scheme). Effect of cultural and integrated methods of weed control on cotton, intercrop yield and weed-control efficiency in cotton-based cropping systems. Indian Journal of Agronomy (India) . (Mar 2006) v. 51(1) p. 34-36 KEYWORDS: WEED CONTROL; CONTROL METHODS; GOSSYPIUM; INTERCROPPING; PHASEOLUS MUNGO.

A field experiment was conducted on clayey soils during the rainy seasons (kharif) of 1999-2000 to 2002-03 at Parbhani to find out the effective and economic method of weed control for cotton (Gossypium spp.) + blackgram [Phaseo/us mungo (L.) Wilczek] and cotton + soybean [G/ycine max L.) Merr.] intercropping systems. In cotton + blackgram intercropping, integrated weed management with pre-emergence application of oxyfluorien 0.100 kg/ha or pendimethalin 0.75 kg/ha supplemented with weeding and hoeing at 6 weeks after sowing proved as effective as that of 3 hand-weedings and hoeings at 3, 6 and 9 weeks after sowing (recommended cultural practice). This treatment aiso helped reduce the weed population and weight of dry weeds at first picking with highest weed-control efficiency, enhanced the cotton-equivalent yield and net monetary returns, and proved more economical than the recommended cultural practice. In cotton + soybean intercropping, preemergence application of oxyfluorien 0.100 kg/ha supplemented with hand-weeding and hoeing at 6 weeks after sowing proved equally effective in controlling the population and dry weight of weeds, and was as economical as that of cultural practice of 3 hand-weedings and hoeings at 3, 6 and 9 weeks after sowing.

168. Deshpande, R.M.; Pawar, W.S.; Mankar, P.S.; Bobde, P.N.; Chimote, A.N. (Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Nagpur (India). (Dept. of Agronomy). Integrated weed management in rainfed cotton (Gossypium hirsutum L.). Indian Journal of Agronomy (India). (Mar 2006) v. 51(1) p. 68-69 KEYWORDS: GOSSYPIUM HIRSUTUM; WEED CONTROL; CONTENT; METHODS.

A field experiment was conducted during the rainy season (kharif) 2000 to 2002 at Agriculture College farm, Nagpur, to find out sUITable integrated method of weed control for rainfed cotton. Pre- and post-emergence application of herbicides along with 2 hand-weedings and 2 hoeings at 20 and40 days after sowing (DAS) gave effective control of weeds. The highest weed-control efficiency was recorded by pre-emergence application of pendimethalin followed by post-emergence application of glyphosate with 2 hand-weedings and 2 hoeings at 20 and 40 days. Maximum seed-cotton yield (8.54 q/ha) was recorded with 3 hand-weedings and 3 hoeings followed by pre- and post-emergence application of pendimethalin and glyphosate with 2 hand-weedings and 2 hoeings (8.44 q/ha). Maximum benefit: cost ratio (1.34) was recorded with 3 hand-weedings and 3 hoeings treatment.

Among integrated weed-management treatments, the post-emergence application of glyphosate with 2 hand-weedings and 2 hoeings recorded more benefit: cost ratio compared to other integrated weed-management treatments.

169. Subramanian, E.; Martin, G.J.; Balasubramanian, R. (Tamil Nadu Agricultural University, Coimbatore (India). (Dept. of Agronomy). Effect of integrated weed-management practices on growth and yield of wet seeded rice (Oryza sativa) and their residual effect on succeeding pulse crop. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 93-96 KEYWORDS: WEED CONTROL; ORYZA SATIVA; RESIDUAL EFFECTS; YIELD; PHASEOLUS MUNGO; HERBICIDES.

A field experiment was conducted at Agricultural College and Research Institute, Madurai during winter (rabf) seasons of 1998-99 and 1999-2000, to study the effect of inlegrated weed-management practices on weed control and yield of wet-seeded rice. Glyphosate (1.5 kg a.i.lha) was applied al pre-sowing stage alone or in combination with pre-emergence application of pretilachlor +Safener (0.4 kg a.i.fha) and early post-emergence application of butanil (3 litres/ha) along with manual weeding. It was compared with weed-free check and unweeded control. All the weed-management practices significantly reduced Ihe weed density of grasses, sedges and broad-leaf weeds, resulting in their reduced dry weight. Pre-sowing application of glyphosate (1.5 kg a.i.lha) effectively reduced the sedges, when combined with pre-emergence application of prelilachlor + Safner (0.4 a.i.lha) followed by two hand-weedings at 25 and 45 days after sowing. These recorded lesser weed density, dry weight and higher weed-control efficiency, resulting in higher grain yield (58.73 q/ha). Bioassay showed no residual effect of the herbicides applied to rice (Oryza sativa L.) on the stand of succeeding crop of blackgram [Phaseo/us mungo (L.) Wilczek].

170. Bali, A.S.; Singh, M.; Kachroo, D.; Sharma, B.C.; Shivran, D.R. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Div. of Agronomy). Efficacy of herbicides in transplanted, medium-duration rice (Oryza sativa) under sub-tropical conditions of Jammu. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 128-130 KEYWORDS: ORYZA SATIVA; JAMMU; HERBICIDES; TRANSPLANTATION; YIELDS.

