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A50 AGRICULTURAL RESEARCH

201. Jain, T.C.; K-12/11, DLF, Phase -II, Gurgaon (India). New paradigms in agronomic research and development. Indian Journal of Agronomy (India) v. 52(4) p. 241-244 KEYWORDS: AGRONOMY; RESEARCH; AGRICULTURAL DEVELOPMENT.

It was encouraging to see that a serious issue of new directions to agronomic research in India was deliberated at the National Symposium held at Navsari Agricultural University, Navsari, Gujaraffrom 19-21 November 2008. Perhaps it is high time to think in this direction to maintain the established reputation of agricultural scientists, especially of Agronomists. The growth in agriculture is not only declining but at times has just stagnated, and it is a difficult task to achieve its 4. growth to maintain the overall national growth of around 8. in the next 5 years. It requires a paradigm shift and there are ample signs of it. But the process of change is too slow, needing a change in overall attitude of the scientific community with enabling policy support. Research must contribute to development (short-term or long-term), and to achieve this objective, the scientists should examine much deeper to the 'quality and relevance of research'. At the same time the development efforts should make the best use of available research. As such, there is need to strengthen the linkages between agricultural research and development. This paper points out some of the changes that are required for a new approach to agricultural research in general and agronomy in particular.

202. Yadav, R.L.; Indian Institute of Sugarcane Research, Lucknow (India). My journey in changing facets of agronomic research during three decades of green revolution in India. Indian Journal of Agronomy (India) v. 52(4) p. 245-254 KEYWORDS: AGRONOMY; RESEARCH; AGRICULTURAL DEVELOPMENT; HIGH YIELDING VARIETIES.

The changing facets of agronomic research in India as observed and followed by me during the past three decades, are reviewed in this paper. Green Revolution ushered in a new paradigm of agronomic management of crops in India. Fertilizer responsiveness of dwarf wheat generated heavy demand of fertilizers and gave major boost to the Indian fertilizer industry. Thus, due to the increased availability of fertilizers in the market, sugarcane farmers also started using heavy doses of N fertilizer to improve the cane yield, but at the cost of sugar content. Therefore, determination of optimum dose of N became important. In the first decade of my research career, I worked in this direction to work out the optimum dose and time of N application in sugarcane. Later on, with the introduction of fertilizer-responsive short-duration varieties in many crops like pulses and oilseeds, multiple cropping emerged as an important concept for intensification of agriculture. Consequently, I reoriented my research activities to develop companion cropping system with sugarcane and worked out fertilizer requirement of different crop combinations. Within two decades of Green Revolution, due to expansion of irrigation facility, rice-wheat crop rotation became predominant production system in the Indo-Gangetic plains, with gradual decrease in the area under pulse cultivation. Efforts were made to introduce pulses as companion crops of

sugarcane for sustaining soil fertility and providing extra income to cane growers. Within a short span of time rice-wheat system, due to heavy demand of nutrients developed soil fatigue and witnessed decline in factor productivity. My research interest again changed during 1980s towards conservation of soil-organic carbon, by utilizing the organic farm waste material and crop residues. Various options of green-manuring were also tried in rice-wheat and sugarcane-based cropping systems to achieve this objective and to increase the fertilizer-use efficiency. From high-input agronomy, my research interest thus, finally changed to conservation agronomy. Conservation of soil moisture through trash mulching, in-situ decomposition of trash using bio-agents and bio-manuring to improve the soil fertility as well as nutrient-use efficiency has now become my prime concern. In sugarcane, the improvement in productivity of ratoon crop remained a major research activity throughout my career.

C20 Extension

203. Singh, P.; Jhamtani, A.; Stapathy, B.; Sekhar, D.; Rahul; Bhaudrtia, C. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Extn.). Impact of assessment of perceived drudgery reduction of farm women through improved agricultural tools and implements. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 126-131 KEYWORDS: EFFICIENCY; EMPOWERMENT; WHEELBARROW.

The prosperity and economic growth of a nation depends on the status and development of its women. Rural women are much more overburdened than men owing to their multiple occupations. Research on women in agriculture shows that on an average women work for 15 to 16 hours a day and 4 to 5 hours more than their men counterparts. Studies reveal that farm activities which are time and labour intensive, monotonous, repetitive adn more drudgery prone are generally performed by women, e.g. transplanting, weeding, thinning, gap filling, harvesting, plant protection, winnowing etc. Since all these operations are done manually they cause remarkable physical strain, mental fatigue and other allied health dosorders. A study was conducted under NATP MM Project titled "Empowerment of women in agriculture" where the impact of improved agriculture tools and implements was assessed for reducing drudgery amongst farmwomen. This paper deals with perceived drudgery of se"lected agricultural implements through comparative ratings for improved and traditional methods. Results revealed that most of the improved tools reduce fatigue and enhance efficiency, except a few.

C30 Documentation and Information

204. Poonam; Kaur, A.; Ladher, D.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Extn. Edn.). Extent of utilization of IFFCO services by the farmers of Punjab. Annals of Biology (India). (Jun 2008) v. 24(1) p. 71-75 KEYWORDS: SERVICES; PUNJAB; FARMERS; FARM HELPER SERVICES; FERTILIZERS; COOPERATIVE SERVICES; SAMPLING.

The present study was conducted purposively in Ludhiana district of Punjab state. A sample of 150 respondents registered as members under village co-operative societies of selected villages during 2005-06 was taken by random sampling technique using proportional allocation method. Data were collected with the help of interview schedule from the members of village co-operative societies. Majority of the respondents utilized

financial services of IFFCO followed by balanced fertilizer use service, social services and educational services.

205. Badodiya, S.K.; KUmar, P.; Meshram, V.; Pathak, K.N. (R.A.K. College of Agriculture, Sehore (India). Listening and viewing behaviour of farmers about farm programming. Annals of Biology (India). (Jun 2008) v. 24(1) p. 77-79 KEYWORDS: FARMERS; PARTICIPATION; BEHAVIOUR; COMMUNICATION TECHNOLOGY; RADIO; TELEVISION; TECHNOLOGICAL CHANGES.

The study clearly indicated that majority of the respondents listened/viewed the farm programmes occasionally and paid partial attention. Further, they discussed and made notes only sometimes after listening/viewing the farm programmes.

E16 Production Economics

206. Ghosh, A. (Uttar Banga Krishi Viswavidyalaya, Coochbehar (India). Dept. of Agricultural Statistics); Satya, P. (Uttar Banga Krishi Viswavidyalaya, Coochbehar (India). Dept. of Genetics and Plant Breeding); Mukhopadhayay, P. (Uttar Banga Krishi Viswavidyalaya, Coochbehar (India). Dept. of Soil Science and Agricultural Chemistry). A simple quantitative method to judge the need of participatory plant breeding programme. Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 374-380 KEYWORDS: PARTICIPATORY; PLANT BREEDING; QUANTITATIVE ANALYSIS.

Participatory plant breeding (PPB) in field crops like rice is gaining rapid attention and importance-in modern crop improvement programme to minimize the gap between potential and realized yield in farmers' field. However, as the process is location specific and resource intensive, utility of this method should be tested before investing in such a venture. A group of rice farmers from Terai region of West Bengal were involved in developing a method for justification of initiating a participatory plant breeding programme. Weighted response matrices were constructed according to farmers' and breeders' choices of traits and were further partitioned into more and less important traits. Distance relationship of the matrices revealed that the attribute preferences differ considerably between farmers and breeders, which justify the need of location specific test for PPB. Results indicated moderate deviation between farmers' and breeders selection preferences. Based on the findings, a method is proposed to judge the need of PPB in a specific location.

207. Singh, G.; Singh, O.P.; Kumar, V.; Kumar, T. (Narendra Deva University of Agriculture and Technology, Uttar Pradesh (India). Effect of methods of establishment and tillage practices on productivity of rice (oryza sativa) wheat (Triticum aestivam) cropping system in lowlands. Indian Journal of Agricultural Sciences (India) v.78(2) p.63-166 KEYWORDS: ORYZA SATIVA; TRITICUM AESTIVUM.

Transplanting method of rice being at par with seeding by drum seeder and direct seeded by zero-till-drill without tillage after spray of glyphosate .5 kg ai/ha but gave significantly higher grain yield of rice over rest methods of establishment. Rice sown in puddled soil depleted significantly higher amount of nutrient as compared to unpuddled soil. Grain yield of whet was significantly lowest in rice plot established in rice plot seed as compared to unpuddled. Wheat sown in rice plot seed by zero till drill without tillage after spray of glyphosate of 0.5 kg ai/ha gave significantly highest grain yield.

208. Surekha, K.; Rao, K.V.; Sam, T.K. (Directorate of Rice Research, Hyderabad (India). Improving productivity and nitrogen use efficiency through integrated nutrient management in irrigated rice (oryza sativa). Indian Journal of Agricultural Sciences (India) v.78(2) p.173-176 KEYWORDS: ORYZA SATIVA; PRODUCTIVITY; NITROGEN.

In a field experiment to study the influences of different organic sources on productivity and nitrogen use effciency in irrigated rice, three organic sources (paddy straw, greengram and dhaincha) were used in different combinations along with chemical fertilizers. Though the green nature, greengram only could result in signficant yield increase (by 13.) over inorganic fertilizers in the first year, all the organic sources resulted in significant grain yield increase over fertilizers alone (by 17-41.) from second year onwords.

E50 Rural Sociology and Social Security

209. Kumar, P.; Singh, S.P. (Jawaharlal Nehru Krishi Vishwa Vidyalaya, Tikamgarh (India). College of Agriculture, Dept. of Agricultural Extension). An evalaution study of training of rural youths for self employment scheme. Annals of Biology (India). (Dec 2007) v. 23(2) p. 201-203 KEYWORDS: RURAL SOCIOLOGY; YOUTH; TRAINING PROGRAMMES; TRAINING; EVALUATION; EMPLOYMENT.

The present investigation was conducted in Damoh district of M. P. to know the trainees under TRYSEM"scheme. The Damoh district consists of seven blocks, out of which Hatta block was selected purposely because maximum number of beneficiaries was in this block. Out of total 395 beneficiaries, 30 percent beneficiaries were selected by simple random sampling without replacement (SRSWOR). One hundred and five respondents received training in different trades under TRYSEM scheme. The majority Of small farmers were from low socio-economic states, belonging to SC & ST groups, low education level and received training in tailoring, electrical and luhargiri. Majority (39.45 percent) beneficiaries earned Rs. 7000-15,000 annually.

210. Kaur, A.; Poonam; Ladher, D.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Extn. Edn.). Identification and reasons for use and not use the herbal plants and food items by the rural women. Annals of Biology (India). (Jun 2008) v. 24(1) p. 67-70 KEYWORDS: RURAL SOCIOLOGY; FOODS; WOMEN; DRUG PLANTS; SAMPLING.

This study was conducted in two districts of Punjab viz., Gurdaspur and Ludhiana. A sample of 200 rural women was selected for the investigation. Twenty-seven herbal plants and 31 food-items were identified' from both the districts by the rural women. The reasons stated by majority of the respondents for the use' of identified herbal plants and food items were that "elders always used these", "having no side effects", "cost effective" and their "easy availability". The reasons' stated for not using were "time consuming for preparation" and "quick relief from allopathic medicines".

F01 Crop Husbandry

211. Chander, S. (CSWRI, Bikaner (India). ARC); Pandey, J. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy); Sharma, K.C. (CSWRI, Bikaner (India). ARC); Kumar, P. (Central Potato Research Station, Modipuram (India). Yield and quality of scented rice pusa basmati 1 (Oryza sativa L.) as influenced by nitrogen and herbicides under varying

rice cultures. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 113-117 KEYWORDS: YIELD; QUALITY; ORYZA SATIVA; NITROGEN; HERBICIDES; CHLORIMURON.

Two years field study on scented rice cv. Pusa Basmati 1 with two nitrogen levels and five weed 'l.tments under different rice cultures showed that the grain and straw yield of scented rice ficantly higher under transplanted rice culture than direct seeded puddled rice culture. ltent and protein yield were also significantly higher under transplanted rice culture than ed rice culture. Hullin~ milling and heads rice recovery (percent); grain length, breadth (mm) fbreadth ratio before and after cooking were statistically identical under different rice rain and straw yield and protein yield were sigTlificantly more under higher nitrogen kg/ha) than lower levels (60 kg/ha), however hulling milling and hand rice recovery, 1, breadth and length/breadth ratio before and after cooking were remained statistically by increased nitrogen application. Among weed control treatments, hand weeding treatment gave significantly higher grain and straw yield as well as protein yield Herbicide were also significantly superior than weedy check treatment in improving grain and and protein yield but statistically inferior to hand weeding. Grain quality characters tically identical under different weed control treatments. The mean grain length, breadth breadth ratio of uncooked Pusa Basmati 1 were 6$ mm, 1.67 mm and 4.1 respectively.

212. Singh, K.P.; Yadav, R.; Minakshi (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Genetics). Photothermal response for french bean (Phaseolus vulgaris L.) in Haryana state. Annals of Biology (India). (Dec 2007) v. 23(2) p. 129-131 KEYWORDS: ADAPTABILITY; PHSEOLUS VULGARIS; GENOTYPES; GENOTYPE ENVIRONMENT INTERACTION; SEED; YIELDS; YIELD COMPONENTS; HARYANA.

Phototherman response showed adaptability of 45 Rajmash genotypes under different agro climatic conditions. Moreover, Rajmash can be cultivated successfully in spring season under Haryana conditions.

213. Sharma, P.K.; Kumar, S.; Verma, R.; Gupta, A. (Rajasthan Agricultural University, Jaipur (India). Dept. of Agronomy). Effect of dates of sowing and seed rate on sets production of onion (Allium cepa) for raising kharif crop. Annals of Biology (India). (Dec 2007) v. 23(2) p. 141-143 KEYWORDS: SOWING DATE; SEED PRODUCTION; SEED SET; ONIONS; ALLIUM CEPA; YIELDS.

A field study was conducted for two years during rabi season of 1999-2000 and 2000-01 to find out the suitable date of sowing and seed rate for higher sets production of onion sets for planting of kharif crop at Agricultural Research Station, Durgapura, Jaipur. Pooled data revealed that sowing of onion seed on 15 December recorded significantly higher yield of total sets (742.08 q/ha) and optimum size sets (593.63 q/ha) over that of later dates of sowing i. e. 15 January to 15 February and it was found at par with 31 December sowing. Sowing of onion seed at 25 glm2 produced significantly higher yield -of optimum size sets i. e. 377.27 q/ha over lower and higher seed rates.

214. Ganajaxi; Rajakumar, S.; Math, K.K. (University of Agricultural Sciences, Dharwad (India). Dept. of Agronomy). Drum seeding - a profitable substantiative of transplanting under rainfed lowland situation. Annals of Biology (India). (Dec 2007) v. 23(2) p. 159-162 KEYWORDS: TRANSPLANTING; SOWING; RAINFED FARMING; ECONOMICS; LOWLAND.

The experiment was conducted at the Agricultural Research Station, Mugad. The seven treatments consisting of different methods of sowing with different agronomic practices

were tried. Drum seeding method recorded on par yield with the transplanting under rainfed lowland situation. By drum seeding, cost of cultivation was reduced to the extent of 36 percent and profit was raised to 15 percent when compared with transplanting.

215. Balu, P.A.; Sumathi, P. (Tamil Nadu Agricultural University, Coimbatore (India). Centre for Plant Breeding and Genetics); Ibrahim, S.M. (Agricultural College and Research Institute, Madurai (India); Kalaimagal, T. (Tamil Nadu Agricultural University, Coimbatore (India). Centre for Plant Breeding and Genetics). G x E interaction and stability analysis in sunflower (Helianthus annuus L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 388-391 KEYWORDS: HELIANTHUS ANNUS; STABILITY; GENOTYPE ENVIRONMENT INTERACTION.

The present study was carried out to identify sunflower hybrids suitable for water and salt stress areas which will be highly essential for increasing area of cultivation under sunflower. This study included sixty hybrids along with their parents viz., four Cytoplasmic Male Sterile (CMS) lines and fifteen restores. The 60 hybrids and their 19 parents were evaluated in three different environments viz., Normal condition, Rainfed condition and Salt stress condition. From this study it was concluded that the hybrids are more adaptive than parents for yield and yield components. Among the 60 hybrids studied, 821 A x 6D-1, 821 A x CO 4 and 852 A x RHA 298 were found to be stable with high mean, regression coefficient (bi) around unity and deviation from regression coefficient (S2d'l) around zero for the three characters viz., diameter of stem, head diameter and seed yield per plant. These hybrids were concluded as stable hybrids.

216. Sutaliya, R. (Dayanand College, Ajmer (India). Dept. of Agronomy); Singh, R.N. (Banaras Hindu University, Varanasi (India). Dept. of Agronomy). Effect of planting time, fertility level and phosphate-solubilizing bacteria on growth, yield and yield attributes of winter maize (Zea mays) under rice (Oryza sativa)-maize cropping system. Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 173-175 KEYWORDS: PLANTING DATE; PHOSPHATE; ORYZA SATIVA; FERTILITY; CROPPING SYSTEMS; ZEA MAYS; GROWTH; YIELDS; YIELD COMPONENTS; INOCULATION; ALSOSOC.

An experement was conducted during winters of 2000-01 and 2001-02 to find out effect of planting time, fertility level and phosphate-solubilizing bacteria on winter maize (Zea mays L.) after rice (Oryza sativa L.) at Varanasi, on sandy-loam soil conditions of eastern plain zone of Uttar Pradesh. Delay in planting from 15 December to 30 December decreased the maize yield by 19.25percentage with mean reduction of 82.7 kg maize yield/hal day. Fertility level up to 180, 90 and 60 kg N, ppsand Kp/ha significantly improved growth, yield and yield attributes. On the basis of the 2 years average data (pooled), the increase in maize yield was 52.6 and 82.97percentage with 120, 60 and 40 kg N, PPs and KP/ha and 180, 90 and 60 kg N, PPs and Kp/ha, respectively, over 60,30 and 20 kg N, ppsand Kp/ha. Phosphate-solubilizing bacteria (PSB) inoculation alone or along with 5 tonnes FYM/ha and no-PSB inoculation also differed significantly with regarding to above parameters. The maximum maize yield was abtained with PSB inoculation along with 5 tonnes FYM/ha, whereas no-PSB inoculation gave the minimum maize yield.

217. Gangaiah, B.; Ahlawat, I.P.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy)). Response of chickpea (Cicer arietinum) to seedling time and phosphorus and their after effects on succeeding baby corn (Zea mays). Indian Journal of Agronomy

(India). (Mar 2008) v. 53(1) p. 42-46 KEYWORDS: CHICKPEAS; CICER ARIETINUM; SOWING; PHOSPHORUS; FERTILIZERS; RESIDUAL EFFECTS; CORN; ZEA MAYS.

A field study conducted during 2005-07 on chickpea (Cicer arietinum L.)-baby corn (Zea mays L.) cropping system on sandy loam soil at New Delhi revealed that chickpea cv 'ICCV 96029' produced higher mean greenseed (chholia) yield (1.20 t/ha) than 'ICCV 96030' (0.93 t/ha). The maximum chholia production was recorded when the crop was sown on 7 October (1.31 t/ha), and the least (0.82 t/ha) when it was sown on 15 October. Application of 26.4 kg P/ha recorded significantly more chholia production (1.15 t/ha) than 13.2 kg P/ha (1.09 t/ha) and unfertilized crop (0.94 t/ha). The performance of the succeeding baby corn was not influenced by chickpea culti-vars. Baby corn raised after chickpea sown on 15 October recorded higher yield than that after chickpea grown af-ter two other dates of seeding. Baby corn after chickpea fertilized with 26.4 kg P/ha produced the highest yield. The chickpea-baby corn cropping system on an average removed 16.47 kg P/ha, whereas the cropping system received 39.6 kg P/ha, resulting in build-up of available soil P by 0.73 kg/ha. The net returns followed the trend of chholia production. Thus sowing chickpea cv 'ICCV 96029' on 7 October with 13.2 kg/ha for chholia with the succeeding baby corn receiving the recommended dose of fertilizers is best for productivity and returns of chickpea-baby corn cropping system.

218. Chopra, P.K.; Angiras, N.N. (Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dep. of Agronomy)). Effect of tillage and weed management on productivity and nutrient uptake of maize (Zea mays). Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 66-69 KEYWORDS: MAIZE; ZEA MAYS; TILLAGE; WEED CONTROL; NUTRIENT UPTAKE. An investigation was carried out at Palampur during rainy season of 2002 and 2003 to assess the influence of three tillage methods (zero tillage, conventional tillage and raised seed-bed) and four weed-control methods (unweeded check, acetachlor 0.75 kg/ha, acetachlor 1.25 kg/ha and atrazine 1.5 kg/ha) on nutrient uptake and productivity of maize (Zea mays L.). Zero tillage resulted in significantly higher soil-moisture content and bulk density than conventional tillage and raised seed-bed. Raised seed-bed resulted in significantly lowest count and dry matter of weeds. Compared with zero tillage, the conventional tillage and raised seed-bed methods being statistically at par, resulted in significantly higher N, P and K uptake by maize crop (18.1, 25.0 and 20.2 percent by the former and 16.1, 36.2 and 16.7 percent respectively by the latter method) and lower depletion of these nutrients by weeds (13.5, 15.6 and 10.8 percent by the former and 30.3, 30.3 and 29.0 percent, respectively by the latter method), increasing the average grain yield of the crop by 16.9 and 13.7 percent by these methods. Among weed-control methods, atrazine 1.5 kg/ha, being statistically on a par with acetachlor 1.25 kg/ha, significantly reduced the population and dry matter of total weeds. Compared with the unweeded check, atrazine 1.5 kg/ha and acetachlor 1.25 kg/ha, being statistically at par, significantly increased the N, P and K uptake by the crop (93.3, 105.3 and 95.4 percent by the former and 87.0, 88.8 and 88.9 percent, respectively by the latter) and lower depletion of N, P and K by weeds (79.4,87.2 and 81.5 percent by the former, and 81.9, 88.7 and 83.5 percent respectively by the latter herbicide), increasing in the grain yield of maize by 75.2 and 71.7 percent by these two herbicides.

219. Reddy, S.V.K.; Krishna, S.K. (Central Tobacco Research Institute, Jeelugumilli (India). Research Stn.); Rao, J.A.V.P. (Central Tobacco Research Institute, Rajamundry (India). Dif. of

Crop Production)). Productivity, quality and economics of irrigated FCV tobacco (Nicotiana tabacum) in relation to spacing, dose and time of nitrogen application. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 70-75 KEYWORDS: TOBACCO; NICOTIANA TABACUM; SPACING; NITROGEN FERTILIZERS; PRODUTIVITY.

A field experiment was conducted during post-rainy season of 2000-01, 2001-02 and 2002-03 at Jeelugumilli to find out optimum spacing, dose and time of N application to flue-cured virginia (FCY) tobacco (Nicotiana tabacum L) in irrigated Alfisols (Northern Light Soils) of Andhra Pradesh. Green leaf yield, cured leaf yield and grade index were significantly higher at a spacing of 100 x 70 cm compared with 100 x 60 cm. Significant increase in greenleaf yield and cured leaf yield was noticed with increase in N level from 90 to 130 kg N/ha. Application of 130 and 110 kg N/ha, being comparable, recorded significantly higher grade index than that of 90 kg N/ha. Application of N in three splits offered significantly higher green leaf yield, cured leaf yield and grade index compared with that of N in two splits. Wider spacing gave higher total N and nicotine levels and lower reducing sugars, equilibrium moisture content (EMC) and filling value of leaf than closer spacing. There was a gradual decrease of sugars and EMC and increase of nicotine, total N and filling value with increased levels of N. Application of nitrogen in three splits gave higher total N, nicotine and filling value and lower reducing sugars and EMC of cured leaf than that of N in two splits. Maximum net returns and benefit: cost ratio accrued when planted at 100 x 70 cm spacing along with 110 kg N/ha applied in three splits. A spacing of 100 cm x 70 cm along with 110 kg N//ha applied in three splits, was found optimum for cv. 'Kanchan' for obtaining higher yield and better grade index with acceptable chemical and physical quality parameters.

220. Hariprasanna, K.; Lal, Chuni; Radhakrishnan, T. (National Research Centre for Groundnet, Junagadh (India). Relationship between flowering duration and physical-quality traits as well as pod yield in groundnet (Arachis hypogaea). Indian Journal of Agricultural Sciences (India) v.78(2) p.180-182 KEYWORDS: ARACHIS HYPOGAEA; FLOWERING; GROUNDNUTS.

An experiment was conducted during 2005 to study the relationship between duration of flowering and physical quality traits as well as pod yield in groundnut (Arachis hypogaea L.). Different duration of flowering simulated through artificial deflowering resulted in signficaunt differences for 100-kernel mass and sound mature kernels signifying that the kernel size and recovery of mature kernels. The regressions of during of flowering upon 100-kernal mass and sound mature kernels were near to unity and significant, thus implying that breeding programmes for large-seeded groundnut varieties should take into consideration the flowering duration also in the genotypes.

221. Mandal, S.K. (Krishi Vigyan kendra, Muzaffarpur (India); Jha, V.B. (Krishi Vigyan kendra, Gopalganj (India). Constraints in adoption of I.P.M. modules among farmers in Gopalganj, Bihar. Annals of Plant Protection Sciences v.16(2) p.396-398 KEYWORDS: CONSTRAINTS; CULTIVATION.

The major constraints in the adoption of IPM modules in various crop cultivation were lack of knowledge of various parameters like determing ETL of insects and diseases, about identifying the harmful and benefical insects, about recommended dose of insecticides, fungicides, weedicides, fertilizers etc., timely and appropriate transfer of technology by extension organizations, dedicated and regular extension personnel, farm literature on various crop cultivion, high cost of pesticides/bio-pesticides and bio-agents etc. The overall

percentage regarding the constraints pertaining to technology was 72.2. constraints pertaining to technology, extension service, supply and marketing and transfer of technology was 74.6, 71.0 and 68.0. respectively.

222. Rajkhowa, D.J.; Borah, D. (Assam Agricultural University, Jorhat (India). Dept. of Agronomy). Effect of rice (Oryza sativa) straw management on growth and yield of wheat (Triticum aestivum). Indian Journal of Agronomy (India) v.52(2) p.112-115 KEYWORDS: RICE; ORYZA SATIVA; RICE STRAW; TRITICUM AESTIVUM; YIELDS.

A field experiment was conducted at Jorhat, Assam during 2004-05 and 2005-06 to find out an effective practice of rice (Oryza sativa L.) straw management in wheat (Triticum aestivum L. emend. Fiori & Paol.) as a component of integrated nutrient management. Straw was incorporated 5 Vha with different decomposers, viz. starter N (one-third recommended dose of N), cellulose-decomposing microorganisms (COM), earthworms culture (EC), EC + FYM, COM + EC, FYM and starter N+ COM + EC + lime. These decomposers significantly improved the yield and yield components in wheat compared with straw removal. Incorporation of rice straw 5 Vha under dual inoculation of cellulose-decomposing microorganisms and earthworms improved the grain yield by 2.46 Vha. These also increased the nutrient uptake, available N, P, K in soil at harvest and benefit: cost ratio. Straw incorporation increased the organic C in the soil by 2-11 compared with straw removal. It also increased the microbial population in soil substantially irrespective of the decomposer used. Inoculation with COM led to build-up of microbial population in the soil. Thus, rice straw incorporation with cellulose decomposing micro-organisms and earthworms resulted in higher yield, increased nutrient uptake, improved residual soil fertility and soil microorganism status and ultimately higher benefit: cost ratio of wheat.

223. Kumar, A. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Productivity, economics and nitrogen-use efficiency of speciality corn (Zea mays) as influenced by planting density and nitrogen fertilization. Indian Journal of Agronomy (India) v. 52(4) p. 306-309 KEYWORDS: ZEA MAYS; PLANT POPULATION; NITROGEN FERTILIZERS; PRODUCTION; ECONOMICS.

A field experiment to study the effect of planting density and N level on pop corn and sweet corn (Zea mays L.) was conducted during rainy season 2005 and 2006 at New Delhi. An increase in planting density recorded taller plants with reduced values of yield attributes of both pop corn and sweet corn. However, in sweet corn the number of cobs/ha increased with the increase in planting density. The planting density of 66,666 and 83,333 plants/ha recorded 23.5 and 40.0. higher grain yield of pop corn compared with that of 55,555 plants/ha respectively. The cob and kernel yields of sweet corn however, improved significantly by 19.4 and 15.2. at a planting density of 83,333 over that of 66,666 plants/ha respectively, but further increase in planting density to 1,11,111 plants/ha decreased both the cob and the kernel yields in comparison with 83,333 plants/ha. The net returns, net returns/Re invested, N uptake and N-use efficiency also showed a similar trend. The increase in N level up to 120 kg/ha resulted in taller plants with higher values of yield attributes of pop corn as well as sweet corn, which consequently resulted in higher yields and returns. The highest N uptake and residual soil N content were recorded at 120 kg N/ ha level. The N-use efficiency was the highest at 40 kg N/ha, and an increase in N level reduced the N-use efficiency. The results show that for getting higher yield and net return, pop corn

and sweet corn should be planted at 83,333 plants/ha planting density and fertilized with 120 kg N/ha.

224. Lal, K. (Himachal Pradesh PWD, Sirmaur (India); Rawat, G.S. (Wildlife Institute of India, Dehra Dun (India). Additions to the flora of Himachal Pradesh from Sirmaur district. Indian Journal of Forestry (India) v. 31(1) p. 113-115 KEYWORDS: FLORA; WILD PLANTS; HIMACHAL PRADESH.

225. Jain, S.C. (University of Rajasthan, Jaipur (India). Medicinal Plants and Biotechnology Research Lab); Jain, R. (University of Rajasthan, Jaipur (India). Dept. of Chemistry). Biopotentialities of Verbesina encelioides cell cultures. Indian Journal of Plant Physiology (India) v. 13(3) p. 224-230 KEYWORDS: ANTIMICROBIALS; ANTIOXIDANTS; ORNAMENTAL PLANTS; PHYTOTOXINS.

