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SAMPLE ENTRY

1 ← 001 Paul, P.R.C.; Xavier, F.; Leena, A. (College of Veterinary and Animal Sciences, Trissur (India), Department, of Livestock Production Management) → 2 → 6
Dairysoft: A computer programme for dairy farms. Indian → 3
Journal of Animal Sciences (India). (Mar 2006).v. 76(3) p. → 4
260-262 KEYWORDS: DAIRY FARMS; COMPUTER → 5
SOFTWARE

To exploit the full potential of dairy sector, a computerized record management system dairysoft was developed. Visual Basis 6.0 was used as front end while MSAccess 97 was utilized as back end for the software. The menu base dairysoft was provided with facilities for obtaining necessary reports along with separate data entry options.

1. Entry number
2. Author(s)
3. Title in English
4. Source
5. Keywords
6. Organisation where work was carried out

C20 Extension

200. Shrivastava, R.; Indira Gandhi Agricultural University, Raipur (India). Dept of Extension. Shrivastava, K.K.; Indira Gandhi Agricultural University, Raipur (India). Dept of Extension. Shrivastava, P.; Indira Gandhi Agricultural University, Raipur (India). Dept of Extension. Sarkar, J.D.; Indira Gandhi Agricultural University, Raipur (India). Dept of Extension. Attitude of farmers regarding adoption of control measures of various diseases of rice. *Journal of Interacademia (India)*. (Jul 2009) v. 13(3) p.320-325
KEYWORDS: HUMAN BEHAVIOUR. FARMERS. DISEASE CONTROL. PLANT DISEASES. RICE. VIRUSES. BACTERIOSES.

The rise in human population is much faster than the rise in food production. Rice is known to be infested by various fungal, viral and bacterial diseases which appear at all the growth stages from nursery till harvest of the crop. Attitude is primarily a way of being set towards or against certain things. A randomly selected sample of 160 farmers was interviewed from two blocks of Dhamtari district to ascertain their attitude towards adoption of control measures of various rice diseases. Majority of them had moderately favourable attitude regarding use of control measure practices of various rice diseases. The variables education, size, of family, social participation, land holding, annual income, occupation, credit facilities, sources of information, extension contact, scientific orientation, knowledge and adoption were found to be positively and significantly correlated with attitude regarding use of control measure of rice diseases.

201. Pradhan, K.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Dept. of Agricultural Extension. Sarkar, A.; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept of Agril. Extension. Estimation of human interaction value from some socio-personal and socio-psychological factors in midnapore district of West Bengal. *Journal of Interacademia (India)*. (Jul 2009) v. 13(3) p.329-335
KEYWORDS: STATISTICAL METHODS. SOCIAL PARTICIPATION. FARMING SYSTEMS.

A study was conducted to predict the human interaction value among the farmers regarding their scientific farming operations. A sample of hundred farmers were selected at random from two randomly selected villages of the purposively selected block Panskura-II in midnapore district of West Bengal, representing more or less the features generally found all through the district. Data regarding eighteen variables were collected with the help of a pre tested interview schedule and processed into linear correlation, multiple regression analysis, path analysis and factors analysis. The study revealed that the variables education, family education status, social participation and marital status of the respondent exercised a significant impact on human interaction value. The path analysis depicted that the variable family education status had channeled the highest indirect effect of as many as seven antecedent variables. The antecedent variables formed "principle components" to wield the cumulative effect rather than influencing the consequent variable in isolation. The critical determining factors were renamed as the family status, motivational status, life style factor, cultural factor, social recognition value and agro professional factor.

202. Rulidaulagupu; Assam Agricultural University, Jorhat (India). College of Home Science, Dept. of Extension Education. Baruah, Minerva Saikia; Assam Agricultural University, Jorhat (India). College of Home Science, Dept. of Extension Education. Das, Maju Datta; Assam Agricultural University, Jorhat (India). College of Home Science, Dept. of Extension Education. Opinion of the members towards self help group. *Journal of Interacademia (India)*. (Jul 2009) v. 13(3) p.336-340
KEYWORDS: HUMAN BEHAVIOUR. SELF HELP. COMMUNITY DEVELOPMENT.

Formation of self help group is a viable alternative to achieve the objectives of rural development and to get community participation. So this study was conducted to determine the opinion of the respondents self help group members towards SHG. Two blocks from Jorhat district were purposively selected to carry out the study namely, Jorhat development block and central Jorhat development block. It was revealed that majority (64.00 percent) of the respondents of SHG expressed their opinion towards

SHG as highly favourable followed by 34.00 percent as favourable and small portion of respondents (3.00 percent) expressed their opinion towards self help group as unfavourable. The finding showed that majority of SHG were active. As the researcher selected active SHGs for present study hence the respondent of SHGs were highly favourable towards SHG.

203. Ghosh, Manas KR.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Dept. of Agril. Extension. Acharya, S.K.; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept. of Agril. Extension. Pradhan, K.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Dept. of Agril. Extension. A study on market value generation process among brinjal (*Solanum melongena*) growers at Haringhata block of Nadia District. *Journal of Interacademia* (India). (Jul 2009) v. 13(3) p.315-319 KEYWORDS: AUBERGINES. FARMERS. STATISTICAL METHODS.

The market led value generation process for producing high value brinjal crops creates a new era of enterprising agriculture for its modernization. A study was conducted to assess and analysis the level of market value generation amongst the brinjal growers and to find out the inter level relationship between the markets value generation process and the score of some selected agro-economic and socio-personal attributes of brinjal growers. The study was conducted at Haringhata block in Nadia district. Multistage random sampling procedure was followed for selection of village, block, district and respondents. The total number of respondents was eighty (80). The pilot survey was conducted for a acquaintance with the local people. The fourteen (14) predictor variables and one (1) predicted variable had been considered for the study. The data were collected with the help of structured interview schedule by personal interview method. The data were process into the statistical analysis like t-test, coefficient of correlation and path analysis. The study revealed that the predictor variable, cultivable land pf brinjal growers had recorded significant but negative associate with market value generation process. After decomposing predictor and predicted variable, it had been revealed that the antecedent variables like cultivable land, education and input knowledge of potato had directly contributed enormously to characterize the performance of market value generation process of brinjal growers the other antecedent variables like per capita income and SSP use status had recorded substantial indirect effect in characterizing the market value generation process. The variable cultivable land had channeled higher indirect effect of as many as nine (9) antecedent variables to exert impact of market value generation process. Lastly it is to infer that even with the interactive agglomeration of fourteen (14) extraneous variable 74.19% of variance embedded with the consequent variable, market value generation process of the brinjal growers could not be explained.

C30 Documentation and Information

204. Hansraj; Directorate of Information and Publications of Agriculture, ICAR, New Dehi. Bharti, V.K.; Directorate of Information and Publications of Agriculture, ICAR, New Dehi. Singh, Vijender; Directorate of Information and Publications of Agriculture, ICAR, New Dehi. Shukla, Anil; Directorate of Information and Publications of Agriculture, ICAR, New Dehi. Content and Citation Analysis of the journal of Soil and Water Conservation. *Journal of Soil and Water Conservation* (India). (Dec 2009) v.8(4) p.72-78 KEYWORDS: NATURAL RESOURCES. SOIL.

A study was conducted to examine the scientific output in the field of soil and water conservation on the research trends in this field and to characterize its most important aspects such as growth of literature, authorship patter, most productive journals, author, institutions ect. An analysis of 1,354 citations given in the *Journal of Soil and Water Conservation* published during 2005-2008 is presented.

205. Sanyal, Manas Kumar; Kalyani University, Kalyani (India). A concept framework and information design for use of ICT in rural India. *Journal of Interacademia* (India).

(Jul 2009) v. 13(3) p.369-375 KEYWORDS: RURAL AREAS. INDIA. INFORMATION TECHNOLOGY.

The major part of India is comprised of rural areas, which are underdeveloped and lack of facilities as compared to their urban counterparts and its ultimate objective of getting into the league of developed country will be achieved only if its rural population problem are solved. This is not possible using the old traditional system unless and until the latest technological development like information technology are available to the door step of the rural masses. To accomplish this purpose we are proposing a model for proper implementation of the development project in rural area. In this paper we are developing a model for implementing a ICT based rural development system which consisting of an area wise wireless networked Rural Kiosk Machines placed at every village.

E16 Production Economics

206. Sinha, M.; Badr-e-Aowliya Research and Development Society, Kolkata (India). Member, Research Advisory Group. Ali, Md. H.; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Faculty of Agriculture. Dept. of Agril. Economics. Banerjee, B.N.; Badr-e-Aowliya Research and Development Society, Kolkata (India). Member, Research Advisory Group. Choudhury, A.; Badr-e-Aowliya Research and Development Society, Kolkata (India). Member, Research Advisory Group. Economic analysis on the production of Tuberose flower in Ranaghat of West Bengal. Journal of Interacademia (India). (Jul 2009) v. 13(3) p.349-357 KEYWORDS: ORNAMENTAL BULBS. PRODUCTION ECONOMICS. ECONOMIC ANALYSIS. CUT FLOWERS. WEST BENGAL. CULTIVATION. PRODUCTION COSTS.

Tuberose has great economic potential for cut flower trade as well as for essential oil industry. There is a direct relationship between costs and size group in the study area. A large percent of the cost is incurred for hired labours, plant protection chemical and fertilizers. Hired labour increase with the increase in farm size. In other words, less privileged group of farmers i.e. poor farmer depend on their own labour. Gross return increases with the increase in the farm size. Though its cultivation is more expensive than the major competing crops, the return is also higher than the competing crops. Tuberose cultivation is found to be good source for gainful employment of family labour and a regular source of income to the family. So, the cultivation of tuberose and other flowers should be encouraged. As the cultivation of flower is a costly affair, the government should arrange to provide credit through cooperative and commercial banks.

207. Shantibala, T.; Institute of Bioresources and Sustainable Development, Imphal (India). Insect Bioresources Division. Singh, T.K.; Manipur University, Canchipur (India). Entomology Laboratory. Dept of Life Sciences. Assessment of avoidable losses and cost benefit ratio different pesticides against pea borer complex. Annals of Plant Protection Sciences (India). (Sept 2008) v.16(2) p.353-355 KEYWORDS: COST BENEFIT ANALYSIS. PESTICIDES. LOSSES.

The avoidable losses vary from 3.8 (endosulfan) to 49.0% (control plot). A gain of 34.14 q/ha was obtained with the treatment endosulfan over the control and afforded maximum net profit of Rs. 49.843.3/ha. On the basis of cost benefit ratio (CBR), the treatment endosulfan could be adjudged as the most profitable treatment (1:36.47) and it was followed by dimethoate (1:32.63).

208. Yadav, R.P.; Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Morena (India). Zonal Agricultural Research Stn. Tripathi, M.L.; Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Morena (India). Zonal Agricultural Research Stn. Trivedi, S.K.; College of Agriculture, Gwalior (India). Effect of irrigation and nutrients levels on productivity and profitability of sunflower (*Helianthus annuus*). Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 332-335 KEYWORDS: HELIANTHUS ANNUUS. PRODUCTIVITY. PROFITABILITY. NUTRIENTS.

A field trial was conducted for 3 consecutive spring season from 2005-06 to 2007-08 on sandy loam soil to study the effect of irrigation and nutrients on productivity, profitability and water use efficiency of sunflower (*Helianthus annuus* L.) at Morena, Madhya Pradesh. Irrigation applied at 8 days interval significantly improved the plant height, leave/plant, head diameter, weight/head, seed weight/head, 1,000-seed weight, nutrient use (12.83 kg seed/kg nutrients), production efficiency (21.81 kg/ha/day), seed yield (1.86 t/ha), stalk yield (6.57 t/ha), N, P and K uptake, net profit (Rs 12,885/ha) and B:C ratio (1.85) and recorded 24.21 % and 58.19% higher seed yield of sunflower over 12 and 16 days irrigation interval. However, maximum water use efficiency (65.45 kg/ha-em) was obtained with 16 days irrigation interval. Similarly the nutrient treatment of 125% recommended dose of fertilizer, RDF (75-40-41.5 kg N-P-K/ha) recorded significantly higher water use efficiency, production efficiency, seed yield (1.76 t/ha), stalk yield (6.56 t/ha), N, P and K uptake, net income (Rs 11,784/ha) and B:C ratio (1.80) over other nutrient levels.

E21 Agro-Industry

209. Das, Subhajit; Haldia Govt. College, Haldia (India). Dept. of Geography. Agriculture and industry: Fundamentals of ever-counting aspects in Indian society-An overview.. Journal of Interacademia (India). (Jul 2009) v. 13(3) p.378-386 KEYWORDS: AGROINDUSTRY. REMOTE SENSING.

No civilization survives without agriculture and no civilization advance without Industry.” Survival and advancement can never be substituted to each other rather they are complimentary to each other. Human being learnt to produce surplus in their agricultural production. Surplus production brought the concept of Economy and then commercialization and then industrialization. Industrialization in further encouraged Green Revolution and it continues in a cyclic order. Any blockage in this cycle can inevitably stop all sectors of economy of any industry in terms of Land acquisition. And the interesting matter is that these disputes are attaining their ever-growing dimension at the cost of ever advancing economy of India. In This situation a system which comprise of Remote sensing data, Geographical Information system and interactive Cartography can serve in an effective way by its proper application. This integrated system can provide a clear and accurate land use pattern of a particular area without any biasness. This paper is an attempt for seeking a way to counterbalance the ever going and ever losing contention between agriculture and industry.