A field experiment was conducted during the rainy season of 2001 and 2002 on sandy-loam soils of Jammu, to test the efficacy of different herbicides in transplanted, medium-duration 'PC 19' ('Tawi') rice. Herbicide combinations, viz. anilophos + ethoxy sulfuron (0.312 + 0.015 kg/ha) applied 10 days alter transplanting (OAT) or metsulfuron-methyl + chlonimuron ethyl + butachlor (0.004 + 0.938 kg/ha applied 3 OAT) or butachlor followed by (fb) metsulfuron-methyl + chlonimuron ethyl (0.938+0.004 kg/ha applied 3 OAT fb 21 OAT) with a mean grain yield of 48.1,44.3 and 45.6 q/ha, respectively, remained at par with 2 hand-weedings (20 and 40 OAT). However, through improvement in weed-control efficiency corresponding mean values being 69.6, 60.8 and 61.5 percent, enhanced the grain yield significantly by 67.6, 54.4 and 58.9 percent, respectively, over control. Among the herbicides, combination of anilophos and ethoxysulfuron proved most profitable with net returns of Rs 14,268/ha and benefit : cost ratio of 1 : 97.

171. Pandey, A.K.; Gopinath, K.A.; Gupta, H.S. (Vivekananda Partiya Krishi Anusandhan Sansthan, Almora (India). Evaluation of sulfosulfuron and metribuzin for weed control in irrigated wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 135-138 KEYWORDS: TRITICUM AESTIVUM; WEED CONTROL; IRRIGATION; METRIBUZIN.

A field experiment was carried out on sandy clay-loam soil in North-western Himalayas of India and the experimental field had enough weed population. An average decrease in grain yield by 29 percent was observed due to season-long weed~rop competition. The best weed-control efficiency (85.7-93.8 percent) was achieved with metribuzin compared to other herbicides, i.e. Sulfosulfuron, isoproturon and 2, 4-0 (55.4-87.5 percent). Earlier timing of metribuzin application (40 days stage) provided excellent control of Phalaris minor (Retz.) Pers., while control of Polygonum plebeium R.Br. and Meli/otus indica All. was better with application at 60 days stage. Sulfosulfuron showed high activity against all weed species except P. plebeium and at equivalent doses, control was greater at the earlier timing of application. Slight crop injury in terms of yellowing of leaves and stunted growth was observed in the plots treated with sulfosulfuron. It was more pronounced under delayed application of the herbicide. The injury, however, disappeared with the advancement of crop growth. All the treatments except 2.4-0 application gave significantly higher grain yield compared to weeded check. The highest grain yield was recorded in manual weeding treatment. Lower doses of sulfosulfuron (20 to 25 g/ha) and metribuzin (230 to 245 g/ha) both applied at 40 days stage gave yields similar to manual weeding treatment.

172. Singh, R.; Sen, D.; Rana, N.S.; Kumar, S.; Singh, V.K.; Singh, R.G. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Efficacy of dicamba alone and in combination with isoproturon on wheat (Triticum aestivum) and associated weeds. Indian Journal of Agronomy (India). (Jun 2006) v. 51(2) p. 139-141 KEYWORDS: TRITICUM AESTIVUM; WEED CONTROL; DICAMBA; ISOPROTURON.

Effect of dicamba alone and in combination with isoproturon on wheat (Triticum aestivum L. emend. Fiori & Paol. and associated weeds was evaluated in a field experiment conducted during winter seasons of 19992000 and 2000-01. Pha/aris minor, Meli/otus sp., Coronopus didymus and Medicago denticu/ata were the major weeds in the experimental field. Post-emergence application of dicamba alone at 250, 500, 1,000 g/ha and in combination with isoproturon at 150+1,000, 200+ 1,000 and 250+1,000 g/ha as well as with 2,4-D at 125+500 gl ha provided excellent control of broad-leaved weeds. Dicamba had no effect on P. minor population. All the weed-control treatments significantly increased the grain yield of wheat over weedy check. Maximum grain yield of wheat (50 qIha) was recorded under dicamba at 200 giha as tank-mix application with isoproturon at 1.0 kg/ha compared with the rest of the treatments except dicamba 250 giha as tank-mix application with isoproturon.

173. Bhullar, M.S.; Kamboj, A. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy and Agro-meteorology); Singh, G.P. (District Extension Specialist (Agronomy), Kheti Bhawan, Hoshiarpur (India). Weed management in spring-planted sugarcane (Saccharum officinarum)-based intercropping systems. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 183-185 KEYWORDS: INTERCROPPING; SANDY SOILS; SUGARCANE; VIGNA RADIATA; MUNGO; WEED CONTROL; HERBICIDES; OKRAS.

Field studies were conducted during spring seasons of 2000-01, 2001-02 and 2002-03 on a sandy loam soil to evaluate relative profitability of intercropping spring-planted sugarcane (Saccharum officina rum L.) with greengram [Phaseolus radiata (L.) Wilczek], blackgram [Phaseo/us mungo (L.) Hepper] and okra (Abe/moschus escu/entus L.) in 1: 1 ratio as compared to its sole cultivation and to assess the efficacy in these intercropping systems. Four weed-control treatments, viz. unweeded control, two hand-hoeings (30 days after

sowing and after harvest of intercrops), pendimethalin 0.75 kg/ha as pre-emergence and trifluralin 1.0 kg/ ha as pre-plant to intercrops. These were tested in randomized block design (RBD) with three replications. The data of 3 years showed that intercropping of okra reduced the cane yield by 8.1 percent compared with sole sugarcane. However, this intercropping system recorded the highest mean cane-equivalent yield (74.2 tonnes/ha) as well as net returns (Rs 37,461/ha) among the cropping systems. The net returns under sole sugarcane were Rs 24,950/ha. Uncontrolled growth of weeds reduced the yield of sole sugarcane by 26.7 percent. One pre-emergence application of pendimethalin 0.75 kg/ha or pre-plant incorporation of trifluralin 1.0 kg/ha recorded effective control of annual weeds and gave cane yield, intercrop yield and net returns comparable to two handhoeings. These herbicides, however, did not show their herbicidal effect on Cyperus rotundus.