Verbesina encelioides (Cav.) Benth. & Hook. fil ex Gray is regarded as ornamental garden plant and there are many reports of its use in folk medicine as analgesic, emetic, febrifuge, insecticide and anti-inflammatory. It is even used to treat cancer, gastrointestinal disturbance, skin ailments, and snake bite. The aim of present investigation is to evaluate the biosynthetic and bioefficacy potentials of the cell cultures of V. encelioides. For this purpose, cell cultures were established from seeds -on MS basal m'edium in the absence or presence of IAA, NAA, Kn and BAP singly or in various combinations. Initiation of callus was observed after 20 days of inoculation and callus was successfully established on MS medium supplemented with 10 mgIL NAA and 0.4 mgIL Kn. The callus was whitish brown in colour and friable in nature. Various compounds viz. friedelin, epifriedelin, lupeol, a-, P- amyrin, stigmasterol, betulin and P-sitosterol have been isolated and identified using spectral studies. Different bioefficacies like antibacterial, antifungal followed by disc diffusion method and antioxidant using 2,2-Diphenyl-1-picrylhydrazyl (DPPH) were studied and compared with in vivo system. J.

F02 Plant Propagation

226. Khulbe, R.K.; Roy, D.; Yadav, V.K. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Inheritance of stigma colour and branching habit in sunflower accession from North West Himalayas. Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 401-402 KEYWORDS: HELIANTHUS ANNUUS; GENETIC INHERITANCE; MORPHOGENESIS; HIMALAYAN REGION.

227. Chauhan, J.S.; Singh, M.; Bhadauria, V.P.S.; Kumar, A.; Meena, M.L. (National Research Centre on Rapeseed-Mustard, Bharatpur (India). Genetic analysis of glycosinolate content in Indian mustard (Brassica juncea L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 411-413 KEYWORDS: BRASSICA JUNCEA; INDIAN MUSTARD; BIOCHEMISTRY; GENETIC VARIATION; GLYCOSINOLATE.

228. Anis, M. (Aligarh Muslim University, Aligarh (India). Plant Tissue Culture Lab., Dept. of Botany). In vitro regeneration of Cicer arietinum L. from callus cultures. Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 414-417 KEYWORDS: CICER ARIETINUM; CHICKPEAS; IN VITRO REGENERATION.

F03 Seed Production and Processing

229. Verma, V.; Varshney, S.K.; Singh, B.; Kumar, A. (Rajendra Agricultural University, Muzaffarpur (India). Dept. of Seed Technology). Effect of seedling tuberlet size on seed potato yield of TPS varieties in calcareous soils of North Bihar. Annals of Biology (India). (Dec 2007) v. 23(2) p. 137-139 KEYWORDS: SEED POTATOES; SEEDLINGS; VARIETIES; YIELDS; CALCAREOUS SOILS; BIHAR.

An experiment was conducted with 15 treatment combinations which included five seed tuberlet sizes and three TPS varieties to assess the effect of seed tuberlet size on tuber yield. The trial was laid out in RBO (Factorial) with three Preplications in a plot size of3.0 x 1.8 m at Dholi Research Farm of T. C. A., Dholi, Muzaffarpur (Bihar) in rabi 2001-02. The results clearly revealed that the seed tuberlet size of 30-40 g gave significantly superior tuber yield which was at par with the tuber yield obtained from 10-20 and 40 g seed tubers in all the three TPS varieties. .

230. Sharma, R.K.; Shukla, S.K.; Singh, O.N.; Singh, R.; Gupta, H.S.; Bhatt, J.C.; Chandra, S.; Shshil, S.N.; Kumar, P.; Verma, P.C.; Lal, D. (Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Notification of crop varieties and registration of germplasm . Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 418-422 KEYWORDS: VARIETIES; GERMPLASM; REGISTRATION.

231. Thu, B.V. (Hybreed Rice Reearch and Development Centre, Ha Tay (Vietnam); Chakrabarty, S.K.; Sharma, S.P.; Dadlani, M. (Indian Agricultural Research Institute, New Delhi (India). Div. of Seed Science and Technology)). Studies on environmental conditions and pololination management in hybrid rice seed production. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 426-434 KEYWORDS: RICE; ORYZA SATIVA; HYBRIDS; SEED PRODUCTION; ENVIRONMENTAL FACTORS; POLLINATION.

In order to understand the effect of environmental conditions in development of hybrid seed production technology of Pusa Rice Hybrid 10 (PRH-10), an experiment was conducted in the Indian Agricultural Research Institute, New Delhi during 2005. The results indicated that in hybrid seed production of PRH-10, application of GAa 90g/ha and two time supplementary pollinations at 10:30 hrs and 1:1:30 hrs in a favourable condition during flowering perioc:f would give the highest hybrid seed yield upto 4.2 ton's/ha. Most favourable ecological conditions for maximizing hybrid rice seed production were temperature ranging from 18.6-34.5 °C, relative humidity ranging from 34-91 percent, mean sunshine as 9.5 h/day and mean wind velocity of 4.1 km/hr during the flowering period. Higher hybrid seed germination and seedling vigour were recorded in seeds produced under favourable condition than that ",ndel: unfavourable condition. Incidence of seed borne fungi was higher in seed lots with higher dose of GAa application and in seeds produced under unfavourable growing conditions.

F04 Fertilizing

232. Meena, S.K.; Sharma, M.; Meena, H.S. (Rajasthan Agricultural University, Jobner (India). Dept. of Soil Science and Agricultural Chemistry). Effect of sulphur and zinc fertilization on yield, quality and nutrient content and uptake of chickpea under semi arid tropics. Annals of

Agricultural Research (India). (Mar 2005) v. 26(1) p. 45-47 KEYWORDS: FERTILIZING; SEMI ARID ZONES; SULPHUR; ZINC; FERTILIZER; YIELD; NUTRIENT; BENGAL GRAM.

An experiment to study the effect of sulphur and zinc on yield, quality, nutrient content and uptake by chiCkpea (Cicer anetum L.) was conducted during 1999-2000 at Agronomy Farm of S.K.N. College of Agriculture, Jobner. The results indicated that application of all the levels of sulphur and zinc progressively increased in grain yield, protein content, nutrient content and nutrient uptake of chickpea. But increase in grain yield, protein content, nutrient content and nutrient uptake were found to be significant upto 40 kg S ha-l and 5 kg Zn ha-l.

233. Pathan, A.R.K.; Kumawat, B.L.; Parihar, N.S. (S.K.N. College of Agriculture, Jobner (India). Dept. of Soil Science and Agricultural Chemistry). Influence of phosphorus and sulphur on yield and nutrient content of taramira. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 59-63 KEYWORDS: PHOSPHORUS; SULPHUR; YIELD; NUTRIENT CONTENT; ERUCA SATIVA; SEED.

In a field experiment on taramira, four levels of phosphorus (0, 15, 30 and 75 kg S ha-l) and four levels of sulphur (0, 25, 50 and 75 kg S ha-l) were tested to find out their effect on the yield and nutrient content of tararnira and post harvest available nutrients (N, P and S) in soil. The yield of taramira seed and straw increased significantly due to the application of 45 kg PzOs ha-l by 39.70 and 38.11 per cent, respectively over control. Sulphur also increased the seed and straw yield of taramira by 38.35 and 38.34 per cent, respectively, with the application of 75 kg S ha-l over control. The application of phosphorus and sulphur individually increased the N, P and S content of seed and straw significantly. The available Nand P in the soil at harvest were influenced significantly with the application of phosphorus but the effect of phosphorus on available sulphur was non-significant. The available nitrogen in the soil at harvest was not influenced with applied sulphur but its application significantly increased the available P and S.

234. Parihar, N.S.; Saini, R.S.; Pathan, A.R.K. (Agricultural Research Station, Jaipur (India). Dept. of Soil Science and Agricultural Chemistry). Effect of sulphur, zinc and organic manures on yield and nutrient uptake of wheat in typic Ustipsamment soil. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 64-68 KEYWORDS: SOIL FERTILITY; SULPHUR; ZINC; YIELD; WHEAT; VERMICOMPOST; FYM; NUTRIENT; SOIL.

In the field experiments on Typic Ustipsamment, the effect of sulphur (0, 25 and 50 kg 5 ha-l), zinc (0, 5 and 10 kg Znha-l) and organic manures (10 tFYMha-l and 5 tvermicompostha-l) were studied on wheat for yield and nutrient uptake by wheat. Application of5 up to 50 kg ha-l enhanced the average grain yield by 7.7 per cent over control. The application of Zn upto 10 kg ha-l increased the grain yield by 7.2 per cent over control. The application of vermicompost 5 t ha-l enhanced the grain yield by 3.27 per cent over 10 t FYM ha-l. Similar trend in yield response of straw was also recorded. TotalS uptake progressively increased from 5.85 to 7.40 kg ha-l with the increase of 5 levels. The uptake of Zn also increased with the levels of Zn application. The uptake of N, P and K increased with the application of 5 and organic manures. Vermicompost recorded higher uptake of nutrients (N, P, K, 5, Zn and Ca) as compared to FYM.

235. Jat, R.L.; Dahama, A.K.; Meena, R.P. (Rajasthan Agricultural University, Bikaner (India). Dept. of Agronomy). Effect of farmyard manure, phosphorus and sulphur nutrition on fatty

acid composition of mustard (Brassica juncea (L.) Czern & Coss). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 80-83 KEYWORDS: FYM; PHOSOPHRUS; SULPHUR; NUTRITION; BRASSICA JUNCEA; ACID.

A field experiment was conducted on loamy sand soil at College of Agriculture, Rajasthan Agricultural University, Bikaner during the winter season of 2000-01 and 2001-02 to study the effect of FYM, phosphorus and sulphur on composition of fatty acid composition of oil showed that manuring of 10 t FYM ha-l marginally improved the saturated and unsaturated fatty acids concentration in mustard oil. Phosphorus application at different levels (0,30,60 and 90 kg P20S ha-l) did not effect significantly the. Concentration of palmetic, stearic, oleic and linoleic acids while linolenic acid concentration decreased gradually as the phosphorus levels increased. Significant improvement in palmetic, stearic, linoleic and linolenic acids concentration of mustard oil were observed upto 60 kg S ha-l. The application of S at increasing levels (0-90 kg ha-l) gradually decreased the oleic acid concentration in mustard oil.

236. Kajla, M.; Thakral, S.K.; Pahuja, S.S.; Mehta, S.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Yield and growth parameters of wheat as influenced by different sources of nutrition. Annals of Biology (India). (Dec 2007) v. 23(2) p. 149-151 KEYWORDS: FERTILIZER APPLICATION; ORGANIC FERTILIZERS; INORGANIC FERTILIZERS; YIELDS; GROWTH; AGRONOMIC CHARACTERS; WHEATS.

The field experiment was conducted during rabi season of 2003-04 at Student's Farm of CCS Haryana Agricultural University, Hisar (India) on different organic and inorganic fertilizer levels. The experiment was comprised of four treatments. Maximum LAI, COR and ROR were recorded in theJreatment with recommended dose of nitrogen through inorganic source. Minimum values were observed in the treatment where recommended dose of nitrogen through organic source was applied.

237. Kumar, S.; Singh, S.; Kumar, S. (Chaudhary Charan Singh University, Meerut (India); Kumar, Y. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Effect of nitrogen level and plant density of production performance of mustard [Brassica juncea (L.) Czern. & Coss]. Annals of Biology (India). (Dec 2007) v. 23(2) p. 153-158 KEYWORDS: NITROGEN; PLANT POPULATION; PRODUCTION POSSIBILITIES; MUSTARD; BRASSICA JUNCEA; YIELDS; YIELD COMPONENTS.

A field trial was conducted on mustard [Brassica juncea (L.) Czem & Coss] to see the effect of nitrogen level and plant density on production performance. It was inferred that number of pods/ plant, pod length, number of grains/pod and weight of 1000 grains were significantly increased with the decrease in plant density and increased with the increased nitrogen levels upto 120 kg N/ha. Grain yield, stover yield and biological yield were increased signific,antly with increasing nitrogen levels upto 120 kg N/ha, while same results were obtained with the decreasing plant density upto 166 x 103 plants/ha. Harvest index (percent) and grain productivity (kg/ha) were significantly higher in 222 x 103 plarits/ha density and 120 kg N/ha nitrogen level. The study showed that higher grain yield/ha could be obtained with 166 x 103 plants/ha density and 120 kg N/ha nitrogen level in mustard.

238. Ganajaxi; Rajakumar, S.; Math, K.K. (Agricultural Research Station, Mugad (India). Dept. of Agronomy). Response of scented rice to organic and inorganic fertilizers under lowland situation. Annals of Biology (India). (Dec 2007) v. 23(2) p. 163-165 KEYWORDS: ORGANIC

FERTILIZERS; SUNHEMP; INORGANIC FERTILIZERS; LOWLAND; RICE; YIELDS; YIELD COMPONENTS.

A field experiment was conducted at Agricultural Research Station, Mugad during the wet season of 200I. The treatments comprised three levels of inorganic fertilizers and four levels of organic manure. There was no significant difference between sources of organics. Even though sunhemp was the cheapest organic source. It had recorded (2843 kg/ha) equivalent yield of costlier FYM (2817 kg/ha). Among the levels of RDF, 50 percent (2997 kg/ha) and 100 percent (3055 kg/ha) recorded on par yield and were significantly superior over zero per cent RDF (2192 kg/ha).

239. Charjan, Y.D. (Mahatma Phule Krishi Vidyapeeth, Jeur (India). Agricultural Research Stn.); Gaikwad, C.B. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Dept. of Agronomy). Integrated nutrient management in cotton (Gossypium hirsutum)-wheat (Triticum aestivum) sequence on vertisol. Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 176-180 KEYWORDS: SEQUENTIAL CORPPING; TRITICUM AESTIVUM; COTTON; WHEATS; GOSSYPIUM HIRSUTUM; VERTISOLS; NUTRIETIONAL REQUIREMENTS; FERTILIZER APPLICATION.

A field experiment was conducted under irrigated condition on intergrated nutrient management system for cotton (Gossypium hirsutum L.) - wheat (Triticum aestivum L. emend. Fiori & Paol.) sequence on Vertisolat Rahuri, during 1999-2000 and 2000-2001. Application of 100percentage recommended dose of fertilizer (RDF) recorded significantly higher seed-cotton yield (20.68 q/ha), stalk yield (47.76 q/ha), nutrient uptake and soil available NPK after cotton over 75percentage RDF. Similarly, wheat grain yield (45.68 q/ha), straw yield (58.11 q/ha), wheat-equivalent yield (109.03 q/ha), net monetary returns, benefit: cost ratio, nutrient uptake and soil-available NPK after wheat were recorded highest with 100percentage RDF to cotton. Application of 10 tonnes FYM/ha to cotton recorded the highest cotton wheat and wheat-equivalent yield, nutrient uptake and soil-available NPK after cotton and wheat. However, it was at par with treatment green-manure + Azotobacter + phosphate-solubilizing bacteria except for P uptake in cotton. The later treatment gave the highest net monetary returns and benefit: cost ratio. Application of 75percentage RDF to wheat gave grain and straw yields, wheats equivalent grain yield, nutrient uptake and soil-available NPK after wheat at par with 100percentage RDF, but the higher net monetary returns and benefit: cost ratio (Rs 2.20). Af. ter sequence the net gain of soil-available N was increased with decrease levels of fertilizer and manures to cotton and increased with increased levels of fertilizer to wheat. The magnitude was increased with increased levels of fertilizer and manures with respect to net gain of soil available P. While net loss of soil-available K, the magnitude of reduction was decreased with increased levels of fertilizer and manure.

240. Singh, K.N.; Hasan, B.; Kanday, B.A. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar (India). Div. of Agronomy); Bhat, A.K. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Div. of Soil Science). Effect of nursery fertilization on seedling growth and yield of rice (Oryza sativa). Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 187-189 KEYWORDS: ORYZA SATIVA; YIELDS; YIELD COMPONENTS; FERTILIZATION; SEEDLINGS; GROWTH; RICE.

A field experiment was conducted at the main campus of Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Kashmir, during 2000 and 2001, to study the effect of fertility levels in rice (Oryza sativa L.) nursery and ultimate effect on yield of rice

crop. The seedling length, dry weight and seedling growth increased significantly by increasing fertility up to the highest level 200 N + 100 P Ps + 50 KP kg/ha. Yield and yield-attributing characters, Le. grains/ panicle, panicles/ m2, and straw yield also recorded highest value at treatment 200 N + 100 P Ps + 50 KP kg/ha in the nursery. Nitrogen content and uptake in nursery increased by increasing fertility levels but N recovery was very low in nursery. Higher fertilizer application in rice nursery increased benefit: cost ratio and grain yield of rice.

241. Singh, A.K.; Singh, R.; Singh, K. (Banaras Hindu University, Varansi (India). Dept. of Agronomy). Growth, yield and economics of rice (Oryza sativa) as influenced by level and time of silicon application. Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 190-193 KEYWORDS: FERTILIZER APPLICATION; GROWTH; YIELDS; YIELD COMPONENTS; ECONOMICS; TREATMENT DATE; SILICON; RICE; ORYZA SATIVA; NUTRIENT UPTAKE.

A field experiment was conducted during rainy (kharif) season of 1999 and 2000 at Research Farm, Department of Agronomy, Banaras Hindu Univeristy, Varansi, Uttar Pradesh, to study the effect of level and time of silicon application on growth, yield and economics of rice (Oryza sativa L.). Different silicon levels led to significant increase in plant height, dry-matter production, panicles/m2, filled grains/panicle, test weight and yield of rice. The maximum grain yield (6,588 kg/ha) was recorded with highest level of silicon, i.e. 180 kg Ṣilha. However, the maximum response was observed at 127 kg Si/ha and thereafter decreased with increase in silicon level. Highest net returns and benefit: cost ratio were recorded when silicon was applied 120 kg Silha full as basal. The apparent silicon recovery and agronomic efficiency were higher at the lowest silicon level (60 kg Si/ha) and de. creased with increasing silicon levels. However, the highest nitrogen, phosphorus, potassium and silicon uptake was associated with 180 kg Si/ha. Among the application time, full basal application of silicon at the time of transplanting significantly increased the growth, yield attributes, yield and uptake of nutrients compared with the other time of silicon application.

242. Kumawat, P.D. (Agricultural Research Station, Sikar (India); Jat, N.L. (S.K.N. College of Agriculture, Jobner (India). Dept. of Agronomy). Effect of organic manure and nitrogen fertilization on productivity of barley (Hordeum vulgare). Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 200-202 KEYWORDS: FERTILIZER APPLICATION; NITROGEN; FARMYAD MANURE; COMPOSTING; YIELDS; OLIGOCHAETA; BARLEY; HORDEUM VULGARE; YIELD COMPONENTS; FERTILIZER COMBINATIONS.

The results of the field experiment conducted during winter (irrigated) seasons of 2000-2001 and 2001-2002 revealed that application of organic manure improved yield attributes and yield of barley (Hordeum vulgare L., s.l.). Application of vermicompost 4.5 tonnes/ha resulted in the highest grain yield over no-organic manure, vermicompost 1.5 and 3.0 tonnes/ha and FYM 5.0, 7.5 and 10.0 tonnes/ha respectively. However, vermicompost 4.5 tonnes/ha being at par with vermicompost 3.0 tonnes/ha recorded significantly highest net returns. However, vermicompost 4.5 tonnes/ha brought significantly highest uptake of NPK over rest of the treatments. Further, the vermicompost 1.5 tonnes/ha was almost equally effective with FYM 7.5 and 10.0 tonnes/ha. Increasing dose of nitrogen improved significantly the yield attributes, yields, net returns, total uptake of NPK in barley crop. The combined application of vermicompost 4.5 tonnes/ha + 40 kg N/ha obtained higher grain yield.

243. Mehta, Y.K.; Shaktawat, M.S.; Singhi, S.M. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Agronomy). Influence of sulphur, phosphorus and farmyard manure on yield attributes and yield of maize (Zea mays) in southern Rajasthan conditions. Indian Journal of Agronomy (India) . (Sep 2005) v. 50(3) p. 203-205 KEYWORDS: FERTILIZER APPLICATION; NUTRIENT UPTAKE; FARMYARD MANURE; SULPHUR; ZEA MAYS; PHOSPHORUS; YIELD COMPONENTS; YIELDS; RAJASTHAN; MAIZE.

A field experiment was conducted at Instructional Farm, Rajasthan College of Agricultrue, Udaipur, during the rainy (kharif seasons of 1999 and 2000 on clay-loam soil, to study the effect of sulphur, phosphorus and farmi yard manure on yield attributes and yield of maize (Zea mays L). Cobs/plant, rows/cob, cob weight, grain weight cob, seed index, seed and stover yields, N, P, S and Fe uptake by seed stover and total uptake by maize increased significantly as a result of sulphur application. Application of 60 kg S/ha significantly recorded higher seed and it over yields over 0 and 30 kg S/ha by 29.1 and 11.0 and 25.1 and 9.5percentage respectively. Application of 40 kg phosphorus increased significantly the yield attributes and seed and stover yields over 20 kg pp/ha, representing a mean increases of 13.6 and 12.5percentage respectively. Application of 10 tonnes FYM/ha enhanced significantly the yield attributes and yield over no farmyard manure to the magnitude of 13.9 in seed and 11.2percentage in sto-ver yield, respectively.

244. Mankotia, B.S.; Shekhar, J.; Thakur, R.C.; Negi, S.C. (Chaudhary Swaran Kumar Himachal Pradesh Krishi Vishvavidyalaya, Malan (India). Rice and Wheat Research Centre)). Effect of organic and inorganic sources of nutrients on rice (Oryza sativa)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 32-36 KEYWORDS: RICE; WHEAT; ORYZA SATIVA; TRITICUM AESTIVUM; CROPPING SYSTEMS; ORGANIC FERTILIZERS; PLANT NUTRITION.

A field experiment was conducted during 2002-03 to 2004-05 at Malan, Himachal Pradesh, to explore the possibility of an alternative to farmyard manure (FYM) as a component of integrated nutrient management in rice (Oryza sativa L.) - wheat (Triticum aestivum L. emend. Fiori & Pao!.) system. Five organic sources, viz. FYM 5 t/ha gobhi sarson straw 5 t/ha, mushroom spent compost 2.5 t/ha, FYM 2.5 t/ha + gobhi sarson straw 2.5 t/ha, FYM 2.5 t/ha + mushroom spent compost 1.25 t/ha, were applied in all possible combinations at three fertility levels, viz. 50, 100 and 150 percentof recommended fertilizer dose (RDF) to rice crop. Direct and residual effects of organic sources significantly affected the productivity of rice-wheat cropping system. Statistically equal rice and wheat yields were obtained with application of FYM 5 t/ha (5.03 t/ha rice, 2.48 t/ha wheat) and FYM 2.5 t/ha + mushroom spent compost 1.25 t/ha (4.94 t/ha, 2.33 t/ha), whereas gobhi sarson straw 5 t/ha recorded lower yields (4.24 t/ha, 1.99 t/ha). Rice responded significantly up to 100 percent recommended dose (4.77 t/ha); residual effects of fertility levels on wheat did not differ significantly. Standard control (100 percent RDF to both crops) resulted in significantly higher grain yield of wheat compared with mean of others receiving only 50 percent RDF. Nutrient uptake uptake (159.1 kg N, 35.0 kg P and 147.9 kg K/ha) and net returns (Rs 41 ,535/ha) from the rice-wheat cropping system recorded higher values with FYM 5 t/ha, followed by FYM 2.5 t/ha + mushroom spent compost 1.25 t/ha (155.0 kg N, 32.5 kg P and 139.0 kg K! ha; Rs 39, 132/ha). The soil-available NPK status remained fairly constant under different treatments. Thus, FYM 2.5 t/ha + mushroom spent compost 1.25

t/ha applied to rice helped in sustained productivity and profitability of the cropping system statistically equal to that with FYM 5 t/ha.

245. Kumar, Suman; Hooda, B.K.; Jaggi, Seema; Singh, Rajendra (Chaudhary Charan Singh Haryana Agriculture University, Hisar (India). Use of dummy variables for investigating structural stability in fertilizer-yield response models. Indian Journal of Agricultural Sciences (India) v.78(2) p.183-186 KEYWORDS: FERTILIZER APPLICATION; FERTILIZATION.

In regression analysis, the dependent variable is influenced not only by the quantitative variabales, but also by variables that are quantitative in nature. A method of quantifying such attributes is by constructing dummy variables that take on value of 1 (presence of an attribute) or 0 (absence of an attribute). in the present paper, dummy variable technique has been used for combining data for different varieties and over years and testing structural stability of fertilizer-yield quadratic responce function fitted on wheat crop grown in Haryana for two years and over three varieties. The result shows that rate of change of yield with respect to nitrogen is different in two years. However, the quadratic response function is stable over three wheat varieties.

246. Munda, G.C. (ICAR Research Complex for North Eastern Hill Region, Umiam (India). Effect of organics and inorganics on productivity and uptake of nutrients in rice (Oryza sativa)-toria (Brassica campestris) cropping system. Indian Journal of Agronomy (India) v.52(2) p. KEYWORDS: RICE; ORYZA SATIVA; CROPPING SYSTEMS; BRASSICA CAMPESTRIS; ORGANIC FERTILIZERS; INORGANIC FERTILIZERS.

A field study was undertaken during 2003-04 to 2005-06 at Modipuram to develop appropriate establishment technique of rice (Oryza sativa L.) and to improve the growth, yield, profitability and soil fertility of rice-based cropping systems. The mean yield of hybrid rice was higher (8.52 Vha) with drum seeding and remained on a par with that of direct seeding and mechanical transplanting (puddled) compared with manual transplanting (puddled) and mechanical transplanting (unpuddled). Direct seeding (dry bed, unpuddled) adopted in the previous rice crop gave higher mean yield of the succeeding wheat (5.70 Vha), chickpea (2.20 Vha) and Indian mustard (1.86 Vha). Drum seeding recorded the highest mean net returns (Rs 47,040 /ha) in rice-wheat system, followed by rice-chickpea (Rs 42,336 /ha) and rice-Indian mustard system (Rs. 39,774 /ha), and benefit: cast ratio (1.24) in rice-chickpea followed by rice-wheat (1.21) and rice-Indian mustard system (1.12). The system-wise soil analysis undertaken after three crop cycles indicated that organic carbon increased positively over initial status in rice-chickpea system; however, the magnitude of increase was largest under mechanical transplanting (puddled), and negative balances were found in rice-wheat system. Available P and K balance was generally positive in rice-wheat, rice-chickpea and rice-Indian mustard crop sequences except for P in rice-wheat and rice-mustard crop sequences under direct seeding. The drum or direct-seeded rice-based cropping system not only produced higher grain yield of hybrid rice but also resulted in greater productivity of the subsequent crops.

247. Shekhawat, K.; Shivay, Y.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effect of nitrogen sources, sulphur and boron levels on productivity, nutrient uptake and quality of sunflower (Helianthus annuus). Indian Journal of Agronomy (India) V. 52(2) p. 129-134 KEYWORDS: NITROGEN FERTILIZERS; SULPHUR FERTILIZERS; TRACE ELEMENTS; NUTRIENT UPTAKE; HELIANTHUS ANNUUS.

A field experiment was conducted during spring season of 2005 and 2006 on sunflower (Helianthus annuus L.) at New Delhi to study the effect of N sources (prilled urea and calcium ammonium nitrate), S levels (0, 25 and 50 kg/ha) and B levels (0, 0.75 and 1.50 kg/ha) on yield attributes, yield and the oil quality of spring sunflower. Application of N, Sand B fertilizers increased significantly yield attributes, yield and the oil quality parameters of spring sunflower. Calcium ammonium nitrate proved superior to urea in terms of nutrient concentration and their uptake by sunflower. Application of 25 kg S/ha was more effective in increasing the growth, yield attributes and yields than of 50 kg S/ha. However, the highest seed yield (1.99 t/ha) was recorded with 50 kg S/ha, which was 13. higher than that of the control. Boron application 0.75 kg and 1.5 kg/ha was effective and the crop responded well up to the second dose, and the higher (1.5 kg/ha) level gave the highest seed yield (2.01 t/ha), which was 13.5 and 6.3. more than of the control and 0.75 kg B/ha respectively. It also increased the total nutrient concentration and their uptake by sunflower. Application of Sand B markedly improved the content of unsaturated fatty acids (linoleic and oleic) and reduced that of the saturated fatty acids (palmitic and stearic). Sand B application reduced the saponification but increased the iodine value significantly. The N sources and Sand B levels did not show marked changes in the acid value of sunflower oil. Thus, application of 80 kg N/ha through calcium ammonium nitrate along with 25 kg S/ha and 1.50 kg B/ha would be sufficient to sustain the productivity and quality of spring sunflower under north Indian conditions.

248. Kumar, N.; Sinha, U.P. (Rajendra Agricultural University, Samastipur (India). Suarcane Research Institute). Response of spring-planted sugarcane (Saccharum officinarum) to phosphorus and sulphur application. Indian Journal of Agronomy (India) V. 52(2) p. 145-148 KEYWORDS: SUGARCANE; SACCHARUM OFFICINARUM; PHOSPHATE FERTILIZERS; SULPHUR FERTILIZERS.

An experiment was conducted during the spring season of 2003-04 and 2004-05 on sandy loam soil at Pusa, Bihar to study the effect of four levels each of phosphorus (0, 17.5, 35.0 and 52.5 kg/ha) and sulphur (0, 40, 80 and 120 kg/ha) on growth and yield of sugarcane (Saccharum officinarum L.). Application of 35.0 kg P/ha to sugarcane recorded significantly higher mean growth (tillers, 175,000lha; cane length, 221.0 cm; leaf area index, 4.04), yield attributes (millable canes, 131,1 OO/ha; single-cane weight, 570 g; cane diameter, 2.02 cm) and cane yield (73.54 t/ha) over no P. The mean increase in cane yield with application of 52.5,35.0 and 17.5 kg P/ha over the control was 20.77, 18.83 and 9.97. respectively. Application of 35.0 kg Plha registered an increase of 4.4. in su¼crose content in juice, 31.8. in P uptake and 22.1 in S uptake over the control. The use efficiency of P decreased with corresponding increase in its level. However, S-use efficiency was maximum at higher level of P application. Apparent P recovery was the highest at 35.0 kg P/ha (8.07 and 8.68.), whereas apparent S recovery progressively increased with increase in P levels from 0 to 52.5 kg/ha. The response of sulphur was also pro¼nounced at 80 kg/ha as evident from significant increase in mean cane length (219 cm), leaf area index (4.02), number of millable canes (131 ,OOO/ha), single cane weight (566.0 g), cane yield (73.17 t/ha) and sucrose content in juice (17.3.). Sulphur levels significantly improved the uptake of P and S up to 80 kg S/ha and the increase was 21.4 and 22.2. over the control respectively. Application of 120 kg S/ha recorded maximum P-use efficiency (361.6 kg cane/kg S applied) and apparent P recovery (8.75.), but it recorded S-use efficiency (121.6 kg cane/kg S applied) up to 80

kg/ha level only. There was decrease in apparent S recovery with successive increase in S level from 40 to 120 kg S/ha.