E50 Rural Sociology and Social Security

210. Verma, Saraj; Banaras Hindu University, Varanasi, (India). Faculty of social Science, Dept. of Psychology. Tiwari, Manoj Kumar; Sri A.K. P.G. College, Varanasi (India). Dept. of Psychology. Psychological health of adolescents reaction to coping strategies.. Journal of Interacademia (India). (Jul 2009) v. 13(3) p.341-348 KEYWORDS: ADOLESCENTS. TOLERANCE. PSYCHOLOGICAL FACTORS. STRESS.

The present study was aimed to explore the relationship between coping behaviour and psychological health of adolescents. Three hundred adolescents (150 males and 150 females) from various schools/colleges were assessed on their coping strategies and psychological health using the ways of coping with stress questionnaire (WCSQ) developed by Singh (2000) based on Lazarus and Folkman (1984) model and general health questionnaire GHQ-28 by Goldberg and Hillier (1979). For statistical analysis coefficient to correlation and regression analysis were worked out. Finding of the study indicated that coping behaviours- detaching, distracting, aggression and self criticism were found to be positively correlated with psychological health problems whereas problem solving was found to be negatively associate with psychological health. The results of regression analysis also revealed that coping strategies such as detaching, distracting, problem solving, aggression and self criticism were found to be lined with psychological health. The results of regression analysis also revealed that coping

strategies such as setaching, distracting, problem-solving, aggression and self criticism were found to be significant predictor of psychological health among adolescents.

F01 Crop Husbandry

211. Patel, M.K.; Indira Gandhi Agricultural University, Raipur (India). Shrivastava, P.; Indira Gandhi Agricultural University, Raipur (India). Sarkar, J.D; Indira Gandhi Agricultural University, Raipur (India). Constraints analysis in adoption of recommended soyabean production technology. *Journal of Interacademia* (India). (Apr 2009) v.13 (2) p.224-231 KEYWORDS: OIL CROPS. SOYBEANS. CONSTRAINTS. PRODUCTION. TECHNOLOGY.

Soyabean was introduced in India for cultivation during seventies of the twentieth century. India with 6.5 million hectares of soyabean area and 7.86 million tonnes of production ranks fifth in the world. There are number of reasons for non adoption of improved practise of soybean cultivation. A research was conducted in two blocks of Kabirdham district by personally interviewing 10 randomly chosen soybean growers. Most of the respondents experienced various constraints like lack of training, non-availability of information at proper time, lack of technical knowledge, lack knowledge about proper dose of insecticide, fungicide, weedicide etc. Some of the major suggestion given by the soybean grower were knowledge should be increased in various aspects of soybean production technology i.e. seed treatment, rhizobium culture, improved variety and use of proper dose of fungicide, insecticide etc. through systematic skill oriented training programme.

212. Haque, Fazilul; Visva Bharati, Santiniketan (India). Center for Environmental Studies. Patra, Pulak Kumar; Visva Bharati, Santiniketan (India). Center for Environmental Studies. Sweet potato cultivation in rain fed laterite one under Bhatina watershed of Birbhum district in West Bengal. *Journal of Interacademia* (India). (Jul 2009) v. 13(3) p.255-259 KEYWORDS: SWEET POTATOES. TUBER (TRUFFLES). CULTIVATION. AGROFORESTRY. ROCK PHOSPHATE. URBAN WASTES. WEST BENGAL.

Sweet potato is the world's highest tuber yielding crop and is growing over a wide range of climatic and edaphic conditions. The crop can be grown as sole crop as well as inter crop in agroforestry system. Largest coverage of sweet potato is in Orissa followed by Bihar and Uttar Pradesh. Its is mainly grown for human consumption. This crop not only mitigates soil reosion but is a remunerative crop also. A field trial this crop was conducted in the run-off plot of the upper ridge of Bhatina watershed (which fully tribal area) in Birbhum district of West Bengal in the year 2006-2007 (code No. 2A3D3) as sole crop and the yield were assessed. The crop yielded 15.5 ton/hectare. Further, it was observed that 5 ton FYM (pig manure, household waste and excreta of domestic animals)+ N30P20O5,25K2O2, 50 kg/hectare+2% foliar spray of Urea gave highest tuber yield in compare to other treatments. The soil in the experimenatl areas is laterite in nature, poor in fertility status, but runoff loss was best checked by sweet potao followed by cow pea, Urd and green gram. Soil with high bulk density or poor aeration tend to retard tuber formation and results in poor yields (Watanabe et al., 1968). The resource poor tribal famers sold the harvested tubers in mid-February, 2007 @ Rs. 9/- per kilogram in the local market for human consumption.

213. Mandal, D.; Uttar Banga Krishi Viswavidyalaya, Chopra (India). Uttar Dinajpur Krishi Vigyan Kendra. Ghosh D.; Uttar Banga Krishi Viswavidyalaya, Chopra (India). Uttar Dinajpur Krishi Vigyan Kendra. Baral, K.; Palli Siksha Bhavana (Institiue of Agriculture), Birbhum (India). Dept. of Plant Protection. Roy, B.C; Uttar Banga Krishi Viswavidyalaya, Chopra (India). Uttar Dinajpur Krishi Vigyan Kendra. Talekar, N.S.; Yunnan Agricultural University, Kunming (China). College of Plant Protection. Impact of IPM Strategy for control of brinjal fruit and shoot borer, *Leucinodes orbonalis* (Guenee). *Annals of Plant Protection Sciences* (India). (Sept 2008) v.16(2) p.399-403 KEYWORDS: LEUCINODES ORBONALIS. SOLANUM MELONGENA.

Due to adoption of IPM technology for the controlling of brinjal fruit and soot borer (*Leucinodes orbonalis*), there were about 4.7, 34.0 and 53.8 % change in yield, fresh fruit and profit amongst brinjal growers. The impacts of IPM practice have its positive effect on brinjal area increasing to 21.6% for adopters while decreasing to 8.7% for non-adopters. IPM practices could not stop pesticide use but able to reduce it substantially as IPM farmers had to apply 52.6% less quantity of pesticide however, for non-adopters it increased by 14.1%. All the farmers adopting IPM technology agreed that high cost of pesticide, convenience of IPM practices, potential health hazards of pesticides and profitability of IPM technology were responded by 91, 75, and 71% farmers, respectively. The internal rate of return as well as benefit-cost ratio was also very high indicating thereby, large potential economic impact of the IPM technology to control EFSB in the study area.

214. Gangwar, K.S.; Farming System Research, Modipuram, (India). Singh, H.R.; SVPUA&T, Modipuram (India). Effect of rice (*Oryza sativa*) crop establishment technique on succeeding crops. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.24-28 KEYWORDS: ORYZA SATIVA. CROP YIELD. INFILTRATION. SOIL DENSITY. DIRECT SOWING. PLANT ESTABLISHMENT.

A field study was undertaken during 2003-2007 at Modipuram to assess the effect of rice (*Oryza sativa* L.) crop establishment methods (direct seeding, drum seeding, mechanical puddle, mechanical transplanting un puddle and manual transplanting) on PHB 71 hybrid rice and their carry over effect on wheat (*Triticum aestivum* L. emend. Fiori & Paol), mustard (*Brassica juncea* L. Czernj. Coss), and Chickpea (*Cicer arietinum* L.) yield and soil properties. Maximum mean yield of rice (805 tonnes/ha) was obtained with drum seeding-wet bed. The direct seeding-dry bed adopted in rice crop resulted in higher yield of succeeding crop of wheat (5.71 tonnes/ha). Chickpea (2.20 tonnes/ha) and mustard (1.86 tonnes/ha). Significantly higher weed intensity and weed dry matter were recorded in mustard under direct seeding-dry bed. Wet bed changes in soil physio-chemical properties after four year indicated that the highest infiltration rate (1.32 cm/ha) and lowest bulk density (1.46 Mg/M³) were recorded under direct seeding-dry bed, while organic C, total N, Available P and K were increased by 4.08, 31.82, 7.59 and 30.5% over their initial content under mechanical transplanting-puddle.

215. Kharub, A.S; Directorate of Wheat Research, Karnal (India) Chander, Subhash; Directorate of Wheat Research, Karnal (India). Effect of nitrogen scheduling on wheat (*Triticum aestivum*) productivity and quality under alternate tillage practices. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.29-32 KEYWORDS: TRITICUM AESTIVUM. PRODUCTIVITY. QUALITY. TILLAGE.

Field experiments were conducted during 2004-2007 to study of nitrogen scheduling on growth, yield and quality on bread wheat (*Triticum aestivum* L. emend. Fiori & Paol) under alternate tillage system on sandy clay loam soil having low to medium soil fertility. A total of 9 nitrogen scheduling treatments including absolute control, full basal, 2, 3 and 4 splits at different stages were undertaken with recommended dose of nitrogen under zero and rotary tillage. Result showed that both the tillage portions gave statistically similar plant height, tillers/m² and 1000 grain weight in all N schedules. Nitrogen splitting at 2 or 3 or 4 times gave almost similar plant height, tillers/ m² and 1000 grain weight but greater than the single dose application either at basal or tillering. Grain and straw yield were statistically similar under rotary and zero tillage. The grain and straw yield were higher under 3 splits of nitrogen scheduling either 1/3 basal+1/3 at tillering+1/3 at floral formation or 1/4 basal+1/2 at tillering+1/4 at floral formation and 2 splits 1/3 basal +2/3 at first node compared to the other treatments. Full N as full at tillering gave significantly less yield as compared to two splits or single N application. Agronomic efficiency was also found to be higher under split application treatments (1/3 basal+1/3 at tillering+1/3 at floral formation or 1/4 basal +1/2 at tillering+1/4 at floral formation and 2 splits 1/3 basal+2/3at first node).

216. Subrahmaniyan, K; Tamil Nadu Agricultural University, Vridhachalam (India). Kalaiselvan, P.; Zhejing University, Hangzhou (China) Balasubramanian, T.N.; Tamil Nadu Agricultural University, Vridhachalam (India). Zhou, Weijun; Tamil Nadu Agricultural University, Vridhachalam (India). Groundnut (*Arachis hypogaea*) response to herbicides, plant geometry and plastic mulches under irrigated condition. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.89-91 KEYWORDS: GROUNDNUTS. HERBICIDES. MULCHES. POLYETHYLENE. FILMS.

Experiments were conducted during dry season of 2002 and wet season of 2002-03 to study the influence of plant geometry and herbicides polyethylene film mulch (black and white polyethylene film mulch) on growth yield of groundnut. The result revealed that the highest pod yield of 2 041 and 2451 kg/ha was observed with black polyethylene film mulch, respectively in dry and wet seasons compared to 1587 and 2029 kg/ha of white polyethylene mulch. Herbicide application significantly improves majority of the growth and yield attributes and pos yield. During both dry and wet seasons, most of the yield and growth attributes and pos yield were not significantly influenced by different plant geometry studies. Summarizing the results, through no significant interaction was obtained, it is recommended to use black polyethylene film mulch with herbicide application under normal population of groundnut irrespective of plant geometry to increase the productivity of irrigated groundnut.

217. Sahay, C.S.; Indian Grassland and Fodder Research Institute, Jhansi (India) Pathak, P.K.; Indian Grassland and Fodder Research Institute, Jhansi (India). Walk behind type reaper-a solution for harvesting of wheat, oat and barley in Bundelkhand region. Indian Farming (India). (Mar 2009) v.58(12) p.3-5 KEYWORDS: HARVESTERS. ECONOMICS. WHEATS. OATS. BARLEY. HARVESTING.

Introduction to walk behind type reaper among the farmers in Bundelkhand region has shown encouraging techno-economic advantage in harvesting crop like wheat and oat. Harvesting crop like wheat and oat using vertical conveyor reaper saves costs and time for the farmer, reduces the dependence on agricultural laborers and minimizes the risk of undesired weather.

218. Pukayastha, Atanu; Government of West Bengal, Kolkata (India). Dept. of Food Processing Industries and Horticulture. Sarkar, Ashis; Government of West Bengal, Kolkata (India). Dept. of Food Processing Industries and Horticulture. Feasibility of cultivation of Kharif cotton in the rainfed upland ecosystem of red and lateritic western tract of west bengal.. Indian Farming (India). (Mar 2009) v.58(12) p.6-10 KEYWORDS: CULTIVATION. COTTON. ECOSYSTEMS. HIGHLANDS. RAINFED FARMING. IRRIGATION. PRODUCTION COSTS.

An analysis of the above environment parameters clearly indicate that apparently the so called less productive western tracts, has a bright prospect of growing cotton, specially in the areas, which remains as current fallow during the kharif season. Cultivation of cotton will allow the farmers of the region to earn additional income and at the same time provide opportunity to develop cotton based industrial units in the state creating opportunity for employment generation,

219. Paramanik, S.C.; Indian institute of Pulses Research, Kanpur (India). Rainwater management techniques for successful production of pulses in rainfed areas. Indian Farming (India). Mar 2009 v.58(12) p.15-18 KEYWORDS: RAINFED FARMING. WATER MANAGEMENT. PRODUCTION. GRAIN LEGUMES. FURROW IRRIGATION.