174. Om, H.; Nandal, D.P.; Dhiman, S.D.; Ram, M. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Rice Res. Stn.). Weed control in wheat (Triticum aestivum) sown by zero tillage. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 199-201 KEYWORDS: TRITICUM AESTIVUM; WEED CONTROL; HERBICIDES; ZERO TILLAGE.

An investigation was carried out during the winter seasons of 2001-02 and 2002-03 at Rice Research Station, Kaul (Kaithal), to study the effect of weed-control treatments in wheat (Triticum aestivum L. emend. Fiori & Paol.) sown by zero-tillage method. Significantly higher grain yield was recorded with the use of Glyphosate + Sulfosulfuron and Glyphosate + Sulfosulfuron + Metsulfluron (each applied at different time) during both the years. Glyphosate and or Metsulfuron was also required to supplement Sulfosulfuron or Clodinafop for better weed management. The highest net returns over the control and benefit: cost ratio was observed with the application of Glyphosate + Sulfosulfuron, followed by Glyphosate + Sulfosulfuron + Metsulfuron. The lowest dry weight of weeds (55.6 to 62.2 and 31.2 to 55.7 g/m2 for first and second year respectively) was observed with Glyphosate + Clodinafop + Metsulfuron, Glyphosate + Sulfosulfuron and Glyphosate + Sulfosulfuron + Metsulfuron treatment. The highest weed-control efficiency was recorded with Glyphosate + Sulfosulfuron + Metsulfuron application (89.2 percent), followed by Glyphosate + Sulfosulfuron (86.9 percent). Metsulfuron was effective in controlling Rumex spp. and other broad-leaf weeds.

175. Singh, D.K.; Singh, K.N. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). (Div. of Agronomy). Weed control in sunflower (Helianthus annuus) under temperate conditions of Kashmir valley. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 225-227 KEYWORDS: HELIANTHUS ANNUUS; WEED CONTROL; KASHMIR; YIELDS.

A field experiment was conducted during the rainy (kharif) seasons of 2003 and 2004 under irrigated temperate conditions on weed control studies in sunflower (Helianthus annuus L.) on silty clay-loam soil of Shalimar, Jammu and Kashmir. Seven weed-control treatments consisted of unweeded check, Pendimethalin 1 kg/ha, Fluchloralin 1 kg/ha, Isoproturon 0.75 kg/ha, 1 hand-weeding at 20 days after sowing, 2 hand-weedings at 20 and 35 days after sowing and weed-free check. Pre-emergence application of Pendimethalin and pre-plant incorporation of Fluchloralin effectively controlled the weeds and resulted in better growth, development and yield of sunflower. Pre-emergence application of Pendimathalin resulted in 75 percent higher yield and additional returns (Rs 9,195) over weedy check.

176. Srivastava, T.K. (Directorate of Seed Research, Mau (India); Chaudhan, R.S. (Indian Institute of Sugarcane Research, Lucknow (India). Weed dynamies and control of weeds in relation to management practices under sugarcane (Saccharum species) complex hybrid) multi-ratooning system. Indian Journal of Agronomy (India). (Sep 2006) v. 51(3) p. 228-231 KEYWORDS: SACCHARUM; WEED CONTROL; RATOONING; MULTIPLE CROPPING; RESIDUAL EFFECTS.

A field experiment was conducted during 2001-2005 at Lucknow, to assess the effect of cultural, mechanical and chemical weed-control measures on weed control, sugarcane ratoon yield and weed population dynamics in multi-ratooning system under the conditions of north-Indian sub-tropics. Losses caused to weeds in first and second ratoon yields were 32.7 and 45.9 percent, respectively. Treatments applied in the first ratoon significantly increased yield, and highest ratoon yield (67.1 tonnes/ha) was recorded either with mulching and hoeing in alternate inter-row spaces or with initial cultivation, followed by glyphosate spray 1.0 kg/ha 30 days after ratoon initiation. Residual effects of the treatments on weeds and crop yield in second ratoon was also significant. The highest second ratoon yield (48.6 tonnes/ha) was obtained as residual effect of mulching and hoeing in alternate inter-row spaces done in the first ratoon. Effect of treatments on weed population dynamics was evident from reduced abundance of grasses (less than 5) both in first and second rations under all the treatments compared to weedy check (abundance index for grasses 5). Adoption of weed-control measures caused occupation of field by grasses, broad-leaf weeds and sedges, whereas in weedy check grasses were most abundant in first as well as second ratoon.