249. Singh, R.; Singh, B.; Patidar, M. (Central Arid Zone Research Institute, Jodhpur (India). Effect of preceding crops and nutrient management on productivity of wheat (Triticum aestivum)-based cropping system in arid region. Indian Journal of Agronomy (India) v. 52(4) p. 267-272 KEYWORDS: TRITICUM AESTIVUM; CROPPING SYSTEMS; CROP RESIDUES; FERTILIZER APPLICATION; ARID ZONES.

A field experiment was conducted during 2003-04 and 2004-05 at Jodhpur to study the effect of preceding crops, viz. pearlmillet [Pennisetum glaucum (L.) R. Br. emend. Stuntz.], greengram (Phaseolus radiatus L.) and clusterbean [Cyamopsis tetragonoloba (L.) Taub.] and nutrient management practices on the production potential of wheat (Triticum aestivum L. emend. Fiori & Paol.)-based cropping systems in arid region of Rajasthan. Growing of clusterbean and greengram as the preceding crop resulted in significantly higher grain yield of wheat and the N and P uptake than the preceding pearl millet. Among the rainy season (kharif) crops, greengram gave the maxi¼mum wheat grain-equivalent yield (WGEY) and net returns, but N uptake was significantly highest with clusterbean. However, highest WGEY (5.58 t/ha) was recorded with greengram-wheat, being 10 and 31.3. higher than that of the clusterbean-wheat and pearl millet-wheat crop sequences respectively. Net returns and benefit: cost ratio were also maximum with greengram-wheat, but maximum gain in available Nand P status was noted with clusterbean-wheat sequence. Integrated use of FYM 7.5 t/ha + 50. RDF (50 kg N + 13.25 kg P/ha) + biofertilizer (Azotobacter + PSB) recorded significantly highest grain yield of wheat, which was 33.2. higher than in the control. Yield and nutrient uptake by kharif crops also increased markedly due to residual effect of FYM applied either alone or in combination. The highest WGEY, net returns and benefit: cost ratio of crop sequences were recorded with combined application of FYM 7.5 t/ha + 50. RDF + biofertilizer. The maximum gain in available N and P status was observed with the application of FYM 15 t/ha, followed by FYM 7.5 t/ha + 50. RDF + biofertilizer. Thus wheat grown after legumes (greengram or clusterbean) with combined application of FYM 7.5 t/ha + 50. RDF + biofertilizer gave maximum WGEY and monetary benefit.

250. Shivakumar, B.G.; Ahlawat, I.P.S.; Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Integrated nutrient management in soybean (Glycine max)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India) v. 52(4) p. 273-278 KEYWORDS: SOYBEANS; GLYCINE MAX; TRITICUM AESTIVUM; CROPPING SYSTEMS; FERTILIZER APPLICATION.

A field experiment was carried out during 2001-03 at Indian Agricultural Research Institute, New Delhi to study the impact of nutrient management practices on the growth, yield and economics of soybean (Glycine max)-wheat (Triticum aestivum) cropping system. The treatments consisted of combinations of 4 nutrient sources in main plots and 3 nutrient levels in subplots in soybean in rainy season. A general crop of wheat was grown during the follow¼ing winter season to study the residual effect of treatments imposed on the previous soybean. The results indi¼cated that application of 5 Vha each of crop residues (CR) and farmyard manure (FYM) along with 5 kg zinc/ha among the nutrient sources and 100. recommended dose of fertilizer (RDF) among the nutrient levels recorded significantly higher growth and yield parameters and yield (1.62 Vha) of soybean. The succeeding crop of wheat too showed a similar trend. The net returns were higher with 5 Vha of FYM in

soybean (Rs 8,154) and 5 Vha each of CR and FYM alongwith 5 kg Zn/ha in succeeding wheat (Rs 12,577), as well as in soybean-wheat cropping system (Rs 20,334). The benefit cost (B:C) ratio was higher with 100. RDF among nutrient levels (0.89) and with 5 Vha CR (0.81) among the nutrient sources in soybean, whereas the 100. RDF among nutrient levels (0.73) and FYM 5 Vha+ CR 5 Vha + 5 kg Zn/ha among sources given to soybean recorded higher B:C ratio (0.72) in wheat. The organic carbon and the available N, P, K and Zn were higher with 5 Vha each of CR and FYM along with 5 kg zinc/ha among the nutrient sources, and 100. RDF among nutrient levels after the completion of 3 years of experimentation. It was concluded that combined application of 5 Vha each of CR and FYM along with 5 kg/ha zinc is necessary for getting higher yield and net returns from soybean-wheat cropping system.

251. Mahanta, D. (Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India); Rai, R.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effects of sources of phosphorus and biofertilizers on productivity and profitability of soybean (Glycine max)-wheat (Triticum aestivum) system. Indian Journal of Agronomy (India) v. 52(4) p. 279-284 KEYWORDS: SOYBEANS; GLYCINE MAX; TRITICUM AESTIVUM; BIOFERTILIZERS; CROPPING SYSTEMS; PROFITABILITY; PHOSPHATE FERTILIZERS.

A field experiment was carried out during 2005-06 and 2006-07 at New Delhi to study the effect of different sources of phosphorus [single superphosphate (SP) and rock phosphate (RP)] and biofertilizers (phosphate-solu-bilizing bacteria and vesicular-arbuscular mycorrhiza) on productivity, nutrient uptake, P balance in the soil, phos-phorus-use efficiency and economics of soybean [Glycine max (L.) Merr.]-wheat (Triticum aestivum L. emend. Fiori & Paol.) cropping system. Application of 50. recommended dose of P as SP + PSB + VAM recorded the highest yield during the first year in soybean (2.0 t/ha) and during both the years in wheat (4.4 and 4.6 t/ha in the first and second years respectively), but that of 50. RD Pas RP + PSB + VAM registered the highest grain yield (2.2 t/ha) during the second year in soybean. P uptake and utilization efficiencies increased on application of both PSB and VAM under both the sources of P. In addition, the available P status of the soil improved by addition of both bio-fertilizers through both the sources. RP performed very poorly, but when inoculated with both the bio-fertilizers, it was comparable to SP. Although the highest net returns per rupee invested was observed in 0.5 RP+PSB+VAM, but 0.5 SP+PSB+VAM provided highest net returns of 34.4 and 41.3 thousand rupees in first and second years respectively, it gave benefit: cost ratio (B:C) very close to that of the previous treatment in the soybean-wheat cropping system. Thus half the dose of P could be saved through inoculation with both P-solubilizing and mobilizing micro-organisms to obtain higher productivity and profitability.

252. Meena, S.L.; Shamsudheen, M.; Dyal, D. (Central Arid Zone Research Institute, Bhuj (India). Regional Research Station). Impact of row ratio and nutrient management on performance of clusterbean (Cyamposis tetragonoloba) + sesame (Sesamum indicum) intercropping system. Indian Journal of Agronomy (India) v. 52(4) p. 285-289 KEYWORDS: INTERCROPPING; SESAMUM INDICUM; FERTILIZERS; CYAMOPSIS; SESAME.

A field experiment was conducted during rainy (kharif) season of 2005 to 2007 at Kukma, Bhuj, (Gujarat) in sandy soil to study the effect of row ratio and nutrient management on sustainability of clusterbean [Cyamopsis tetragonoloba (L.) Taub.] + sesame (Sesamum indicum L.) intercropping system under arid condition. Treatments comprised of 15 combinations of cropping systems, viz. sole clusterbean, sole sesame, clusterbean + sesame

in 1 :2, 1:1 and 2:1 row proportions and nutrient management, viz. the control, 40 kg N/ha and 20 kg N + 5 t FYM/ha. Intercropping declined the seed yield of clusterbean by 30. compared to sole crop (mean of 3 years 0.71 t/ha). However, clusterbean-equivalent yield (0.92 t/ ha), net returns (Rs 6,251/ ha) and benefit: cost (B : C) ratio (1.67) were higher with clusterbean + sesame (2 : 1) intercropping system over the corresponding values of 0.71, 3,572 and 1.41 in sole clusterbean. Irrespective of the cropping system, application of 20 kg N + 5 t FYM/ha recorded significantly higher clusterbean-equivalent yield (1.036 t/ha), net monetary returns (Rs 7,793/ha) and B: C ratio (1.79) than of 40 kg N/ha alone and the absolute control. Addition of 5 t FYM/ha along with 20 kg N/ha gave 8.5 and 9.8. higher uptake of N than of 40 kg N/ha and the control respectively. The sustainable yield index (SYI) and sustainable value index (8VI) were higher with clusterbean + sesame under 2:1 row ratio (0.74, 0.76), and the highest SYI (0.81) and SVI (0.82) indices were observed under the application of 20 kg N/ha with 5 t FYM/ha. Clusterbean + sesame (2:1) with application of 20 kg N + 5 t FYMlha was more advantageous and saved 50. rec-ommended dose of N fertilizer.

253. Srivastava, T.K.; Singh, K.P.; Lal, M.; Suman, A.; Kumar, P. (Indian Institute of Sugarcane Research, Lucknow (India). Productivity and profitability of sugarcane (Saccharum spp complex hybrid) in relation to organic nutrition under different cropping system. Indian Journal of Agronomy (India) v. 52(4) p. 310-313 KEYWORDS: SUGARCANE; SACCHARUM; ORGANIC FERTILIZERS; CROPPING SYSTEMS; PROFITABILITY.

A field experiment was conducted at Lucknow during 2003-2006 in autumn and spring-planted sugarcane (Saccharum spp. complex hybrid) grown in different cropping systems to assess the effect of organic nutrition on productivity, profitability and on soil health. Five organic nutrition modules were compared with the control (no manure or fertilizer). The highest number of millable canes (82.7 and 95.2 thousands/ha) and cane length (220.8 and 182.5 cm) were recorded with sulphitation pressmud (SPM) 10 t/ha + farmyard manure (FYM) 10 t/ha in autumn and spring planted crops respectively. SPM 10 t/ha + FYM 10 t/ha caused the highest uptake of N, P and K and produced the highest cane yield of 79.4 t/ha in autumn - and 68.8 t/ha in spring-planted sugarcane. The highest net profit (Rs 52,480) and benefit: cost (B: C) ratio (1.5) were recorded in autumn planted cane with FYM 20 t/ha + Trichoderma viride + lentil [Lens culinaris (L.) medic.] intercrop (1 :2). In spring planted cane, the highest net profit (Rs 45,101) and B: C ratio (1.3) was recorded with FYM 20 t/ha + Trichoderma viride + mungbean [Vigna radiate (L.) hepper] intercrop (1 :2). Significant improvement was observed over initial organic C (up to 70.7.), bulk den¼sity (up to 8.4.), water-infiltration rate (up to 46.7.) and total N (up to 61.5.) at crop harvest under various treatments. The finding revealed profitable sugarcane cultivation under organic nutrient management with positive ef¼fect on soil health.

254. Reddy, S.V.K.; Krishna, S.K.; Singh, K.D.; Kumar, P.H.; Chandrasekharao, C.; Krishnamurthy, V. (Central Tobacco Research Institute, Rajanundry (India). Div. of Crop Production). Effect of conjunctive use of FYM and nitrogen on yield, quality and economic of FCV tobacco (Nocotiana tabacum). Indian Journal of Agronomy (India) v. 52(4) p. 318-322 KEYWORDS: TOBACCO; NICOTIANA TABACUM; FARMYARD MANURE; NITROGEN FERTILIZERS.

A field experiment was conducted during 2001-02 and 2002-03 at Rajahmundry, Andhra Pradesh to find out optimum level of farmyard manure (FYM) and nitrogen for getting

higher productivity, quality, monetary returns of tobacco (Nicotiana tabacum L.), and changes in soil fertility after tobacco. Application of FYM 0 Vha, being comparable with 20 and 30 Vha, significantly increased mean yields of green leaf by 16.8, cured leaf by 15.6, bright leaf by 25, grade index by 20.2 and cured leaf production efficiency by 15.6. ; the lamina N P and K uptake by 22.2, 21.0 and 18.9. ; the residual soil organic C, available Nand P by 0.08, 6.6 and 15.5. , respectively than that of no FYM application; and also accrued the highest net returns (Rs 25,800/ha), benefit: cost ratio (1.47) and profitability (Rs 191.11) compared with those of other FYM levels. Application of 40 kg N/ha, being comparable with 60 kg N/ha, significantly increased mean yields of green leaf by 9.5, cured leaf by 8.0, bright leaf by 12.8, grade index by 8.1 and cured leaf production efficiency by 7.9. ; the lamina Nand K uptake by 18.3 and 17.1. respectively; the residual soil available N by 4.2. compared with those of 20 kg N/ha application; and also accrued highest net returns (Rs 23,590/ha), benefit: cost ratio (1.42) and profitability (Rs 174.7 4/ha/day) compared to those of 20 and 60 kg N/ha application. Increasing the rate of N fertilizer from 20 to 60 kg N/ha increased the concentration of total N, nicotine and decreased sugars and sugar: nicotine ratio in tobacco cured leaf. Conjunctive application of 10 V ha of FYM and 50 kg N/ha was found optimum for obtaining higher yields and better grade index of tobacco with acceptable chemical quality parameters and higher monetary returns under conserved soil moisture conditions in Vertisols of Andhra Pradesh.

F06 Irrigation

255. Das, J.C.; Barkakoty, P.K.; Sarmah, N.N. (Assam Agricultural University, Jorhat (India). AICRP on Water Management). Irrigation management of sunflower (Helianthus annus) in Assam. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 106-109 KEYWORDS: IRRIGATION SYSTEMS; IRRIGATION SCHEDULING; HELIANTHUS ANNUS; GROWTH; YIELD; ASSAM.

A field experiment was conducted to eyaluate the effect of ten irrigation schedules on growth, yield and water use efficiency of sunflower. Results revealed that"three irrigations each at flower bud initiation, discformation.ancfseed setting stages resulted in significantly highest yield over one or two,irrigations at one or two of the above growth stages. Higher seed yield'was recorded with same number of irrigations when applied at critical growth stages as compared to 1W:CPE ratios. The consumptive use of water was 'also higher under IW:CPE ratios resulting lower water use efficiency of the crop. The water use efficiency decreased with increasing number of irrigations.

256. Sharma, P.K.; Kumar, S.; Yadav, G.L.; Verma, R.; Gupta, A. (Rajasthan Agricultural University, Jaipur (India). Dept. of Agronomy). Effect of last irrigation and field curing on yield and post harvest losses of rabi onion (Allium cepa). Annals of Biology (India). (Dec 2007) v. 23(2) p. 145-148 KEYWORDS: IRRIGATION; FIELD EXPERIMENT; FARM MANAGEMENT; ONIONS; ALLIUM CEPA; YIELDS; POST HARVEST LOSSES.

An experiment was conducted for two years at Agricultural Research Station, Durgapura, Jaipur during rabi seasons of 1999-2000 and 2000-01 to see the effect of last irrigation and field curing on yield and post-harvest losses of rabi onion. After field curing, the onion bulbs were kept for four months upto September under ambient conditions to assess the post-harvest losses. The results indicated that application of last irrigation in onion crop five days before harvesting recorded maximum marketable bulb yield of 106.51 and 155.46 q/ha

after storage with a minimum loss of 8.72 and 10.05 percent in field curing as well as of 34.06 and 33.54 percent during storage in 1999-2000 and 2000-01, respectively, which was significantly superior over irrigation applied just before harvesting. As regards to field curing treatments, field curing of onion bulbs for three days produced significantly higher marketable yield ofl03.30 and 147.75 q/ha after storage with a minimum loss.of 15.08 and 16.9 percent in field curing and of30.78 and 32.23 percent during storage in 1999-2000 and 2000-01, respectively, over no curing.

F08 Cropping Patterns and Systems

257. Kalaichelvi, K.; Chinnusamy, C. (Agriculture College and Research Institute, Coimbatore (India). Dept. of Agronomy). Productivity of cotton-blackgram cropping system as influenced by STCR based fertilizer nutrients and potassium humate. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 75-79 KEYWORDS: GOSSYPIUM HERBACEUM; CROPPING SYSTEMS; FERTILIZER; NUTRIENT; POTASSIUM; COTTON; BLACKGRAM.

A field experiment was conducted to study the influence of STCR recommended levels and potassium humate on the productivity of cotton - blackgram cropping system under irrigated condition. Yield attributes of cotton such as nutrient of sympodial branches, fruiting points, boll setting (percent) and boll numbers were increased with application of 100 percent STCR recommended level contributed to higher seed cotton yield (22 qjha) rather than 75 and 50percent STCR recommended level. Among potassium humate treatments, soil application of either 30 or 40 kgjha recorded higher yield attributes and yield. The interac percent ion effect was found to be significant, among which application of 100 percent or 75 percent STCR recommended levels of NPK along with 30 kgjha potassium humate application and 40 kgj ha or combination of soil application of potassium humate 20 kgjha + 1 percent seed soaking + 0.1 percent foliar spraying with 100 percent STCR recommended fertilizers recorded higher yield attributes and yield. Application of 100 percent or 75 percent STCR recommended levels and 40 kgjha soil application of potassium humate had residual influence in terms of black gram yield.

258. Dutta, D.; Bandyopadhyaya, P.; Banerjee, P. (Bidhan Chandra Krishi Viswavidyalaya, Nadia (India). Dept. of Agronomy). Influence of sowing date and nutrient level on yield and its attributes of wheat (Triticum aestivum). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 93-96 KEYWORDS: CROPPING SYSTEM; SOWING; SOWING DATE; NUTRIENT UPTAKE; YIELD; TRITICUM AESTIVUM.

A field experiment was conducted to study the response of wheat to sowing date-and nutrient level in split plot design on sandy loam alluvial soil of West Bengal. Main-plot consisted of 5 sowing dates, viz., 25 November, 10 December, 25 December, 10 January and 25 January and sub-plot consisted of 5 nutrient levels (N, P20S and K20), viz., NoPoKo, N4QP30K2Q1 NsoP4SK30' N12oP60K4Q and N16oP7SKSO kgfha. Late sowing reduced the grain yield, straw yield, yield attributes, benefit: cost ratio and nutrient-use efficiency of wheat. The crop responded significantly up to the highest nutrient level, viz., N160P7S and Kso kgfha. Interaction of sowing date and nutrient level showed that the wheat crop sown on 25 November responded to 160 kg N, 75 kgP20S and 50 kg K20 producing highest grain yield of 4763 kg/ha.

259. Gawai, P.P. (Mahatma Phule Krishi Vidyapeeth, Thane (India). Regional Res. Stn.); Pawar, V.S. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Dept. of Agronomy). Yield and yield components of sorghum (Sorghum bicolor) as influenced by integrated nutrient management system and its residual effect on chickpea (Cicer arietinum). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 97-100 KEYWORDS: CROPPING SYSTEMS; PROPERTIES OF FERTILIZER; YIELD; SORGHUM BICOLOR; CICER ARIETINUM; NUTRIENT AVAILABILITY; RESIDUAL EFFECTS.

A field experiment was conducted to study the effect of integrated nutrient management system in sorghum - chickpea cropping sequence in the vertisols of Rahuri, Maharashtra under irrigated conditions. Application of 75 per cent RDF + FYM + biofertilizer to sorghum proved beneficial in significantly improving the yield components over inorganics alone resulting in increase in the grain yield of sorghum. The residual effect of INMS to sorghum was not significant in respect of yield component and yield of chickpea. However, the treatment 50 per cent RDF + FYM was numerically better than rest of the treatments. The nodule count of chickpea showed higher values where FYM was combined with reduced levels of RDF. The graded levels of RDF to chickpea resulted in significantly higher values of yield components and yield of chickpea due to 100 per cent RDF. However, 50 per cent RDF was at par with that of 100 per cent RDF in respect of yield components and grain yield.

260. Ram, S.N.; Kumar, S.; Roy, M.M. (Indian Grassland and Fodder Research Institute, Jhansi (India). Grassland and Silvopasture Management Div.). Performance of jujube (Ziziphus mauritiana)-based hortipasture system in relation to proning intensities and grass-legume associations under rainfed conditions. Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 181-183 KEYWORDS: ZIZIPHUS; AGROPASTORAL SYSTEMS; INTERCROPPING; PRUNING; RAINFED FARMING; FORAGE; FRUIT; YIELDS.

\n experiment was conducted during 2001-02 and 2002-03 on sandy-loam soil to study the productivity of ,r or jujube (Ziziphus mauritiana Lamk.)-based hortipasture system in relation to pruning intensities and grasslegume associations under rainfed conditions. Pruning of secondary branches of trees at 20 cm length from I se recorded significantly higher dry matter and crude protein yields of pasture than pruning at 60 cm length, however, dry leaf forage yield, fruit yield and fuel wood were significantly increased when pruning of secondarylinches was done at 40 cm length than 20 cm length. Intercropping of Guinea grass (Panicum maximum Jacq.) Caribbean stylo (Stylosanthes hamata Taub.) gave significantly higher dry forage and crude protein yields I mpared to other grass-legume combinations. Dry leaf forage yield and fuel wood production were not signifi~tly influenced with different pasture combinations. However, significantly higher fruit yield was recorded unr natural pasture than other grass-legume intercroppings.

261. Kumar, S.; Rawat, C.R.; Melkania, N.P. (Indian Grassland and Fodder Research Institute, Jhansi (India). All India Coordinated Project for Research on Forage Crops). Forage production potential and economics of maize (Zea mays) and cowpea (Vigna unguiculata) intercropping under rainfed conditions. Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 184-186 KEYWORDS: INTERCROPPING; VIGNA UNGUICULATA; LAND USE; RAINFED FARMING; COWPEAS; YIELDS; MAIZE; ZEA MAYS; FORAGE; PRODUCTION.

A field experiment was conducted during the rainy seasons (kharif) of 1999, 2000 and 2001, to study the pro. duction potential and economic feasibility of maize (Zea mays L.) + cowpea [Vigna unguiculata (L.) Walp.] inter. cropping under rainfed conditions. Pooled

analysis of data indicated that intercropping of maize and cowpea in the row proportion of 2:2 recorded significantly higher total green fodder (338.3 q/ha), dry matter (83.0 q/ha) and crude protein yield (10.3 q/ha) as well as net returns (Rs 8,346/ha) over other treatments. However, benefit: cosl ratio for maize (sole) was higher (1.78) than the other treatment except maize+cowpea planted in the row ratio of 2:1 (2.04),2:2 (2.21) and mixed seed in the same row (1:1) (1.89). Monetary advantage ranged from Rs 38 with in. tercropping of maize and cowpea in the row ratio of 1:4 to Rs 2,427 (check) under maize + cowpea (2:2) and was negative with intercropping of maize and cowpea in a row ratio of 1: 1 and 1:2 land-equivalent ratio was more than 1 in all intercropping systems except maize and cowpea planted in the row ratio of 1:1 and 1:2 maximum being with maize + cowpea (2:2) intercropping system (LER 1.41).

262. Kumar, A.; Tripathi, H.P.; Yadav, R.A.; Yadav, D.S. (Narendra Deva University of Agriculture and Technology, Faizabad (India). Dept. of Agronomy). Diversification of rice (Oryza sativa) - wheat (Triticum aestivum) cropping system for sustainable production in eastern Uttar Pradesh. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 18-21 KEYWORDS: RICE; ORYZA SATIVA; WHEAT; TRITICUM AESTIVUM; CROPPING SYSTEMS; SUSTAINABILITY; DIVERSIFICATION.

A field experiment was conducted at Faizabad during 2000-05 to find out the feasibility of diversification of tra-ditional rice (Oryza sativa L.) - wheat (Triticum aestivum L. emend. Fiori & Paol.) cropping system. Rice - potato (So/anum tuberosum L.) - greengram [(Phaseo/us radiatus (L.) Wilczek)] sequence was found the most efficient for production (18.1 t/ha/year), employment generation (1.18 mandays/ha/day), monetary return (Rs 43,180/ha/year) and water-use efficiency (20.1 kg/ha/mm), followed by rice-onion (Allium cepa L.). Berseem [(Trifolium a/exandrinum (L.) Tuslen.] may be taken as a break crop successfully for reducing weed problem (weed-control efficiency 88.7 percent) in continuous rice-wheat system without any monetary loss. Rice - berseem sequence was also found the most efficient in terms of nitrogen-use efficiency (80.2 kg grain/kg N). Inclusion of potato or onion (vegetable crops) was found quite stable with stability index of 0.86 and 0.83 respectively. The sequences including greengram or berseem (leguminous crops) improved the availability of NPK and organic C of the soil.

263. Bastia, D.K.; Garnayak, L.M.; Barik, T. (Orissa University of Agriculture and Technology, Bhubaneswar (India). Dept. of Agronomy)). Diversification of rice (Oryza sativa) - based cropping systems for higher productivity, resource-use efficiency and economics. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 22-26 KEYWORDS: RICE; ORYZA SATIVA; CROPPING SYSTEMS; RESOURCE MANAGEMENT; PRODUCTIVITY.

A field experiment was conducted at Bhubaneshwar under irrigated medium land condition from 2002 to 2005 to evaluate the production potential, resource-use efficiency and economics of 10 cropping systems based on rice (Oryza sativa L.). Rice-groundnut-greengram system resulted in maximum number of effective tillers in rice (362/m2). longest panicles (23.0 em) and maximum number of grains/panicle (112). However, system productivity of rice-maize-cowpea was the maximum (15.98 t/ha) which was on a par with that of rice-maizegreengram (15.30 t/ha). Rice-sunflower-greengram registered the minimum rice equivalent yield (REV) of 11.66 t/ha among the three-crop sequences and rice-toria-fallow (8.36 t/ha) among the two-crop sequences. Sustainable yield index (0.85), production efficiency (50.73 kg REY/ha/day), employment generation (550 man days/ha)

and net returns (Rs 40,415/ha) were maximum in rice-maize-cowpea followed by rice-maize-greengram system. Inclusion of two legumes improved the sustainability and that of groundnut increased the land-use efficiency of the systems. Returns per Re invested were the highest for rice-field pea-sesame system (Rs 1.94), which were on a par with that of rice-maize-cowpea and rice-maize-greengram systems (Rs 1.85 and 1.83 respectively). Cropping systems having maize as a component crop expressed higher production efficiency (Rs 124 to 128/ha/day), water-use efficiency (Rs 203 to 213/ha-cm) and energy intensiveness (11.23 to 12.56 MJ/Re) in economic terms. Rice-maize-cowpea was the most productive, sustainable, resource-use efficient and remunerative cropping system.

264. Tripathi, S.C.; Singh, R.P. (Directorate of Wheat Research, Karnal (India)). Effect of crop diversification on productivity and profitability of rice (Oryza sativa)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 27-31 KEYWORDS: RICE; ORYZA SATIVA; WHEAT; TRITICUM AESTIVUM; CROPPING SYSTEMS; DIVERSIFICATION; PRODUCTIVITY.

A field study with eight crop sequences was conducted at Karnal during 2001-06 to diversify or intensify the rice (Oryza sativa L.) - wheat (Triticum aestivum) cropping system and to select suitable cropping system based on productivity and profitability. Combined analysis of the data of 6 years showed that rice - vegetable pea - wheat . greengram sequence produced 27.91 percent higher wheat equivalent yield than rice - wheat system. Diversification or intensification of rice - wheat system, once in 3 years, improved the net returns when all the crops (except rice) were grown on raised-bed in a system approach. Inclusion of oilseed or pulses in rice - wheat system once in 3 years or intensification by growing vegetable pea in between rice and wheat or greengram after wheat showed higher net returns and sustainable value index (SVI) compared with rice - wheat system. Maximum SVI (0.92) and net returns (Rs 38.6 x 103 fha/year) were recorded in rice - Indian mustard - greengram – rice - wheat - greengram - rice - wheat - greengram crop sequence. Benefit: cost ratio (1.74) and profitability (Rs 124/ha/day) were highest in pigeon pea - wheat - rice - wheat - rice - wheat crop sequence. Growing of berseem in the rotation reduced the weed population in the subsequent wheat cycle. After 6 years, rice - vegetable pea - wheat - greengram, rice - Indian mustard - greengram - rice - wheat - greengram - rice - wheat - greengram and pigeonpea - wheat - rice wheat - rice - wheat showed 37.5, 25.0 and 20.0 percent increase, respectively in organic C content (0-15 cm) than continuous rice-wheat system.

265. Kumar, A. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy)). Direct and residual effect of nutrient management in maize (Zea mays)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 37-41 KEYWORDS: MAIZE; ZEA MAYS; WHEAT; TRITICUM AESTIVM; CROPPING SYSTEMS; RESIDUAL EFFECTS; FERTILIZERS; PLANT NUTRITION.

A field experiment was conducted at New Delhi to investigate the response of maize (Zea mays L.) - wheat [Triticum aestivum (L.) emend. Fiori & Pao!.] cropping system to different nutrient-management practices during 2003-04 and 2004-05. The highest leaf-area index (LAI), yield attributes and yield of maize were recorded with the application of 120 kg N + 26.2 kg P + 41.5 kg Klha, closely followed by 120 kg N + 5 kg Zn + 10 t FYM/ha. The LAI, yield attributes and yield of wheat were found maximum at the residual fertility of 5 kg Zn + 20t FYM/ha. Wheat gave 22.7 percent more yield at residual fertility of 5 kg Zn + 20 t FYM/ha.

The data on maize-wheat system indicated that when 120 kg N + 5 kg Zn/ha was applied with 10 t FYM/ha, production efficiency (46.0 kg/ha-day), total productivity (10.8 t/ha), net returns (Rs 46,784/ha) and benefit: cost ratio (2.17) were the maximum. The Zn uptake by maize and wheat was the highest at 120 kg N + 5 kg Zn + 10 t FYM/ha and 5 kg Zn + 20 t FYM/ha, respectively. Except available P at 60 kg N + 10 t FYM/ha, 5 kg Zn + 10 t FYM/ha and 5 kg Zn + 20 t of FYM/ha, all the nutrients increased in the soil at different fertility levels. Higher residual organic C and available N, P, K and Zn in the soil were obtained with 5kg Zn + 20 t FYM/ha. It was concluded that combined application of 120 kg N + 5 kg Zn + 10 t FYM/ha was essential for higher productivity and profitability of maize - wheat cropping system.