Being mainly rainfed crop, efficient rainwater harvesting and management is essential for successful production of pulses. The main pulse growing tract of central and western India suffers from light and heavy soils undulating terrain and weather extremities. The various technologies like raised bed sunken bed, broad bed furrow, deep ploughing, leveling and bunding, and checkdams, farm ponds have been evaluated extensively in the farmers field and found most effective. However, the adoption of water conservation technologies is very low in the farmers field mainly due to involvement of huge cost and machinery which discourage the small and marginal

farmers to adopt these practices in small scale. Thus participatory management of rainwater technologies are necessary for wider adoption and successful production of pulses in the country.

220. Malsawmkimi; Kerala Agriculture University, Vellanikkara (India). College of Horticulture. J, Salikutty; Kerala Agriculture University, Vellanikkara (India). College of Horticulture. Colve bean- A promising vegetable. Indian Farming (India). Mar 2009 v.58(12) p.26-27 KEYWORDS: IPOMOEAE. CULTIVATION. PRODUCTION.

Clove bean (*Ipomoea muriccta*) is an important under-exploited vegetable. The tender fruits are eaten as vegetable; the edible fruits are prepared into tasty curries. The seeds stem and leaves are said to be effective in treating several types of skin ailments.

221. Dhyani, S.K.; National Reserch Centre for Agroforestry, Jhansi (India)Newaj, R.; National Reserch Centre for Agroforestry, Jhansi (India)Sharma, A.R.; Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy. Agroforestry : its relation with agronomy, challenges and opportunities. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 249-266 KEYWORDS: AGROFORESTRY. AGRONOMY. SILVICULTURE. MIXED CROPPING.

Agroforestry has gained popularity among farmers, researchers, policy makers and other for its ability to contribute significantly in meeting deficit of tree products, socio-economic and environmental benefits. Agroforestry is a land use option that increase livelihood security and reduce vulnerability to climate and environmental change. According to Planning Commission report "Greening India", that 33% forest cover can only be achieved through agroforestry. The Prime Minister released India's National Action Plan on 'Climate Change' recently and The National Action Plan focuses attention on 8 priority National Missions in which Greening India and sustainable agriculture having close relation with agroforestry. In agriculture, agronomy as sub-discipline deals with multiple cropping (intercropping, mixed cropping, sequential cropping), soil management, crop production and all the ways in which soils and crops interact and also interfaces between two species. In agronomy, mixed cropping might be considered to be similar to that of agri-silviculture, which is one of the systems of agroforestry. Agroforestry as a multidisciplinary approach needs agronomist, soil scientist, forester, plant physiologist, economist, extension, social scientist and others to undertake research on its various aspects. The basic principles of agronomy are also applicable in agroforestry research and agroforestry is a complex system than other fields of agriculture.

222. Singh, L.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Singh, J.K.; Banaras Hindu University, Varanasi (India). Dept. of Agronomy Chand, L.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Hasan, B.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Srinagar (India). Productivity, economics and competitive indices of lentil (*Lens culinaris*)-based intercropping systems in Kashmir valley. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 291-295 KEYWORDS: PRODUCTIVITY. LENS CULINARIS. ECONOMICS. INTERCROPPING.

A field experiment was conducted during winter seasons of 2005-06 and 2006-07 at Shalimar, Srinagar to study the productivity and profitability of lentil (*Lens Culinaris Medik*)-based intercropping systems. Eleven lentil based cropping systems viz., lentil sole, brown sarson (*Brassica campestris* L. var. brown sarson) sole, oats (*Avena sativa* L.) sole, lentil+brown sarson 1:1, lentil+brown sarson 2:1, lentil+brown sarson 4:1, lentil+brown sarson 6:1, lentil+oats 1:1, lentil+oats 2:1, lentil+oats 4:1 and lentil+oats 6:1, were tested in randomized block design with three replications. Number of pods! plant of lentil were significantly higher in sole crop followed by 6:1 and 4:1 row ratio of lentil + brown sarson and lentil + oats systems, respectively. Significantly higher siliquae! plant was recorded in intercropping systems compared to sole brown sarson. Seed yield of lentil (1.46 t/ha) and brown sarson (1.37 t/ha) was highest in sole stand. Based on lentil seed equivalent yields (1.47 t/ha), net returns (Rs

25,750) and B:C ratio (3.32), lentil + oats in 2:1 was found the best. It was closely followed by sole lentil.

223. Singh, A.K.; Indian Institute of Sugarcane Research, Lucknow (India) Lal, M.; Indian Institute of Sugarcane Research, Lucknow (India) Singh, P.; Indian Institute of Sugarcane Research, Lucknow (India) Singh, I.; Directorate of Maize Research, New Delhi (India) Yadav, D.V.; Indian Institute of Sugarcane Research, Lucknow (India). System productivity and profitability of sugarcane (*Saccharum* spp. hybrid complex) + grain amaranth (*Amaranthus hypochondriacus*) intercropping system. *Indian Journal of Agronomy* (India). (Sep 2009) v. 54(3) p. 296-300 KEYWORDS: PRODUCTIVITY. SACCHARUM. INTERCROPPING. AMARANTHUS HYPOCHONDRICUS. PROFITABILITY.

Field experiments were conducted during 2003-04 and 2004-05 at Lucknow, to study performance of sugar-cane (*Saccharum* spp. hybrid complex) + grain amaranth (*Amaranthus hypochondriacus* L.) intercropping at various planting geometries (sugarcane sole at 90 cm row spacing, amaranth sole at 45 cm row spacing, sugar-cane + amaranth in 1:1 row ratio and sugarcane paired (45:135 cm) + amaranth 2 rows in 135 cm spacing in 2:2 row ratio) and nutrient levels (50% of the recommended dose of fertilizer-(RDF), 75% RDF, 100% RDF, 125% RDF, 150% RDF for the system. Significantly higher number of tillers (318.9 thousand/ha), plant height (324.9 cm), number of millable canes (120.9 thousand/ha), cane length (248.2 cm) and the cane yield (75.7 t/ha) were recorded in sugarcane planted in paired rows of 45:135 cm accommodating 2 rows of grain amaranth intercrop (2:2). The cane equivalent yield (94.6 t/ha), sugar yield (8.77 t/ha) and sugar equivalent yield (11.04 t/ha) were also the highest with this treatment which was, however, on par with sugarcane (90 cm) + amaranth (one row) system. Nourishing the crop with high doses of fertilizer (150% RDF) significantly increased the cane yield (89.2 t/ha) as well as cane equivalent yield (109.1 t/ha). Higher yield advantage (LER 1.92) was realized with sugar-cane + amaranth (2:2) intercropping system followed by sugarcane + amaranth (1:1). Sugarcane + amaranth fertlized at 150% RDF fetched the highest net return (Rs 78,135/ha) and B: C ratio (3.14). It was concluded that 2 rows of grain amaranth can be intercropped in autumn sugarcane planted in paired rows (45:135 cm) with 150% RDF to achieve highest system productivity and profitability.

224. Pandey, I.B.; Rajendra Agricultural University, Samastipur (India). Dept. of Agronomy Dwivedi, D.K.; Rajendra Agricultural University, Samastipur (India). Dept. of Soil Science Pandey, R.K.; Rajendra Agricultural University, Samastipur (India). Dept. of Soil Science. Integrated nutrient management for sustaining wheat (*Triticum aestivum*) production under late sown condition. *Indian Journal of Agronomy* (India). (Sep 2009) v. 54(3) p. 306-309 KEYWORDS: YIELDS. TRITICUM AESTIVUM. PRODUCTIVITY. NUTRITION POLICIES.

A field experiment was conducted at research farm of Rajendra Agricultural University, Pusa, Samastipur during the rabi seasons of 2002-03 and 2003-04 to find out the effect of integrated nutrient management on productivity of late sown wheat (*Triticum aestivum* L.). Addition of 10 Vha FYM + 25 kg ZnSO₄/ha together with RDF (recommended dose of fertilizers i.e. 120-26.2-33.3 kg N-P-K/ha), 125% RDF and 150% RDF recorded significantly higher values of yield attributes, grain (3.5-3.7, 3.6-3.8 and 3.8-3.9 Vha, respectively) and straw (5.2-5.4, 5.3-5.5 and 5.5-5.6 Vha, respectively) yields than application of RDF (2.9-3.1 Vha), 125% RDF (3.2-3.5 Vha) and 150% RDF (3.3-3.6 Vha) alone. Application of 10 t FYM/ha with RDF produced similar grain yield (3.4-3.6 Vha) as the yield obtained under 150% RDF alone (3.3-3.6 Vha). Application of 150% RDF together with 10 tonnes FYM + 25 kg ZnSO₄/ha although produced maximum grain yield (3.8-3.9 Vha), however, highest benefit: cost ratio (1.5-1.7) was obtained with 10 t FYM/ha together with RDF only. Addition of 10 t FYM with fertilizers levels significantly increased the nutrient uptake by the crop, improved the organic carbon content, N, P and K status and significantly reduced the bulk density of the soil as compared to chemical fertilizer alone.

225. Ambrish, K.; Botanical Survey of India, Dehra Dun (India). Northern Circle. *Passiflora jugorum* W.W.SM. (Passifloraceae) : a new plant record for India from Arunachal Pradesh. *Indian Journal of Forestry*. (Dec 2008) v. 31(4) p. 647-649
KEYWORDS: PASSIFLORACEAE. PASSIFLORA. FLOWERS. ARUNACHAL PRADESH.

Passion flower is one of the most beautiful flowers of all flowres and distributed world wide from S.America to Europe and Asia. One of its species *Passiflora jugorum* W.W. Sm., Passifloraceae, so far known from China (Yunnan) and Myanmar (Bhamo) is reported for the first time from India as a new distributional record. It is explored from the subtropical forest areas of Limiking (All. 1200 :i:: 50 m), Upper Subansiri District, Arunachal Pradesh, India. A brief taxonomic description of the taxon along with a colour photograph is provided.

226. Sharma, Peeyush; Dryland Research Sub Station, Jammu (India). Abrol, Vikas; Dryland Research Sub Station, Jammu (India). Sankar, G R Maruthi; All India Co-ordinated Research Project for Dryland agriculture, Hyderabad (India). Singh, Brinder; Dryland Research Sub Station, Jammu (India). Influence of tillage practices and mulching options on productivity, economics and soil physical propertise of maize *Zea mays*-wheat (*Triticum aestivum*) system. *Indian Journal of Agricultural Sciences (India)*. (Nov 2009) v.79(11) p.865-70
KEYWORDS: ECONOMICS. GRAIN. MAIZE. SOIL CHEMICOPHYSICAL PROPERTIES. TILLAGE. WHEATS. MULCHING. CHEMICOPHYSICAL PROPERTIES. PRODUCTIVITY.

A field experiment was conducted during 2005-06 and 2006-07 at Dryland research Sub Station. Dhiansar to study the influence of tillage and mulching practices on crop productivity, economics and soil properties of maize-wheat system under rainfed situation. Four different tillage methods, viz conventional, minimum, no tillage and raised bed were used in the main plots and four different mulch materials, viz straw, polyethylene, soil mulch including no mulch were used I the sub plots. Tillage practices significantly influenced the yield of maize and wheat. Grain yield of maize and wheat was statistically at par in conventional and minimum tillage system and significantly higher than no tillage system in both the years. Mulching also resulted in I increased in yield. Significantly higher mean grain yield of maize (1.91 tonnes/ha) and wheat (0.63 tonnes/ha) was recorded from polyethylene mulch, followed by straw mulch (1.77 tonnes/ha, 0.61 tonnes/ha) respectively. Minimum tillage and polyethylene mulch or straw mulch conserve more moisture and infiltration rate than other tillage methods and mulch application. The highest mean net return (Rs 10078) and the benefit:cost ratio (1.28) was obtained with minimum tillage and lowest with conventional tillage (Rs.86310.90). Minimum tillage in conduction with polyethylene mulch or straw mulch was economically profitable and improves the crop production and soil quality for maize wheat sequence in rainfed condition.

227. Singh, Dilip; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture, Dashora, L N; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture. Influence of integrated nutrient management on productivity of sugarcane (*Saccharum officinarum*) in southern Rajasthan. *Indian Journal of Agricultural Sciences (India)*. (Nov. 2009) v.79(11) p.931-33
KEYWORDS: ORGANIC FERTILIZERS. SUGARCANE. NUTRIENTS. PRODUCTIVITY. RAJASTHAN.

The experiment was conducted during autumn season of 2003 and 2005 evaluate and develop integrated nutrient management package for sugarcane and its ratoon. Application of 100% recommended dose of fertilizer through chemical fertilizer + 25% additional N, P and K through farmyard manure and biofertilizer application (T10) in plant crop and application of 100% recommended dose of fertilizer along with trash incorporation and biofertilizer application (T10) in ratoon crop recorded the highest cane yield and commercial sugar (tones/ha) in plant as well as ratoon crop. The combination proved economically viable integrated nutrient management practice with highest net return (Rs 79 134/ha) and B: C ratio (4.12).

228. Singh, D.K.; GBPUA&T, Panthnagar (India). College of Agriculture. Dept. of Agronomy Singh, J.K.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Dept. of Agronomy. Singh, Lal; Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar (India). Real time nitrogen management for higher N use efficiency in transplanted rice (*oryza sativa*) under temperate kashmir conditions.. Indian Journal of Agricultural Sciences (India). (Oct. 2009) v.79(10) p.772-75 KEYWORDS: ORYZA SATIVA. ECONOMICS. NITROGEN FERTILIZERS. SEEDLINGS.