J10 Handling, Transport, Storage and Protecion of Agricultural Products

177. Chaturbhuj, M. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Pathology); Rai, P.K. (S.K.N. College of Agriculture, Jobner (India). Dept. of Plant Pathology). Epidemiology of post harvest fruit rot of tomato by Fusarium pallidoroseum. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 8-12 KEYWORDS: EPIDEMIOLOGY; TEMPERATURE; TOMATO MOSAIC; TABAMOVIRUS; HUMIDITY CONTROL; TOMATOES; TOMATO YELLOW LEAF; GERMINIVIRUS CURL; FUSARIUM PALLIDOROSEUM.

In present investigations epidemiological factors affecting tomato fruit rot; caused by Fusarium pallidoroseum, were studied. Injury of fruits was found to be pre-requisite for infection. Fruits inoculated without injury did not show symptoms of rot Cork wounding proved to be most efficiency method of inoculation. Temperature had a profound effect on development of rot The maximum severity of rot was observed in inoculated fruits incubated at 30°C. The severity of rot increased with increasing levels of relative humidity. Maximum severity of rot was observed at 100 percent relative humidity.

P10 Water Resources and Management

178. Dhindwal, A.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science); Hooda, I.S.; Malik, R.K.; Kumar, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science). Water productivity of furrow-irrigaged rainy-season pulses planted on raised beds. Indian Journal of Agronomy (India).

(Mar 2006) v. 51(1) p. 49-53 KEYWORDS: FURROW IRRIGATION; GRAIN; LEGUMES; WET SEASON.

Water use, yield and economics of furrow-irrigated raised-bed system (FIRBS) of planting in pigeonpea, [Cajanus cajan (L.) Millsp.] clusterbean [Cyamopsis tetragonoloba (L.) Taub.] and greengram {Phaseo/us radialus (L.) Hepper] were studied under three moisture regimes, viz. irrigations at 150, 200 and 250 mm cumulative pan evaporation (CPE), during 2001 and 2002. FIRBS resulted in 22 percent higher grain yield of pigeonpea, 8 percent of clusterbean and 15 peercent of greengram compared with flat-sown crops. In FIRBS 21.6, 18.8 and 14.4 em irrigation water was applied in the three respective crops, with 25 percent saving compared with flat sown. Irrigation-water productivity (WP1m) of pigeonpea, cluster bean and greengram under FIRBS was 76, 44 and 54 percent more than that of flat-sown crops. In all three crops, it was lowest in irrigation at 150 mm CPE and highest in irrigation at 250 mm CPE moisture regime. FIRBS-planted pigeonpea, clusterbean and greengram gave additional net benefit of Rs 2,820, 830 and 1,465/ha respectively compared with flat-sown crops.

P30 Soil Science and Management

179. Singh, A.K.(Indian Agricultural Research Institute, Water Technology Centre, New Delhi (India). Use of pedotransfer functions in soil science. Journal of the Indian Society of Soil Science (India). (Dec 2004) v.52 (4) p.344-356 KEYWORDS: SOIL SCIENCE; SOIL MANAGEMENT.

180. Nandagoudar, S.A.; Patil, S.G. (AICRP on Management of Salt-affected Soils and Use of Saline Water in Agriculture, Gangawati (India). Agricultural Res. Stn.); Manjunatha, M.V.; Hebbbara, M.; Gupta, R.K. (National Agricultural Sciences Complex, New Delhi (India); Minhas, P.S. (Central Soil Salinity Reseach Institute, Karnal (India). Impact of growing trees/grasses on physical properties of a saline soil. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 407-410 KEYWORDS: TREES; GRASSES; SALINE SOILS; SOIL STRUCTURE.

A field experiment was conducted at Agricultural Research Station, Gangawati, Karnataka to study the effect of tree species alone or in combination with grasses on physical properties of a saline soil. Six tree species viz. Casuarina equisetifolia, Acacia nilotica, Dalbergia sissoo, Azadirachta indica, Sesbania grandiflora and Hardwickia binnata and napier grass were planted in 1991 and physical properties were determined during 1995-96. Due to the improvement in soil organic carbon, physical characteristics such as porosity, infiltration rate, hydraulic conductivity and aggregate stability improved under different tree covers while, bulk density and erodibility of soil decreased. Acacia nilotica and Casuarina equisetifolia had higher influence on these bio-physical properties than the other species. Grasses when planted with trees had complementary effect.

181. Chakraborty, D. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Physics); Santra, P. (Central Arid Zone Research Institute, Jaisalmer (India). Regional Res. Stn.); Garg, R.N.; Tomar, R.K.; Sahoo, R.N. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Physics); Sen, U. (Indian Agricultural Research Institute, New Delhi (India). Nuclear Research Lab.); Chaudhuri, S.G. (Central Agricultural Research Institute, Port Blair (India). Hydrophysical characteristics of some soils

in Andaman Islands. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 30-35 KEYWORDS: SOIL PHYSICOCHEMICAL PROPERTIES; POROSITY; SOIL WATER CONTENT; HYDRAULIC ENERGY; SOIL HYDRAULIC PROPERTIES.