266. Kumar, N.; Prakash, V.; Mina, B.L.; Gopinath, K.A.; Srivastava, A.K. (Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Div. of Natural Resource Management)). Evaluation of toria (Brassica campestris) and lentil (Lens culinaris) varieties in intercropping system with wheat (Triticum aestivum) under rainfed conditions. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 47-50 KEYWORDS: TORIA; BRASSICA CAMPESTRIS; LENTILS; LENS CULINARIS; INTERCROPPING; WHEAT; TRITICUM AESTIVUM; RAINFED FARMING.

A field experiment was conducted during winter (rabi) season of 2003-04 and 2004-05 at Almora to evaluate the varietal performance of lentil (Lens culinaris Medikus) and taria (Brassica campestris L. var. black taria) with wheat (Triticum aestivum L. emend. Fiori & Pao!.) intercropping system. Intercropping of wheat + lentil and wheat + taria showed an added advantage over sole and mixed cropping. In intercropping systems, lentil yield was higher with'VL Masoor 4' (0.35 t/ha) than with 'VL Masoor 120'. Similarly, 'VL Toria 2' gave higher yield (0.35 t/ha) than 'VL Toria 1'. The highest wheat-equivalent yield (5.87 t/ha), net return (Rs 19,651/ha), benefit: cost ratio (2.1), monetaryadvantage (5,172) and land-equivalent ratio (1.26) were obtained under wheat + lentil ('VL Masoor 4') intercropping, followed by wheat + taria 'VL Toria 2'. Negative values of aggressivity under intercrop showed that wheat was dominant, and lentil and taria were the dominated crops in the systems. Competitive ratio and relative crowding coefficient of wheat was higher under intercropping of wheat with lentil 'VL Masoor 120' and taria 'VL Toria 1'. Relative crowding coefficient of the system was highest for wheat + lentil ('VL Masoor 4') (5.72), followed by wheat + taria ('VL Toria 2') (4.77). Thus lentil 'VL Masoor 4' and taria 'VL Toria 2' were found suitable under intercropping system with wheat in comparison with other varieties.

267. Sharma, K.C. (Central Sheep and Wool Research Institute, Bikaner (India)). Fodder productivity and economics and multi-cut pearlmillet (Pennisetum glaucum) intercropped with clusterbean (Cyamopsis tetragonoloba). Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 51-56 KEYWORDS: PEARLMILLET; PENNISETUM GLAUCUM; INTERCROPPING; CLUSTERBEANS; CYAMPOSIS TETRAGONOLOBA.

A field experiment was conducted during summer seasons of 2006 and 2007 at Bikaner, Rajasthan to find out the effect of sole, mixed and intercropping in different row ratios (1:1, 1 :2, 2:2 3:2 and 3:3) of pearl millet [Pennisetum glaucum (L.) R.Br. emend. Stuntz] and clusterbean (Cyamopsis tetragonoloba (L.) Taub] on fodder productivity and its economics. Green and dry fodder yields of both the component crops, viz. pearlmillet and clusterbean, were substantially reduced under intercropping system compared with their sole crop yields. Pooled analysis of 2 years showed that intercropping of pearl millet and clusterbean

with a row ratio of 2:2 recorded the maximum values of growth parameters, viz. height and number of plants or tillers per unit area, green fodder (59.7 t/ha), dry matter (13.18 t/ha) , crude protein (1.27 t/ha) , land-equivalent ratio (1.35), price-equivalent ratio (1.44), net returns (Rs 47,300/ha) and benefit: cost ratio (3.27) than other intercropping row ratios, mixed cropping and sale stands of pearlmillet and clusterbeen. However, maximum aggressivity index (0.66) and relative crowding coefficient (12.37) were obtained with mixed seed sowing of pearl millet and clusterbean. Thus intercropping system of multi-cut fodder pearmillet and clusterbeen in a row ratio of 2:2 may be adopted for higher productivity, better quality and profitability in hot arid conditions.

268. Bhargavi, K.; Reddy, C. Ragnava; Reddy, T. Yellamanda; Reddy, D.Srivivasulu (Acharya N.G. Ranga Agricultural University, Anantapur (India). Effect of preceding crops in rainy season rice (Oryza sativa). Indian Journal of Agricultural Sciences (India) v.78(2) p.170-172 KEYWORDS: ORYZA SATIVA; GREEN MANURES.

A field experiment was conducted during 2000-2002 with sunnhemp (Crotalaria juncea L.)greengramm (Vigna radiata L. Wilczek) and sesame (Sesamum indicum L.)as preceding crop to rice and incorporated before planting of kharif rice, followed by rabi crops, viz groundnut, rice sunflower to study the qulity of rice. The grain and straw yield of kharif rice recorded with incorporation of sunnhemp green manure (5856 and 11196 kg/ha) or haulms of greengramm (5751 and 10509 kg/ha) were higher than thouse preceded by either fallow or sesame. N,P and K uptake of rice was improved with incorporation of green manure during kharif. The uptake of micronutrients, viz iron, zinc manganese and copper was doubled by green manure incorporation in kharif rice. greenmanuring improved the protein, iron zinc manganese, copper as well as the cooking quality of rice.

269. Dubey, Y.P.; Datt, Naveen (CSK Himachal Predesh Krishi Vishvavidyalaya, Palampur (India). Affectivity of Rhizobium leguminosarum phaseoli with nitrogen in French bean (Phaseolus valgaris)-wheat (Triticum aestivum) cropping sequence. Indian Journal of Agricultural Sciences (India) v.78(2) p.167-169 KEYWORDS: PHASEOLUS VULGARIS; TRITICUM AESTIVUM; FERTILIZER APPLICATION; NITROGEN; SEQUENTIAL CROPPING.

A field experiment during year 2002 and 2003 consisting of one -rhizobium strain with and without 4 levels of nitrogen (0, 20, 40 and 60 kg N/ha) was conducted on northwest Himalayan acid alfisol using French bean (Phaseolus vulgaris L.) as summer crop and its residual effect on succeeding cereal crop (whet) was studid. Indigenous strain with starter dose of nitrogen was the best as compared to inoculation alon and higher doses of nitrogn with and without inoculation. higher dose of nitrogen application reduced nodule numbers and affected the nitrogen fixation process. Residual effect of rhizobium culture inoculation on succeeding cereal crop (whet) was more pronounced in inoculated treatments than the alone nitrogen applied treatments.

270. Gill, M.S.; Pal, S.S. (Project Directorate for Cropping Systems Research, Modipuram (India); Ahlawat, I.P.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Approaches for sustainabillity of rice (Oryza sativa)-wheat (Triticum aestivum) cropping system in Indo-Gangetic plains of India - A review. Indian Journal of Agronomy (India) v.53(2) p.81-96 KEYWORDS: RICE; ORYZA SATIVA; TRITICUM AESTIVUM; CROPPING SYSTEMS; SUSTAINABILITY.

This paper describes the results of some innovative approaches for sustaining productivity of rice-wheat cropping system in the Indo-Gangetic plains. Integrated nutrient management with green manuring as a substitute saved 50 of the chemical fertilizers, with an average productivity of rice (4.8 Vha) and wheat (3.3 Vha). Site-specific nutrient management using judicious application of primary, secondary and micronutrients as per soil test and specific yield target was also found an economically-viable option with benefit: cost ratio of 4.9 under multi-location trials, with 15-17 Vha of productivity of rice and wheat. Resource conservation technologies (RCT) like zero tillage, bed planting and laser land leveling saved substantial quantity of irrigation water. Zero tillage saved 20 irrigation water, along with saving of 300 million litres of diesel per annum. Likewise, bed planting saved 37.5 em irrigation water. Laser land leveling led to 18.4 saving of water and higher water productivity (1.19 kg grain/m3 water) in wheat under on-farm trials. The average water productivity in wheat under on-farm trials in Punjab was 0.33 and 0.52 kg grain/m3 water under no levelling and laser leveling, respectively. Happy seeder gave 7-8 higher productivity and retained 5-7 Vha rice crop residue for soil fertility improvement. Besides water-saving and direct productivity gain, RCT was a valuable option for reducing the cost of cultivation in terms of land preparation, timely sowing, decreased seed rate, improved water and nutrient-use efficiency, and left indirect effect on mitigating the adverse effect of climate change. Remote-sensing technology also proved valuable for decision-support system in N saving, based on management-zone approach.

271. Sharma, R.P.; Pathak, S.K.; Haque, M. Lal, M. (Rajendra Agricultural University, Sabour (India). Dept. of Agronomy). Productivity, profitability and nutrient balance as influenced by diversification of rice (Oryza sativa)-wheat (Triticum aestivum) cropping system. Indian Journal of Agronomy (India) v.52(2) p.97-101 KEYWORDS: RICE; ORYZA SATIVA; TRITICUM AESTIVUM; CROPPING SYSTEMS; DIVERSIFICATION.

A field experiment was conducted during 2004-2005 and 2005-06 at Sabour, Bihar to diversify the existing rice (Oryza sativa L.) n wheat (Triticum aestivum L. emend. Fiori & PaoL.) cropping system. Among the 14 rice-based cropping systems tested, rice-potato (Solanum tuberosum L.)nonion (Allium cepa L.) + maize (Zea mays L.) relay cropping gave the highest mean rice-equivalent yield (30.66 t/ha/year), followed by rice-garlic (Allium sativum L.) maize (30.35 t/ha/year) and rice-potato-onion (27.95 t/ha/year). The highest net returns of Rs 96,581/ha/year were realized from rice-garlic-maize, which were on a par with that of rice-potato-onion + maize relay cropping (Rs 92,837/ha/year). However, the benefit: cost ratio was highest (1.73) in rice-berseem [Trifolium alexandrinum (L.) Juslen.] n maize + cowpea [Vigna unguiculata (L.) Walp.], both grown for fodder. The highest water-use efficiency (37.01 kg rice-equivalent yield/ha/mm) was recorded with ricengarlicnmaize system. The rice-potato-onion + maize relay cropping proved the most effective in producing highest calorific value (61,155 K calories/ha) and showed the maximum land-use efficiency (94.8.). The same cropping system removed the maximum quantity of N (371.6 kg/ha), P (110.4 kg/ha) and K (451.4 kg/ ha), followed by rice-berseem -maize + cowpea (F), having corresponding values 352.0, 88.2 and 361.0 kg/ ha/year. Heavy removal of NPK by rice-berseem-maize+cowpea (F) resulted in maximum negative balance of nitrogen (152.9 kg/ha), phosphorus (31.4 kg/ha) and potassium (304.6 kg/ha/year). Potassium balance was negative in all the cropping systems, indicating that K was the most removable nutrient by the crops, which results in mining of soil K and thus calls for adequate K fertilization.

272. Gangwar, K.S.; Gill, M.S.; Tomar, O.K.; Pandey, D.K. (Project Directorate for Cropping Systems Research, Modipuram (India). Effect of crop establishment methods on growth, productivity and soil fertility of rice (Oryza sativa)-based cropping systems. Indian Journal of Agronomy (India) v.52(2) p.102-106 KEYWORDS: RICE; ORYZA SATIVA; CROPPING SYSTEMS; SOIL FERTILITY; PLANT ESTABLISHMENT.

A field study was undertaken during 2003-04 to 2005-06 at Modipuram to develop appropriate establishment technique of rice (Oryza sativa L.) and to improve the growth, yield, profitability and soil fertility of rice-based cropping systems. The mean yield of hybrid rice was higher (8.52 Vha) with drum seeding and remained on a par with that of direct seeding and mechanical transplanting (puddled) compared with manual transplanting (puddled) and mechanical transplanting (unpuddled). Direct seeding (dry bed, unpuddled) adopted in the previous rice crop gave higher mean yield of the succeeding wheat (5.70 Vha), chickpea (2.20 Vha) and Indian mustard (1.86 Vha). Drum seeding recorded the highest mean net returns (Rs 47,040 /ha) in rice-wheat system, followed by rice-chickpea (Rs.42,336 /ha) and rice-Indian mustard system (Rs. 39,774 /ha), and benefit: cast ratio (1.24) in rice-chickpea followed by rice-wheat (1.21) and rice-Indian mustard system (1.12). The system-wise soil analysis undertaken after three crop cycles indicated that organic carbon increased positively over initial status in rice-chickpea system; however, the magnitude of increase was largest under mechanical transplanting (puddled), and negative balances were found in rice-wheat system. Available P and K balance was generally positive in rice-wheat, rice-chickpea and rice-Indian mustard crop sequences except for P in rice-wheat and rice-mustard crop sequences under direct seeding. The drum or direct-seeded rice-based cropping system not only produced higher grain yield of hybrid rice but also resulted in greater productivity of the subsequent crops.

273. Sharma, R.P. (Rajendra Agricultural University, Sabour (India); Singh, A.K. (Sher-e-Kashmir University of Agriculture and Technology, Bhadarwah (India). Regional Horticultural Research Sub-Station); Poddar, B.K.; Rajendra Agricultural University, Sabour (India); Raman, K.R.; Rajendra Agricultural University, Sabour (India). Forage production potential and economcis of maize (Zea mays) with legumes intercropping under various row proportions. Indian Journal of Agronomy (India) V. 52(2) p. 121-124 KEYWORDS: MAIZE; ZEA MAYS; INTERCROPPING; FEED LEGUMES; FORAGE.

A field experiment was conducted during the summer season of 2006 and 2007 at Sabour, Bihar to assess the production potential and economic viability of intercropping of forage maize (Zea mays L.) with cowpea [Vigna unguiculata (L.) Walp.], rice bean [Vigna umbel/ata (Thumb) ohwi and ohashi] and clusterbean [Cyamposis tetragonaloba (L.) Taub.] under four row proportions, viz. 1:1, 1 :2, 2:1 and 2:2. Intercropping of maize and cowpea in the row proportion 2: 2 recorded significantly higher total green fodder (43.2 t/ha), dry matter (9.6 t/ha) and crude-protein yield (1.1 t/ha) as well as net returns (Rs 16,104/ha) and benefit: cost ratio (1.84) compared with the other treatments except maize + rice bean planted in the ratio 2:2. The association of maize and cowpea in row ra¼tio 2:2 also showed the highest land-equivalent ratio (1.84) and relative crowding coefficient (7.08), followed by maize + rice bean in 2:2 ratio. Among the component crops, maize was more competitive and aggressive than legume intercrops. However, maize intercropped with cowpea and rice bean both in row proportion 2:1 was found to be a compatible intercropping system with lower values of aggressivity (0.01) and competition ratio (1.03). Thus intercropping of forage

maize with cowpea or rice bean both in 2:2 row ratio are the biologically and economically sustainable intercropping systems.

274. Nanjappa, H.V.; Soumya, T.M.; Ramachandrappa, B.K.; Prabhakara, B.N. (University of Agricultural Sciences, Bangalore (India). Dept. of Agronomy). Productivity and economics of transparent polyethylele for soil solarization in groundnut (Arachis hypogaea)-bell pepper (Capsicum annum) sequence. Indian Journal of Agronomy (India) V. 52(2) p. 125-128 KEYWORDS: GROUNDNUTS; ARACHIS HYPOGAEA; SEQUENTIAL CROPPING; SWEET PEPPERS. POLYETHYLENE; SOIL SOLARIZATION; CAPSICUM ANNUUM.

A field experiment was conducted during 2004 and 2005 at Bangalore to work out the economics of soil solar¼ization on break-even basis with different thicknesses (0.05 and 0.01 mm) of transparent polyethylene (TPE) in groundnut (Arachis hypogaea L.) fi bell pepper (Capsicum annum L.) sequence. Soil solarization with TPE 0.05 mm covered twice in the same season recorded significantly higher pod yield of groundnut (2.36 t/ha) and fruit yield of bell pepper (15.1 t/ha), followed by TPE 0.05 mm covered once in the same season (2.27 t/ha and 12.0 t/ ha respectively) and TPE 0.10 mm covered twice (2.17 t/ha and 12.6 t/ha). Similarly, leaf area/plant and yield attributes, viz. number of pods/plant (23.0) and number of fruits/plant (6.4) were also superior in soil solarization with 0.05 mm twice, TPE 0.05 mm once (21.7 and 5.3 respectively) and TPE 0.10 mm twice (22.1 and 6.0). Significantly lower number of weeds and weed dry weight was recorded with TPE 0.05 mm twice in both groundnut and bell pepper crop sequence. Repetitive use of TPE 0.05 mm for two times in the same season recorded higher net income (Rs 139.95 x103/ha) and B : C ratio (3.86) followed by TPE 0.05 mm for three times and TPE 0.10 mm for two times continuously in the same season. Soil solarization with TPE 0.05 mm thickness twice in the same season for groundnut fi bell pepper sequence was found to be highly productive and most economical practice.

275. Singh, U.; Hasan, A.A.S.B.; Singh, P.; Singh, S.R. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Sopore (India). Regional Research Station). Production potential and economics of intercropping of lentil (Lens culinaris) with brown sarson (Brassica compestris) and oat (Avena sativa). Indian Journal of Agronomy (India) V. 52(2) p. 135-139 KEYWORDS: LENTILS; LENS CULINARIS; INTERCROPPING; OATS; AVENA SATIVA; PRODUCTION ECONOMICS; BRASSICA CAMPESTRIS.

A field experiment was conducted during winter season of 2004-05 and 2005-06 at Wadura, Jammu and Kashmir to evaluate the production potential, biological feasibility and economic viability of intercropping of lentil (Lens culinaris Medikus) either with brown sarson (Brassica campestris L. sub sp. oleifera var. brown sarson) or oat (Avena sativa L.) in row ratios of 1:1, 2:1, 4:1 and 6:1. Lentil yield decreased by 16fi68. due to intercropping, and yield of oat was inversely proportional to lentil row number, whereas yield of brown sarson was in the order 4:1,2:1, 1:1 and 6:1. Yield components, viz. pods/plant, grains/pod and 1 ,OOO-grain weight of main crop of lentil, and siliqua/plant or tiller/m row, grains/siliqua or grains/panicle and 1,000-grain weight of intercrops (brown sarson or oat) also decreased in the intercropping systems. Lentil with brown sarson in 4:1 row proportion or oat in 2:1 row proportion was most remunerative in respect of net returns (Rs 20,755 and 21,782) and benefit: cost ratio (3.13 and 2.67). These two intercropping systems showed higher lentil-equivalent yield, land-equivalent ratio, income-equivalent ratio, area-time

equivalent ratio, biological efficiency and monetary advantage among all the intercropping systems.

276. Singh, A.K.; Lal, M.; Suman, A. (Indian Institute of Sugarcane Research, Lucknow (India). Effect of intercropping in sugarcane (Saccharum complex hybrid) on productivity of plant cane-ratoon system. Indian Journal of Agronomy (India) V. 52(2) p. 140-144 KEYWORDS: SUGARCANE; SACCHARUM OFFICINARUM; INTERCROPPING; RATOONING.

A field experiment was conducted at Lucknow during 2002-03 and 2003-04 to assess the production potential and economic viability of autumn-planted sugarcaneiibased intercropping systems, viz. sugarcane sole and sug¼arcane intercropped with lentil (Lens escu/entus), rajmash (Phaseo/us vulgaris L.), Indian mustard (Brassica compestris), rapeseed (Brassica sp.) and maize (Zea mays L.) for cobs at 2 row spacings of 90 and 75 cm. The intercropping with rajmash had no adverse effect on the number of millable canes (117.6 thousand/ha), cane length (213 cm) and cane yield (83.4 t/ha) compared with sole cane. Intercropping of rajmash and maize for green cobs resulted in highest net profit (Rs 89,883 and 83,815/ha) and benefit: cost ratio (B : C) (2.53 and 2.34) com¼pared with sole sugarcane (Rs 50,199 /ha). Ratoon sugarcane intercropped with lentil gave higher cane yield (64.2 t/ha) than that from sugarcane sole. Besides, there was improvement in the physico-chemical properties of the soil under sugarcane + lentil intercropping system with lower bulk density (1.26 g/cm3) and higher infiltration rate (4.75 mm/hr) compared with sole sugarcane. Inclusion of short-duration intercrops like rajmash, and maize for green cobs in autumn-planted sugarcane improved the productivity and profitability, and lentil intercropping improved the soil health under plantiiratoon system.

277. Prasad, J.V.N.S. (Central Research Institute for Dryland Agriculture, Hyderabad (India); Gill, A.S. (Indian Grassland and Fodder Research Institute, Jhansi (India); Baig, M.J. (Indian Grassland and Fodder Research Institute, Jhansi (India); Burman, D. (Central Soil Salinity Research Institute, Canning Town (India). Regional Research Station); Gupta, S.K. (Indian Grassland and Fodder Research Institute, Jhansi (India). Fodder and fuel-wood production through agroforestry in semi-arid Central India. Indian Journal of Agronomy (India) V. 52(2) p. 152-156 KEYWORDS: AGROFORESTRY; FORAGE; WOOD PRODUCTION; INDIA.

A study was conducted at Jhansi (Uttar Pradesh) during 1999fi2002 to evaluate the production potential of tree-crop systems under rainfed situations. Four tree species, viz. Azadirachta indica, Albizia lebbeck, Dalbergia sissoo and Acacia nilotica were evaluated in sole stands and intercropped with chickpea (Gicer arietinum L.) in 6 x 12 m spacing. The intercrop had a positive effect on the growth of Azadirachta indica and Albizia lebbeck but not on Acacia nilotica and D. sissoo. Acacia nilotica and D. sissoo produced maximum growth. Azadirachta indica produced minimum growth and Albizia lebbeck intermediate growth. None of the tree species reduced the crop yield in agroforestry in the first 3 years of tree growth. In the fourth year (2001-02), 25 to 36% reduction in grain yield and 37 to 45% reduction in stalk yield across the four tree species was recorded. The highest reduction was observed nearer to the tree row and the negative effect decreased with distance from the tree. Forage and crude-pro¼tein yields were higher from D. sissoo and the fuel-wood yield was higher from Acacia nilotica. Benefit: cost ratio and the net present worth was the highest with Acacia nilotica system, followed by that of D. sissoo. Hence both these tree species can be grown in combination with crops in the semi-arid central India to produce fodder and fuelwood.

278. Nanjappa, H.V.; Soumya, T.M.; Ramachandrappa, B.K.; Prabhakara, B.N. (University of Agricultural Sciences, Bangalore (India). Dept. of Agronomy). Productivity and economics of transparent polyethylele for soil solarization in groundnut (Arachis hypogaea)-bell pepper (Capsicum annum) sequence. Indian Journal of Agronomy (India) V. 52(2) p. 125-128 KEYWORDS: GROUNDNUTS; ARACHIS HYPOGAEA; SEQUENTIAL CROPPING; SWEET PEPPERS; POLYETHYLENE; SOIL SOLARIZATION; CAPSICUM ANNUUM.

279. Singh, K.A.; Indian Grassland and Fodder Research Institute, Jhansi (India). Resource management perspective for forage production and agroforestry system development in eastern Himalayan region: a review. Indian Journal of Agronomy (India) v. 52(4) p. 255-266 KEYWORDS: FORAGE; AGROFORESTRY; RESOURCE MANAGEMENT; HIMALAYAN REGION.

Advances in forage research in eastern Himalayan zone show that forage-resource development can play a vital role in improving the traditional ago-pastoral economy. Forage-based feeding systems have shown high produc., tion and economic efficiencies in ruminants. Besides, new possibilities have emerged to substitute a part of the total concentrate requirements of non-ruminant livestock by succulent forage crops. Tailoring of a number of forage plant species in the hill land-use systems will also provide continuous vegetative cover on the hill slopes to protect land resources and conserve the abundant native forage-plant species. An unbalanced and unsustainable form of a short-cycle shifting cultivation Uhuming) and limited opportunity to expand the arable lands and their mechanization on the hill slopes necessitate a greater intervention through agrbforestry in this region. To optimize integrated land-use capacity, many traditional agroforestry practices are existing in this region; besides, farmers own innovative approach to agroforestry systems and a number of agroforestry systems developed and perfected by research. All these systems have shown a way to improve jhum-fallow through agroforestry and contour hedge intercropping. There is a need to encourage product diversification in a unit of land through agroforestry to increase the land capacity to produce full potential and linking them to assured marketing channels by identifying demands and outlets for outputs.

280. Kumaresan, M. (Central Tobacco Research Institute, Vedasandur (India). Regional Station); Kumar, P.H. (Central Tobacco Research Institute, Rajamundry (India); Krishnamurthy, V. (Central Tobacco Research Institute, Rajamundry (India); Athinarayanan, R. (Central Tobacco Research Institute, Vedasandur (India). Regional Station). Economic viability and residual soil - nutrient status in chewing tobacco (Nicotiana tabacum)-based cropping system. Indian Journal of Agronomy (India) v. 52(4) p. 290-294 KEYWORDS: TOBACCO; NICOTIANA TABACUM; CROPPING SYSTEMS; CROP RESIDUES; SOIL FERTILITY.

A field experiment was conducted during 2002-03 to 2004-05 at Vedasandur, Tamil Nadu to study the economic viabil,ity of various chewing tobacco (Nicotiana tabacum L.) based cropping systems and their effect on residual soil-nutrient status. The treatments consisted of six chewing tobacco-based cropping sequences, viz. ragi [E/eusine coracana Gaertn]-tobacco [Nicotiana tabacum L.]-sunflower [Helianthus annuus L.]; sunnhemp [Grata/aria juncea L.]-tobacco-sorghum fodder [Sorghum bic. r L. Moench]; maize [Zea mays L.]-tobacco-sun¼flower; maize-tobacco-groundnut [Arachis hypogaea L. sunflower-tobacco-maize; and sunflower-tobaccogroundnut with a sole tobacco crop. The leaf length and width, first grade leaf yield (FGLY) and total cured-leaf yield (TCLY) of rabi chewing tobacco increased with sunnhemp as a green-manure crop in kharif and with sorghum fodder in

summer. The increase in FGLY and TCLY was 15 and 14, respectively. Residual soil-nutrient status and uptake of nutrients by tobacco lamina improved with sunnhemp-tobacco-sorghum fodder sequence. Tobacco leaf-equivalent yield (6.14 t/ha) increased with maize-chewing tobacco-groundnut sequence. Sunflower-to¼bacco-groundnut sequence significantly increased the net returns by 76. over sole tobacco. It was concluded that the sequence sunflower - tobacco - groundnut was economically viable and the residual soil nutrients improved with sunnhemp-tobacco-sorghum fodder sequence.

281. Gill, B.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy); Singh, A. (Punjab Agricultural University, Ludhiana (India). Dept. of Forestry and Natural Resources); Singh, D. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy); Gandhi, N. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy). Studies on intercropping of medicinal, aromatic and spice crops in poplar plantation. Indian Journal of Agronomy (India) v. 52(4) p. 295-298 KEYWORDS: INTERCROPPING; DRUG PLANTS; ESSENTIAL OIL CROPS; SPICE CROPS; POPULUS.

The performance of lemongrass, Tagetes minuta, turmeric, celery, coriander, fennel, dillseed, fenugreek, Mentha arvensis, Mentha spicata, sarson (Brassica napus L.) and wheat in compact poplar plantation (clone 'Udai') established in March 2004 at 5 m x 4 m spacing, was studied at Ludhiana. Results revealed that an increase in the age of poplar decreased the yield of crops. During 2004-05 the reduction in yield was more in crops like Mentha arvensis (64.9), M. spicata (65.5), coriander (26.7) and Tagetes minuta (16.1), but was less in lemongrass (2.6), turmeric (1.1), fennel (6.8), dillseed (12.6), fenugreek (7.1), sarson (1.84) and wheat (4.75). During 2005-06 the reduction in the yield of lemongrass, Tagetes minuta, Mentha arvensis and M. spicata; and yield of turmeric rhizome, seed of coriander, fennel, dillseed, fenugreek, sarson and wheat was 6.55, 7.50, 60.5, 50.0, 40.6, 28.1,43.9, 27.6, 37.4 and 34.4 and 32.7. , respectively in compact poplar plantation compared with that in sole or pure cultivation of these crops; and in 2006-07 it was 25.4, 39.3, 78.6, 77.0, 56.3, 70.4, 88.5, 79.6, 65.6, 85.9 and 67.2, respectively.

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282. Sarawgi, S.K.; Rajput, R.S. (Indira Gandhi Agricultural University, Raipur (India). Dept. of Agronomy). Response of soybean (Glycine max L. Merril) varieties to phosphorus levels vertisols of Chhattisgarh plain. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 27-29 KEYWORDS: SOYBEANS; VERTISOLS; GLYCINE MAX; PHOSPHORUS; NUTRIENT; NITROGEN; YIELDS.

A field experiment was conducted to ascertain response of soybean varieties at varying phosphorus levels in vertisols of Chhattisgarh plain agroclimatic zone. On the basis of pooled analysis, variety J~335 recorded significantly higher grain yield and its attributes with higher monetary return per hectare followed by PK-472. However, variety J5-80-21, J5-75-46 and J5-72-44 recorded the same grain yield. In case of phosphorus response 0 it was observed that grain yield and its attributes increased significantly with increasing levels of phosphorus from 30 to 60 kg P20S ha-l. Further increase in phosphorus level resulted in decrease of grain yield.

283. Goswami, P.K. (Assam Agricultural University, North Lakhimpur (India). Regional Agricultural Res. Stn.); Behl, R.K. (Chaudhary Charan Singh Haryana Agricultural University,

Hisar (India). Dept. of Plant Breeding). Exploitation of heterosis and selection of superior combiners in Indian mustard. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 56-58 KEYWORDS: HETEROSIS; CONDIMENTS; BRASSICA JUNCEA; COMBINING ABILITY; GENE INTERACTION; HYBRIDS; PROGENY; BREEDING.

Combining ability studies using line x tester in Indian mustard revealed that both additive and non. additive gene actions were important for number of secondary branches, siliquae on main shoot, seeds/siliqua, l000-seed weight and seed-yield/plant, Non-additive gene action was predominant (or all the traits studied. The parents, RH-9621, RH-9617, RH-9⊥09 and RH-9404 as lines and RH-30 and T-6342 as testers can be used for hybridization progri:immes because of high gca effects and per se performance. Unconventional breeding methods emerged as essential for breaking undesirable linkage blocks. The hybrids between RH-9404 xRH-30 and RH-9615 x T-g342 showed high mean expression, sca effect and. standard heterosis for seed yield which offered scope for exploitation of the above crosses through heterosis breeding.