A field experiments was conducted at Sher-e-Kashmir University of Agricultural Sciences and technology of Kashmir, Shalimar Campus, Srinagar during 2004- and 2005 to study the leaf colour chart (LCC) based nitrogen management for increasing N use efficiency and reducing nitrate N leaching in transplanted rice temperate conditions of Kashmir. The experiment comprised 8 N management practices; control, use of threshold values of LCC 3 and LCC 5 and use of recommended N rate [120 kg/ha applied in 3 splits (50% as basal, 25% at active tillering and 25% at panicle initiation)] were conducted in randomized block design with 3 replications. LCC 5 (180 kg N/ha applied in 6 splits) recorded significantly higher grain yields (6.61 and 6.70 tonnes/ha respectively in 2004 and 2005) without basal dose of nitrogen application (total of 100 kg N/ha), as compared to recommended dose of 120 kg N 4.86 and 4.81 tonnes/ha) and LCC 3 (60 and 90 kg N/ha). The LCC 3 (60 and 90 kg N/ha applied in 2 and 3 splits, respectively) was statistically at par with recommended dose of 120 kg N /ha in respect of yield and yield attributes. The nitrogen use efficiency and apparent recovery were significantly higher with LCC based N management than the recommended N management. Further higher agronomic efficiency (29.4 and 32.7 kg grain/ka N applied) apparent N recovery (52 and 57% respectively in 2004 and 2005) and returns/rupee investment in account of applied N (19.2 and 19.3/Re in the respective years) were recorded with LCC 5 where 20 kg N/ha was applied in 5 equal splits without basal application. Thus LCC threshed value 5 (100 kg N/ha) helped avoid over application of N to rice.

229. Sharma, S N; Indian Agricultural Research Institute, New Delhi (India). Prasad, R; Indian Agricultural Research Institute, New Delhi (India). Dwivedi, M K; Indian Agricultural Research Institute, New Delhi (India). Kumar, Sandeep; Indian Agricultural Research Institute, New Delhi (India). Effect of residue and rates and sources f phosphate application on growth, yield and economivs of Wheat (*Triticum aestivum*). Indian Journal of Agricultural Sciences (India). (Oct. 2009) v.79(10) p.776-81 KEYWORDS: TRITICUM AESTIVUM. AGRONOMIC CHARACTERS. PHOSPHATES. YIELDS. ECONOMICS.

Field experiments were conducted during 2001-02 and 2003-04 to study the effect of crop residue incorporation on the relative efficiency of diammonium phosphate and Mussoorie rock phosphate. The result indicate that phosphorus application significantly increased plant height from 78-81 to 81-84 cm, number of grains from 56-58 to 5765, 1000 grain weight from 33-34 to 234-39 g grain yield 4.1-4.5 to 4.4-6.2 tonnes/ha gross profit from Rs 28014-31657 to Rs. 29528-43121/ha and net profit from Rs. 7086 -10729 to Rs 8603-20908/ha. The response was limited to 40 kg P₂O₅ either as diammonium phosphate or Missoorie rock phosphate, however the economic optimum dose of Mussoorie rock phosphate was 53-79% higher than that a dimmonium phosphate but prouced almost similar yield (4.6-6.1 tonnes/ha) at their economic optimum dose. Agronomic efficiency and response and economic returns at economic optimum dose was higher with diammonium phosphate than Mussoorie rock phosphate. Residue incorporation had no significant effect on growth, yield attributes, yield and gross and net return of wheat but significantly increased the efficiency of both diammonium phosphate and Mussoorie rock phosphate. Thus a combination of Mussoorie rock phosphate + phosphate-solubilizing bacteria + crop residue incorporation hold a great promise as a P fertilizer in wheat for its increased productivity under north Indian condition.

230. Sharma, S N; Indian Agricultural Research Institute, New Delhi (India). Prasad, Rajendra; Indian Agricultural Research Institute, New Delhi (India). Effect of different sources of phosphorus on summer mungbean (*vigna radianta*) in alkaline soil of Delhi.. Indian Journal of Agricultural Sciences (India). (Oct. 2009) v.79(10) p.782-89
KEYWORDS: PHOSPHORUS. MUNG BEANS. ALKALINE SOILS. DELHI. CROP RESIDUES.

The field experiments were conducted at the Indian Agricultural Research Institute, New Delhi for 3 years from 2002 to 2004 to study the effect of incorporation of 6 tonnes/ha of residue of wheat crop the efficiency of diammonium phosphate (DAP) and Mussoorie rock phosphate plus inoculation of phosphorus solubilizing bacteria (MRP+PSB) on summer mungbean var. PS 16. application DAP @ 17.5 and 35 kg/ha significantly increased seed yield over control by 16-34 and 39-49%, respectively, P uptake by 18-26 and 35-44%, respectively, gross return by 13-25 and 32-41% respectively and net return of mungbean by 23-288 and 87-278%, respectively, whereas application MRP + PSB @ 17.5, 35 and 52.5 kg/P/ha increased seed yield over control by 9-17, 24-31 and 40-70%, respectively, P uptake by 7-16, 23-35 and 38-51%, respectively gross return by 8-13, 18-28 and 37-56%, respectively and net return of mungbean by 14-138, 43-146, and 85-678% respectively. Thus MRP + PSB at 35 and 52.5 kg/ha was at par with DAP at 17.5 and 35 kg/ha, respectively in terms of seed yield, P uptake and gross and net return of mungbean. Agronomic efficiency ranged between 5.3 and 10.1 kg seed/kg P for DAP and between 3.1 and 6.3 kg seed/kg P for MRP + PSB. Similarly, apparent recovery of MRP + PSB was lower (3.1-7.0%) than that of DAP (7.0-10.2%). However, incorporation of residue of preceding wheat crop significantly increased the efficiency of MRP + PSB and thus MRP + PSB along with residue incorporation can be used for P fertilizer in mungbean crop.

231. Chander, Subhash; DWR, Karnal (India) Sharma, K.C.; Central Sheep and Wool Research Institute, Bikaner (India). Arid Region Campus Jat, H. S.; CSSRI, Karnal (India) Meena, Raj Pal; DWR, Karnal (India). Influence of varieties and cutting schedules of perennial pasture grasses on soil fertility, nutrients content and uptake, productivity and economics in hot arid condition of Rajasthan. Indian Journal of Agricultural Sciences (India). (Oct. 2009) v.79(10) p.798-803
KEYWORDS: CENCHRUS. ECONOMICS. NUTRIENT UPTAKE. ARID CLIMATE. SOIL FERTILITY. VARIETIES. PRODUCTIVITY.

A field experiment was conducted during 2000-04 on coarse sandy soil having fertility status to study the manipulation of soil fertility with lays, enhancing fodder productivity with improved varieties, cutting schedules and economics of fodder production. The study showed that soil organic carbon, pH electrical conductivity and available NPK were not affected significantly either by perennial pastures (Cenchurs (*Cenchrus ciliaris* L.) or sewan (*Lasiurus sindicus* Henrad). Different cutting schedule or their varieties were improved noticeably over the years compared to their initial levels indicating a positive impact of these pasture grasses on soil fertility status. Nutrients contents in dry fodder of cenchurs and sewan were statistically similar but nitrogen was significantly higher in half yearly cutting than annual cutting. Among varieties CAZRI 75 of cenchurs and CAZRI m 30-5 of sewan were found containing significantly higher nitrogen compared to their respective other varieties. Nutrients (NPK) uptake was recorded significantly higher in sewan than cenchurs, in half yearly cutting than annual cutting their respective other varieties. Dry fodder production was significantly higher by sewan (29.39 tonnes/ha) than cenchurs (25.69 tonnes/ha) on yearly as well as total basis. Half yearly cutting schedule production significantly higher dry fodder yield than annual cutting schedule during initial two years but reserved trend was observed in latter years and both were found statistically similar on total basis. Among varieties CAZRI 75 (29.62 tonnes/ha) of cenchurs and CAZRI m 30-5 (32.75 tonnes/ha) of sewan gave significantly higher dry fodder yield compared to their respective other varieties on yearly and total basis. Higher gross and net return were recorded in sewan grass than the cenchurs grass half yearly cutting schedule than annual cutting schedule and in CAZRI 75 of cenchurs and CAZRI m 30-5 of sewan.

232. Kumar, Lalan; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture Campus. Mahawer, L.N.; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture Campus. Shukla, Anil Kumar; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture Campus. Kaushik, R.A.; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture Campus. Upadhyay, B; Maharana Pratap University of Agriculture and Technology, Udaipur (India). Rajasthan College of Agriculture Campus. Performance of dahlia (*Dahlia vriabilis*) cultivars for vegetative, floral and relative economic parameters under sub humid southern plains and Aravalli hills of udaipur. Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.816-20 KEYWORDS: CUT FLOWERS. DAHLIA. SPRAYS. FLOWERS. HIGHLANDS.

An investigation was carried out with 9 cultivars of Dahlia variables L. at Horticulture farm, Department of Horticulture, RCA Campus, MPUAT, Udaipur during winter season 2006-08 to evaluate the cultivars for vegetative, floral and relative economics parameters. The experiment was laid out in randomized block design with 3 replications by planting 12 plants/replication and data were recorded on plants for various parameters. The data were analyzed by analysis of variance technique. The maximum value for plant height at 30, 60 and 90 days after translating were recorded in. Black out (8.61 cm), DRS (27.71, 52.86 cm) respectively. The maximum number of leaves at 30, 60 and 90 days after transplanting were obtained in cv. NT Pompon (10.1.22.87) and Jyotsna (58.13). While maximum plant spread were recorded in Jyotsna for north south (55.10 cm) and east west (52.23 cm), similarly, number of lateral shotts (6.07), number pf spray (11.67), and number of tubers/plant (6.73) in NT Pompon. Minimum days required for flower bud initiation (81.60 DAT) and bud break (22.40 DAI) were recorded in cultivar Jyotsna and complete flower opening (6.30 DAB) was recorded in cultivar Korean Yellow. The maximum flowers duration (90.73 days) was recorded in cultivars NT Pompon. The maximum freshness of flower (7.73 days) on plant under open field condition was recoded in cultivar NT Pompon. The maximum number of flowers/plant (60.40) flower diameter (19.66 cm) and average weight of flower (62.69), were recorded in cultivar NT Pompon, Korean Yellow and Black out respectively, In cultivar NT Pompon minimum flower diameter (11.20 cm) and flower weight(17.77 g/flower) were recorded. The maximum flower weight/plant (1072.56 g) was recorder in cultivars NT Pompon. On the basis of data recorded for vegetative, floral and relative economics parameters cv. NT Pompon for cut flowers and Jyotsna were found best for exhibition/standard purpose under Udaipur condition.

233. Somkumar, R.G.; National Research Centre for Grapes, Pune (India). Satish, J; National Research Centre for Grapes, Pune (India). Ramteke, S.D.; National Research Centre for Grapes, Pune (India). Sharma, J; National Research Centre for Grapes, Pune (India). Root distribution, partitioning of dry matter and nutrient uptake in Thompson seedless grapes (*Vitis vinifera*) grafted on different rootstocks. Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p.669-73 KEYWORDS: DRY MATTER CONTENT. GRAPES. NUTRIENT UPTAKE. ROOTSTOCKS. PLANT PRODUCTION.

A Study was conducted during 2005-06 on the root distribution pattern of 4 grape rootstock, namely 'Dog Ridge', 'Salt Creek', 1613-C' and 'St George' grafted Thompson Seedless (*Vitis vinifera*). The soil is heavy black cotton soil (vertisols) with pH of 8.0 Roots of different thickness, viz @ mm, 2-5 mm, -10 mm and 10 mm, were examined at a depth of 0-30, 31-60 and 61-90 cm from the surface. Dog Ridge put forth maximum root length in 2 mm category at 0.30 cm distance from the trunk, while at 30-60 cm distance, salt Creek recorded maximum root length in 2 mm category. The total root length of 2-5 mm category was higher at 31-60 cm distance both in Dog Ridge and St. George. The total spread of thicker roots of 10 mm till 60 cm distance, beyond which there was no spread in all the rootstocks. At 0-30 cm depth, Dog Ridge put forth greater root mass, followed by salt Creek and St. George. But, highest root mass was recorded in all the rootstock at 30-60 cm depth. The food material (dry matter) is stored in different parts of grapevine after back pruning. Considering the major vine part, ie trunk,

the dry matter accumulation was highest in Thompson seedless grafted on Dog Ridge (69.48%), while St. George was last in the order (43.79%). Canes of Salt Creek grafted vines produced highest dry matter of 72.64 and 69.48% respectively. However less dry matter was recorded in roots of 1613-C grafted vines. The nitrogen accumulation in trunk of Salt Creek rootstock was higher (1.45%). Similarly, the phosphorous was accumulated more (0.25%) in canes of St. George. Potash was accumulated more in canes as compared to other parts in St. George and it was moderate in Dog Ridge rootstock. Considering the parameters studied in the present investigation, among the rootstock, Thompson Seedless grafted on Dog Ridge rootstock seems to be better as compared to other rootstocks.

234. Tripathi M.K.; Central Research Institute for Jute and Allied Fibres, Pratapgarh (India). Sunnhemp Research Station. Majumdar, B.; Central Research Institute for Jute and Allied Fibres, Pratapgarh (India). Sunnhemp Research Station. Sarkar, S.K.; Central Research Institute for Jute and Allied Fibres, Pratapgarh (India). Sunnhemp Research Station. Chowdhary, H.; Central Research Institute for Jute and Allied Fibres, Pratapgarh (India). Sunnhemp Research Station. Mahapatra, B.S.; CRIJAF, Barrackpore (India). Effect of integrated nutrient management on sunnhemp (*Crotalaria juncea*) and its residual effect on succeeding rice (*oryza sativa*) in eastern Uttar Pradesh. Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p.694-98 KEYWORDS: SOIL FERTILITY. UTTAR PRADESH. ORYZA SATIVA. CROTALARIA JUNCEA.