Scientific water management in any place requires basic hydrophysical characterization of soils in that area. This information for the soils of the Union Territory of Andaman & Nicobar Islands is very scanty. Though these islands receive high rainfall spread over two-thirds period of the year, it faces a shortage of water in the drier months because of the low water retention capacity of soils and high drainage. This paper gives a brief account of water retention and transmission characteristics of soils of a watershed in Port Blair, South Andaman. These were studied in the laboratory using standard methods. Majority of the soils were identified as sandy ~ay loam and sandy clay for which most of the sample sites are having available moisture onlyie-2Q,per cent with a high drainable porosity between 15-30 per cent. Hydraulic diffusivity and conductivity values were found to be low, which indicate that the soil can not supply necessary water to the crops in the drier period, making it necessary to apply water in small amount but frequently. These findings supported by field investigations can be used for possible suggestions/recommendations for in-situ water conservation and management.

182. Dolui, A.K.; Maity, B. (Calcutta University, Calcutta (India). Dept. of Agricultural Chemistry and Soil Science). Nature of soil acidity in relation to different forms of iron and aluminium of some alfisols of West Bengal. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 415-420 KEYWORDS: SOIL ACIDITY; ALFISOLS; IRON; ALUMINIUM.

Acid-soils of West Bengal, belonging to the order Alfisols, were studied to characterize the nature of acidity in relation to different forms of iron and aluminium. The mean contents of iron and aluminium, extracted by various extracting reagents, were found to be in the following descending order: Dithionite oxalate pyrophosphate KCI ammonium acetate. The electrostatically bonded EB-H+ and EB-AP+ acidities constituted 32 and 68 percent, respectively of exchangeable acidity while EBW, EB-AP+, exchangeable and pH-dependent acidities comprised 7, 15, 22 and 78 percent, respectively of total potential acidity. Correlation between different forms of acidity and Fe and Al in soils suggested that the effect of different forms of Al was more dominant, which directly participate in the formation of different forms of acidity.

183. Singh, R.P. (Aligarh Muslim University, Aligarh (In dia). Dept. of Botany); Kumar, R. (Aligarh Muslim University, Aligarh (India). Chemistry Dept.). Endosulfan adsorption on soils in soil-water suspensions containing cationic, non-ionic and anionic surfactants. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 439-447 KEYWORDS: SOIL SCIENCE; SOIL MANAGEMENT; ENDOSULFAN; SURFACTANTS; ADSORPTION; SORPTION; ANIONS.

The adsorption of endosulfan in aqueous surfactant-free and surfactant (cationic, nonionic and anionic) solutions of different critical micelle concentrations (Yz x CMC, CMC and 2 x CMC) on three different Indian soils varying in physico-chemical and mineralogical composition has been studied using batch shake technique. The measured equilibrium adsorption isotherms for surfactant-free and surfactant/soil/water systems at different critical micellar concentrations were $shaped and in close agreement to the Freundlich isotherms. Highest adsorption of endosulfan in both systems was observed on silt loam soil

followed by loam and sandy loam soils, and could be anticipated with Freundlich constant, KF and partition coefficients, KD values. The obtained values of KF and KD also confirmed that the adsorption of endosulfan in aqueous surfactant solutions followed the order cationic non-ionic anionic at all the CMCs values studied. The affinity of endosulfan towards organic matter and the clay content of the soils was evaluated by calculating the K"m and Kc values when it was found that endosulfan adsorption was better correlated with the clay content than with the organic matter content. The predicted log Kom values were also calculated by using aqueous solubility, l-octanol/water partition coefficient (K"w), adsorbability index (AI) and first-order molecular connectivity index (IX) of endosulfan. Use of l-octanol/water partition coefficient (K"w) of endosulfan to predict adsorption gave values with considerable error in comparison with those measured experimentally, whereas the use of aqueous solubility, adsorb ability index and the first order molecular connectivity index of endosulfan improved the predictions considerably. The results obtained are interesting in that they afford basic data relating to the possible use of surfactants for solving problems of soil contamination posed by endosulfan.

P32 Soil Classification and Genesis

184. Chhonkar, P.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Soil Science and Agricultural Chemistry). Phtoremediation: A 'Green cure'for heavy metal contaminated soils. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 357-373 KEYWORDS: SOIL CLASSIFICATION; GENESIS; CONTAMINATED SOILS; BIOREMEDIATION; MINERAL SOILS.

185. Kaur, N.; Singh, D.; Hundal, H.S. (Punjab Agricultural University, Ludhiana (India). (Dept. of Soils). Adsorption and desorption of native and added cadmium in relation to properties of some alluvial soils in Punjab. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 426-433 KEYWORDS: SOIL CLASSIFICATION; GENESIS; CADMIUM; ADSORPTION; PUNJAB; DESORPTION.

The adsorption and desorption of cadmium (Cd) in relation to soil properties were examined on twenty-four surface soils collected from different locations in Punjab. Soils varying widely in physico-chemical properties such as CEC, clay content, calcium carbonate content, organic matter stock, EC and pH. Diethylenetriamine pentaacetic acid extractable Cd of the experimental soils ranged from 0.024 to 0.054 Ilg Cd g-1 soil while the total soil Cd varied from 0.9 to 2.25 Ilg Cd g-1 soil. For Cd adsorption soil samples were shaken with O.OIM Ca (N03h containing 20 mg Cd mL-l till an equilibrium was attained. Desorption of Cd was carried out by repeated washing of the soils with cadmium-free O.OIM Ca (N03)2 solution. The-amount of cadmium adsorbed varied from 267.5 to 446.3 Ilg Cd g-! soil, which represented 53.5 to 89.3 percent of the initially added cadmium. Cadmium adsorption was significantly correlated with CEC, percent clay content, EC, CaC03 content and soil pH. The linear multiple regression explained 41 perecent of the total variation in cadmium adsorption in terms of CEC, whereas CEC, pH and organic matter together predicted 73 percent of variation in cadmium adsorption; Adsorbed cadmium was significantly and negatively correlated with cumulative cadmium desorbed and percent cadmium desorbed. Desorption of native soil cadmium was negligible. The amount and pattern of desorption varied with the soil properties. About 12.6 to 41.2 percent of adsorbed cadmium could be desorbed back into the soil solution after six consecutive desorption runs. The per cent

cadmium desorbed was significantly and negatively correlated with pH, EC, CaC03, CEC and clay content. Calcium carbonate, CEC and pH together explained 69 percent of variation of per cent cadmium desorption.