284. Sanjeev, R. (College of Agriculture, Indore (India). Dept. of Plant Breeding and Genetics); Prasad, S.V.S. (Indian Agricultural Research Institute, Indore (India). Regional Stn.); Billore, M. (College of Agriculture, Indore (India). Dept. of Plant Breeding and Genetics). Heterobeltiosis for grain yield and its components in Triticum durum. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 69-74 KEYWORDS: HETEROBASIDION; PLANT BREEDING; GRAIN; YIELD; TRITICUM DURUM; HETEROSIS.

A set of line x tester crosses involving ten lines and four testers were evaluated with parents fOJ heterotic manifestation of grain yield and its contributingg characters to have information on thE extent of heterosis. The maximum heterobeltiosis for grain yield per plant was observed to be 33..3 per cent. The extent of standard heterosis, however, was not of appreciabe magnitude being 18.75, 24.81 and 37.9 percent for grain yield per plant over the standard released varieties HD 4672 (Malav Ratna), Hl8381 (Malavshree) and HI 8498 (Malavshakti), respectively. The crosses showing heterosis for grain yield were not heterotic for all the characters. The crosses between high x high, high x low and low x high performing (gca) parents exhibited greater hybrid vigour. Magnitude of heterosis ovel better parent indicated that grain yield per plant was the most heterotic character followed by 1000-grain weight and harvest index. Four promising hybrid combinations heterotic over better parent and standard varieties i.e., HI 8591 x HG 110, HI 8591 x MFO 215, HI 8596 x HG 110 and HD 4692 x Bijaga Red were identified for selecting good segregants in the subsequent generations to develop high yielding purelines through progeny selection.

285. Sultana, R.; Malik, S.K. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding). Genetic variability and character association between yield and yield attributing in bread wheat (Triticum aestivum L. EM. Thell). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 118-125 KEYWORDS: PLANT GENETICS; YIELD; GENETIC VARIABILITY; TRITICUM AESTIVUM.

A total 210 genotypes of bread wheat including indigenous and exotic collection were evaluated for ten yield attributing characters in order to identify the superior lines that can be used as potential donors for yield arid yield contributing characters and to identify the relationship between different characters in order to assess the role of quantitative characters in crop improvement. Analysis of variance showed significance for the characters, such as - number of tillers per plant, ear length, 100grain weight, biological yield, grain yield

and harvest index, which indicates the existence of genetic diversity in the parental material. High phenotypic coefficient of variation was obtained for number of tillers per plant, grain yield, biological yield and harvest index. Among the other traits plant height, number of spikelets per ear, 100D-grain weight and ear length showed moderate variability, while days to heading and days to maturity showed relatively low variability. Correlation studies indicated the nature of relationship between yield and yield attributing traits in order to assess the role of quantitative characters in crop improvement. Phenotypic correlation indicates that plant height, biological yield and 10DD-grain weight were positively and significantly associated with grain yield. On the basis of genetic variability and character association it is suggested that grain yield may be improved with improvement in number of tillers per plant, ear length, biological yield, 1DOO-grain weight and harvest index.

286. Vani, S.K.; Sridevi, O.; Salimath, P.M. (University of Agricultural Sciences, Dharwad (India). Dept. of Genetics and Plant Breeding). Studies on genetic variability, correlation and path analysis in chilli (Capsicum annuum L.). Annals of Biology (India). (Dec 2007) v. 23(2) p. 117-121 KEYWORDS: GENETIC CORRELATION; HERITABILITY; GENETIC AVAILABILITY; STATISTICAL METHODS; GENOTYPES; QUANTATIVE ANALYSIS; PHENOTYPES; CHILLIES; CAPSICUM ANNUM; GENETIC GAIN.

Fifty-five accessions of chilli were evaluated for 12 quantitative characters including yield. High heritability coupled with high genetic advance was noticed through number of fruits per plant, number of seeds per fruit, seed weight, fruit length and stalk length suggesting that these characters could be c'Onsidered reliable indices for selection. The phenotypic and genotypic coefficients of variation observed were highest for yield per plant, number of fruits per plant and seed weight, indicating the highest level of variability for these traits and also indicated ample scope for effective improvement through selection. Correlation studies revealed that fruit yield per plant was significantly and positively associated with all yield attributes except stalk weight. High positive direct effect of yield attributing characters like fruit length, stalk weight and fruit weight resulted in significant correlation with yield. Number of fruits per plant and average fruit weight also contributed jndirectly through all characters which made the correlation significant.

287. Vani, S.K.; Sridevi, O.; Salimath, P.M. (University of Agricultural Sciences, Dharwad (India). Dept. of Genetics and Plant Breeding). Genetic divergence in chilli (Capsicum annuum L.). Annals of Biology (India). (Dec 2007) v. 23(2) p. 123-128 KEYWORDS: GENETIC DISTANCE; CHILLIES; CAPSICUM ANNUUM; QUANTATIVE ANALYSIS; GENOTYPES.

Fifty-five accessions of chilli were evaluated for 15 quantitative characters including yield. Plant height followed by yield per plant showed maximum contribution towards diversity. 02 analysis grouped all the genotypes into XIV clusters with 10 solitary clusters and D2 values ranged between 14.38 ar.d 85.01. Cluster 1 was largest containing 32 gt;:notypes followed by cluster 11 and IV with tive genotypes each. Maximum intra-cluster distance was reported in cluster I, whereas inter-cluster distance was maximum between clusters VII and XI. Cluster mean analysis showed that solitary clusters viz., cluster Xl (IC-32), cluster XII (Pusa Jwala) and cluster XIV (IC-16) were having high mean values for yield per plant, average fruit weight, seeds per fruit and fruit length.

288. Kalia, R.; Dogra, P. (Chaudhary Swaran Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dept. of Plant Breeding and Genetics). Genetic variability for yield and quality traits in horsegram. Annals of Biology (India). (Dec 2007) v. 23(2) p. 133-136 KEYWORDS: HORSEGRAM; GENETIC VARIABILITY; GENETIC GAIN; HERITABILITY; QUALITY; YIELDS; YIELD COMPONENTS; MACROTYLOMA UNIFLORUM.

Genetic variability for 18 yield and quality traits was studied in 35 diverse genotypes of horsegram [Macrotyloma unlfzorum (Lam.) Verde.]. Both phenotypic and genotypic coefficients of variation were high for crop growth rate and seed yield per plant. Hence, direct selection of these traits will prove effective. Phenotypic coefficient of variation for pods per plant and harvest index was high, whereas genotypic coefficient of variation for these characters was moderate. High heritability coupled with high genetic advance for leaf area index (70 DAS) and crop growth rate indicated the influence of additive gene action and consequently a likelihood of high genetic gain from phenotypic selection.

289. Mishra, A. (Orissa University of Agriculture and Technology, Balugaon (India). Sugarcane Research Stn.); Dhar, B.; Singh, R.M. (Banaras Hindu University, Varanasi (India). Dept. of Genetics and Plant Breeding). Symbiotic behaviour of phage-resistant mutants of pigeonpea [Cajanus cajan (L.) cv. Bahar] rhizobial strain IHP-195 with the main and alternate hosts. Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 131-132 KEYWORDS: PIGEONPEAS; CAJANUS CAJAN; DISEASE RESISTANCES; BACTERIOPHAGTES.

290. Singh, J.; Bajpai, G.C. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding). Analysis of gene effects for yield and yield atrbituting traits in interspecific crosses of pigeonpea [Cajanus cajan (L.) Millsp]. Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 133-134 KEYWORDS: PIGEONPEAS; CAJANUS CAJAN; YIELD COMPONENTS; GENOTYPES.

291. Talukder, D.; Biswas, A.K. (University of Kalyani (India). Dept. of Botany). Induced seed coat colour mutations and their inheritance in grasspea (Lathyrus sativus L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 135-136 KEYWORDS: LATHYRUS SATIVUS; INDUCED MUTATION; INHERITANCE; TESTA.

292. Tripathi, A.K.; Bhajan, R.; Kumar, K. (Narender Dev University of Agriculture and Technology, Faizabad (India). Dept. of Genetics and Plant Breeding). Combining ability analysis for seed yield and its components over environments in Indian colza (Brassica rapa L. var. yellow sarson). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 137-138 KEYWORDS: BRASSICA CAMPESTRIS; BRASSICA RAPA; COMBINING ABILITY; YIELD COMPONENTS; PHENOTYPES.

293. Maloo, S.R.; Nair, S. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Plant Breeding and Genetics). Generation means analysis for seed yield and its components in soybean [Glycine max (L.) Merrill]. Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 139-140 KEYWORDS: SOYBEANS; GLYCINE MAX; YIELD COMPONENTS; STATISTICAL METHODS.

294. Anjani, K. (Directorate of Oilseeds Research, Hyderabad (India). Statilization and maintenance of male sterility percent in recessive genetic male sterile lines of safflower

(Carthamus tinctorius L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 141-142 KEYWORDS: SAFFLOWERS; CARTHAMUS TINCTORIUS; GENOTYPES; MALE INFERTILITY.

295. Tuteja, O.P.; Singh, P.; Kumar, S.; Singh, M. (Central Institute for Cotton Research, Sirsa (India). Regional Stn.). Identification of fertility restores for Gossypium harknessii based cytoplasmic male sterility system in cotton (Gossypium hirsutum L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 143-144 KEYWORDS: COTTON; GOSSYPIUM HIRSUTUM; CYTOPLASMIC MALE STERILITY; IDENTIFICATION; FERTILITY.

296. Tuteja, O.P.; Verma, S.K.; Monga, D. (Central Institute for Cotton Research, Sirsa (India). Regional Stn.); Singh, P. (Central Institute for Cotton Research, Nagpur (India). A new genetic male sterile line of desi cotton (Gossypium arboreum L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 145-146 KEYWORDS: COTTON; GOSSYPIUM ARBOREUM; GENOTYPES; MALE INFERTILITY.

297. Manivel, P. (Central Potato Research Institute, Shimla (India); Kumar, V. (Central Potato Research Station, Kufri (India); Thakur, K.C.; Pandey, S.K. (Central Potato Research Institute, Shimla (India). Stigma receptivity and pollination success in potato (Solanum tuberosum L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 149-150 KEYWORDS: POTATOES; SOLANUM TUBEROSUM; GYNOECIUM; POLLINATION.

298. Singh, A.K.; Chaudhary, B.R. (Banaras Hindu University, Varanasi (India). Centre of Advanced Study in Botany). Combining ability and generation mean analysis in Capsicum. Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 151-152 KEYWORDS: CAPSICUM; COMBINING ABILITY; STATISTICAL METHODS.

299. Singh, S.P.; Shukla, S.; Yadav, H.K.; Chatterjee, A. (National Botanical Research Institute, Lucknow (India). Div. of Genetics and Plant Breeding). Genotype x environmental interaction in relation to stable genotypes in opium poppy (Papaver sominferum L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 153-154 KEYWORDS: PAPAVER SOMNIFERUM; GENETIC STABILITY; GENOTYPES; PHENOTYPES.

300. Lal, R.K. (Central Institute of Medicinal and Aromatic Plants, Lucknow (India). Dept. of Quality Genetic Material Production Cell); Khanuja, S.P.S. (Central Institute of Medicinal and Aromatic Plants, Lucknow (India). Dept. of Genetic Resources and Biotechnology). Influence of heterosis, genetic association and variance on crude tropane alkaloids in black henbane (Hyocyamus niger L.). Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 155-157 KEYWORDS: HYOSCYAMUS NIGER; HETEROSIS; GENETIC VARIATIONS; MEDICINAL PLANTS; BIOCHEMISTRY.

301. Janila, P. (Centre for DNA Fingerprinting and Diagnostics, Hyderabad (India); Ashok Kumar, A.; Reddy, N.R.; Hemalatha, V. (Acharya N.G. Ranga Agricultural University, Mahaboobnagar (India). Regional Agricultural Research Stn.). Gamma-ray induced mutants in castor (Ricinus communis L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 381-383 KEYWORDS: CASTOR; RICINUS COMMUNIS; INDUCED MUTATION; GAMMA RADIATION.

We report isolation of three recessive mutants in castor using dry seed irradiation with gamma rays. The crinkled leaf mutant (cri) was identified in K-55-112 M2 family and leafy mutant (lea) in H-55-577 M2 family; both are recessive lethal and thus maintained as heterozygotes. The cri mutant has highly wrinkled leaves resembling finger millet head and failed to enter reproductive phase, consequently did not produce seeds. The number of leaf lobes is reduced in lea mutant and though it produced spikes, the male and female flowers are converted to leafy appendages. The third mutant, fused (fus) stem identified in H-55-617 M2 family is a recessive mutant. The branches of which are fused at the base and though each branch terminates in to monoceous spike like normal plant, the spike is highly condensed. The three mutants under report are valuable genetic stocks for development of linkage maps in castor, which is at infancy.

302. Shanthi, R.M.; Alarmelu, S. (Sugarcane Breeding Institute, Coimbatore (India). Assessment of the first cycle hybrid progenies for early high sugar content in sugarcane. Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 384-387 KEYWORDS: SUGARCANE; HYBRIDS; CARBOHYDRATE CONTENT.

Enhancing the sucrose content of the varieties througl1 breeding is essential for attaining sustainable sugar production. To achieve this, new parental clones capable of much higher levels of sucrose accumulation than found in the commercial varieties are to be developed. A recurrent selection scheme with a base population of eighteen Indian commercial hybrids and eight exotic hybrids was adopted. Preliminary screening of 5420 hybrid seedling progenies from thirty biparental crosses for juice brix in the ground nursery revealed four productive cross combinations viz., CoC 671 x Co 99002, Co 86002 x Co 7915, Co 7201 x Co . 62198 and PR 1080 x Co 94008. These crosses contributed more individuals with high juice brix performing better than the cross average. In the subsequent clonal evaluation of cycle I hybrid progenies, 104 clones registered more than 23 percent juice brix at ten months of crop age. With regard to the progress made in cycle I for juice sucrose, five clones viz., 02-071,02-094,02-137,02-230 and 02-295 recorded more than ten percent improvement over the best check variety CoC 671. Screening the high quality clones for their reaction to red rot pathogen indicated three crosses viz., Co 7201 x Co 62198, Co 85002 x CoT 8201 and CP 49-50 x CoT 8201 giving more clones combining high sucrose and red rot resistance.

303. Dubey, R.B.; Jain, S.K.; Maloo, S.R. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Plant Breeding and Genetics). Combining ability and heterosis for latex yield, seed yield and other agronomic traits in opium poppy (Papaver sominferum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 392-395 KEYWORDS: PAPAVER SOMNIFERUM; COMBINING ABILITY; HETEROSIS; YIELDS; AGRONOMIC CHARACTERS.

Twenty one hybrids along with seven parents and two checks viz., Chetak Aphim and IC-42 were evaluated for combining ability and standard heterosis for latex yield/plant, seed yield/plant, husk yield, stem diameter, number of effective capsules/plant, plant height, peduncle length, days to flower initiation and days to 50 percent flowering. Both additive and non-additive gene effects were present in the material under study. However, the ratio of additive and non-additive genetic variance revealed that there was preponderance of non-additives gene action in the expression of all the traits under study. Among the parents, the UOP-82 was identified as good general combiner for latex yield/ Plant, seed yield/plant, husk yield/plant, plant height and peduncle length. The hybrid UOP-82 x NOP-204 exhibited

highest magnitude of positive significant sea effects with highest standard heterosis and per se performance for latex yield/plant. This hybrid also exhibited positive significant sea effects for stem diameter, number of effective capsules/plant and peduncle length. In general, close association between sca effects and standard heterosis was observed among the best hybrids identified on the basis of sea effects for latex yield.

304. Talukdar, D.; Biswas, A.K. (University of Kalyani, Nadia (India). Dept. of Botany). Inheritance of flower and stupule characters in different induced mutant lines of grass pea (Lathyrus sativus L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 396-400 KEYWORDS: LATHYRUS SATIVUS; INDUCED MUTATION; GENETIC INHERITANCE; MORPHOGENESIS.

305. Sadawarti, M.J.; Chakbrabarty, S.K.; Sharma, S.P. (Indian Agricultural Research Institute, New Delhi (India). Div. of Seed Science and Technology). Maximization of seed production in CMS line of rice hybrids. Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 403-407 KEYWORDS: RICE; ORYZA SATIVA; HYBRIDS; SEED PRODUCTION.

306. Gill, B.S.; Chahal, G.S.; Sohu, R.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Plant Breeding, Genetics and Biotechnology). Effect of cytoplasmic genetic male sterility on combining ability and genetic control of quantitative characters in upland cotton (Gossypium hirsutum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2007) v. 67(4) p. 408-410 KEYWORDS: COTTON; GOSSYPIUM HIRSUTUM; COMBINING ABILITY; GENETIC CONTROL; CYTOPLASMIC; MALE STERILITY.

307. Pani, D.R. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Molecular Biology and Genetic Engineering); Arif, M. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Plant Pathology); Raj, G. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Molecular Biology and Genetic Engineering); Kar, C.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding); Singh, U.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Plant Pathology)). Random amplified polymorphic DNA analysis of indigenous small and medium - grained scented rices (Oryza sativa L.) of Orissa. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 360-365 KEYWORDS: RICE; ORYZA SATIVA; RAPD; DNA; GENETIC VARIATION.

Scented rices are highly preferred due to their pleasant aroma and palatability. A large number of indigenous aromatic rice collections are awaiting systematic study for the assessment of genetic diversity. Random amplified polymorphic DNA technique was used for genetic diversity analysis among 24 rice cultivars consisting of 20 nonbasmati scented and 4 non-scented rice varieties collected from Orissa. A total of 86 bands were amplified by 15 pre screened polymorphic decamer primers at an average rate of 5.73 bands/primer. The polymorphic loci recorded in the present study clearly discriminate all the accessions. The pair-wise genetic similarity coefficient varied from 0.52 between three pairs of rice genotypes viz., Samudrabali Nariyaphula, Gayatri-Nadiarasa and IR64 - Gurmatia to 0.94 between Gurmatia and Samudrabali. The UPGMA cluster analysis revealed considerable variability among the population of 24 cultivars and discriminated all the nonscented rices from scented rice varieties. All the 24 rice genotypes were classified into three clusters and

separated the non-scented rice varieties from rest of the scented rices. The group consisting of Nadiarasa and Nariyaphula with pair wise similarity coefficient 0.75 was separated from rest of the varieties at 60 peercent similarity level. No duplicate entry was detected among the 24 rice cultivars included in the present study.

308. Mohan, D. (Directorate of Wheat Research, Karnal (India); Mishra, P.C. (Jawaharlal Nehru Krishi Vishwaviayalya, Powarkheda (India); Misra, S.C. (Agricultural Research Institute, Pune (India); Jadon, B.S.; Rasal, P.N.; Meena, B.K. (Directorate of Wheat Research, Karnal (India)). Genetic improvement for deficit irrigation in bread wheat (Triticum aestivum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 373-379 KEYWORDS: SOFTWHEAT; TRITICUM AESTIVUM; BREEDING METHODS; IRRIGATION.

A study was conducted for four years in the central and peninsular India to examine the route to yield under deficit irrigation in bread wheat and devise suitable selection criteria for variety development. Yield components and genotypes were compared at two irrigation levels (zero and one) in the first two years whereas trials were conducted in the following two years to realize the yield potential and genotype specificity under supplementary irrigation. Majority of the yield governing traits responded to the supplementary irrigation but the magnitude of realized advantage varied vividly in the associated traits. In yield determinants; biomass, stem elongation rate, spike weight and a disincentive to plant height was common in both treatments. Delayed heading in zero irrigation and longer duration but quick grain ripening for one-irrigation were additional attributes of selection. Proper site selection and screening of the germ plasm was found crucial to raise prospects of high genetic yield potential under deficit irrigation.

309. Kulkarni, P.; Desai, S.A. (University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab.); Lohithaswa, H.C. (All India Coordinated Research Project on Forage Crops, Mandya (India); Hanchinal, R.R. (University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab.)). Breeding for free thresshability in emmer wheat [Triticum dicoccum (Schrank.) Schubl.] through induced mutagenesis. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 380-386 KEYWORDS: WHEAT; TRITICUM DICOCCUM; PLANT BREEDING; INDUCED MUTATION; THRESHSING.

Twelve hundred and sixty one advanced breeding lines derived through mutagenesis of the Fls of 14 Triticum dicoccum x T. dicoccum, two T. dicoccum x T. durum and T. durum x T. durum crosses and six elite lines of T. dicoccum using Gamma rays treatment of seeds at equilibrium seed moisture content of eight per cent were studied for selecting superior genotypes with respect to various agronomic and quality traits. Based on rachis fragility and glume tenacity; 51 free-threshable dicoccum lines were selected comprising 48 from eight T. dicoccum x T. dicoccum crosses viz., NP-200 x MACS 2912 (10), NP 200 x DDK 1009 (19), DDK 1001 x MACS 2928 (2), DDK 1013 x DDK 1001 (5), 266-10 x 248-4 (1), NP 200 x DDK1015 (1), NP-200 x MACS 2336 (4) and DDK 1009 x MACS 2931 (6), one from the elite T. dicoccum line MACS 2931 and one each from the T. durum x T. durum crosses viz., Bijaga Yellow x D 2571 and DWR 2006 x DWR 1005. Out of these 51 stable free threshable mutants; two lines derived from the cross NP-200 x MACS 2912 (line nos. 886 and 915) and one from DDK 1013 x DDK 1001 (line no. 206) were nutritionally superior with early flowering, increased seed weight and amber coloured grains. The line No. 206 recorded higher sedimentation value of 42ml, p-carotene of 3.90 ppm and protein content of 14.36 per cent. Hybridization followed

by mutation created enormous variability in the study indicating its effectiveness as a breeding strategy for developing free threshability in emmer wheat.

310. Gill, R.S.; Puja; Dhindsa, G.S.; Bains, N.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Plant Breeding and Genetics)). Maize-induced haploid production from triticalex wheat crosses. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 387-390 KEYWORDS: TRITICALE; HYDRIDIZATION; WHEAST; MAIZE; ZEA MAYS; HAPLOIDY; TRITICUM AESTIVUM.

The system of maize induced haploidy was used to devise a rapid technique for generating D/R substitutions from Fls of hexaploid triticale x bread wheat. Standard wheat x maize protocol was ineffective. Two refinements which included supplementing the 2,4-D (100ppm) with picloram (100 pm) for use in post pollination tiller injection and advancing the' Fls of triticale x wheat to subsequent generations via selfing and backcrossing proved effective. Caryopsis formation frequency (CFF) to the tune of 52.30 percent, 11.59 percent embryo formation frequency (EFF) and 13.10 percent plant regeneration frequency (PRF) were achieved. Using above modified auxin treatment the response of Fls of triticale x wheat (Chinese spring with Ph suppressor) towards maize induced haploid induction was also obtained with CFF of 17.54 and EFF of 4.65 percent. The maize mediated haploid induction is proposed as a rapid technique for the genetic enhancement of triticale and wheat.

311. Ahuja, M.; Malhi, N.S. (Punjab Agricultural Unviersity, Ludhiana (India). Dept. of Plant Breeding and Genetics)). Genetic analysis of zenia effects in high oil maize lines. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 391-397 KEYWORDS: MAIZE; ZEA MAYS; GENETIC VARIATION; MAIZE OIL.

Twenty high oil inbred lines and three normal maize testers were mated in a Line xTester mating design and 60 crosses were developed to study the xenia effect of high oil inbred lines on the three normal maize testers and the gene action. Xenia analysis of F1 seeds along with the parents and checks was carried out. Mean squares due to parental seeds and F1 seeds were found significant for all characters. Additive gene action was found important for embryo weight and endosperm weight whereas dominance gene action was found important for protein content and in case of oil content both additive and dominance gene action were of equal importance. Six lines viz., L11' L12' L16' L17' L6 and L3 were observed to be good combiners for oil content along with tester T3. Oil content and protein content of the F1 seeds was higher than the check hybrid Buland. Ratio of endosperm weight/embryo weight of these F1 seeds was less than the check hybrid Buland. Present studies revealed that use of high oil pollinators lead to improvement in oil content of F1 seed.

312. Mallikarjuna, N.; Jadhav, D.R. (International Crops Research Institute for the Semi Arid Tropics, Patencheru (India)). Techniques to produce hybrid beween Cicer aritinum L. x C. pinnatifidum Jaub.. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 398-405 KEYWORDS: CICER ARIETINUM; CICER PINNATIFIDUM; HYDRIDIZATION.

Androgenesis has not been reported in chickpea (Cicer arietinum L.). Interspecific hybridization between C. arietinum and C. pinnatifidum was possible by hormoneaided pollinations, embryo rescue and tissue culture techniques to save aborting hybrid embryos. Since the hybrids did not have a good root system, hybrid shoots were grafted to cultivated

chickpea stocks. By this method it was possible to transfer hybrids to soil. Hybrid plants were fragile and were maintained in a growth room. Hybrid plants flowered only when the cytokinin zeatin (1 mg/l) was added to the sterilized tap water used to water the plants. Flowers were pale violet and cleistogamous. All of the components of the flower were present, although the anthers did not dehise. Anthers squashed in acetocarmine revealed from 4-10 divisions in many of the microspores. Induction of androgenesis is believed to be due to wide hybridization between C. arietinum and C. pinnatifidum.

313. Sreelatha, E.; Gowda, C.L.L.; Gour, T.B.; Sharma, H.C.; Ramesh, S.; Upadhyaya, H.D. (International Crops Research Institute for the Semi Arid Tropics, Patancheru (India). Global Theme-Crop Improvement)). Genetic analysis of pod borer (Helicoverpa armigera) resistance and grain yield in desi and kabuli chickpeas (Cicer atietinum) under unprotected conditions. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 406-413 KEYWORDS: CHICKPEAS; CICER ARIETINUM; DISEASE RESISTANCE; HELICOVERPA ARMIGERA; GENETIC VARIATION.

Half-diallel cross progenies of desi(45F1s and 45F2s) and kabuli (28F 1S and 28F 2S) chickpeas (Cicer arietinum) along with their parents (10 desi and 8 kabul/) with varying levels of pod borer resistance (PBR) were evaluated in replicated field trials under unprotected conditions during 2001-2002 post-rainy season at International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India to study the inheritance of pod borer, Helieoverpa armigera (Hub.), and grain yield. Additive genetic variation was important for the inheritance of PBR in desi chickpea. However, both additive and dominance genetic variations were important in the inheritance of PBR in kabuli chickpea. However, dominance genetic variation was predominant in the inheritance of grain yield in both des; and kabuli chickpeas. The correlation coefficient between general combining ability (gea) effects estimated based on data of F1 and F2 generations was fairly higher, while it was lower for specific combining ability (sea) effects, in desi chickpea for PBR. The correlation coefficient betwe~Q gea effects and between sea effects estimated based on F1 and F 2 generations' data for PBR in kabuli chickpea and for grain yield in des; and kabuli chickpeas were very low. Chickpea lines with significant gea effects for PBR and grain yield in desi and kabul; chickpeas were identified. The implications of study results are discussed in relation to strategies to enhance PBR and grain yield levels.

314. Yadav, M.K. (Rajasthan Agricultural University, Jobner (India). Dept. of Plant Breeding and Genetics); Raje, R.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics)). Response to selection in early segregating generation in fenugreek (Trigonella foenum-graecum L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 414-418 KEYWORDS: FENUGREEK; TRIGONELLA FOENUM GRAECUM; SELECTION.

Selected seven F 4 progeny families and the same number of corresponding F3 parent families were evaluated in paired rows in compact family block design with three replications, for primary branches per plant, pods per plant and seed per pod as an independent selection criterion in fenugreek. Out of the three selection criterion, highest realized selection response in percentage was recorded for pods per plant (34.76 pewrcent), and was followed by that for primary branches per plant and seeds per pod. The highest realized correlated response to selection for seed yield per plant was recorded under the selection criterion, primary branches per plant (25.89 percent), followed by that under selection criterion pods per plant (24.84 percent) and under seeds per pod (14.99 percent).

Thus the selection criterion, primary branches per plant and pods per plant were more efficient than the seeds per pod.

315. Muduli, K.C.; Misra, R.C. (Orissa University of Agriculture and Technology, Bhubaneswar (India). Dept. of Plant Breeding and Genetics)). Induced polygenic variability in M2 generation and its relationship with production of high yielding mutants in finger millet. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 419-425 KEYWORDS: FINGERMILLETS; ELEUSINE CORACANA; INDUCED MUTATION; GENETIC VARIATION.

Seeds of two finger millet varieties, VR 708 and GPU 26 were treated with three doses each of gamma rays (150, 300 and 450 Gy), ethyl methane sulphonate (0.15, 0.30 and 0.45 percent) and nitroso guanidine (0.015, 0.030 and 0.045 percent) in addition to two combination treatments of gamma rays 300 Gy + EMS 0.30 percent and gamma rays 300 Gy + NG 0.030 percent. The MI generation was harvested as treatment bulk and the M2 to M4 generations were raised. In M2 generation, most treatment populations exhibited reduction in population mean and increase in population variance for all the six traits studied and the magnitude of such changes varied with mutagens, their doses and the variety. In general, greater shift in mean and variance was observed in treatments with higher doses of NG and EMS in case ofVR 708 and higher doses of NG and combination treatments in case of GPU 26. Most mutagen treated populations showed wider range of variation than the parent variety and the variation was in both directions. Genetic advance estimates showed that selection in many M2 treatment populations would be effective in bringing about improvement in yield/plant and its direct components like tillers/plant, fingers/ear and finger length. Following selection among M2 plants and M3 progenies on the basis of higher yield, eight high yielding mutant cultures in VR 708 and nine mutants in GPU 26 were isolated in M4 generation. Vast majority of the high yielding M3 progenies and M4 mutant cultures were from the groups of M2 mutagenic treatments showing significantly higher population variance for yield/plant. Thus, selection of highyielding M2 plants and M3 progenies in mutagenic treatments with much increased M2 variance for yield would be effective in isolation of high yielding micromutant cultures.

316. Sharma, K.D.; Kumar, A. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy)). Genetic diversity for plant water relations, gaseous exchange, leaf anatomical characteristics and seed yield in cowpea under receding soil moisture. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 435-440 KEYWORDS: COWPEAS; VIGNA UNGUICULATA; GENETIC DISTANCE; PLANT WATER RELATIONS; SOIL WATER CONTENT.