A field experiment was conducted during summer and rainy seasons of 2003-05 at Sunnhemp Research Station, Pratapgarh, Uttar Pradesh to find out the effect of integrated nutrient management on yield attributes and nutrient uptake by sunnhemp (*Crotalaria juncea* L.) its residual effect on succeeding rice (*oryza sativa* L.) crop and residual fertility build-up in soil. The fiber yield of sunnhemp was significantly higher (0.76 tonnes/ha) with 75% NPK + Rhizobium + PSB (T5) over the control but was at par with 100% NPK & 75% NPK + Rhizobium, while significantly higher NPK uptake was observed with T5 over the other treatments. On the other hand, residual effect of integrated nutrient management on rice yield was nonsignificant but 75% NPK + Rhizobium + PSB recorded significantly higher nutrient uptake over treatments except 100% NPK & 75% NPK + Rhizobium. The maximum net returns from sunnhemp (Rs 9822/ha) was recorded with 75% NPK + Rhizobium + PSB with adequate soil fertility build up under sunnhemp rice cropping sequence in inception of eastern Uttar Pradesh.

235. Singh, M.; Punjab Agricultural University, Ludhiana (India) Manes, G.S.; Punjab Agricultural University, Ludhiana (India) Singh, Surendra; Central Institute of Agricultural Engineering, Bhopal (India). Development and testing of axial-flow groundnut (*Arachis hypogaea*) thresher. Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 740-44 KEYWORDS: GROUNDNUTS. OIL CROPS. THRESHERS.

Investigations were carried out during 2005-2006 on an axial-flow groundnut thresher at different feed rate, cylinder peripheral speed and concave clearance to optimize its operational parameters for better performance. The feed rate of 800 kg/hr, cylinder peripheral speed 5.8 m/s and concave clearance of 30 mm gave best field results for threshing M 522 groundnut (*Arachis hypogaea* L.) At this optimum operational setting, threshing efficiency was 99.4% cleaning efficiency 94.2% thrower loss 0.54% pod breakage 0.35% sieve overflow 2.35% output capacity 138.4 kg/hr and specific energy requirement 1.06 kWh/q.

236. Pandey, Poonam; Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India) Kumar, Anil; Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Urea treatment effect on straw of different paddy cultivars grown in Tarai region of Uttarakhand. Indian Journal of Animal Sciences (India). (Nov 2009) v.79(11) p.1149-1152 KEYWORDS: DIGESTIBILITY. RICE. STRAW. UREA. VARIETIES.

The present experiment was planned to study the response of urea treatment in different paddy straw cultivars. In study, samples of 18 cultivars were collected and half

of the sample was treated with 4% urea (35% moisture) and kept for 4 weeks in air-tight polythene bags. Chemical composition and degradability of these paddy straw cultivars for DM, NDF, ADF, CP, HC and cellulose content were determined by using nylon bag technique. Three rumen fistulated animals were used to incubate nylon bags for 72 h. These animals were fed with green oat ad lib. just after feeding of concentrate mixture prepared from 30 parts of GNC, 32 parts of deoiled rice bran, 35 parts of wheat grain, 2 parts of mineral mixture and 1 part of common salt. After urea treatment, the mean CP content increased significantly while DM, NDF, ADF, HC and cellulose content decreased significantly. Significant urea treatment effect was seen as enhanced degradability of all parameters. Some low nutritive value paddy straw cultivars responded more due to urea treatment in comparison to the paddy straw cultivars of higher nutritive value.

237. Rana, Rajesh K.; Central Potato Research Institute, Shimla (India) Pandey, N.K.; Central Potato Research Institute, Shimla (India) Pandit, Arun; Central Potato Research Institute, Shimla (India) Pandey, S.K.; Central Potato Research Institute, Shimla (India). Profitability analysis of Kufri Chipsona-1 cultivation in Uttar Pradesh. *Potato Journal (India)*. (Jul 2009) v.36(3-4) p.166-172 KEYWORDS: PROFITABILITY. POTATOES. CULTIVATION.

This study has attempted to assess farmers' opinions on distinguishing features and profitability of processing variety Kufri Chipsona-1 vis-à-vis the other varieties grown at farmers' fields in UP state of India. Except the problem of undersized tubers this variety was either better or at par with the average performance of other varieties. K. Chipsona-1 had about 9% higher cost of cultivation than other varieties at farmers' fields. However, the gross income and net income of this variety were higher by 22% and 30%, respectively. The benefit-cost ratio for K. Chipsona-1 was 1.91 while this ratio was 1.61 for other potato varieties. Higher seed, fertilizer, irrigation and machine labour costs after adjusting for the lower cost of plant protection chemicals was responsible for overall higher cost of cultivation for this variety. Farmers got higher net profit on per unit area as well as per unit capital bases.

F03 Seed Production and Processing

238. Masilamani, P.; Tamil Nadu Agricultural University, Kumulur (India). Agricultural Engineering College and Research Institute. Annadurai, K.; Tamil Nadu Agricultural University, Kumulur (India). Agricultural Engineering College and Research Institute. Saravanapandian, P.; Tamil Nadu Agricultural University, Kumulur (India). Agricultural Engineering College and Research Institute. Bhaskaran, M.; National Seed Research and Training Centre, Varanasi (India). Effect of soil alkalinity and organic matter on seedling emergence and growth attributes of anjan (*Hardwickia binata* Roxb.). *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 399-404 KEYWORDS: ORGANIC MATTER. SEEDLINGS. SOIL. PH. EMERGENCE.

An experiment was conducted to find out the effect of different soil alkaline pH and organic matter on germination, seedling growth attributes and bio-chemical constituents of *Hardwickia binata* Roxb. The seeds were sown in soil with different pH (8.1, 9.0, 10.2 and 10.5) mixed with sand + farm yard manure (2:1:1 ratio) and compared with control (red earth + sand + farm yard manure at 2:1:1 ratio). Fourteen days after sowing it was found that the seeds sown in normal nursery soil (mixture of red earth + sand + farm yard manure) showed maximum germination (89.0%) and initial seedling vigour (1568), which was similar with seeds sown in soil with pH 10.2 + sand + farm yard manure. In 180 days old seedlings, the biometric and biochemical constituents recorded were higher in control treatment. From this experiment, it could be concluded that the *Hardwickia binata* seeds sown in higher soil pH along with sand and farm yard manure mixture showed good germination, seedling growth and biochemical constituents.

239. Kumar, Raj; Central Potato Research Station, Jalandhar (India). Marwaha, R.S.; Central Potato Research Station, Jalandhar (India). Gopal, J.; Central Potato Research Institute, Shimla (India) Pandey, S.K.; Central Potato Research Institute, Shimla (India). Relationship between chip colour and compositional characters in potato (*Solanum tuberosum*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p.679-83 KEYWORDS: DRY MATTER CONTENT. FREE AMINO ACIDS. STATISTICAL METHODS. POTATOES. REDUCING SUGARS. SOLANUM TUBEROSUM. SUCROSE. PHENOLIC COMPOUNDS.

A study was conducted during 2004-07 to evaluate 5272 germplasm accessions for importance of 5 compositional factors, namely, reducing sugars, dry matter sucrose, phenols and amino acids of tubers to chip colour. Correlation, path analysis and multiple regression studies showed that reducing sugar and dry matter were important constituents in determining the chip colour in freshly harvest potatoes. The correlation of reducing sugar content with chip color was positive and significant. Tuber dry matter had a significant and negative correlation with the intensity of chip colour. Dry matter had a negative and significant correlation co-efficient with reducing sugars. The low reducing sugar and high tuber dry matter contents had both direct and indirect favorable effects on chip colour. As the low reducing sugars and high dry matter were associated with each other contributed to lighter chip colour, simultaneous selection for both of these parameters will better facility the development of potato varieties suitable for chipping. The multiple regressions based on both these characters explained more variation in chip colour compared to either of these characters. Between the two, reducing sugar was more important and both reducing sugars and dry matter explained 50% variation in chip colour. The other three chemical constitutional, viz sucrose, total phenols and free amino acids showed no consistent association with chip colour. Further studies are required to find the other compositional factors contributing to the chip colour.

240. Kannababu, N.; National Research centre for Sorghum, Rajendranagar (India) Das, I.K.; National Research centre for Sorghum, Rajendranagar (India) Seetharama, N.; National Research centre for Sorghum, Rajendranagar (India). Effect of chemicals and bioagents on control of molds and improvement of seed quality of rainy season sorghum (*Sorghum bicolor*). Indian Journal of Agricultural Sciences (India). (Jun 2009) v.79(6) p.461-465 KEYWORDS: SPRAYERS. GERMINATION. SEEDS. MOULDS. QUALITY. AGRICULTURAL CHEMICALS. SORGHUM.

Field experiments were conducted during rainy (kharif) season of 2004 and 2005 to study the effects of various spray treatments (propiconazole, acetic acid, fluorescent *Pseudomonas* spp and garlic extract) on seed germination, seedling vigour, viability potential and grain mold severity of susceptible '296B' and tolerant 'CSHI6' and 'SVD960-I' genotypes. Spraying panicles with fluorescent *Pseudomonas* spp at grain-filling stage significantly increased seed germination, improved seedling vigor index and reduced grain mold severity on tolerant and susceptible genotypes. Fluorescent *Pseudomonas* spp., garlic extract and propiconazole significantly increased α -amylase activity (range 8.30 to 10.15 mg maltose/g/3 min compared with the 4.68 mg maltose/g/3 min. in control) in seedlings raised from seeds with different treatments. Reduction of grain mold severity resulted in improvement in seed quality parameters.

241. Uppal, Rajesh; CSKHPKV, Palampur (India). College of Agriculture, Department of Agroforestry, Singh, Charan; CSWCRTI, Uttarakhand (India). Division of HRD&SS. Effect of seed source variation on seed and seedling characteristics of *Toona ciliata*: A promising timber tree species of western Himalaya. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.132-136 KEYWORDS: SEED. MELIACEAE. MELIA. TOONA. WOOD. SEED CHARACTERISTICS.

Based on seed polymorphism and average growth performance of progenies of Dhelu, Solan, Darang, and Gagaj recorded as ideal seed sources for healthier seedling production. Test of significance ('t') computed between per cent of sound seed and various seed characters revealed that the seed source significantly enhanced root and shoot lengths, root collar diameter and dry weight of seedlings. Larger food reserves in

the seed might have allowed more pre-photosynthetic growth of the seedlings that emerged from heavy seeds. Since the seedlings of all the sources were grown at the same place, variations occurring in seedling characters might be attributed to genetic differences. Results indicate that the root and shoot lengths come under genetic control, whereas germination percentage falls under environmental influence. Besides this, heritability (h^2), genetic advance and genetic gain were again higher for root and shoot lengths, indicating that these characters are under strong genetic control. This suggests that judicious screening/selection of seed sources considering these traits could be meaningful for the improvement of *Toona ciliata*.

F04 Fertilizing

242. Roy, Tuhin Narayan; Uttar Banga Krishi Viswavidyalaya, Pundibari (India). Dept. of Agril Economics Ray, Jhiliam; University of Burdwan, Rajbati (India). Dept. of Economics. Fertilizer subsidy in India- status and future. Journal of Interacademia (India). (Apr 2009) v.13 (2) p.235-244 KEYWORDS: FERTILIZERS. ORGANIC FERTILIZERS. WTO. FOOD SECURITY. SOCIAL WELFARE. INDIA.

Fertilizer subsidy incurs huge quantity of govt. exchequers and become a graet concern for policy makers in the event of WTO agreement wherein India faces a cntinuous pressure from the international body to reduce this subsidy. Agriculture is the backbone of Indian economy. Fertilizer is a very important input for increasing production and productivity. Indian resource poor farmers can not afford to high cost of fertilizer. They need easy access to fertilizer at cheaper rate to continue agriculture in a sustainable manner. So, India's social need and WTO's directions come face to face in the event of globalization of trade. Empirical evidence show that subsidy increase consumption of fertilizer leading to increase of production and productivity of food gain. Level of fertilizer application has a direct linear relationship with food production which plays the role of maintain food security. Easy access to fertilizer is possible only when it supplied with macro economic policy for subsidy. This will help increase in total agricultural production and productivity and keep the indian farmers competitive in the international level. Beside efforts are needed for expansion of fertilizer consumption and its judicious application. Fertilizer industry in India needs much attention. Therefore, being a member of WTO, India may find out alternative venues within the WTO's directions so that policy of providing fertilizer subsidy can continue to ensure consistent agricultural production. This effort will help technical improvement in agriculture and also ensure a long term process towards societal up-liftment of million of poor rural masses of the country.

243. Kumpawat, B.S.; Maharana Pratap University of Agriculture and Technology, Arjia (India). Dryland Farming Research Station.. Integrated nutrient management in blackgram (*Vigna mungo*) and its residual effect on succeeding mustard (*Brassica juncea*) crop. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.76-79 KEYWORDS: BIOFERTILIZERS. ECONOMICS. MUSTARD. NUTRIENT UPTAKE. YIELDS. VIGNA MUNGO.