186. Singh, R.; Kundu, D.K. (Water Technology Centre for Eastern Region, Bhubaneswar (India). Influence of leaching on development of water repellency in three coastal saline soils of Orissa. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 462-466 KEYWORDS: SOIL CLASSIFICATION; SOIL GENESIS; SALINE SOILS; ORISSA; LEACHING.

187. Gupta, J.P.; Sharma, M.P.; Bindroo, R.K. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Div. of Soil Science and Agricultural Chemistry). Characterization of healthy and unhealthy citrus orchard soils and plants of subtropical zone of Jammu region. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 473-475 KEYWORDS: SOIL CLASSIFICATION; SOIL GENESIS; ORCHARD SOILS; PLANTS; JAMMU.

188. Rathore, R.K.; Garg, D.K. (Rajasthan Agricultural University, Jobner (India). Dept. of Genetics and Plant Breeding). Gene effects of interaction analysis in saline environments for grain yield and quantitative traits in wheat (Triticum aestivum (L.) EM. Thell.). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 36-39 KEYWORDS: SOIL FERTILITY; PLANT GENETICS; PLANT BREEDING; GENE INTERACTION; GRAIN; TRITICUM AESTIVUM; GROWTH; YIELD; SALINITY CONTROL.

Development of salinity tolerant genotypes is important for sustaining wheat productivity in suppressive soils. The generation mean analysis of three bread wheat crosses viz., Lok 1 x Raj 3880, Job 666 x Kharchia 65 and Raj 1972 x Kharchia 65 under normal and saline-sodie environment revealed presence of both additive and non-additive gene effects in the inheritance of grain yield per plant and other contributing characters under both the environments. Among the digenic interactions, all three types of epistatic effects were involved in the inheritance of characters studied. Only duplicate gene interaction was present, wherever available. Hence, intermating in early generations and intense selection in later generations could be successfully adopted for breeding wheat varieties having appreciable salinity tolerance level.

P33 Soil Chemistry and Physics

189. Singh, R. (Central Soil Salinity Research Institute, Lucknow (India). Regional Res. Stn.); Bhandari, A.R.; Thakur, B.C. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). (Dept. of Soil Science and Water Management). Effect of mulching on in-situ soil moisture, growth, yield and economics of plum fruit trees under rainfed conditions in mid hills of Himalyayas. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 411-414 KEYWORDS: ECONOMICS; MULCHING; GROWTH; SOIL MOISTURE; YIELDS; HIMALAYAS.

In mid hills of Himalayas in Himachal Pradesh state, plum is an important fruit crop. Most of the plum orchards under rainfed condition have low productivity and production. For this an investigation was carried out on 8-years bearing plum (cv. Santa Roza) trees. The experiment was laid out under three mulch treatments viz., unmulched (control); plastic mulch (black polythene sheet); and hay mulch, in a randomized block design and replicated

six times. The results demonstrated that growth and fruit yield of plum trees increased significantly under mulch treatments in sandy loam soil as compared to unmulch treatment. Fruit yield in hay mulch was 93.3 q ha-1 which was 41.0 q ha-I higher in comparison to unmulched condition. However, average fruit yield was higher by 6.8 q ha-I under hay mulch, which was statistically at par in comparison to plastic mulch trees. In hay mulched fruit trees, in-situ soil moisture conservation was 1.74 to 8.20 percent higher than that of unmulched trees. The seasonal income under hay mulch and plastic mulch was 1.56 and 1.34 times higher in comparison to the unmulched fruit trees.

190. Sureshkumar, P. (Kerala Agricultural University, Vellanikkara (India). Radio Tracer Lab.); Rattan, R.K. (Indian Agricultural Research Institute, New Delhi (India). (Div. of Soil Science and Agricultural Chemistry); Singh, A.K. (Indian Agricultural Research Institute, New Delhi (India). Water Technology Centre). Chemical forms of zinc in soils and their contribution to available pool. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 421-425 KEYWORDS: SOIL CHEMISTRY; SOIL CLASSIFICATION.

Surface samples of seventeen soils, widely varying in their physico-chemical properties, were analyzed for available zinc content using different extractants. Different fractions of zinc in these soils were sequentially extracted by different reagents. The contribution of these fractions to the available pool was estimated with help of path coefficient Analysis. Water soluble, organic matteroccluded, specifically adsorbed and acid soluble fractions contributed directly to the available pool of zinc. Exchangeable zinc fraction did not contribute directly to any of the extractable forms of zinc. Residual fractions in many cases had negative or adverse influence on labile zinc pool.