Drought stress is the major constraint in cowpea grown on stored soil moisture conditions especially during the pod formation period. The long term sustainable and environmentally desirable solution is development of new varieties with drought tolerance. To generate information on the effect of receding soil moisture on physiological traits and yields would be helpful in identifying and developing drought-tolerant cowpea genotypes. A field experiment was conducted on 25 diverse genotypes of cowpea at CCS Haryana Agricultural University, Hisar. The genotypes were grouped on the basis of flowering initiation and the physiological observations were recorded during the flowering stage. Highly significant genotypic differences were detected between and within the group for physiological traits, biomass, yield attributes and seed yield. The early flowering genotypes

(Group-I) showed lower leaf water potential (LWP), higher leaf water content (RWC), canopy temperature depression (CTD) and photosynthetic rate (P J compared to medium (Group-II) and late (Group III) flowering genotypes. RWC and CTD were significantly associated with seed yield. RWC was also correlated with P N Therefore, the traits RWC and CTD, which are simple to measure, could be used for screening cowpea germ plasm for drought tolerance.

317. Bajpai, A.; Chandra, R.; Rajan, S.; Srivastava, N. (Central Institute for Subtropical Horticulture, Lucknow (India)). RAPD and minisatellite markers for genetic diversity and relationship in guava varieties. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 441-445 KEYWORDS: GUAVA; PSIDIUM GUAJAVA; RAPD; GENETIC MARKERS; GENETIC VARIATION.

PCR based Random Amplified Polymorphic DNA (RAPD) and Directed Amplification of Minisatellite DNA (DAMD) markers were used to study the genetic diversity and relatedness among 22 guava accessions comprising commercial cultivars, breeding lines 'and unimproved cultivars. DNA isolated by CTAB method was used for amplification of 96 markers by using 7 RAPD primers and 56 workers generated by 40 DAMD primers. Genetic distance matrix based on Jaccard's coefficient revealed maximum distance between Purple Guava and Allahabad Safeda (43 percent), whereas minimum distance was as low as 5.4 percent between two breeding lines HPSI-20 and HPSI-26. Interestingly half-sib progenies CISH-G-1 to CISH-G-6 had slightly more distance ranging from 10.8-24.0 percent. The clustering revealed that most of the cultivars/accessions originated from Indo-Gangetic plains are grouped together. DAMD was found to suitably cluster the cultivars from exotic origin or having exotic parentage.

318. Mishra, S.K. (National Bureau of Plant Genetic REsoruces, New Delhi (India). Germplasm Evaluation Div.); Sharma, B.; Tyagi, M.C.; Singh, B.B. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics); Basandrai, D.; Basandrai, A.K. (Himachal Pradesh Krishi Vishwa Vidyalaya, Dhaula Kuan (India). Regional Stn.); Singh, D.P. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India); Hegde, V. (Indian Agricultural Research Institute, Dharwad (India). Regional Stn.); Singh, B.B. Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics)). Screening of cowpea germplasm for field tolerance against biotic and abiotic stresses. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 446-448 KEYWORDS: COWPEAS; VIGNA UNGUICULATA; SELECTION; STRESS; TOLERANCE.

319. Patil, B.S.; Ravikumar, R.L. (University of Agricultural Sciences, Dharwad (India). Dept. of Genetics and Plant Breeding)). Genetic correlation between test environments and genotype ranking for moisture stress tolerance in sorghum (Sorghum bicolor L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 449-452 KEYWORDS: SORGHUM; SORGHUM BICOLOR; WATER TOLERANCE; GENETIC CORRELATION; GENOTYPES; ENVIRONMENT INTERACTION.

320. Amudha, K.; Thiyagarajan, K. (Tamil Nadu Agricultural University, Coimbatore (India). Centre for Plant Breeding and Genetics)). Genetic variability studies in physico chemcial and cooking characteristics of land races of rice grown in Nilgiris. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 453-455 KEYWORDS: RICE; ORYZA SATIVA; GENETIC VARIATION; CHEMICOPHYSICAL PROPERTIES.

321. Chauhan, J.S.; Meena, S.S.; Singh, K.H.; Meena, M.L. (National Research Centre on Rapeseed - Mustard, Bharatpur (India)). Effect of outcrossing on quality characteristics in Indian mustard (Brassica juncea L.). Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 459-462 KEYWORDS: INDIAN MUSTARD; BRASSICA JUNCEA; HYBRIDIZATION; QUALITY.

322. Yadav, Rajbir; Meena, S.S.; Singh, G.P.; Yadav, D.K. (National Research Centre on Rapeseed-Mustard, Bharatpur, Rajasthan (India). Host-insect interaction in Brassica against turnip aphid (Lipaphis erysimi). Indian Journal of Agricultural Sciences (India) v.78(2) p.155-158 KEYWORDS: BRASSICA; TURNIPS; LIPAPHIS ERYSIMI; ANTAGONISM.

The experiment was counducted during 2004-06 to study host-insect interaction in Brassica against turnip aphid (Lipaphis erysimi Kalt). Factorial analysis of variance showed that aphid population collected form taramira (Eruca sativa Miller) differed significantly in its behavior form the other 5 populations of aphid. Other 5 populations of aphid were similer in their infestation and multiplication on all the tested species of Brassica. Eruca sativa and Sinapis alba carried significantly less number of aphids than other four species under contined conditions and has antibiosis against Lipaphis erysimi. Ethiopin mustard (Brassica carinata) and gobhi sarson (Brassica napus) showed antixenosis only.

323. Gupta, G.P.; Birah, Ajanta; Rani, Seema (Indian Agricultural Research Institute, New Delhi (India). Growth-inhibitory effects of winged bean (Psophocarpus tetragonolobus) proteinase inhibitors on two problematic lepidopteran pests. Indian Journal of Agricultural Sciences (India) v.78 (2) p.159-162 KEYWORDS: PSOPHOCARPUS TETRAGONOLOBUS; SPODOPTERA LITURA.

A laboratory study conducted during 2004-05 showed that winged bean (Psophocarpus tetragonolobus L. DC) proteinase inhibitors inhibited the growth and development of Helicoverpa armigera (Hubner) and Spodoptera litura (Fab). It affected the larval and pupal survival and adult emergence in a dose-dependent manner. larval-pupal intermediates and malformed adults were also observed. At higher dose of winged bean proteinase inhibitors (4.5 trypsin inhibitor units/g of diet), 44.1. of H. armigera and 50. of S. litura could only survive. There was no fecundity at this dose, however, at its lower dose less fecundity. The growth and development indices reduced form 5046 (control) to 3.53 (proteinase inhibitors fed) and 2.84 to 1.36 in H.armigera and their values in S. litura reduced form 5.55 to 5.0 and 3.0 to 1.44 respectively.

324. Nagarajan, Shantha; Anand, Anjali; Chaudhary, H.B. (Indian Agricultural Research Institute, New Delhi (India). Response of spring wheat (Triticum aestivum) genotypes under changing environment during grain filling period. Indian Journal of Agricultural Sciences (India) v.78(2) p.177-179 KEYWORDS: TRITICUM AESTIVUM; GENOTYPES; SEED FILLING.

Twenty diverse wheat (Triticum aestivum L. emend. Fiori and Paol) genotypes were grown in field for two consecutive season during 2002-04 as normal sown crop at IARI farm, New Delhi. The first season was normal cool winter and the second seasion was characterized by sudden increase in temperature during active grain filling period that raised the mean maximum and minimum temperatures by 7 and 6 degree C respectively. Grain yield varied between 276 and 570 g/m2 in the cool seasion and between 204 and 419 g/m2 in the hot seasion. The adapted genotypes escaped the heat by maturing early and

compensated the reduced grain growth period by enhanced grain growth rate or tolerated the heat stress with minimum change in their grain growth duration and grain growth rate as compared to cool seasion. Most of the genotypes that had low susceptibility to high temperature stress were potentially low yielding types and these genotypes if combined with high yield potential will perform well under both optimum as well as heat shock conditions as it happened in the second year trial.

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325. Kalaiyarasan, S. (Tamil Nadu Agricultural University, Vellore (India). Agricultural Res. Stn.); Palanisamy, S.) (Tamil Nadu Agricultural University, Coimbatore (India). Dept. of Entomology). Comparative biology of sesame pod bug, Elasmolomus sordidus Fabricius on Sesamum indicum and Cleome viscosa. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 101-105 KEYWORDS: BIOLOGY; SESAME; ELASMOLOMUS; SESAMUM INDICUM.

The studies on biology of Elasmolomus sordidus both on Sesamum indicum and an alternate weed host Cleome viscosa were carried out at Agricultural Research Station, Virinjipuram. The biology of insects on two host showed significant difference in the development. While the incubation period, nymphal period and nymphal mortality were lesser, the hatchability and the nymphal survivability were greater on S. indicum than on C. viscosa. The oviposition period and fecundity of female bugs were higher on S. indicum. On both the hosts the males outlived the females. However the adult longevity of both male and female was significantly higher on sesame indicating that sesame was the most preferred host.

326. Reshi, Shabir A.; Azim, M. Nayyar (University of Kashmir, Srinagar (India). Dept. of Zoology). Studies on some aspects of biodiversity of cyrtacanthacridini (Orthoptera: Acrididae) of Kashmir, Himalayas. Annals of Plant Potection Sciences. v.16(2) p.393-395 KEYWORDS: BIODIVERSITY; ORTHOPTERA; ACRIDIDAE.

Four genera of the tribe Cyrtacanthacridini were reported for first time from Kashmir, India. Key to these genera along with their diagnostic characters were given distribution and habitat of all the species studied were mentioned.

327. Subharani, S. (Institute of Bioresources and Sustainable Development, Imphal (India); Singh, T.K. (Manipur University, Canchipur (India). Biological studies of Plume moth, exelastis atomosa wals. on Cajanus cajan (L.) millsp. Annals of Plant Protection Sciences (India) v.16(2) p.367-369. KEYWORDS: BIOLOGY; CAJANUS CAJAN.

The mean longevity adult was 6.59+-0.38 days. The average number of egs laid bay an adult femail was 93 to 101 egges hatched in 2.92 to 3.02 days. There were five larval instars witch took 23.12+-0.93 days to enter into pupal stage. Pupation took place on pod surface or entrance of hole or in the burrow of infested pods and the pupal period lasted for about 7.97+-0.33 days. The life cycle of E. atomosa was completed in 40to 42 days.

328. Hemchandra, O.; Singh, T.K. (Manipur University, Canchipur (India). Biology and bionomics of brachymeria excarinata gohan, a pupal parasitoid of Plutella xylostella L. on cauliflower. Annals of Plant Protection Sciences (India). v.16(2) p.363-366. KEYWORDS: BRACHYMERIA; PLUTELLA XYLOSTELLA; PARASITISM.

The endoparasitic stages (egg to pupal) and adult periods were lasted 18.24+-0.37 and 10.85 +-0.75 days, respectively. Under laboratory conditions, the parasitoid completed its life cycle in 29.09+-1.13 days and the females survived longer than males. A female parasitoid usually laid egg an average of 20.05+-0.85eggs. The pupal mean population ranged from 5to70. . The mean level of parasitisation ranged from 9.38 to 55.85 and was positively correlated with the increase of DBM population. Among the abiotic factors, temperature and sunshine showed positive significant influence on the parasitoid activity. The percentage of parasitisation also increased the late stage of cropping season.

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329. Kumar, R.V.; Tripathi, Y.K.; Yadav, V.P.; Ahalawat, S.P.; Gupta, V.K. (National Research Center for Agroforestry, Jhansi (India)). Oil percentage in Jatropha curcas L. germplasm of National Agroforestry Repository. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 463-466 KEYWORDS: JATROPHA CURCAS; OILS.

330. Kamakshi, N.; Srinivasan, S. (S.V. Agricultural College, Tirupati (India). influence of certain bio-physical factors on incidence of pod borer complex in selected genotypes of field bean. Annals of Plant Protection Sciences (India). v.16(2) p.407-409. KEYWORDS: LABLAB PURPUREUS; HELICOVERPA ARMIGERA.

Five plant parameters viz., pod length, pod width, trichome density, thickness and toughness of the pod were studied in nineteen selected genotypes of field bean which influenced the incidence of pod borer complex. Based on field incidence, HA-4 (white) was identified as a resistant genotype. Pod length and pod width were least in (4.51x0.75cm, respectively) in HA-4 genotype. The susceptible cultivar (USA GP 36 (12-1) FBKO2) had least number of trichomes on pod. Rind thicknes and pod toughness showed a negative correlation with pod damage. The susceptible genotype, GA 2-27, possessed lowest rind thickness (0.72mm), lest pod toughness (0.75 kg cm-1)as compared to resistant genotype, HA-4(white) (1.42mm$0.85 kg cm-2) respectively.

331. Dhawan, R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy); Singh, R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Regional Research Station); Dhawan, A.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Regional Research Station); Dhindsa, J.P.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Regional Research Station). Isoproturon induced changes in peroxidase and catalase enzymes in susceptible resistant biotypes of Phalaris minor Retz. Indian Journal of Plant Physiology (India) v. 13(3) p. 217-223 KEYWORDS: CATALASE; ISOPROTURON; PEROXIDASES; PHALARIS; ENZYMES.

Peroxidase and catalase activity was studied in isoproturon susceptible and resistant populations of P.minor with a view to observe differences in innate capacity of different populations under/herbicide stress. Resistant populations differed from susceptible populations in exhibiting higher acitivity of these enzymes at the seedling stage. Isoproturon spray caused increase in peroxidase acivity in the susceptible biotypes 5 days after spray. Catalase activity remained low in the sprayed susceptible biotypes. Unsprayed susceptible and resistant biotypes did not differ in isoenzyme pattern of these enzymes. Sprayed resistant plants differ from sprayed susceptible plants in continued presence of

isoperoxidases at Rfs 0.32 and 0.36 at 5 days of sampling and at Rfs 0.28, 0.30 and 0.58 at 10 days of sampling.

F61 Plant Physiology - Nutrition

332. Yaligar, Raghavendra; Nandihalli, B.S. (University of Agril Sciences, Dharwad (India). Dept. of Agril Entomology); Reddy, N. Aswathanarayana (Zonal Agricultural Research Station, Mudigere (India). Management of coconut perianth mite, accria guerreronis keifer through plant nutrition. Annals of Plant protection Sciences (India) v.16(2) p.294-297 KEYWORDS: NUTRIENT AVAILABILITY; PLANT NUTRITION; COCOS NUCIFERA; ACERIA GUERRERONIS.

The study revealed that soil application of Murate of Potash (1.5kg)+ MgSO4 (0.5 kg) + borax (50g) + gypsum (1.0 kg) + recommended dose of fertilizer 91.3 kg N + 2kg P + 2kg K) found to be superior in reducing mite population with low damaged nuts (33.6.) with highest number of healthy marketable nuts (43/palm), total number of nuts (88 nuts/palm) highest C:B ratio was recorded (1:2.53) compared to all other treatments. The treatment COT+RDF recorded lowest number of nuts/palm with highest mite population and damaging score over other treatments.

333. Kumar, P. (Central Potato Research Institute, Modipuram (India); Trehan, S.P. (Central Potato Research Institute, Shimla (India); Singh, B.P.; Rawal, S.; Khan, A. (Central Potato Research Institute, Modipuram (India). Precising nitrogen requirement of table potato (Solanum tuberosum) cultivars for different growth periods. Indian Journal of Agronomy (India) v. 52(4) p. 314-317 KEYWORDS: POTATOES; SOLANUM TUBEROSUM; NUTRITIONAL REQUIREMENTS; NITROGEN.

A field experiment was conducted for 3 consecutive seasons (2004-2007) at Modipuram to optimize the growth period-specific N requirements of table potato cultivars 'Kufri Pukhraj' and 'Kufri Anand' in sandy loam soils. Growth, yield and economic parameters of both the genotypes were evaluated for their response to 4 N levels (0, 90, 180 and 270 kg/ha) and 2 growth periods (75 and 110 days). The crop-growth traits and tuber number were not influenced due to harvest stages; however, tuber yield was 31.3% higher with extended duration (110 days). N application had favourable effect on growth parameters, but showed quadratic response to marketable and total tuber number/ha. Likewise, it showed steady increase in marketable and total tuber yields. Agronomic N-use efficiency (118.6-66.0 kg tubers/kg N applied) decreased linearly with increase in N levels. 'Kufri Anand' recorded better growth than 'Kufri Pukhraj', but tuber number and yield as well as economic variables were statistically similar in both the cultivars. Net income and benefit: cost (8: C) ratio indicated that both the cultivars should be fertilized with 270 kg N/ha when harvested at 110 days, but 180 kg N/ha is sufficient when harvested at 75 days.

F62 Plant Physiology – Growth and Development

334. Singh, S.; Mishra, S.K.; Kumar, J.; Yadav, S.S.; Kumar, M. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics). Diversity in seed protein pattern of chickpea genotypes and its wild relatives. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 132-138 KEYWORDS: CHICKPEAS; GENOTYPES; SEED.

Electrophoretic pattern of twenty cultivated and wild genotypes of chickpea were subjected to Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis (SDS-P AGE) analysis. The similarity index (51) was calculated to establish diversity. The 5.1. values rangedJrom 80.0-98.4 percent among the cultivated species piz., Cicer arietinum L. The 5.1. Value of Cicer arietinum L. with Cicer microphylum L. (88.9 to 97.4 percent) was higher than with Cicer arietinum L. (81.1 to 92.percent). Cicer microphylum L. may be the immediate progenitor of cultivated chickpea as evidenced by divergence index (DI) in seed protein pattern.

335. Pathak, P.K. (Zhejiang University, Hangzhou (People's Republic of China. Dept. of Agronomy)). Dynamic mapping QTLs for rice seeding growth. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 366-372 KEYWORDS: RICE; ORYZA SATIVA; SEEDINGS; QUANTITATIVE ANALYSIS.

QTLs associated with growth of rice seedling were mapped using a doubled-haploid (DH) population derived from a cross between lowland indica variety, IR64 and upland japonica variety, Azucena. Age-specific measures on seedling growth parameters such as seedling height, root depth, seedling weight, recorded at seven days interval, starting from 16th day of sowing, were used to detect the QTLs. A QTL mapping technique termed as 'conditional mapping' has been described and the utility of the technique has been illustrated. Altogether 11 QTLs each for seedling height and root depth and 10 QTLs for seedling weight were detected. The number of QTLs varied according to stages of growth indicating age-specific action of QTLs. The number of QTLs detected by conventional mapping at different stages of observation varied between 4 to 7 for seedling height and 2 to 4 for root depth and seedling weight with few QTLs for all the traits appearing consistently over the stages of observation. The conditional mapping technique allowed detection of three QTLs for seedling height and four QTLs each for root depth and seedling weight which remained undetected by the conventional mapping technique.

F63 Plant Physiology - Reproduction

336. Jyothilakahmi, V. (Institut fur Allgemeine Botanik und Pflazenphysiologie, Jena (Germany); Singh, A.; Gaikwad, K. (Indian Agricultural Research Institute, New Delhi (India). National Research Centre for Plant Biotechnology); Vinod (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics); Singh, N.K.; Tomar, S.M.S. (Indian Agricultural Research Institute, New Delhi (India). National Research Centre on Plant Biotechnology)). RNA editing in CMS wheat: influence of nucelar background leads to differential editing on orf 256. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 353-359 KEYWORDS: CYTOPLASMATIC MALE STERILIGY; NUCLEOTIDE SEQUENCE; WHEAT; TRITICUM AESTIVUM.

RNA editing and cytoplasmic male sterility are two important and correlated phenomenons in mitochondria of higher plants. We investigated the occurrence of RNA editing in ort 256, which is implicated in causing male sterility in wheat in two different CMS lines carrying different cytoplasms along with their fertility restored lines. This study provides the first preliminary report of RNA editing in ort 256 with greater frequency observed in a fertility-restored line compared to male sterile line carrying the T. timopheevi cytoplasm. ln order to investigate whether a similar process occurs in a line carrying the T. araraticum cytoplasm, it was observed that the male sterile line showed a complete lack of

editing in ort 256 whereas in the restored hybrids there was an increase in frequency of editing. Editing sites were also found conserved in both the hybrids at 381 position of C residue indicating the non random nature of editing especially under different nuclear backgrounds. Thus RNA editing might be involved in either causing male sterility or restoration of fertility in these two systems suggesting that a common mechanism may exist in these two different cytoplasms.

H10 Pests of Plants

337. Bairwa, D.K.; Kanwat, P.M.; Kumawat, K.C. (S.K.N. College of Agriculture, Jobner (India). Dept. of Entomology). Effect of dates of sowing on the incidence of Jassids, whiteflies and shoot and fruit borer of the okra. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 110-112 KEYWORDS: INSECTS INJURIOUS TO PLANTS; SOWING DATE; OKRA; ALEYRODIDAE INSECT.

Four dates of sowing vizo, July 7, July 14, July 21 and July 28, 2000 were tried to find out the appropriate dates of sowing in relation to insect-pest incidence. The data on jassid and whitefly revealed that there was minimum population on the early sown crop (7th July) which increased gradually with the delayed sowing dates. The increase in infestation of the shoot and fruit borer and decrease in yield of okra fruit was recorded with the advancement of sowing time.

338. Yadav, S.P.; Goyal, N.P.; Nath, A.; Gupta, J.K. (Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni (India). Dept. of Entomology). Effect of storage of honey for different periods at different temperatures on the HMF contents of Indian honey. Annals of Biology (India). (Dec 2007) v. 23(2) p. 195-200 KEYWORDS: HMF; CELLULOSE PRODUCTS; HONEY; PERIODICITY; STORAGE; TEMPERATURE.

Determination of hydroxymethylfurfural (HMF) was carried out on 58 honey samples of Himachal Pradesh and adjoining area of Haryana and Punjab, India. The effect of different storage periods at different temperatures in the appearance of HMF in different honey samples was also studied. Fiehe's test was negative for HMF in case of all the fresh honey samples. It was also observed negative at 22:13°C upto 345 days of storage. However, it was positive after 210 to 345 days of storage at 40°C. The quantity of HMF was found in increasing order (56.23 to 124.95 ppm) at 40°C upto 2 [0 to 345 days of storage. The fresh honey of Himachal Pradesh and that of adjoining areas of Haryana and Punjab was found safe for consumption.

339. Phogat, S. (Kalpana Chawla College of Education, Hisar (India); Seema (Meerut College, Meerut (India). Dept. of Chemistry); Yadav, B.S. (D.N. College, Meerut (India). Dept. of Chemistry). Nematicidal activity of some synthesized nitrone compounds . Annals of Biology (India). (Jun 2008) v. 24(1) p. 63-66 KEYWORDS: NEMATODA; NITROGEN; HETEROCYCLIC COMPOUNDS; AGARICUS BISPORUS; EDIBLE FUNGI.

Reaction of each of phenylhydroxylamine, p-chlorophenylhydroxylamine, m-chlorophenylhydroxylamine, and p-tolylhydroxylamime with 3, 4, 5-trimethoxybenzaldehyde, vanillin and ethylvanillin, respectively, resulted in the synthesis of 12 nitrone compounds. The synthesized compounds were tested for their nematicidal activity against Ditylenchus myceliophagus following poison-bait technique. The radial mycelial growth of the fungus Agaricus bisporus with compounds p-dimethoxyphenyl)-N-(p-

chlorophenyl) nitrone (VI) and C-(3, 4, 5-trimethoxyphenyl)-N-(p-chlorophenyl) nitrone (X) had the minimum colony diameter and suppressed the fungal growth by 39.12 and 43.02 percent, respectively, as compared to untreated control. The presence of methoxy group at 3 and 4 position in the C-pnenyl ring and Cl at the 4-position in N-phenyl ring was most toxic to the growth of A. bisporus. The effect on the population build up of D. myceliophagus was significantly reduced for compounds with-CH3 group in N-phenyl ring at 4th position.

340. Sofi, A.M.; Malik, G.N.; Dar, H.U.; Malik, M.A.; Farooq, M. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Dif. of Sericulture). Analysis of genetic variability and character association in bivoltine silkworm (Bombyx mori L.) and their hybrids. Indian Journal of Genetics and Plant Breeding (India). (May 2005) v. 65(2) p. 147-148 KEYWORDS: SILKWORMS; BOMBYX MORI; GENETIC VARIATION; HYBRIDS.

341. Chaudhari, B.N.; Patil, C.S.; Ghorpade, S.A.; Chandele, A.G. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Toxicity of insecticides against helicoverpa armigera on cotton in Maharashtra. Annals of Plant Protection Sciences. v.16(2) p.298-301. KEYWORDS: TOXICITY; INSECTICIDES; PEST INSECTS.

Bioassay of five insectcides viz., fenvalerate, cypermethrin, quinalphos, carbaryl and endosulfan were undertaken in laboratory against populations of helicoverpa armigera collected form known pesticide usage locations in Maharashtra. The log dose probit assays indicated that H. armigera population form Amalner with heavy pesticide usage area recorded higher LD50 values compared to Madha population representing low pesticide usage area. Irrespective of locations, fenvalerate was most toxic to H. armigera followed by cypermethrin, Endosulfan was lest toxic to H. armigera.

342. Kumar, Arvind; Singh, C.P. (G.B. Pant University of Agriculture and Technology, Pantnagar (India). Population dynamics of Papilio demoleus linn. on Psoralea corylifolia in tarai Uttarakhand. Annals of Plant protection Sciences (India) v. 16(2) p.370-372 KEYWORDS: PAPILIO; PSORALEA CORYLIFOLIA.

It is observed that population and infestation of Papilo demoleus appeared from 14th August to 27th November (3 to 18 WAT) the highest population and infestation observed 0.5/plant and 44.0, respectively.The population and infestation were also influenced weather parameters.

343. Dhaman, S.C.; Bhardwaj, Man Mohini Hira (M.S. P.G. College, Saharanpur (India). Host and pest relationship, host specificity and orientation towards food of physopelta schlanbuschii (Heteroptera: Pyrrhocoroidea : Largidae). Annals of Plant Protection Sciences (India) v.16(2) p.373-376. KEYWORDS: PEST CONTROL; HOSTS.

Physopelta schlanbuschii, a phytosuccivorous bug fed mainly on Trivea nudiflora bark and seeds and provided fat, carbohydrate and some amount of protein to the bug. Besides this bug population feeds on other host plants to meet the demand of water, minerals and amino acids. Food perference studies revealed that among a good number of food plants, it had preferential feeding on T. nudiflora.

344. Marmit, Kamal S.; Meena, Vijay P.; Sharma, Suman L. (University of Rajasthan, Jaipur (India). Quantitative estimation of phenolics and related enzymes in insect induced leaf galls

of Mangifera Indica. Annals of Plant Protection Sciences (India) v.16(2) p.306-308 KEYWORDS: MANGIFERA INDICA; INSECTA; PHENOLIC COMPOUNDS.

Amradiplosis allahabadensis, an insect of order-diptera induced galls on leaf of Mangifera indica. Quantitative estimation of phenolices and related enzymes in insect leaf galls of Mangifera indica were studied. The contents of total phenols, o-dihydroxy phenol, peroxidase and polyphenol oxidase activities in leaf galls and normal counter parts of M. indica were measured. Total phenols o-dihydroxy phenol and peroxidase were recorded higher in gall tissue while polyphenol oxidase activities were recorded higher in normal counter parts as compared gall tissues.

345. Kamakshi, N.; Srinivasan, S.; Muralikrishna, T.; S.V. (Agricultural College, Tirupati (India). Influence of biochemical constitunts on incidence of pod borer complex in selected field bean genotypes. Annals of Plant Protection Sciences (India) v.16(2) p.302-305 KEYWORDS: DEFENCE MECHANISMS; LABLAB PURPUREUS; GENOTYPES.

Seven biochemical constituents viz. proteing, reducing sugars, phenols, tannins, crude fiber, silica and fat were studied in relation to expression of varietal reaction against borer complex in 19 selected genotypes of field bean.Of the various biochemical components, protein content and reducing sugar exhibited significant positive correlations with pod damage by deferent pod borers in the different genotypes. The most susceptible genotype, GA 2-27 with 49% damage had comparatively high amount of proten content (27.5.) and reducing sugars (1.13 mg g-1), while the resistant genotype (HA-4, white) had less content of protein 20.1. and sugars 0.60 mg g-1. The correlation coefficients between total phenols/tannins/fiber/silica/fat in pods and pod damage due to pod borers were negative and significant. The genotype HA-4 (white) had comparatively high amount of phenols (1.79 mg g-1), tannins (1.23 mg g-1), fiber (16.9.) and silica (0.7).

346. Srivastava, Chitra (Indian Agril. Res .Inst., New Delhi (India); Sinha, S.N. (Indian Agril. Res .Inst., Karnal (India). Regional Station). Suseceptibility of Callosobruchus sp. collected from various NSP centres to insecticides . Annals of Plant Protection Sciences (India) v.16(2) p.337-340 KEYWORDS: INSECTA; CALLOSOBRUCHUS.

Susceptibility of pulse beetles Callosobruchus and maculatus and C. analis collected form different national seed programme centers was studied against commonly used insecticides viz., malathion, dichlorvos and deltamethrin. insects form different populations were found to be susceptible to deltamethrin. toxicity of malathion was decreased to some population of C. maculatus. All populations showed highest susceptibility for deltamethrin and lest to dichlorvos.

347. Nigam, V.D.; Sharma, R.C.; Ali, S. (N.D. University of Agriculture and Technology, Faizabad (India). Evaluation of rice germplasms at different cropping stages for resistance to cnaphalocrocis medinalis. Annals of Plant Protection Sciences (India) v.16(2) p.333-336 KEYWORDS: CNAPHALOCROCIS MEDINALIS; ORYZA SATIVA; PEST CONTROL.

Twenty five rice germplasms were tested and six germplasms viz., IET 13310, NDR 6023, IET 10649-1, Mahsuri, NDR 6232 and NDR 6175 showed a consistent damage rating of 1. Among the plant morphological characters studied, number of tillers, plant height (cm), number of leaf, leaf width (cm) and leaf texture, only leaf width (cm) showed significant correlation with leaf folder infestation. Majority of the germplasms which had damage rating of 1 and 3 had rough texture.

348. Prakasam, V.; Singh, R.P. (G.B. Pant Univ. of Agriculture and Technology, Pantnagar (India). Mushroom Research Training Centre). Cultural and morphological characterization of Agaricus bisporus strains. Annals of Plant Protection Sciences (India) v.16(2) p.454-457 KEYWORDS: AGARICUS BISPORUS.