The experiment was conducted during rainy (kharif) and winter (rabi) season of 2006-07 and 2007-08 at Arijia, Bhilwara to evaluate the direct and residual effect of integrated nutrient management practice on blackgram and succeeding Indian mustard under sub-humid southern plain and Aravalli hills region of Rajasthan. Integrated nutrient management showed significant influence on productivity and nutrient uptake of blackgram. Application of 25% RDF +FYM 2.5 tonnes/ha along with Rhizobium+PSB registered maximum improvement in seed yield (1 342 kg/ha) which was 18.2% higher than 100% RDF. Treatment receiving 75% RDF with vermicompost 0.63 tonnes/ha gave maximum N and P uptake. Residual effect of integrated nutrient management practices was also equally effective in improving the yield and nutrient uptake of mustard. Application of FYM 5 tonnes/ha along with Rhizobium + PSB recorded the highest seed yield of mustered (1 642 kg/ha). Followed by treatment receiving 25% RDP +

vermicompost 1.25 tonnes/ha with Rhizobium + PSB (1 600 kg/ha) and 25% RDF + FYM 2.5 tonnes/ha with Rhizobium _PSB (1 594 kg/ha). Similar trend was also observed for N and P uptake. Maximum net return (Rs 50 342/ha) with B: C ratio (3.2) was obtained from treatment receiving 25% RDF+FYM 2.5 tonnes/ha with Rhizobium+PSB.

244. Naik, I.A.; Sher-e Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar (India). Gupta, A.J.; Directorate of Onion and Garlic Research, Rajgurunagar. Effect of plant density and integrated nutrient management on growth, yield, quality and economics of kale (*Brassica oleracea* var: *acephala*) in temperate region. *Indian Journal of Agricultural Sciences* (India). (Jan 2010) v.80(1) p.80-84
KEYWORDS: GROWTH. KALES. ORGANIC FERTILIZERS. SPACING. YIELDS. QUALITY.

An experiment was laid out during 2006-2007 with 18 treatment combinations of 3 spacing and 6 nutrition levels in a factorial randomized block design with 3 replications. Among the plant spacing, 30cm 40 cm recorded higher plant spread (37.80cm), leaf area (216.23 cm²), number of leaves/plant (11.13), average leaf weight (22.13 g). Petiole length (12.95cm), petiole mid-rib weight (8.95 g), leaf weight/plant (166.04 g), dry matter content (13.69%), total chlorophyll III content (61.06 mg/100 g), total carotenoids (2.53 mg/100 g) and vitamin C content (100.65 mg/100g). But significantly higher leaf yield (26.25 tonnes/ha) was recorded with a spacing of 30cm 20 cm due to large plant population/unit area. Among the nutritional levels 50% recommended fertilizers dose + 3 tonnes vermicompost/ha recorded significantly higher plant spread (43.17 cm), leaf area (268.36 cm²), number of leaves/plant (12.65), average leaf weight (24.124 g), during of picking (45 days), leaf weight (188.93 g/plant) and leaf yield (26.25 tonnes/ha). The highest net return of Rs 2 12 801 and benefit: cost ratio of 4.28 was accrued with 30cm 20 cm plant spacing along with 50% recommended fertilizers dose+3 tonnes vermicompost/ha.

245. Singh, Bijay; Punjab Agricultural University, Ludhiana (India) Singh, Varinderpal; Punjab Agricultural University, Ludhiana (India) Singh, Yadvinder; Punjab Agricultural University, Ludhiana (India) Gupta, R.K.; Punjab Agricultural University, Ludhiana (India). Need based field specific nitrogen management in rice for high fertilizer use efficiency. *Indian Farming* (India). Mar 2009 v.58(12) p.11-14
KEYWORDS: NITROGEN FERTILIZERS. RICE. MANAGEMENT.

Blanket recommendation for applying fertilizer nitrogen to rice cannot help increase fertilizer use efficiency beyond a limit. Further improvement can be achieved by following strategies based on principles of feeding crop needs of nitrogen. Real time fertilizer nitrogen management based improving synchrony between nitrogen demand by rice crop and supply of nitrogen from all source including soil and fertilizer seem to be promising strategy to improve fertilizer nitrogen use efficiency in rice. As real time N management is based on periodic assessment of plant N status, leaf colour chart (LCC) has emerged as visual and subjective indicator of plant N deficiency and it can guide application of fertilizer nitrogen based on colour of first fully opened leaf of rice plant from the top. Recommendations for guiding need using LCC has already been given to farmers. On farm reevaluation of the crop demand driven field specified nitrogen management show that rice yield similar to those obtained by following farmers practice can be obtained but applying substantially less amount of nitrogen fertilizer.

246. Sharma, Manish K; Dr. Y S Parmar University of Horticulture and Forestry, Nauni-Solan (India). Negi, Saurabh; Nunhems Pvt. Ltd, Rajgarh (India) Kumari, Santosh; Dr. Y S Parmar University of Horticulture and Forestry, Nauni-Solan (India). Effect of different growing media and fertigation levels on production of cucumber (*Cucumis sativus*) under protected conditions in the hills.. *Indian Journal of Agricultural Sciences* (India). (Nov 2009) v.79(11) p.853-56
KEYWORDS: CUCUMBERS. GREENHOUSE CROPS. FERTIGATION. GROWING MEDIA. QUALITY. PRODUCTIVITY. OFF SEASON CULTIVATION.

A Study was conducted during 2007-2008 to study the effect of growing media and fertigation level on the cucumber (*Cucumis sativus* L.) production and its quality when

grown in the low cost plastic greenhouse. The whole experiment was arranged over 9 treatment consisting of 3 growing media H0 (soil) M1 (soil:farmyard manure:and) and M2 Soil:vermicompost:and) in the ratio of 2:1:1 and 3 fertigation levels [F1 (100 kg NPK/ha), F2 (200 kg NPK/ha), F3 (300 kg NPK/ha)]. Interaction effects of growing media and fertigation level showed significant effect for most of the character except days to marketable maturity and fruit weight. It is revealed that growing media M comprising soil:vermicompost:and (2:1:1) along with fertigation level F3 300 kg NPK/ha is highly suitable for growing cucumber in naturally ventilated polyhouse in mid hills of Himachal Pradesh for off season production during August-December and February-June. The result indicated an increased yield of 8.33 kg/plant and 16.66 kg m² with superior quality in the treatment comprising soil: vermicompost: and (2:1:1) as growing media and fertigation with 300 kg NPK/ha.

247. Rasool, Rehana; Krishi Vigyan Kendra, SKUAST-K, Srinagar (India) Kukal, S.S.; Punjab Agricultural University, Ludhiana (India) Hira, G.S.; Punjab Agricultural University, Ludhiana (India). Root growth and soil water dynamics in relation to organic and inorganic fertilization in rice (*Oryza sativa*)-wheat (*Triticum aestivum*) cropping system. Indian Journal of Agricultural Sciences (India). (Nov. 2009) v.79(11) p.922-26 KEYWORDS: RICE. TRITICUM AESTIVUM. SOIL WATER CONTENT. FARMYARD MANURE. INORGANIC FERTILIZERS.

A study was undertaken during 2004-05 to evaluate soil water dynamics and crop performance in relation to organic and inorganic fertilizers in rice (*Oryza sativa* L.) wheat (*Triticum aestivum* L. emend. *fori* & *paol.*) cropping system in a sandy loam soil. The treatment during rice and wheat cropping system were (T1) control (without any fertilizer or farmyard manure), (T2) farmyard manure 20 tonnes/ha. (T3) N 120 (nitrogen 120 kg/ha), (T4) N120 P30 (nitrogen and phosphorus 120 and 30 kg/ha) and (T5) N120 P30 K30 (nitrogen, phosphorus and potash 120, 30 and 30 kg/ha), replicated four times in randomized block design. The root mass density of rice and wheat was higher in farmyard manure and N120 P30 K30 plots. The root length density of rice was highest in N120 P30 K30 plots (0.387 cm/cm³), followed by that farmyard manure treated plots (0.37 cm³/cm³). The soil water storage at wheat harvest was highest (24.5 cm) in control and lowest (19.7 cm) in FYM treated plots. The soil water status root growth and crop performance increased with balance fertilization.

248. Govindan, M.; Kerala Agricultural University, Pilicode (India). Regional Agricultural Research Station. Sreekumar, K.M.; Kerala Agricultural University, Pilicode (India). Regional Agricultural Research Station. Subramanian, Madhu; College of Agricultural, Palakkad (India). Dept. of Agricultural Microbiology. Response of ginger (*Zingiber officinale*) to *Azospirillum* inoculation at different levels of nitrogen application.. Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.821-23 KEYWORDS: AZOSPIRILLUM. BIOFERTILIZERS. GINGER. NITROGEN FIXATION. RHIZOBACTERIA.

Field trials were carried out during 2004-and 2005 to study the efficiency of *Azospirillum*, a nitrogen fixing rhizobacterium as biofertilizer for ginger at different levels of fertilizer nitrogen. The treatment of *Azospirillum* with 100% fertilizer nitrogen was found to be superior to all other treatments in terms of maximum root length, number of fingers, yield and starch content at harvest. Inoculation also resulted in increased protein content of rhizome at all the levels of fertilizer nitrogen.

F06 Irrigation

249. Biswas, Sonali; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept. of Agronomy Saha, Abhijit; College of Agriculture, Lembuchera (India). Dept. of Agronomy. Effect of irrigation and *Rhizobium* inoculation on growth, yield and consumptive use of summer groundnut (*Arachis hypogaea* Linn.). Journal of Interacademia (India). (Apr 2009) v. 13(2) p.156-158 KEYWORDS: IRRIGATION. RHIZOBIUM. YIELD INCREASES. GROUNDNUTS. OILSEEDS.

A field experiment was conducted in the entisol soil of neutral reaction having 0.07, of total N, 26.66 kg ha⁻¹ available potassium at the Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal during 2004 and 2005 to study the effect of irrigation and Rhizobium inoculation on growth, yield than other levels of irrigation. Three irrigations at vegetative, flowering and pod formation stage gave highest consumptive use of groundnut. Rhizobium inoculation with Jcg-1 strain showed maximum potentiality in regard to growth and yield of groundnut.

250. Manjunatha, M.V.; University of Agricultural Sciences, Dharwad (India). College of Agriculture. Dept. of Agricultural Engineering. Hebbara, M.; University of Agricultural Sciences, Dharwad (India). College of Agriculture. Ravishankar, G.; Krishi Vignan Kendra, Hagari (India). Response of cotton (*Gossypium hirsutum*) to single and paired row method of sowing under drip and furrow irrigation in saline vertisols. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.38-41 KEYWORDS: COTTON. TRICKLE IRRIGATION. FURROW IRRIGATION. VERTISOLS. SOWING. SALINE SOILS.

A field experiment was conducted during 2004-2006 to study the response of cotton (*Gossypium hirsutum* L.) to various level of drip and furrow irrigation in saline vertisols. The canal water (EC cw, 0.20 dS/m) and well water (EC ww, 4.0 dS/m) was used for furrow and drip irrigation respectively. Crop performance was better under drip compared to furrow method of irrigation. The highest (1.34 tonnes/ha) and lowest 1.10 tonnes/ha) seed cotton yield were recorded in case of drip irrigation at 1.2 evapotranspiration in single row method and furrow irrigation at 1.0 evapotranspiration in paired row method of sowing, respectively. Net saving in irrigation water through drip irrigation was 13.8 and 10.6% at the irrigation levels of 1.0 evapotranspiration and 1.2 evapotranspiration, respectively compared to the same level of irrigation through furrow method. The highest (17.19 kg/ha-cm) and lowest (13.00kg/ha-cm) water production efficiencies were achieved in case of paired row method of sowing at 1.0 evapotranspiration through drip irrigation and 1.2 evapotranspiration through furrow irrigation, respectively. In drip irrigation, higher gross benefit: cost ratio and net profit/cm of water used was achieved under paired row method of sowing than the single row method due to reduction in system cost. To minimize the system cost of drip irrigation (up to 35%) without reductions in yield and net economic returns, one could adopt paired row method of sowing in cotton in saline vertisols. Even though the gross B:C ratio are marginally less in drip irrigation than furrow irrigation, use of poor quality groundwater through drip irrigation seems to be a feasible solution, especially in water scarcity area.

251. Sihag, Mukesh; Punjab Agricultural University, Ludhiana (India) Chawla, J.K.; Punjab Agricultural University, Ludhiana (India) Vashisht, Ajay; Punjab Agricultural University, Ludhiana (India) Bhushan, Indu; Punjab Agricultural University, Ludhiana (India). Efficient use of canal water through drip irrigation in cotton (*Gossypium hirsutum*). Indian Journal of Agricultural Sciences (India) . (Oct. 2009) v.79(10) p.794-97 KEYWORDS: COTTON. TRICKLE IRRIGATION. WATER MANAGEMENT.

A study was conducted during 2003-06 to optimally utilize the drip irrigation system already available with the orchardists of south west Punjab wherein adaptive research trials at farmers field using drip irrigation in cotton (*Gossypium hirsutum* L.) with paired row planting were laid in Abohar (Ferozepur district) to see the performance of crop and compare with the farmers practice of applying irrigation through flooding. the average increase in yield in drip irrigated plot was 21% (with a maximum yield of 2812 as compared to 2036 kg/ha under flooding) with water saving of 30% beside early maturity labour savings and risk coverage under heavy downpour than the flooding method. The economic analysis showed that the method of using drip irrigation in cotton was technically feasible and economically viable in canal command area with a benefit cost ratio (2.03:1) as compared to flooding (1.88:1).