191. Mehta, S.C.; Sinwar, P.; Grewal, K.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). (Dept. of Soil Science). Effect of organic matter and clay content on cadmium qdsorption in calcium-saturated soils from semi-arid region. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 434-438 KEYWORDS: SOIL CHEMISTRY; SOIL PHYSICS; SOIL CLASSIFICATION; GENESIS; CADMIUM; ADSORPTION.

The effect of organic matter and clay content on adsorption of Cd on soil samples from semi-arid region was investigated. Three soil samples, varying in organic matter and clay content, were made homoionic with Ca. The Ca-homoionic soil samples were equilibrated with solutions having a wide range of Ca+Cd at 500 /umol L-I total electrolyte concentration. The per cent adsorption of Cd decreased with increasing concentration of Cd in equilibrium solution. The values of distribution coefficient, Kd, also followed a similar trend as that of per cent adsorption. Higher organic matter soil had higher percentage of Cd adsorption as compared to low organic matter soil. Langmuir and Freundlich adsorption isotherms were fitted to the data. Langmuir adsorption isotherm was resolved into two parts i.e., part-I (0-100 /lIIlol L-I) and part-II (l00-500 J.lmol VI) concentration. Effect of organic matter content on Cd adsorption was found to be dominating whereas effect of clay content was secondary.

192. Surekha, K.; Reddy, M.N.; Rao, K.V. (Directorate of Rice Research, Hyderabad (India). Div. of Soil Science); Cruz, P.C.S. (International Rice Research Institute, Manila (Philippines). Evaluation of crop residue management practices for improving yields, nutrient balance and soil health under intensive rice-rice system. Journal of the Indian Society of Soil Science

(India). (Dec 2004) v. 52(4) p. 448-453 KEYWORDS: SOIL FERTILITY; CROP RESIDUES; NUTRIENT BALANCE; PLANTS; YIELDS; CROPPING PATTERNS.

Field experiments were conducted during 1998 - 2000 on a sandy clay loam soil (Deep Aquic Ustorthent) to evaluate the influence of different crop residue management practices on rice yields, nutrient balance and soil health/quality indicators. Incorporation of 100 and 50 percent paddy straw in both seasons, incorporation of 100 percent straw+green manure, GM (in situ grown Sesbania aculeata) in kharif season and 100 percentstraw burning in both seasons were compared with a control (straw removal). Significant improvement in rice productivity was observed with recycling of 100 percent straw directly or its ash or straw+GM over straw removal or 50 percent straw addition after two crop cycles. Recycling of crop residues substantially improved partial N balance in the system by 123, 33 and 24 percent with 100 percent straw+GM, 100 and 50 percent straw, respectively over straw removal or burning indicating nutrient addition to soil reserves. Partial K balance was positive with crop residue treatments and negative when straw was removed (-107 kg ha -I). A decrease in bulk density and increase in infiltration rate was observed by crop residue incorporation over control or straw burning. Available K increased significantly with incorporation of straw or its ash (440-519 kg ha-I) over control (377 kg ha-1) with no significant change in available Nand P. Soil organic carbon (SOC) content and soil respiration rate increased significantly in all the crop residue treatments over control with maximum values in straw+GM treatment. Thus, incorporation of paddy straw alone or in combination with green manure improved yields, nutrient balance and soil health under intensive rice mono-cropping conditions.

193. Thangasamy, A. (Indian Agricultural Research Instiutte, New Delhi (India). (Div. of Soil Science and Agricultural Chemistry); Naidu, M.V.S.; Ramavatharam, N. (Acharya N.G. Ranga Agricultural University, Tirupati, (India). Dept. of Soil Science and Agricultural Chemistry). Clay mineralogy of soils in the Sivagiri micro-watershed of Chittoor district, Andhra Pradesh. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 454-461 KEYWORDS: SOIL CHEMISTRY; SOIL PHYSICS; SMECTITE; CLAY MINERALS; KAOLINITE.

The mineralogical and chemical characteristics of soils developed from quartzite and granite-gneiss parent materials of the Sivagiri micro-watershed in Chittoor district of Andhra Pradesh were studied. The clay film invariably exhibited the characteristic peaks of smectite, kaolinite and mica. Semi-quantitative estimates of clay fractions based on relative areas under corresponding peaks indicated that the pedons 1, 2, 3, 5, 6, 7, and 8 are dominated by smectite followed by kaoiinite and mica whereas pedons 4 and 9 are dominated by kaolinite followed by considerable amounts of smectite and mica. Feldspar and quartz are present in traces. However, use and management of these soils for agricultural production require an understanding of their clay mineralogy.

P34 Soil Biology

194. Kikon, Z.J.; Sharma, S.K. (Nagaland University, Mediziphema (India). (Dept. of Agricultural Chemistry and Soil Science). Total and available nitrogen, phosphorus and potassium content in vermicompost of different species of earthworms. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 13-17 KEYWORDS: COMPOSTING; OLIGOCHAETA; NITROGEN; PHOSPHORUS; POTASSIUM; VERMICULTURE.