Cultural and morphological variations of seven strains of Agaricus bisporus (CM-1, CM-5, CM-10, Delta, S-130, S-140 and X-13) and a strain (NCB-13) of A.bitorquis were studid on the basis of growth on MEA medium, syntheetic compost and casing soil and different characters of their fruiting body. S-130 showed maximum growth on MEA medium, compost and casing soil whereas NCB-13 produced higher fruit body weight and stipe width. Lesser stipe length and maximum pileus diameter were observed in strain delta. Maximum pileus thickness was observed in CM-5. these informations generated in the present study will be useful in breeding programmes to develop high yielding strains of button mushroom.

349. Singh, D.K.; Singh, Ram; Dwivedi, R.K. (C.S.A. University of Agri. & Tech., Kanpur (India). Evaluation of bio-pesticides against lepidopterous pests of cabbage. Annals of Plant Protection Sciences (India) v.16(2) p.316-319 KEYWORDS: PESTICIDES; CABBAGES; PESTS.

Bacillus thuringiensis var. kurstaki formulation viz. delfin, dipel halt, biobit, biolep, bioasp, botanical insecticide neemgold, nematode (steinernema feltiae), green commandos and endosulfan insecticide were evaluated against lepidopterous pests of cabbage under field conditions. Delfin was very effective in reducing the population of cabbage leaf webber, crocidolomia binotalis (67.6) and diamond back moth, plutella xylostella (57.1.). Dipel was equally effective against these pests and recorded 67.4 and 56.2% reduction, respectively. Endosulfan proved to be effective against tobaco caterpillar spodoptera litura, witch recorded 55.45 reduction. All the test insecticides were found to be safe and did not show adverse effect on coccinellid population under field conditions.

H20 Plant Diseases

350. Ashtaputre, S. (Agricultural Research Station, Devihosur (India); Kulkarni, S. (University of Agricultural Sciences, Dharwad (India). Dept. of Plant Pathology); Shivaprasad, M. (Agricultural Research Station, Devihosur (India); Rao, M.S.L.; Kulkarni, V.R. (University of Agricultural Sciences, Dharwad (India). Dept. of Plant Pathology); Mohankumar, H.D. (Agricultural Research Station, Devihosur (India). Survey and surveillance for the incidence of powdery mildew of chilli in northern Karnataka. Annals of Biology (India). (Dec 2007) v. 23(2) p. 177-183 KEYWORDS: CHILLIES; MORBIDITY; MIDLEWS; DISEASE SURVEILLANCE; DISEASE SURVEYS; KARNATAKA; LEVEILLULA.

Survey conducted for the incidence of powdery mildew of chilli in northern Karnataka for two years revealed the maximum disease severity of powdery mildew in Bellary and Gulbarga districts, where chilli crop was grown under irrigated condition. However, less disease severity was recorded in rainfed chilli growing areas compared to irrigated areas. The disease intensity depends on factors like location, cultural practices, followed by susceptibility of the cultivars grown, the microclimate congenial for disease progress and meteorological factors like temperature, relative humidity and rainfall. The higher incidence of powdery mildew during kharif 2005 may be attributed to the temperature and relative humidity prevailing during the crop period was favourable for disease development and spread.

351. Ashtaputre, S. (Agricultural Research Station, Devihosur (India); Kulkarni, S. (University of Agricultural Sciences, Dharwad (India). Dept. of Plant Pathology); Shivaprasad, M. (Agricultural Research Station, Devihosur (India); Rao, M.S.L. (University of Agricultural Sciences, Dharwad (India). Dept. of Plant Pathology); Mohankumar, H.D. (Agricultural Research Station, Devihosur (India). Histopathological studies of powdery mildew of chilli. Annals of Biology (India). (Dec 2007) v. 23(2) p. 185-189 KEYWORDS: PLANT DISEASES; CHILLIES; MILDEWS; HISTOPATHOLOGY; LEVEILLULA; POLYSACCHARIDES; PROTEIN CONTENT; NUCLEIC ACIDS.

The histological study of powdery mildew infected and healthy leaves of chi Ili revealed that the microtome sections of healthy leaves showed thick and intact epidermal layer with cylindrical palisade and parenchyma cells. Whereas in diseased leaf microtome sections, the upper and lower epidermis were disintegrated but not intact. The cells were irregularly distributed, and disintegration of stomata and damaged cuticle were also observed. Histochemical studies revealed that the concentration of polysaccharides, proteins and nucleic acids differed between healthy and diseased leaf tissues. Healthy tissues exhibited medium to rich concentration of polysaccharides, total proteins and nucleic acids, while the reduction of insoluble polysaccharides, total proteins and nucleic acids in diseased leaf tissues was observed during the present study under report. The pathogen depleted the host leaf tissues of these important metabolites due to fast degradation i. e. varied metabolism.

352. Parashar, Anamika; Lodha, Payal (University of Rajasthan, Jaipur (India). Quantification of total carbohydrates and related enzymes in ramularia blight infected fennel plants. Annals of Plant Protection Sciences (India) v.16(2) p.438-440 KEYWORDS: PATHOGENESIS; RAMULARIA; FOENICULUM VULGARE; CARBOHYDRATES.

Quantification of carbohydrates and their related enzymes was studied in fennel (Foeniculum vulgare) infected with Ramularia foeniculi causing blight disease. The content of total carbohydrates and their related enzymes were recorded in healthy and diseased counter parts. Different plant parts showed varation in their sugar contents, total soluble sugars and reducing sugars were recorded higher in blight infected plant parts while starch contents were recorded lower in infected plant parts. A mylase and invertase activity were recorded higher in blight infected plant then healthy counter parts.

353. Deepak (Rajasthan Agril. Uinv., Jodhpur (India). Agril. Res. Station. AICRP on Pearl Millet); Arora, D.K. (University of Rajasthan (India); Saran, P.L.; Lal, G. (Rajasthan Agril. Uinv., Jodhpur (India). Agril. Res. Station. AICRP on Pearl Millet). Evaluation of cumin varieties against Bilight and Wilt disease with time of sowing. Annals of Plant Protection Sciences (India) v.16(2) p.441-443 KEYWORDS: MORBIDITY; CUMINUM CYMINUM; SOWING DATE; WILTS.

Cumin plants with age ranging from 20 to 75 days indicated that period of 10 weeks from sowing was favourable for initiation and further spread of the blight disease. The wilt disease symptoms appeared when the crop was 08 week old from the date of sowing. The lowest blight and wilt disease incidence was observed in December month sown crop with 75% R.H. The highest blight and wilt disease incidence was observed in October month sown crop with 65% R.H.

354. Johnson, M.; Reddy, P. Narayan (Agricultural Research Station, Anantapur (India); Reddy, D. Rajaram (ANGRAU, Hyderabad (India). Effective management of stem root of groundnut through application of Pseudomonas Fluorescens. Annals of Plant Protection Sciences (India) v.16(2) p.428-432 KEYWORDS: ARACHIS HYPOGAEA; PSEUDOMONAS FLUORESCENS; CORTICIUM; TRYPTOPHAN.

The treatments involving Pseudomonas Fluorescens with or without tryptophan along with and without FYM were superior in decreasing the stem rot incidence (22.8 $ 25.2.). In addition, the same treatments gave increased pod (1441 $1372 kg ha-1) and haulm yield (3045 $ 2953 kg ha-1) besides decreasing pods left over in soil (118 $117 kg ha-1) and leaf drop (259 $280 kg ha-1) then other treatments.

355. Singh, A.K. (I.G. Agril. Univ., Raipur (India); Singh, Ajit K. (Dhanuka Agritech Ltd., New Delhi (India); Singh, Mandvi; Singh, Jitendra; Singh, S.P. (C.S.A. University of Agriculture and Technology, Kanpur (India). Bio-intensive management of soilborne diseases of sunflower. Annals of Plant Protection Sciences (India) v.16(2) p.433-437 KEYWORDS: ANTAGONISM; CONIOTHYRIUM; HELIANTHUS; TRICHODERMA VIRIDE.

In virto all the bio-agents were able to inhibit of test organisms where Trichoderma viride exerted maximum against Pythium aphanidermatum (27.8.), Rhizoctonia solani (38.2.)sclerotinia sclerotiorum (33.4.) and sclerotiorum rolfii (36.9.). Under pot conditions, maximum seed germination, shoot and root length were observed in those tritement where formulation of T.veride was applied except for S. sclerotiorum. Maximum reduction in disease severity (17.1.) and higher yield (13.52q/ha) were observed when seeds were treated with a combination of T.viride (4 g/kg seed)+ vitavax (1 g/kg seed). T.viride (2.5kg) alon as a soil applicant gave maximum reduction in disease severity (20.0.) with maximum reduction in disease severity (20.0.) with maximum yield (13.5q/ha).

356. Bardia, P.K. (S.K.N. College of Plant Pathology, Jobner (India); Rai, P.K. (S.V.B. Patel University of Agriculture and Technology, Meerut (India). Variability in Fusarium oxysporum f. sp. Cumini causing cumin wilt. Annals of Plant Protection Sciences (India) v.16(2) p.444-448 KEYWORDS: WILTS; CUMINUM CYMINUM; FUSARIUM OXYSPORUM.

A total six isolates of fusarium oxysporum f.sp.cumini, isolated from different cumin growing areas of Rajasthan, had cultural and morphological variability on different agar and broth media. Significant varsion in mycelial growth and conidia formation was observed on different media. Maximum mycelial growth (8.16cm) and conidia formation was observed on Czapek Dox agar followed by PDA. highest fungal biomass (246.87 mg) was observed with Czapek Dox broth followed by PDB (233.66mg). Pathogenic variability was also observed among the isolates. Isolate A3 was found moist virulent showing 8.0 wilt incidence on 4th day of inoculation followed by isolate A5. Isolate A2 was found least virulent as wilting appeared on 9th day of inoculation.

357. Tiwari, P.K.; Thrimurty, V.S.; (Rajasthan Agril. Uinv., Jodhpur (India). Agril. Res. Station. AICRP on Pearl Millet); Dantre, R.K. (Indira Gandhi Agricultural Univ., Raipur (India). Dept. of Plant Pathology). Influence of temperature, concentration, fumigation and organic amendment on plant growth promoting efficacy of Pseudomonas fluorescenns. Annals of Plant Protection Sciences (India) v.16(2) p.449-453 KEYWORDS: PSEUDOMONAS FLUORESCENS; TEMPERATURE; FUMIGATION; ORGANIC AMENDMENTS; PLANT GROWTH SUBSTANCES.

Preconditioning of Pseudomonas fluorescens at 40, 35 and 300C temperatures for 48 and 72 hours were found increasing plant growth promoting efficacy. Influence of different concentrations on plant growth promoting efficacy were also studied by using P. fluorescens as seed treatment. The dilutions starting from 10-1 to 10-8 significantly increased the growth of rice seedling over control. The bacterial inoculums applied under fumigated conditions as seed dressing or soil application sifnificantly increased the growth of rice seedling over non-fumigated conditions. P. fluorescens growth promoting performance was recorded superior with FYM amended soil over unamended soil.

358. Usharani, S,; Sujaritha, A.; Christopher, D.John (Annamalai University, Annamalainagar (India). Effect of PGPR on fusarium oxysporum f.sp. lycopersici infection through elicitation of defense enzymes. Annals of Plant Protection Sciences (India) v.16(2) p.410-413 KEYWORDS: FUSARIUM OXYSPORUM; LYCOPERSICON ESCULENTUM.

Seed treatment, soil application and ST+SA of plant growth promoting rhizobacterial strains viz., Pseudomonas fluorescens Pf-04 strains on tomato induced synthesis of peroxidases (PO) and polyphenol oxidases (PPO)when challenge inoculated against Fusarium oxysporum f.sp. lycopersici. All the treatments increased PO and PPO activities when compared to control. Thus, the investigation suggested that seed treatment and soil application were effective methods and could be used to manage diseases under field conditions. Further, maxmum enzyme activity was observed after 48hrs. All the methods of application of pseudomonas strains was suggestive of induced systemic resistance.

359. Maheshwari, S.K.; Bhat, Nazir A.; Masoodi, S.D.; Beig, M.A. (Regional Research Station, Wadura (India). Dept. of Plant Pathology). Chemical control of lentil wilt caused by Fusarium oxysporum f. sp. lentis. Annals of Plant Protection Sciences (India) v.16(2) p.419-421 KEYWORDS: DISEASE RESISTANCE; FUNGICIDES; FUSARIUM OXYSPORUM; WILTS.

Seven fungitoxicants were tested against Fusarium oxysporum f.sp. lentis. All these significantly checked the growth of the pathogen as compared to control. Carbendazim proved most effective fungitoxicant for checking the funganal growth (5.6 mm) followed by captan (9.9 mm) and hexaconazole and diniconazole. Seed treatment + soil drenching with carben dazim was most effective to minimize the wilt incidence (10.6.), plant mortality (4.5.) and gave highest grain yield 97.48q/ha) followed by captain (15.9. , 6.3. , and 6.10q/ha). Hexaconazole and diniconazole were the next best fungitoxicants in order of superiority in case of disease incidence, mortality and grain yield.

360. Johnson, M; Reddy, P. Narayan (Agricultural Research Station, Anantapur (India); Reddy, D. Rajaram (ANGARU, Hyderabad (India). Comparative efficacy of rhizosphere mycoflora, fungicides, insecticides and herbicides against groundnut stem rot caused by sclerotium rolfsii. Annals of Plant Protection Sciences (India) v.16(2) p.414-418 KEYWORDS: ANTIMETABOLITES; PESTICIDES; CORTICIUM ROLFSII.

Trichoderma viride was found significantly superior over other antagonists in inhibiting the growth of sclerotium rolfsii. Among five pesticides tested for their efficacy, hexaconazole (1000, 1500&2000 ppm) and propiconazole (500,750&1000 ppm) completely inhibited the growth of S. rolfsii. Whereas chlorpyriphos completely inhibited the pathogen at one step lower (1500 ppm) and at recommended concentration (2000 ppm), while quinalphos inhibited the growth at 2000ppm. Of the four herbicides, pendimethalin completely inhibited the growth of S. rolfsii at recommended concentration 91000 ppm).

Sensitivity of T. viride against three agrochemicals showed complete inhibition of the growth of t. viride with hexaconazole and 48. with pendimethalin. However, no inhibition of the fungal antagonist was observed with calcium ammonium nitrate.

361. Verma, K.C.; Gaur, A.K.; Singh, U.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Evaluation of in vitro responses from different explants of elite Jatropha curcas L. Indian Journal of Plant Physiology (India) v. 13(3) p. 231-237 KEYWORDS: JATROPHA CURCAS; PETIOLES; REGENERATION; IN VITRO; EVALUATION.

Jatropha is a genus of approximately 175 succulents, shrubs and trees (some are deciduous like Jatropha curcas L) from the family Euphorbiaceae. Seeds, besides being a source of oil for biodiesel, can also be used for manufacturing other useful products such as candles, high quality soaps and cosmetics, and other herbal products. Since J. curcas is primarily a cross pollinated crop, vegetative propagation is important to maintain genetic purity of the elite lines and transformants. A regeneration protocol was optimized for the faster propagation of elite jatropha plant. Out of different explants tested (petiole, apical bud and leaf), apical buds were found to be the best for callus induction. Shoot regeneration from calli induced from petioles was the best. Various combinations of auxins with cytokinins were suitable for callus induction. The best shoot regeneration (75) was in MS medium supplemented with IBA (1.23IlM) and BAP (6.6IlM). Root induction (100.) was successfully obtained in MS and 1/2 MS medium. Acclimatization and hardening was quite successful with survival rate of 75 per cent.

H60 Weeds and Weed Control

362. Pandya, N.; Chouhan, G.S.; Nepalia, V. (Rajasthan College of Agriculture, Udaipur (India). Dept. of Agronomy). Nutrient utilization in soybean weed ecosystem under different varieties, crop geometries and weed control treatments. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 51-55 KEYWORDS: WEED TAXONOMY; CROP MANAGEMENT; WEED CONTROL; NUTRIENT PHYSIOLOGY; NUTRIENT UPTAKE; CLOMAZONE; WEEDING; FENOXAPROP.

A field experiment was conducted during rainy season of 2001 and 2002 at Udaipur. Results revealed that variety J5-335 was found most efficient in total Nand P uptake at harvest as compared to NRC-37 and JS 71-05 though there was no significant difference in N and P uptake by monocot, dicot and total weeds at 40, 60 DAS and at harvest. Both the crop geometries did not show any significant effect on Nand P uptake by both weeds and crop. At harvest, all the weed control treatments resulted in significantly lower uptake of Nand P by monocot and dicot weeds and also total uptake compared to weedy check, except uptake by dicot weeds due to fenoxaprop-p-ethyl 75g/ha post emergence (POE). All the weed management practices significantly enhanced total N and P uptake by soybean at 60 DAS, and at harvest as compared to weedy check. Lower N and P uptake (total) by weeds and higher Nand P uptake by soybean were recorded with two hand weeding at 20 and 40 DAS and colomazone + HW at 40 DAS and followed by colomazone 1.0 kg/ha pre emergence (PE).

363. Mukherjee, D.; Singh, R.P. (Banaras Hindu University, Varansi (India). Dept. of Agronomy). Effect of low doses of herbicides on weeds, nutrient uptake and yield of transplanted rice (Oryza sativa). Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p.

194-196 KEYWORDS: RICE; ORYZA SATIVA; WEEDS; HERBICIDES; NUTRIENT UPTAKE; CONTROL METHODS; WEED CONTROL; YIELDS; PLANTING DATE.

A field experiment was conducted during the rainy season of 2001 and 2002 at Research farm of Institute of Agricultural Science, Banaras Hindu University, Varanasi. Pre-emergence application of mixture of almix + 2,4. DEE 15 + 500 g/ha recorded the minimum weed density and their biomass than rest of the herbicidal treatments. This treatment registered higher weed-control efficiency next to hand-weeding thrice. Hand-weeding and chemical weeding treatment with almix + 2, 4 DEE 15 + 500 g/ha significantly increased the nutrient uptake by crop and gave higher grain yields. However, the minimum nutrient uptake by crop was noted under unweeded check. On an average, almix + 2, 4-DEE 15 + 500 g/ha registered 88 and 83percentage higher grain yield in 2001 and 2002, respectively, compared to weedy check.

364. Pandey, J.; Verma, A.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effect of low doses of atrizine and metribuzin on Phalaris minor and yield of wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Sep 2005) v. 50(3) p. 197-199 KEYWORDS: HERBICIDES; ATRAZINE; METRIBUZIN; WEEDS; WEED CONTROL; CONTROL METHODS; PHALARIS; TRITICUM AESTIVUM; YIELD COMPONENTS.

A study was conducted during the winter (rabJ) season of 2000-2002 to find out the optimum dose of atrazine and metribuzin and their effect on canary grass (Phalar is minor Retz.) and yield of wheat (Triticum aestivum emend. Fiori & Paol.). Canary grass lowered the crop yield by 57.6percentage but their control by atrazine lessened yi loss up to 53percentage. Atrazine at 50 and 75 g/ha completely ceased the growth of canary grass till the end of crJ growth and resulted in significantly higher increase in productive tillers, yield attributes and grain yield comparedt metribuzin. The latter caused higher decrease in canary grass and sweet clover (Melilotus spp.) population, but with its increasing dose the yield decreased significantly. Hand-weeding resulted in the highest increase, be significantly superior to all other treatments.

365. Ravisankar, N.; Shandrasekaran, B.; Raja, R.; Din, M.; Chaudhuri, S.G. (Tamil Nadu Agricultural University, Coimbatore (India). Dept. of Agronomy)). Influence of integrated weed management practices on productivity and profitability of wet seeded rice (Oryza sativa). Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 57-61 KEYWORDS: RICE; ORYZA SATIVA; WEED CONTROL; PRODUCTIVITY.

A field experiment was conducted at Coimbatore during 2000-2001 and 2001-2002 to study the effect of seeding methods (surface and anaerobic), in-situ incorporation of dhaincha (Sesbania aculeata) and time of pretilachlor-plus application on productivity and profitability of wet-seeded rice (Oryza sativa L.). Treatments in-cluded two seeding methods, viz. surface wet seeding and anaerobic seeding, with two intercropping levels, viz. sole rice and rice + dhaincha; and four weed-control treatments, viz. pretilachlor-plus 0.30 kg/ha 2 days after sowing (DAS) followed by (fb) 1 hand-weeding (HW) at 45 DAS, pretilachlor-plus 0.30 kg/ha 5 DASAb 1 hand-~eeding at 45 DAS, hand-weeding twice at 20 and 45 DAS, and unweeded check. Surface and anaerobic drill seeding were comparable in terms of weed density, growth and productivity of rice. Conjoint cropping of rice + dhaincha and incorporation of the latter at 37 DAS using cono weeder proved better in terms of reducing the total weed density, increasing the crop growth, productivity (5.1 t/ha) and weed-smothering efficiency (25.5 percent) of wetseeded rice. Pre-emergence application of

pretilachlor-plus 0.30 kg/ha on 2 DAS + hand-weeding at 45 DAS registered lower total weed density (53.6/m2) and higher weed-control efficiency, as well as markedly improved the growth and yield parameters and grain yield (5.6 t/ha). Anaerobic seeding, rice + dhaincha and pretilachlor-plus at 2 DAS gave better profit (Rs 13,892/ha). It was concluded that anaerobic seeding, dual cultivation of rice + dhaincha and pretilachlor plus 0.30 kg Iha on 2 DAS + hand-weeding at 45 DAS is an efficient method for im-proving weed control, productivity and profitability of wet-seeded rice.

366. Chopra, N.K.; Chopra, N.; Singh, H. (Janta Vedic College, Baraut (India). Dept. of Agronomy)). Bio-efficacy of herbicide mixtures against complex weed flora in wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 62-65 KEYWORDS: WHEAT; TRITICUM AESTIVUM; WEEDS; WEED CONTROL.

A field experiment was conducted at Baraut in Uttar Pradesh during 2001-02 and 2002-03 to study the effect of different herbicides as sole and their tank mixtures on wheat (Triticum aestivum L. emend. Fiori & Pao!.). The highest grain yield of 4.49 t/ha was recorded with fenoxaprop-p-ethyl + carfentrazone (100 + 10 g/ha) applied 30 days after sowing, which was at par with weed-free treatment. The lowest dry weight of weeds (22.0 g/m2) and highest weed-control efficiency (84.7 percent) were observed with fenoxaprop-p-ethyl + carfentrazon'e;" due to control of grassy and broad-leaf weeds. Although the tank mixture of isoproturon + carfentrazone showed greater control of broad-leaf weeds, it gave significantly lower control of grassy weed (Phalaris minor) compared with fenoxaprop-p-ethyl + carfentrazone. Metsulfuron alone at 4 and 8 g/ha was found superior to 2,4-D and carfentrazone 10 g/ha for dry weight of weeds and weed-control efficiency. There was reduction of 25,7 percent in seed yield under weedy check conditions. None of herbicide alone or in mixture showed residual effect on suc-ceeding crops of fodder maize and mungbean.

367. Maity, S.K.; Mukherjee, P.K. (Uttar Banga Krishi Viswavidyalaya, Cooch Behar (India). Dept. of Agronomy). Integrated weed management in dry direct-seeded rainy season rice (Oryza sativa) . Indian Journal of Agronomy (India) v.52(2) p.116-120 KEYWORDS: RICE; ORYZA SATIVA; DIRECT SOWING; WEED CONTROL.

A field experiment was carried out during rainy season (kharif of 2006 and 2007 at Pundibari, West Bengal to work out integrated weed management practices and their economics in dry direct-seeded rice. The weed flora emerged during experimentation were: grasses like Cynodon dactylon and Echinochloa colonum; sedges like Cyperus rotundus, C. iria, and Fimbristylis miliacea; and broad-leaved weeds like Ludwigia parviflora, Ageratum conyzoides, Spilanthes paniculata, Eclipta alba and Enhydra fluctuans. In integrated weed-management practices, butachlor 1.5 kg/ha as pre-plant surface application + brown manuring with Sesbania rostrata + 2,4-D 0.50 kg/ha recorded the highest grain yield (3.00-3.88 t/ha), which was significantly on a par with that obtained from season-long weed-free situation (3.14-3.98 t/ha). The highest net returns (Rs11,889 and 19,029/ha) and benefit: cost ratio (0.74 and 1.19) were also recorded in this treatment. Therefore, this integrated weed management prac-tice could become effective in dry-direct seeded kharif rice under foothill (tera/) agro-climatic region of West Bengal.

368. Ghorai, A.K. (Central Research Institute for Jute and Allied Fibres, Barrackpore (India). Integrated weed management in jute (Corchorus olitorius). Indian Journal of Agronomy (India) V. 52(2) p. 149-151 KEYWORDS: JUTE; CORCHORUS OLITORIUS; WEED CONTROL.

An experiment was conducted at Barrackpore during 2003-2005 to find out suitable eco-friendly and remunera-tive integrated weed-control approaches for jute cv EiRO 524f (eNavinf). Cultural, organic and integrated chemical weed-control methods were found better than conventional manual weeding twice. In cultural method, smothering of weeds by leafy vegetable mixtures [red amaranth (Amaranthus tricolor L., cv Ealabakusumf), white amaranth (Amarantus spp.) and summer radish (Raphanus sativus L. cv EPaus mulaf] in jute, reduced the dry matter of weeds up to 45% when the field was dominated by grasses and broad-leaf weeds. This was followed by two manual weedings which gave 3.57 t/ha jute fibre (along with 2.9 t/ha red amaranth, 0.6 t/ha white amaranth and 0.7 t/ha summer radish, respectively). The organic approach, rice straw mulch 10 t/ha and mixed cropping with same vegetables, followed by one manual weeding produced 3.9 t/ha jute fibre (1.15, 0.64 and 0.94 t/ha red and white amaranth and summer radish, respectively). It reduced the dry matter of weeds by 68 to 82. . In integrated chemical approach, spray of quizalofop ethyl (DT 50 1 d) 60 g/ha + dhanuvit 0.5 to 0.6 I/ha (adjuvant) at 21 DAE combined with 1 hand weeding produced 3.87 t/ha jute fibre. The benefit: cost ratio from conventional, cul¼tural, organic and chemical approaches was 1.50, 1.57, 2.19 and 1.66 respectively. The residue of quizalofop ethyl was found below the detectable limit (0.84 to 4.2 ppm) within 8 days of its application.

369. Mishra, J.S.; Singh, V.P. (National Research Centre for Weed Science, Jabalpur (India). Integrated weed management in dry-seeded irrigated rice (Oryza sativa). Indian Journal of Agronomy (India) v. 52(4) p. 299-300 KEYWORDS: RICE; ORYZA SATIVA; WEED CONTROL.

A field experiment was conducted during rainy seasons of 2006 and 2007 on clay-loam soil at Jabalpur, Madhya Pradesh to find out the effect of tillage (zero and conventional), time of sowing (before and after monsoon) and weed-control measures (integration of hand weeding and Sesbania with herbicides and rotational use of her-bicides) on weeds, yield, nutrient uptake and economics of dry-seeded irrigated rice (Oryza sativa L.). The major weeds associated with dry-seeded rice were: Echinoch/oa c. na (31.5.), Phyllanthus spp. (26.5.), Commelina communis (17.8.), Cyperus iria (9.9.), A/ternanthera sessi/is (5.9.), Dinebra retro/exa (5.1.), Physalis minima (1.8.) and Caesulia axil/aris (1.2.). Zero tillage significantly reduced the total population and dry matter of weeds compared with conventional tillage, but the difference in yield was not significant. Dry seeding before monsoon resulted in lower grain yield due to higher population and dry matter of weeds. Infestation of weeds reduced the grain yield of dry-seeded rice by 60. compared with hand-weeding twice and removed 10.99 kg N, 2.78 kg P and 7.22 kg K/ha. The maximum rice yield (3.41 t/ha) was obtained from 2 hand-weeding. Integration of pendimethalin 1.0 kg/ha or pretilachlor 0.75 kglha with 1 hand-weeding at 30 days after sowing or sequential application of pre-emergence herbicides followed by post-emergence application of 2, 4-D (0.5 kg/ha) and fenoxaprop (0.07 kg/ha), being on a par with each other, proved quite effective against weeds and gave significantly higher grain yields and benefits than weedy check.

J10 Handling, Transport, Storage and Protecion of Agricultural Products

370. Jayachandran, K.S.; Masto, E. (Acharya N.G. Ranga Agricultural University, Hyderabad (India). College of Agriculture). Influence of pre-harvest sprays of growth regulators on post harvest behaviour of guava fruits. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 139-141 KEYWORDS: GROWTH CONTROL; PSIDIUM GUAJAVA; POST HARVEST; PRE HARVEST TREATMENT.

371. Srivastava, A.K.; Tewari, A.; Shah, S.; Tewari, B. (Kumaun University, Nainital (India). Dept. of Forestry). Species composition and regeneration pattern along a transect perpendicular to a river course in foot hill deciduous tropical forest of Kumaun. Indian Journal of Forestry (India) v. 31(1) p. 7-12 KEYWORDS: FOREST TREES; REGENERATION; TROPICAL FORESTS; HIMALAYAN REGION.

Thirteen forest stands located perpendicular to a river course were studied for species composition and regeneration pattern in the Bhabhar belt located at the foothill of the Himalaya characterized by tropical climate. The study area was severely impacted by anthropogenic disturbances. In the stands complete dominance by anyone species was lacking except one stand were Sal (Shorea robusta) the late successional Dipterocarpaceae species grew pure. In a few stands trees of Holoptela integrifolia, Dalbergia sissoo and Tectona grandis (planted), Trewia nudiflora and Acacia catechu were present in sizable number. Mallotus phillipensis is the greatest reproducer in this study area recruiting generally many more seedlings and saplings than other forest species. This non-fodder species had comparatively better regeneration than good fodder species.

372. Verma, R.K.; Jishtu, V.; Kapoor, K.S.; Kumar, S. (Himalayan Forest Research Institute, Shimla (India). Plant diversity in alpine pasture of talra wildlife sanctuary of district Shimla, Himachal Pradesh. Indian Journal of Forestry (India) v. 31(1) p. 13-18 KEYWORDS: PLANT ECOLOGY; HIMACHAL PRADESH; ALPINE GRASSLANDS.

Studies to evaluate the plant diversity and growth forms in alpine pasture of Taira Wildlife Sanctuary ofOistrict Shimla, Himachal Pradesh were carried out during August, 2003. Total 75 species of plant, comprising of 7 grasses, 4 sedges, 4 leguminous forbs and 60 non-leguminous forbs were recorded from the area. On the basis of Importance Value Index (lVI). Sibbaldia cuneata O. Ktze., was found to be the dominant species followed by Geum elatum Wall ex O.Don., Ligularia amplexicaulis Oc., Primula denticulata Smith and Saxifraga parnassifolia O.Oon. The distribution of all the plant species was contagious. Index of dominance was 0.036 and index of diversity 5.386. The contribution of tall forbs, short forbs and cushioned and spreading forbs in the alpine pasture was 29.33, 54.66 and 16.0 respectively.