252. Bahadur, Anant; Indian Institute of Vegetable Research, Varanasi (India). Singh. K.P.; Indian Institute of Vegetable Research, Varanasi (India). Rai, Ashutosh; Indian

Institute of Vegetable Research, Varanasi (India). Verma, Ajay; DWR, Karnal (India) Rai, Mathura; Indian Institute of Vegetable Research, Varanasi (India). Physiological and yield response of okra (*Abelmoschus esculentus*) to irrigation scheduling and organic mulching. Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.813-15
 KEYWORDS: IRRIGATION SCHEDULING. OKRAS. STRAW MULCHES. YIELDS. ORGANIC COMPOUNDS.

A field experiment carried out during spring summer of 2006-2007 at Indian Institute of vegetable Research, Varanasi. The treatment comprised 4 levels of surface irrigation (4, 7, 10 and 12 days intervals) and 2 level of mulch (Pea straw mulch at 12.5 tonnes/ha and no mulch). Significant difference on morpho physiological and yield attributes were observed in various irrigation treatments and organic mulches. Irrigation scheduled at 4 day in interval exhibited maximum fresh pod yield of okra (15.03 tonnes/ha) with higher leaf water potential, (0.91 MPa), relative water content in leaves (83%), photosynthetic rate (14.10umole CO₂/m²/s¹) and stomatal conductance (351.9 mmol H₂O/m²/S¹). Higher chlorophyll II concentration index was recorded in 4 or 7 day irrigation intervals. Pea straw mulch significantly enhanced the plant height, number of nodes/plant, number of pod/plant; pod weight and fresh pod yield over non-mulched. Significant improvement was observed in plant physiological parameters and soil water content under pea straw mulch. Irrigation at 10 day interval along with pea straw mulch exhibited maximum water use efficiency (455.72 kg/ha-cm). Significant reduction in weed population (65.4%) and considerable water saving (29.6%) was recorded with use of pea straw mulch over no mulch.

253. Singh, R.K.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Verma, S.K.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Sharma, Rajvir; IARI, New Delhi (India). Division of Agronomy. Singh, S.B.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Bio-efficacy and selectivity of sulfosulfuron and metribuzin before and after irrigation in wheat (*Triticum aestivum*) under zero-tillage system.. Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 735-39
 KEYWORDS: ECONOMICS. HERBICIDES. NUTRIENT UPTAKE. WEEDS. WHEATS. ZERO TILLAGE.

A field experiment was conducted during winter (rabi) season of 2003-04 and 2004-05 at agronomy research farm, BHU, Varanasi, to study the bio-efficacy and selectivity of sulfosulfuron and metribuzin before and after irrigation in wheat (*Triticum aestivum* L. emend. Fiori & Paol) under zero-tillage system. Eight weed control treatments viz metribuzin 0.21 kg/ha before first irrigation (BFI) metribuzin 0.21 kg/ha after first irrigation (AFI) sulfosulfuron 0.025 kg/ha BFI sulfosulfuron 0.025 kg/ha AFI, isoproturon + 2,4-D 0.75 + 0.5 kg/ha AFI, 1 hand weeding at 30 days after sowing and weedy check were tested in randomized block design with 3 replications. Sulfosulfuron (AFI) significantly reduced weed density, dry weight and NPK depletion by weeds with maximum weed control efficiency (79.4%) and improve the NPK uptake by crop which cause significant impact on crop growth and yield attributes which resulted higher grain yield (3.24 and 3.53 tonnes/ha). Being at par with that of one hand weeding at 30 days after sowing. Isoproturon + 2, 4-D (AFI) significantly reduced density and dry weight of weeds over metribuzin (BFI) and sulfosulfuron (BFI) and it was at par with metribuzin (AFI) and 1hand weeding. Among the herbicidal treatments, maximum net returns (Rs 7564 and 9165/ha) and benefit: cost ratio (1.54 and 1.63) was recorded under isoproturon + 2, 4-D (AFI). Hand weeding twice at 30 and 45 ADS recorded significantly higher yield attributes, grain yield, nutrients uotale with maximum weed control efficiency, net returns and benefits: cost ratio over all other weed control treatments.

F07 Soil Cultivation

254. Yadav, D.S.; Narendra Deva University of Agriculture and Technology, Faizabad (India) Kumar, V.; Narendra Deva University of Agriculture and Technology, Faizabad (India) Yadav, V.; Narendra Deva University of Agriculture and Technology, Faizabad (India). Effect of organic farming on productivity, soil health and economics of rice

(*Oryza sativa*)-wheat (*Triticum aestivum*) system. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 267-271 KEYWORDS: ORGANIC AGRICULTURE. PRODUCTIVITY. ORYZA SATIVA. TRITICUM AESTIVUM. ECONOMICS. SOIL FERTILITY.

A study was done from 2003 -2008 at Kumarganj, Faizabad to assess the impact of organic manures on performance of (*Oryza sativa* L.)-wheat (*Triticum aestivum* (L.) Fiori & Paol.) system. Among different organic farming treatments, incorporation of crop residues in both the crops + green manuring + phosphorus solubilising microbes (PSM) + poultry manure (PM) 5 t/ha + neem cake 0.2 t/ha, resulted in highest values of growth and yield components, yield and net return. This treatment gave 16.1, 16.6, 13.1, 13.1 and 44.5 % higher yield of rice and 19.7, 17.0, 14.5, 7.5 and 26.8% higher yield of wheat over T1, T2, T3, T4 (organics) and T5 (inorganics) respectively. Maximum amount of balance or un-utilized NPK was computed with inorganics treatment (T5) All the organic farming treatments improved soil health as evident by increased organic carbon and reduction in soil pH. Highest values of organic carbon (0.64%) after 5 years of experimentation was recorded with wheat residues + FYM 10 t/ha + 0.2 t/ha neem cake in rice and rice residue + pressmud 10 t/ha in wheat (T3). Treatment with crop residue + green manuring + poultry manure 5 t/ha + PSM + neem-cake 0.2 t/ha also proved most remunerative and gave 15.46, 16.08, 14.17, 8.87 and 36.48 x 10³ Rs/ha higher net return over T1, T2, T3, T4 and T5 respectively. Highest benefit: cost ratio (1.60) was also recorded with this treatment.

255. Singh, R.K.; Indian Institute of Sugarcane Research, Lucknow (India). Krishi Vigyan Kendra, Sharma, Jyotsana; National Research Centre on Pomegranate, Maharashtra (India) Singh, G.K.; Indian Institute of Sugarcane Research, Lucknow (India) Trehan, S.P.; Central Potato Research Station, Jalandhar (India). Effect of soil Solarization on multiplication of in-vitro planting materials of potato under field conditions. Potato Journal (India). (Jul 2009) v.36(3-4) p.143-148 KEYWORDS: SOIL SOLARIZATION. WEEDS. PRODUCTIVITY. POTATOES. SOIL TEMPERATURE.

A field experiment was carried out at CPRS, Jalandhar to study the effect of soil solarization on weeds and productivity of micro-tuber and mini-tuber crops of 3 potato cultivars. Mean maximum soil temperature recorded under the polyethylene mulch was 53.3°C at the surface, 50.5°C at 5 cm, 44.0°C at 10 cm and 38.6°C at 15 cm soil depth, which was higher than unsolarized plots by 10.96°C, 9.4°C, 5.6°C and 3.9°C at respective depths. Soil solarization for 4 weeks increased available nutrients (N, P, K) by 15.7, 67.3 and 49.0% at planting and 11.44, 13.1 and 32.2% at harvesting. It reduced the weed population up to 98.0% and its fresh weight up to 99.2%. Yield from micro-tuber and mini-tuber crops was higher in solarized plots (279.0 and 456.9 q/ha, respectively) as compared to unsolarized plots (193.2 and 399.2 q/ha, respectively).

F08 Cropping Patterns and Systems

256. Saha, R.; Indian Institute of Soil Science, Bhopal (India). Ghosh, P.K.; ICAR Research Complex for NEH Region, Umiam (India). Effect of land configuration on water economy, crop yield and profitability under rice (*Oryza sativa*)-based cropping system in north-east India. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.16-20 KEYWORDS: CROPPING SYSTEMS. WINTER CROPS. WATER MANAGEMENT. PROFITABILITY. ORYZA SATIVA. PRODUCTION POSSIBILITIES. PROFIT. MEGHALAYA.

A field experiment was conducted during the winter (rabi) season of 2006 and 2007 to evaluate the water economy and performance of different crop combinations under standard raised and sunken bed system of cultivation in mid-hills of Meghalaya, north-eastern part of India. The treatment consisted of various winter vegetables crop like tomato, (*Lycopersicon esculentum* L. Mill.nom. cons.), potato (*Solanum tuberosum* L.) grown on sunken beds and garden pea (*Pisum sativum* L.) and Frenchbean (*Phaseolus vulgaris* L.) grown in raised beds under organic mulched and without mulched condition. Periodical observations on soil moisture content and yield attributes of various crop were recorded for further analysis on water economy and profitability of cropping system. Organic mulching significantly increased the soil moisture content in all the crop

combinations. The profile soil moisture content was significantly higher in rice (*Oryza sativa* L.)- tomato/garden cropping system (29.3%), lowest being in rice-fallow system (22.5%). Results showed that organic mulch decreased soil temperature by 3-5°C compared to that in the plots without mulch. Among the various crop combinations, rice-tomato/gardenpea gave the highest rice equivalent yield and production efficiency (18 138 kg/ha and 77.18 kg/ha/day, respectively), followed by rice-potato/gardenpea system (16982 kg/ha and 76.50 kg/ha/day, respectively), lowest being in rice monocropping (4420 kg/ha/day, respectively). Highest net returns (Rs 56730/ha) was recorded in rice-tomato/gardenpea, followed by rice-potato gardenpea (Rs. 51435/ha).

257. Balakrishnan, M; Central Agricultural Research Institute, Port Blair (India). Ravisankar, N.; Central Agricultural Research Institute, Port Blair (India). Swarnam, T.P.; Central Agricultural Research Institute, Port Blair (India). Din, M; Central Rice Research Institute, Cuttack (India). Influence of prickly sesban (*Sesbania cannabina*) intercropping in wet-seeded rice (*Oryza sativa*) on productivity, profitability, energetics and nitrogen balance under island ecosystem. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.21-25 KEYWORDS: SESBANIA. ORYZA. PRODUCTIVITY. GREEN MANURES. INTERCROPPING. NITROGEN. ISLANDS.

Experiments were conducted during 2005 and 2006 at Port Blair, to evaluate prickly sesban (*Sesbania cannabina* (Retz.) Pers) intercropping in wet-seeded rice under island ecosystem. The results revealed that though rice + dhaincha or prickly sesban registered higher yield when dhaincha is incorporated mechanically with cono weeder (4.24 tonnes/ha), it is on par with manual and manual+ conoweeder incorporation. In terms of economics and energetics, rice dhaincha incorporation using cono weeder recorded higher net returns (Rs 15876/ha) and higher ratio (8.38). Significant increase in available soil N was observed at harvest in rice+ dhaincha (254.7 kg/ha) compared to sole rice (226.8 kg/ha). N loss was maximum in sole and unweeded conditions compared to rice+dhaincha in incorporation through manual or conoweeder or its combination.

258. Das, Anup; ICAR Research Complex for NEH Region, Umiam (India). Patel, D.P.; ICAR Research Complex for NEH Region, Umiam (India). Munda, G.C; ICAR Research Complex for NEH Region, Umiam (India). Ghosh; ICAR Research Complex for NEH Region, Umiam (India). Effect of organic and inorganic sources of nutrient on yield, nutrient uptake and soil fertilizer of maize (*Zea mays*)-mustard (*Brassica campestris*) cropping system. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.85-88 KEYWORDS: CROPPING SYSTEMS. SOIL FERTILITY. MAIZE. MUSTARD. ORGANIC FERTILIZERS.

In north-eastern region of India, improper and imbalance nutrient use in maize-mustard cropping system leads to poor system productivity. Maize being an exhaustive crop also depletes soil fertility. The study on judicious integrated nutrient management strategy revealed that application of full dose of inorganic fertilizer along with Azolla compost 2.5 tonnes/ha application to maize not only enhanced productivity of maize-mustard cropping system by 90% and 13.4% over the control and recommended N P and K respectively, But also improved soil fertility in terms of higher available N, P, K and organic carbon. This nutrient management option had considered able residual effect on succeeding mustard in terms of yield and income. However, maximum residual effect on mustard in terms of yield attribute and yield was recorded when whole nutrient was applied using organic manure (Azolla compost +farmyard manure).

259. Palsaniya, D.R.; National Research Centre for Agroforestry, Jhansi (India). Ahlawat, I.P.S.; Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy. Sulphur management in pigeonpea (*Cajanus cajan*)-wheat (*Triticum aestivum*) cropping system. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 272-277 KEYWORDS: SULPHUR. CAJANUS CAJAN. TRITICUM AESTIVUM. GYPSUM.