The highest total nitrogen content was recorded in vermicompost of weed using earthworm species Amynthas diffringens/while the lowest was recorded inpaddy straw without earthworm. The highest amount of total phosphorus and potassium content were recorded in vermicompost of vegetable waste using earthworm species Amynthas diffringens and the lowest were recorded in paddy straw without earthworm moculation. On the other hand, available nitrogen, phosphorus"and potassium content of vermicompost were influenced significantly due to different source of biomass using both the species of earthworm. The highest available nitrogen was recorded in vermicompost of weed using both the species of earthworm. While, highest available phosphorus and potassium were recorded in vermicompost of paddy straw and vegetable waste, respectively.

P35 Soil Fertility

195. Singh, J. (Shri Vallabh Bhai Patel University of of Agriculture and Technology, Meerut (India). (Dept. of Agricultural Engineering); Kothari, M. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of SWE, CTAE); Jain, S.K. (National Institute of Hydrology, Roorkee (India); Kumar, V. (Shri Vallabh Bhai Patel University of Agriculture and Technology, Meerut (India). Dept. of Agricultural Engineering). Delineation of salt affected areas of Muktsar district, South-West Punjab using Landsat-TM and IRS-ID LISS-III data. Annals of Biology (India). (Jun 2006) v. 22(1) p. 13-17 KEYWORDS: SOIL BIOLOGY; SOIL AIR; SOIL ANALYSIS.

Poor water management coupled with inadequate drainage in the irrigated tracts of the arid and semi-arid regions leads to salinity. Space born multispectral data have been found to be extremely useful in deriving information on salt affected soils. The study, reported here, reveals that the pre-monsoon and post-monsoon salt}ffected areas were delineating using satellite-remote sensing data for Mukstar district in south-west Punj-ab. Digital data of Landsat TM and-IRS-II) LJSS-III acquired on May IS, 1997, l'fovember 11, 1997 and November 28,2003 were analyzed using digital image processing software ERDAS Imagine 8.5. For delineation of salt affected areas the unsupervised classification approach was used. In multispectral image, each pixel has a spectral signature determined by the reflectance of that pixel in each of the spectral bands. In this study, unsupervised classification approach with ISth clusters and a 95 percent confidence threshold has been performed. The result was an image with ISth groups of pixels each represented by different colours. It was observed that the last class i.e. ISth class falls under salt affected soils. The pre-monsoon May IS, 1997 salt affected area was found to be 87lS.46 haand also for post-monsoon November 28,2003 salt affected area was found to be 15223.85 ha for Muktsar district.

196. Setia, R.K. (Punjab Agricultural University, Ludhiana (India). Punjab Remote Sensing Centre); Sharma, K.N. (Punjab Agricultural University, Ludhiana (India). Dept. of Soils). Vertical distribution of chemical pools of potassium and their relationship with potassium nutrition of wheat under long-term differential fertilization. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 469-472 KEYWORDS: SOIL FERTILITY; FERTILIZING; POTASSIUM; WHEAT.

197. Kumawat, B.L.; Pathan, A.R.K.; Chauhan, R. (Rajasthan Agricultural University, Jobner (India). (Dept. of Agricultural Chemistry and Soil Science). Response of taramira to sulphur

and phosphorus application on typic psamment. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 476-478 KEYWORDS: SOIL FERTILITY; DROUGHT RESISTANCE; ERUCA SATIVA; SULPHUR; PHOSPHORUS; SILIQUA; ROCK COMPOSED OF SAND GRAINS.

P36 Soil Erosion, Conservation and Reclamation

198. Bhushan, L.S.; Yadav, R.C.; Srivastava, S.K (Central Soil and Water Conservation Research and Training Institute, Agra, (India). Hypodermic need type laboratory rainfall simulator for erosion studies. Journal of the Indian Societry of Soil Science (India). (Dec. 2004) v. 52(4) p. 478-481 KEYWORDS: SOIL EROSION; CONSERVATION AND RECLAMATION; EROSION.

Q04 Food Composition

199. Dhull, N.; Singh, N.; Panghal, A.; Khatkar, B.S. (Guru Jambheshwar University, Hisar (India). (Dept. of Food Technology). Study on the effect of pulse flours on quality of biscuits. Annals of Biology (India). (Jun 2006) v. 22(1) p. 75-78 KEYWORDS: BISCUITS; GRAIN LEGUMES; QUALITY.

The effect of replacing wheat flour with dried pea and red gram flours on the nutritional and sensory quality of the biscuits was studied. Protein contents of biscuits increased as the level of pulse flours increased in the formulations. The protein content increased from 5.1 percent (control biscuits) to 8.2 percent and 9.0 percent with replacement of 30 percent of wheat flour with dried pea and red gram, respectively. Addition of pulse flour upto 20 percent did not show significant effect on the texture and flavour attributes of biscuits. Biscuits made with supplementation of red gram flour were harder and required higher compression force. The biscuits made from 10 percent dried pea scored the highest for texture and flavour. Thickness, diameter and spread ratio of biscuits containing different levels of pulse flours were significantly different from control sample. Sensory evaluation scores suggested that acceptable biscuits could be prepared from wheat flour supplemented with dried pea and red gram flours upto a level of 20 percent.

U40 Surveying Methods

200. Sharma, P.K. (Punjab Renote Sensing Centre, Ludhiana (India). Emerging technologies of remote sensing and GIS for the development of spatial data infrastructure. Journal of the Indian Society of Soil Science (India). (Dec 2004) v. 52(4) p. 384-406 KEYWORDS: REMOTE SENSING AND SENSORS; GEOGRAPHICAL INFORMATION SYSTEMS.