373. Jamwal, P. (Intel Education, Educomp Solution Pvt., New Delhi (India); Uniyal, S.K.; Institute of Himalayan Bioresource Technology, Palampur (India). Biodiversity Div.). Vegetation characteristics and under - canopy assemblages of subtropical chir pine forests at two sites in Western Himalaya. Indian Journal of Forestry (India) v. 31(1) p. 29-36 KEYWORDS: VEGETATION; HIMALAYAN REGION; FORESTS; SUBTROPICAL CLIMATE; SHRUBS; CANOPY.

Chir pine forests occurring at 750 amsl (Site I) and 1400 amsl (Site 2) in Western Himalaya were studied for vegetation characteristics and under-canopy assemblages. The vegetation was sampled using quadrats. Total of 40 plant species belonging to 27 families were encountered in the sampling plots. Members of Asteraceae, Leguminosae and Rosaceae

dominated the Chir pine under-canopy. At both the Sites, species to genera ratio was found to be one. Amongst the two Sites, the number of tree and shrub species was more at Site I; while that of herbs was more at Site 2. Higher tree and shrub diversity was recorded at Site 1,0.63 and 1.32 respectively, while Site 2 had higher (2.12) herb diversity. In general, both Sites had higher shrub and herb diversity compared to tree diversity. Chir pine forests at lower altitude (Site I) were found to be more diverse than at higher altitude (Site 2). Above ground biomass of Chir pine at the study Sites ranged from 302 t/ha at Site I to 338 tlha at Site 2. The density, diversity and biomass estimates from the present study area are comparable to other Chir pine forests in the Western Himalaya; however, regeneration potential of the present area was recorded to be comparatively poor.

374. Raj, A.; Sharma, P.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Leh (India). Regional Agriculture Research Station). Populus euphratica community in nubra valley of Ladakh : A comment. Indian Journal of Forestry (India) v. 31(1) p. 47-51 KEYWORDS: POPULUS EUPHRATICA; HIMALAYAN REGION; COMMUNITY FORESTRY; VEGETATION.

Phytosociological study of Populus euphratica community in the Trans Himalayas of Ladakh was conducted. The vegetation was a high altitude riverain forest with low species diversity (H'=O.8569) and high concentration of dominance (Cd=O.5I62). In the upper layer P euphratica dominated the association with IVI value of 219.26 while in the middle layer Berberis ulicina was the dominant species (IVI=57.33). A change in nomenclature of the forest under type 13/1Sz in the Forest Types of India is suggested in light of the present observations.

375. Sharma, D.P. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India); Nanda, R. (Himalayan Forest Research Institute, Shimla (India). Volume prediction model for chir pine (Pinus roxburghii Sargent). Indian Journal of Forestry (India) v. 31(1) p. 57-60 KEYWORDS: VOLUME; MODELS; PINUS ROXBURGHII; FORECASTING.

The study was conducted on Chir pine stand (Pinus roxburghii Sargent) at Barog range (R-31) under Solan Forest Division (H.P.) during the year 2004-2005, to develop volume prediction model based allometric relationships between stand volume and stem growth parameters (DBH and Height). Among various linear and non-linear function, both log-linear and power function performed comparatively better over other functions. In both the functions, DBH and Height parameters explained 99 per cent and 95 per cent of variation in the stem volume, respectively. However, the power function outperformed the log-linear function, when data were subjected to chi-square test of goodness of fit and thereafter using Theil-U test. The predicted volumes based on DBH and Height was cross validated and the DBH proved to be the best predictive parameter for stem volume estimation.

376. Khantwal, A. (Government Post Graduate College, Kotdwara (India); Negi, K.S. (Post Graduate College, Vedikhal (India); Madwal, K. (Forest Research Institute, Dehra Dun (India). Impact of pre-sowing seed treatments on germination of common fodder tree species of lower Siwalik range of Garhwal Himalayas. Indian Journal of Forestry (India) v. 31(1) p. 73-75 KEYWORDS: SEED TREATMENT; GERMINATION; SOWING; HIMALAYAN REGION; FORAGE; TESTA.

The Present investigation based on experiment conducted at Kotdwara Forest Division nursery to assess the effects of certain type of treatment for increasing regeneration

potential of common fodder tree species especially having tough seed coat viz., Bauhinia variegata (Kachnar), Linn. ; Grewia disprema (Dayamul), Schleichera oleosa (Kusum) and Terminalia bellirica (Bahera). It was found that hard seed coat act as a barrier for general seedling growth on natural condition. The percentage germination of seed has been found to be very low which affects regeneration under natural condition. The present study was undertaken to find out the effect of various pre-sowing treatment on such fodder tree species to get early germination with good germination percentage.

377. Nair, K.K.N.; Jayakumar, R. (Kerala Forest Research Institute, Peechi (India). Phytogeography, endemism and affinities of the flora of new amarambalam reserve forests in the Western ghats of India. Indian Journal of Forestry (Indai) v. 31(1) p. 85-94 KEYWORDS: BIOGEOGRAPHY; SURVEYS; AFFORESTATION; FLORA; KERALA; FORESTS; BOTANICAL COMPOSITION.

Floristic analysis of New Amarambalam Reserve Forests, situated in the Western Ghats of India and forming part of Nilgiri Biosphere Reserve, based on surveys conducted during 1997-2000, has been presented in the paper. The forest area extents to about 265 km2, at an altitudinal range of 40-2600 m above ms!. The area is the abode of almost all the forest types of the Indian Peninsula, preserved in an almost pristine state. Intensive floristic survey of the area recorded of a total of 1135 taxa of angiosperms, which belonged to 136 families and 644 genera. The flora is composed of 78 per cent dicotyledons and 22 per cent monocotyledons. Phytogeographical analysis of the flora revealed very high endemism, and almost 21 per cent of the total flowering plants recorded from there were those endemic to Western Ghats of India. Among them, 12.5 per cent were species restricted to Southern part of the Western Ghats. Peninsular Indo-Sri Lankan elements represented 15 per cent of the total flora, which demonstrates the affinity of the region with that of the adjacent ocean Island. Regarding the pattern of distribution of various species outside India, 66 per cent of them were of Indo-Malayan and South and South-East Asian range and 30 per cent of the total flora were composed of pluri-regional species or wides. There were only four per cent taxa in the flora, which are either exotic weeds or escapes from cultivation, showing the less disturbed status of the vegetation.

378. Sati, S.C.; Pargaien, N. (Kumaun University, Nainital (India). Dept. of Botany). VAM fungi in some ravine plant roots of Kumaun Himalayan forest. Indian Journal of Forestry (India) v. 31(1) p. 103-108 KEYWORDS: MYCORRHIZAE; VESICULAR ARBUSCULAR MYCORRHIZAE; HIMALAYAN REGION; ROOTS.

Wet and ravine forest areas of Nainital locality was surveyed to assess the VAM infection in some selected plant roots. Fine roots of selected plants were carefully dug out, washed and stained using root clearing methods and observed under microscope. Out of 18 plant roots only 16 were found to be associated with VA mycorrhiza. Acer pic/um and Berberis species had no VAM colonization in this study. Percentage root colonization varied among the selected plant roots. In Valeriana wallichii 100. infection was observed whereas it was only 31. in Myrsine semiserra/a. Vesicles were very common in VAM infected plant roots. The per cent infection was observed more in herbaceous plants followed by shrubs and woody plants. All the plant species surveyed were screened for the first time for VAM from Nainital, Kumaun Himalaya.

379. Murugesan, M.; Balasubramaniam, V. (Kongunadu Arts and Science College, Coimbatore (India). P.G. Research Detp. Of Botany). Tropical velliangiriensis (Poaceae)-a new species from Tamil Nadu, India. Indian Journal of Forestry (India) v. 31(1) p. 109-111 KEYWORDS: POACEAE; SPECIES; TAMIL NADU; TROPICAL FORESTS; NEW SPECIES.

A new species of Poaceae, Tripogon velliangiriensis Murugesan and Balasubramaniam, from Tamil Nadu, India is described and illustrated.

K10 Forestry Production

380. Kumari, B. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Forestry). Tree planting-an answer for improvement of saline/alkaline and waterlogged soils. Annals of Biology (India). (Jun 2008) v. 24(1) p. 81-84 KEYWORDS: AFFORESTATION; TREES; PLANTING; WATERLOGGING; SALINITY; ALKALINITY.

Salinization/alkalization of agricultural lands is occurring throughout the world, waterlogging occurs as a result from sodicity generated infiltration. Because salinity, alkalinity and waterlogging induce injury, inhibit seed germination and vegetative, reproductive growth of plants, hence are in a way threatening the existence of life. The need of the hour is to find out some viable solution for handling this menace. Since the mechanical pumping of water is not feasible for vast areas, because of cost factor The best solution seems to be the use of salinity/alkalinity and waterlogging tolerant tree germplasm, which is known for high transpiration rates. Some of the trees viz., Tamarix articulata, Casuarina equisetifolia, Prosopis juliflora, Acacia nilotica, Eucalyptus camaldulensis, Terminalia arjuna and Leucaena leucocephala can be effectively used to pump out the ground water and recovering the valuable lands from all the related problems.

381. Thakur, P.S.; Singh, S. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Silviculture and Agroforestry). Impact of tree management on growth and production behaviour of intercrops under rainfed agroforestry. Indian Journal of Forestry (India) v. 31(1) p. 37-46 KEYWORDS: INTERCROPPING; INHIBITION; RAINFED FARMING; AGROFORESTRY; PRODUCTION; FOREST MANAGEMENT.

This investigation was aimed to evaluate the impact of changes in incident radiation through crown modification on crop performance. Different shade intensities created through tree crown management significantly affected growth, physiological attributes and yield related parameters in Vigna mungo (syn. Phaseolus mungo) and Pisum sativum grown as understorey field crops with Morus alba under rain fed conditions. The crown management treatments namely, no crown removal, 25, 50 and 75. crown removal resulted in 91, 85, 63 and 47. shade, respectively. Plant height, number of flowers, leaf area of crops was reduced significantly with the increase in shade. Intensities and decrease in distance from t~e tree trunk. Higher pods per plant, grains per pod, grain yield and harvest index were observed at lower shade intensities. Growth and yield was maximum in open control (without tree) while unmanaged canopy of Morus trees caused overall yield reduction of 42. beneath canopy up to 3 m distance from the tree trunk. The crown management regulated physiological attributes in the field crops. The maximum photosynthetic rate was recorded for open plot plants, which declined in plants beneath dense canopy. The amount of water transpired from the crop plants decreased with increase in shade intensity. The conversion efficiency was maximum for plants growing as sole crop which decreased with increasing shade intensities. Based on the results of present

investigation, it can be recommended that out of the four tree canopy management options tried i.e. 0, 25, 50 and 76 crown removal; 75 crown removal causing least negative effects on crop growth and yield may be adopted as a compromised crown management practice.

382. Thakur, M.K.; Chauhan, R. (Regional Horticultural Research Station, Kullu (India). Growth performance of seven tree species in riverain area of North Western Himalaya. Indian Journal of Forestry (India) v. 31(1) p. 53-55 KEYWORDS: DEVELOPMENTAL STAGES; HIMALAYAN REGION; CHOICE OF SPECIES.

The growth performance of 17 years old seven tree species namely Salix tetrasperma, Robinia pseudoacacia, Alnus nitida, Populus deltoides, Eucalyptus tereticornis, Pinus roxburghii and Dalbergia sissoo was evaluated in riverain site of Kullu valley of Himachal Pradesh. The growth performance of these tree specie were recorded in the order of Populus deltoides Alnus nitida Salix tetrasperma Eucalyptus tereticornis Robinia pseudoacacia Pinus roxburghii Dalbergia sissoo. The species like Populus deltoids, Alnus nitida, Salix tetrasperma and Eucalyptus tereticornis are more suitable for plantation along the river basin of Kullu valley as they exhibited high growth under such conditions.

K50 Processing of Forest Products

383. Hegde, R. (College of Forestry, Kodagu (India); Varghese, M. (Institute of Forest Genetics and Tree Breeding, Coimbatore (India). Genetic divergence analysis in Eucalyptus camaldulensis Dehnh. Indian Journal of Forestry (India) v. 31(1) p. 61-66 KEYWORDS: GENETIC VARIATION; ANALYTICAL METHODS; EUCALYPTUS CAMALDULENSIS.

Eucalyptus camaldulensis Dehnh. is one of the important tree species used in modern plantation forestry programme. The genetic divergence analysis helps in assessing the genetic diversity within the species and also provide information for developing breeding plan, establishment of seed orchards and expolitation of heterosis through hybridization. In the present study attempts were made to assess the genetic diversity among the different open pollinated families of E. camaldulensis based on growth parameters at 24 months of age in three different locations.

384. Athar, B.; Joshi, K.C. (Tropical Forest Research Institute, Jabalpur (India). Forest Entomology Div.). Effectiveness of some synthetic pyrethroids against larvae of the teak skeletonizer Eutectona machaeralis (Walker). Indian Journal of Forestry (India) v. 31(1) p. 67-71 KEYWORDS: SYNTHETIC PYRETHRINS; LARVAE; SKELETONEMA COSTATUM; CHEMICOPHYSICAL PROPERTIES.

Three synthetic pyrethroids viz. alphamethrin (Alphaguard 10 EC), cypermethrin (Bilcyp 10 EC) and deltamethrin (Decis 2.8 EC) in different concentrations were tested against the 4^{th} instar larvae of E. machaeralis. All the insecticidal formulations were found superior to the control. Foliar sprayings of 0.02 per cent cypermethrin and deltamethrin 0.01 per cent were highly effective to control the larvae. Deltamethrin 0.01 per cent was proved effective, safer and economical as compared to cypermethrin O. 01 per cent for the control of these larvae.

385. Tikader, A. (Central Sericultural Germplasm Resources Centre, Hosur (India); Dandin, S.B. (Central Sericultural Research and Training Institute, Mysore (India). Foliar morphology and venation pattern in different mulberry (Morus spp.). Indian Journal of Forestry (India) v.

31(1) p. 77-84 KEYWORDS: PLANT NUTRITION; MORUS; MORACEAE; FUNGAL MORPHOLOGY; MORUS ALBA; MORUS INDICA; MORUS NIGRA; MORUS SERRATOR.

The morphological features are the basis of taxonomic identification of Mulberry species. The leaf morphology and venation pattern have been described in 4 Indian Mulberry species Le., M. indica, M. alba, M. laevigata and M. serrata of the family Moraceae. The median strand joined and formed the mid rib, which extends into secondary in the opposite of both sides of lamina. The veins turned into a dense reticulum. The overall venation is reticulate with marked diversity in the mode of ramification. The development of areole showed variation in different species. The leaf size of Morus species varied and a wide range Le., M. indica (120.00 - 234.00 cm2), M. alba (168.00 - 253.00 cm2), M. laevigata (204.00 - 480.00 cm2) and M. serrata (168.00 - 272.00 cm2). Number of strands ending into petiole is more or less similar in all species, which ranges from 3 - 5 but the venation pattern is thick in case of M. laevigata and M. serrata. The areole number/mm2 varies from 1.54 - 5.20 and areole size from 0.18 - 0.65/mm2 in different species. The areole number is higher in M. laevigata .and M. serrata and lower in M. indica and M. alba. The leaf morphological characters, the foliar venation pattern, areole formation, number of veins ending into petiole and veins/areole are the important features for identification of different Morus species at the vegetative stage. The minor venation, which ramifies into lamina also indicates the leaf quality i.e. palatability to silkworm.

386. Srivastava, K.K.; Sharma, A.K.; Singh, S.R.; Khalil, A. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Div. of Pomology). Estimate of genetic variability, heritability and genetic advance in plum (Prunus salicina L.) cultivars. Indian Journal of Forestry (India) v. 31(1) p. 99-102 KEYWORDS: GENETIC VARIATION; GENETIC INHERITANCE; GENETIC GAIN; PRUNUS SALICINA; VARIETIES.

Studies on correlation coefficient and genetic variability along with heritability were conducted in Plum cultivars. A wide range of variability along with high estimates of genotypic coefficient variability and phenotypic coefficient of variability was noted for plant spread North-South and East-West spread, tree volume, yield and fruit weight. High heritability noted for days taken to maturity, yield, fruit weight, fruit length and fruit diameter, Total soluble solids and acidity. High genetic advance was recorded for days taken to maturity, yield and fruit weight. Genetic gain was found high for plant spread (E-W), yield and fruit weight, which might be assigned to additive gene action.

K70 Forest Injuries and Protection

387. Prakash, O.; Sharma, R. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Determining people's participation in forest fire control : a study of Himachal Pradesh. Indian Journal of Forestry (Inda) v. 31(1) p. 1-6 KEYWORDS: FORESTS; FOREST FIRES; FOREST PROTECTION; PARTICIPATION.

Among the different causes of forest fires accidental causes result into m0re than 90 per cent fires followed by natural causes. Socio-economic factors, viz., land holding and social participation play an importan't role in the management of forest fires. This finding was further conformed by the regression analysis. However, education was found inversely related. The lack of interaction with forest department was reported as an important factor for the non participation of the respondent in the forest fire control.

388. Kumar, R.; Thakur, V. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Tree Improvement and Genetic Resources). Effect of forest fire on trees, shrubs and regeneration behaviour in Chir Pine forest in Northern aspects under Solan Forest Division, Himachal Pradesh. Indian Journal of Forestry (India) v. 31(1) p. 19-27 KEYWORDS: FORESTS; FIRE CONTROL; REGENERATION; HIMACHAL PRADESH.

Effect of forest fire on woody vegetation and regeneration behavior was studied in Chir pine forest situated between 1150-1800 m in Solan Forest Division in Himachal Pradesh, India. Four fire affected Sites and one control Site were surveyed for floristic composition, density, basal area, lVI, AIF, Shannon-Weaver index, Simpson's Index of dominance (Cd), Species richness (d), Sorenson index (S) and natural regeneration potential of tree and shrubs. A total of 3 tree species and 10 shrub species were recorded on the five experimental sites. Fire resistant species were observed more in selected Chir pine forests. There was not observed any consistent trend for density, basal area, lVI, H. Sorenson's index of similarity between fire affected and control'sites fortrees. Density and basal area in fire affected sites were lesser than control sites for shrubs. Contagious pattern of distribution for trees and shrubs was common. Seedlings density of trees and shrubs was higher on occasional fire affected sites than control sites. Density of saplings of trees was higher in control sites than fire affected sites.

389. Sangha, K.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Forestry and Natural Resources); Sohi, A.S.; Punjab Agricultural University, Ludhiana (India). Dept. of Entomology). Prospective biological control agents for regulation of population of Clostera fulgurita (Walker) on poplar in Punjab. Indian Journal of Forestry (India) v. 31(1) p. 95-98 KEYWORDS: BIOLOGICAL CONTROL AGENTS; POPULUS DELTOIDES; PUNJAB; BIOLOGICAL COMPETITION.

Population of Closterafulgurita (Walker) can be regulated by natural enemies. Canheconafurcellata Wolff (Hemiptera: Pentatomidae), a predatory bug and Aleoides percurrens Lyle (Hymenoptera: Braconidae), larval parasitoid have potential in regulating the population of this defoliator. Both these biocontrol agents are host density dependent. Temperature range of 20-25^{0}C for Aleoides and 15-20^{0}C for Canthecona is optimum for the development of their population. Adult longevity of Aleoides was more during August-October with maximum parasitisation during Octoher-November, 2003.

P33 Soil Chemistry and Physics

390. Murthy, J.S.V.S.; Kumari, S.R.; Chamundeshwari, N.; Reddy, K.V.S. (Acharya N.G. Ranga Agricultural University, Guntur (India). Regional Agricultural Res. Stn.). Stability of yield and other quantitative traits in cotton (Gossypium herbaceum L.). Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 88-92 KEYWORDS: SINGLE CROPPING; STATISTICAL METHODS; GOSSYPIUM HERBACEUM; GENOTYPES; YIELD; ENVIRONMENT.

The present study was undertaken to study the genotype x environment interaction affecting yield and its component traits and to identify stable genotype for these traits under saline soil situation. Eleven genotypes of Gossypium herbaceum were tested over three environments under NATP CES herbaceum project in saline soils during Kharif 2002-03 at farmers field in Konanki (El) and Uppugundur (E0 of Prakasam district and Regional Agricultural Research Station, Lam (E3)' Guntur district in Andhra Pradesh. The observations were recorded on eight important yield and its component characters, both linear and non-

linear components were found significant for majority of the characters studied. In general linear was higher in magnitude than non-linear component for most of the traits studied. Among three locations, Lam, Guntur (E3) was best suited for herbaceum cotton cultivation. Regression analysis indicated that desi hybrid GCot DH 9 is found suitable under favourable environments while RAHS 14 for unfavorable environments for seed cotton yield and its components traits.

P34 Soil Biology

391. Kumar, A.; Pandey, A.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Pathology); Mathur, N. (Indian Agricultural Research Institute, New Delhi (India). Div. of Microbiology); Lata (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Pathology). Isolation and screening of thermophilic fungi for Lignocellulolytic enzymes. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 84-87 KEYWORDS: FUNGAL PLANT DISEASES; LIGNOCELLYLOSE; FUNGI; ENZYMES; RICE; TESTING.

Ten fungal isolates were purified after enrichment of paddy straw with FYM/ soil/wheat compost. The isolates were grown on PDA and Reese Mandels medium. Each of these isolates was screened for its activity of cellulase, xylanase, Carboxymethylcellulase, laccase, catcilase and peroxidase enzyme by qualitative means.

392. Maiti, D.; Das, D.K. (Bidhan Chandra Krishi Viswavidyalaya, Nadia (India). Dept. of Agricultural Chemistry and Soil Science). Nitrogen management through spad and LCC in rice (Oryza sativa L.) grown in an inceptisol. Annals of Agricultural Research (India). (Mar 2005) v. 26(1) p. 142-143 KEYWORDS: NITROGEN MANAGEMENT; ORYZA SATIVA; GROWTH.

393. Dahiya, P.; Chaudhury, A. (Guru Jambheshwar University of Science and Technology, Hisar (India). Dept. of Biotechnology); Chand, S. (Indian Institute of Technology, New Delhi (India). Dept. of Biochemical Engineering and Biotechnology); Dilbaghi, N. (Guru Jambheshwar University of Science and Technology, Hisar (India). Dept. of Biotechnology). Isolation and characterization of an extracellular lipase from Pseudomonas aeruginosa M-13. Annals of Biology (India). (Dec 2007) v. 23(2) p. 103-107 KEYWORDS: ENZYME ACTIVITY; TRIACYLGLYCEROL LI9PASE; PSEUDOMONAS AERUTINOSA; SOIL ANALYSI; LIPASES; ISOLATION.

Among the 13 bacterial strains isolated from oil industry soil samples, Pseudomonas aeruginosa M-13 was selected for lipase characterization because of its high lipase activity. The bacterial strain presented a volumetric lipase activity of2.65 U/ml in medium containing nutrient broth supplemented with 2 percent olive oil after 24 h of incubation. P aeruginosa M-13lipase was optimally active at pH 7.0 and at 35°C temperature. The lipase is capable of hydrolyzing synthetic triglycerides and a variety of lipidic substrates.

394. Saharan, B.S. (Kurukshetra University, Kurukshetra (India). Dept. of Microbiology); Badoni, P. (SBS PGI, Dehradun (India). Dept. of Microbiology); Narula, N. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Microbiology). Isolation and characterization of Azotobacter species from soils. Annals of Biology (India). (Dec 2007) v. 23(2) p. 109-116 KEYWORDS: NITROGEN FIXATION; AZOTOBACTER; SOILS; PLANT GROWTH SUBSTANCES; ISOLATION; SOIL MICROORGANISMS.

Azotobacter is an aerobic soil-dwelling organism with a wide variety of metabolic capabilities which include the ability to fix atmospheric nitrogen by converting it to ammonia. Total 19 samples were collected from various sites of Dehradun. The soil samples collected were of rice-wheat, rice-maize, rice-pea rotation system and various agro-ecosystems. Total 30 isolates were obtained from the collected soil-samples. The isolates were named as APB-l to APB-30. The isolates gave morphology like circular, pulvinate, raised and smooth colonies. Out of 30, almost 50 percent were gram negative and others were gram positive. On the basis of morphology and gram reaction, only seven cultures (APBI, APB-5, APB-9, APB-17, APB-22, APB-24 and APB-27) were selected. Among different isolates, the maximum IAA was produced by APB-24 (0.026) followed by APB-27 (0.023) and APB-22 (0.019). APBI andAPB-5 also produced significant amount of phytohormone (IAA) i. e. 0.014 and 0.012, respectively. The isolate APB-17 produced very less amount i. e. 0.005. Maximum PHB production was shown by isolate APB-22 (0.981). This was followed by APB-27 (0.968) andAPB-I (0.954). The significant amount of PHB was also produced by the isolates APB-17 (0.824), APB-5 (0.723), APB-9 (0.625) and APB-24 (0.241). The isolates APB-I, APB-5, APB-17 and APB-22 showed 90 percent germination of wheat seeds. Further the isolates have positive result on root and shoot proliferation. The maximum root and shoot length was observed in case of isolate APB-9 (30 and 40 mm, respectively).

395. Yadav, R.L.; Yadav, D.V.; Duttamajumder, S.K. (Indian Institute of Sugarcane Research, Lucknow (India)). Rhizospheric environment and crop productivity : A review. Indian Journal of Agronomy (India). (Mar 2008) v. 53(1) p. 1-17 KEYWORDS: SOIL FERTILITY; RHIZOPHERE; PLANT PRODUCTION; CROPPING SYSTEMS.

Dwarf architecture of wheat and rice plants and their extensive cultivation made India a nation of food surplus. Realisation of higher crop yield required intensive use of fertilizers and water, which in turn resulted in over-exploitation of natural resources, leading to decline in factor productivity, soil organic C content, groundwater table and multiple-nutrient deficiencies. Therefore, it has became essential to manage natural resources to sustain health and fertility status of the soil for maintaining adequate supply of water and nutrients to the crop plants. The rhizospheric environment, which regulates the dynamics of water and nutrient availability as well as their uptake by the roots from the soil, is crucial in this regard. Soil organic matter plays a key role in sustaining soil health. It has been envisaged that increase in the use of legumes in crop rotation, green manuring, organic mulches, farmyard manure (FYM), residue recycling, biological N2 fixers and mycorrhizal associations along with effective use of soil microbes hold the key to sustain appropriate rhizospheric environment and crop productivity.

P40 Meteorology and Climatology

396. Mani, J.K.; Singh, R.; Singh, D.; Kumar, M.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agricultural Meteorology). Microclimatic studies in barley (Hordeum vulgare L.) under different growing environments. Annals of Biology (India). (Dec 2007) v. 23(2) p. 167-171 KEYWORDS: MICROCLIMATE; BARLEY; HORDEUM VULGARE; TEMPERATURE; HUMIDITY; ENVIRONMENT.

Field experiment was conducted at Research Farm of CCS Haryana Agricultural University, Hisar located at 29°10'N latitude, 75°46'E longitude and altitude of215.2 m above mean sea level during rabi season of 2005-06 to study the microclimate over barley variety BH-393 at

different growth stages. The value of Rn and latent heat flux in barley were recorded highest at anthesis (coinciding with peak LAI). The inclination of temperature profile during the noon was greater at anthesis because of the presence of higher leaf area than at physiological maturity where it was largely absent due to the senescence. The values of sensible heat flux and soil heat flux were higher during physiological maturity. The temperature varied between 8.5 to 20.6°C at vegetative, 16.2 to 30.4°C at anthesis and 23.1 to 36.6°C at physiological maturity stage in the cropped and bare soil, respectively. The maximum relative humidity during the day was observed at 0900 h. The humidity values were highest at the anthesis stage of crop growth. The relative humidity varied between 51 to 98 percent at vegetative, 61 to 99 percent at anthesis and 27 to 85 percent at physiological maturity stage in the cropped and bare soil, respectively.

397. Kumar, M.S.; Singh, D. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agricultural Meteorology). Agroclimatic models for growth and yield of soybean [Glycine max (L.) Merr.] Annals of Biology (India). (Dec 2007) v. 23(2) p. 173-176 KEYWORDS: CLIMATOLOGY; SOYABEAN; GLYCINE MAX; AGRONOMIC CHARACTERS; STATISTICAL METHODS; CROP YIELD; GROWTH.

The field experiment was conducted on four genotypes (SH-40, DS-9814, PK-416 and PS-1042) of soybean [Glycine max (L.)Merr.] during the kharif 2004 at Hisar to work out simple agroclimatic models for estimation of soybean growth and yield under Hisar conditions. The results indicated that a correlation existed between the agroclimatological indices and agronomic indices. Significant regression relationships were observed for leaf area index, dry matter accumulation and crop maturity with agroclimatic indices. Regression relationships developed between crop growth indices and leaf area index showed reasonable good correlation except relative growth rate.

Q02 Food Processing and Preservation

398. Prekshi; Dahiya, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Foods and Nutrition). Physico-chemical properties of raw potato for processing. Annals of Biology (India). (Jun 2008) v. 24(1) p. 85-88 KEYWORDS: PROCESSING; VARIETIES; POTATOES; CHEMICAL PHYSICAL PROPERTIES; RAW MATERIALS.

Physico-chemical properties of two varieties of potatoes i. e. Kufri Bahar and Kufri Ashoka were investigated. Tuber firmness and specific gravity varied non-significantly. Colour, size, shape and dry matter content were also determined. These two varieties were processed into flour. Physico-chemical parameters i. e. oil absorption, swelling power, water absorption and density of potato flour I of both the Varietjes varied non-significantly. Further Kufri Bahar had significantly higher viscosity as compared to Kufri Ashoka.

399. Vasuidev, S.; Yadava, D.K.; Malik, D. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics); Tanwar, R.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Chemicals); Prabhu, K.V. (Indian Agricultural Research Institute, New Delhi ((India). Div. of Genetics). A simplified method for preparation of fatty acid methyl esters of Brassica oil. Indian Journal of Genetics and Plant Breeding (India). (Nov 2008) v. 68(4) p. 456-458 KEYWORDS: BRASSICA; PLANT OILS; FATTY ACIDS; ESTERS.