A field experiment was conducted at New Delhi during 2003 and 2005 on sandy loam soil with 14.35 kg/ha available S to evaluate the relative efficiency of sulphur (S) sources and rates in pigeon pea [*Cajanus cajan* (L.) Millsp.]-wheat [*Triticum aestivum* (L.)

emend. Fiori & Pao!.] cropping system. The study revealed that application of 30 kg 8/ha being at par with 60 kg/ha produced 24.9 and 0.62 more pods/plant and seeds /pod respectively than control (no 8). This increase in yield attributes finally led to 0.47 Vha higher pigeon pea yield over no 8 application (1.15 Vha). 8 applied to pigeon pea at 60 kg/ha left behind 1.19 kg/ha more 8 in soil than 30 kg/ha, which resulted in higher grain yield of succeeding wheat by 0.58 tonne/ha. Among the 8 sources, cosavet being on par with gypsum gave 14.8% (0.23 t/ha) more grain yield of pigeon pea over elemental 8 (1.55 Vha). Both these sources also proved superior in their residual effect on succeeding wheat when compared with elemental 8. Wheat responded to direct application of 30 kg 8/ha only. Cosavet was the best source from productivity point of view. However, application of 30 kg 8/ha to pigeon pea as gypsum and to wheat as elemental 8 was promising in terms of 8 efficiency and economics.

260. Ramesh, P.; Indian Institute of Soil Science, Bhopal (India). Panwar, N.R.; Indian Institute of Soil Science, Bhopal (India). Singh, A.B.; Indian Institute of Soil Science, Bhopal (India). Ramana, S.; Indian Institute of Soil Science, Bhopal (India). Production potential, nutrient uptake, soil fertility and economic of soybean (*Glycine max*)-based cropping systems under organic, chemical and integrated nutrient management practices. *Indian Journal of Agronomy* (India). (Sep 2009) v. 54(3) p. 278-283
KEYWORDS: PRODUCTION. SOIL FERTILITY. ECONOMICS. GLYCINE MAX. INTERCROPPING. NUTRIENTS.

A field experiment was conducted during 2004-05 to 2007-08 at Bhopal, Madhya Pradesh, to study the effect of organic, chemical and integrated (50:50) nutrient management (INM) practices on the productivity, nutrient up-take, soil fertility and economics of 4 soybean (*Glycine max* (L.) Merr.) based cropping systems involving durum wheat (*Triticum durum* Desf), mustard (*Brassica juncea* L. Czern & Coss.), chickpea (*Cicer arietinum* L) and isabgol (*Plantago ovata* Forsk). The productivity of crops in these systems was higher in the integrated nutrient management compared to either chemical fertilizers or organic manures, in all the years. In the first year (2004-05), the organic manure treatment recorded 7.8, 5.6, 9.4, 3.0 and 2.5 % reduction in the productivity of soybean, durum wheat, mustard, chickpea and isabgol crops, respectively, whereas in the fourth year (2007-08), the productivity of these crops was improved by 11.1, 1.1, 3.0, 4.2 and 11.2 % than chemical fertilizers. Among the treatments, soybean-durum wheat cropping system recorded the highest soybean equivalent yield (4.54 t/ha) under integrated nutrient management. Maximum uptake of N, P and K was recorded in integrated nutrient management and soybean-durum wheat cropping system. At the end of the 4 cropping cycles, application of organic manures resulted in significantly higher soil organic carbon, available N, P and K than chemical fertilizers but was on par with the integrated nutrient management. Economic returns were the highest in the INM and soybean-durum wheat cropping system and they were similar between the treatments receiving organic manures and chemical fertilizers.

261. Purushothama, P.; College of Forestry, Sirsi (India). Madiwalar, S.L.; College of Forestry, Sirsi (India). Naik, G.V.; College of Forestry, Sirsi (India). Effect of competition reducing methods on growth and productivity of component crops in teak (*Tectona grandis*) based agroforestry system. *Indian Journal of Forestry* (India). (Sep 2008) v. 31(3) p. 379-382
KEYWORDS: GROWTH. TECTONA GRANDIS. AGROFORESTRY.

A field study was conducted to find out suitable method to reduce tree - crop competition in Teak based Agroforestry system. The grain yield and yield components of Paddy were significantly higher due to thinning over no thinning. Higher grain yield was recorded in treatment receiving trenching (2819 kg/ha) which was at par with treatment receiving root barrier of thinning with trenching recorded higher grain yield (3642 kg/ha). After 8 months of imposing the treatments, the main stem volume of Teak increased by 33.3 and 22.2 per cent due to branch pruning and root barrier respectively, over control. Therefore, it is inferred that trenching along Teak row and thinning in combination with branch pruning are useful agro-techniques for improving growth and productivity of both the component crops in Teak based Agroforestry system.

262. Chand, K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Silviculture and Agroforestry. Mishra, V.K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Silviculture and Agroforestry. Effect of cutting height of biomass productivity and physiological attributes in four fodder tree species of Himachal Pradesh. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 405-411 KEYWORDS: CUTTINGS. HIMACHAL PRADESH. TREES.

The effect of cutting heights viz., 0.5, 1.0, 1.5 and 2.0 m was investigated on biomass productivity and physiological attributes of four fodder trees species i.e. *Morus alba*, *Grewia optiva*, *Celtis australis* and *Bauhinia variegata*. *Morus alba* accumulated maximum leaf+branch biomass followed by *Grewia optiva*, *Celtis australis* and *Bauhinia variegata*, respectively. The productivity of leaf, branch and their total improved with increase cutting height up to 2.0 m under all species. The photosynthesis rate and photosynthetic active radiation (PAR) showed non-significant effect due to cutting height and significant effect due to species as well as species x cutting height interaction. Transpiration rate manifested significant variation due to species, cutting height and their interaction and tended to depress with increasing cutting height. Simple correlation matrix revealed a significant positive relation between photosynthesis rate and PAR; photosynthetic rate and transpiration rate and PAR and Transpiration rate, respectively.

263. Bahar, N.; Forest Research Institute, Dehradun (India). Forest Tree Seed Lab. Studies on seed source variation in *Albizia lebbeck* (L.) Benth.. *Indian Journal of Forestry*. (Sep 2008) v. 31(3) p. 417-422 KEYWORDS: ALBIZIA. SEED.

Source variation study of *Albizia lebbeck* was undertaken to identify the superior seed sources for production of quality seedling. Twenty nine seed sources sampled from the greater part of its natural range. Variation for most of the studied characters indicated non-clinal pattern. On average, the population of Debra Dun (Uttarakhand), Kathua (Jammu & Kashmir) and Tirunelveli (Tamil Nadu) were found to be the best on the basis of weight, germination per cent and vigour index of seed as an important criterion for delineating the superior seed source. This preliminary investigation will be useful for further improvement of the species for better productivity.

264. Sood, K.K.; Sher-e-Kashmir University of Agricultural Science and Technology, Jammu (India). Agroforestry Div. Najjar, C.; North Eastern Regional Institute of Science and Technology, Nirijuli (India). Faculty of Forestry. Singh, K.A.; North Eastern Regional Institute of Science and Technology, Nirijuli (India). Faculty of Forestry. Handique, P.; North Eastern Regional Institute of Science and Technology, Nirijuli (India). Faculty of Forestry. Singh, B.; North Eastern Regional Institute of Science and Technology, Nirijuli (India). Faculty of Forestry. Rethy, P.; North Eastern Regional Institute of Science and Technology, Nirijuli (India). Faculty of Forestry. Association between socio-economic parameters and agroforestry uptake : evidences from Eastern Himalaya. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 559-564 KEYWORDS: AGROFORESTRY. SOCIOECONOMIC ENVIRONMENT. HIMALAYAN REGION.

Many Agroforestry programmes, started during 1970s in various countries, suffered on account of ignoring the socio-economic structure of farm households in the design of these programmes. The empirical studies on behaviour of households on on-farm tree cultivation are now gaining importance to design socially acceptable Agroforestry programmes to encourage Agroforestry uptake. The study has been carried out in Jaintia hills district of Meghalaya which is located in Indian Eastern Himalayas. The data have been collected on a pre-structured schedule in personal interviews with the head of the households. Amongst social factors family literacy, government employment, size of agricultural holding, religion and mobility of head of household showed significant influence on on-farm tree cultivation. Cropping intensity, size of agricultural holding, annual agricultural income, on-farm income, total household income and area under paddy cultivation were the economic aspects of farm households which influenced cultivation of trees on the farms. The study implies need to consider socio-economic

factors to encourage the level of on-farm tree cultivation and design socially acceptable Agroforestry programmes.

265. Ram, S.N.; Indian Grassland and Fodder Research Institute, Jhansi (India). Production potential, biological feasibility and economics of guinea grass (*Stylosanthes hamata*) intercropping system under various fertility levels in rainfed condition.. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.871-75 KEYWORDS: FERTILITY. INTERCROPPING. PANICUM MAXIMUM. PRODUCTIVITY. STYLOSANTHES HAMATA.

A field experiment was conducted during 2003-07 on sandy loam soil to study the effect of row ratios and fertility levels on growth, persistence of legume, productivity, quality and monetary returns of guinea grass-*Stylosanthes hamata* (L.) taub intercropping system under rainfed conditions. Intercropping of guinea grass with *S. hamata* in paired row gave significantly higher green forage (20.35 tonnes/ha), dry forage (5.01 tonnes/ha) and crude protein yield (438.8 kg/ha) compared with the sole stand of both grass and legume and alternate row and it was at par with 3:3 and 4:4 row ratios during all the four years. The dry matter yields of the recommended dose of fertilizer was reduced by 22.71% over 75% of recommended dose of fertilizer + 5 tonnes farmyard manure/ha persistence of *S. hamata* were higher (85.19, 74.72 and 69.78%) in its sole stand when compared to alternate row of grass legume intercropping (76.26, 56.38 and 45.37%) during all three years. Intercropping of guinea grass with *S. hamata* in all the relative crowding co-efficient was recorded in paired row of grass-legume intercropping, which indicated comparative yield advantage of this system over the other intercropping treatments. The maximum net return (Rs 5 103/ha) as well as net returns/Re invested (0.72) were obtained in paired row of grass-legume intercropping. Among fertility levels, highest net return (Rs 5276/ha) and net return/Re invested (0.55) were achieved with application of 75% of the recommended dose of fertilizer in combination with 5 tonnes farmyard manure/ha.

266. Meena, Samrath Lal; Indian Grassland and Fodder Research Institute, Tonk (India). Regional Station. Shamsudheen, M; Central Arid Zone Research Institute, Bhuj (India). Regional Research Station. Dayal, Devi; Central Arid Zone Research Institute, Bhuj (India). Regional Research Station. Productivity of clusterbean (*Cyamopsis tetragonoloba*) and sesame (*Sesamum indicum*) intercropping system under different row ratio and nutrient management in arid region/. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.901-05 KEYWORDS: FARMYARD MANURE. INTERCROPPING. NUTRITIONAL REQUIREMENTS. SESAME. CYAMOPSIS PSORALIOIDES.

A study was conducted during rainy (kharif) seasons of 2005 to 2007 at Bhuj to find out possibility of increasing production of clusterbean (*cyamopsis tetragonoloba* L. and sesame (*Sesamum indicum* L.) through spatial arrangement and nutrient management. The soil was gravelly sandy loam with shallow depth (21 cm) and pH 8.7. The clusterbean equivalent yield (919 kg/ha), net return (Rs 7440/ha), benefit:cost ratio (1.80) and sustainable yield index (0.74) were higher with clusterbean + sesame (2:1) intercropping system over the sole crop of clusterbean (710 kg/ha, Rs 5945/ha, 1.68 and 0.71 respectively). Irrespective of cropping system, application of 20 kg N/ha + 5 tonnes farmyard manure/ha recorded significantly higher clusterbean equivalent yield (1036 kg/ha) net return (Rs 11171/ha), benefit:cost ratio (2.14) and sustainable yield index (0.80) over 40 kg N/ha alone and absolute contrl. The row ratio of 2:1 in clusterbean + sesame intercropping fertilizer with 20 kg N+5 tonnes farmyard manure/ha may be recommended to get more economic benefit and sustained yield in arid region.

267. Parihar, C.M.; Indian Agricultural Research Institute, New Delhi (India). Directorate of Maize Research. Rana, K.S.; Indian Agricultural Research Institute, New Delhi (India). Parihar, M.D.; CCSHAU, Hissar (India). Crop productivity, quality and nutrient uptake of pearl millet (*Pennisetum glaucum*) Indian mustard (*Brassica juncea*) cropping system as

influenced by land configuration and direct and residual effect of nutrient management.. Indian Journal of Agricultural Sciences (India). (Nov. 2009) v.79(11) p.927-30 KEYWORDS: PLANT PRODUCTION. FARMYARD MANURE. NUTRIENT UPTAKE. PENNISETUM GLAUCUM. BRASSICA JUNCEA. CROPPING SYSTEMS.

Field experiments were carried out during 2005-07 to assess the effect of land configuration and nutrient management in pearl millet (*Pennisetum glaucum* (L.) R. Br. Emend stultz)-Indian mustard (*Brassica juncea* (L.) Czernjsscoss) cropping system. The principal findings revealed that ridge and furrow sowing method improved grain yield (912.5 and 11.1%) stover yield (14.9 and 9.5%) protein content (0.96 and 1.6%) total N (15.5 and 12.6%) and P (16.8 and 29.0%) uptake, net returns (20.1 and 16.2%) and pearl millet equivalent yield and production efficiency in pearl millet and also to succeeding mustard over the flat sowing respectively. The integrated application of 30 kg N+20kg P₂O₅+ farmyard manure 6 tonnes/ha gave significantly higher grain yield (33.5 and 37.9%) Stover yield (29.8 and 36.7%) protein content (6.9 and 13.8%), total N (56.2 and 55.5%) and P (55.2 and 68.7%) uptake, net return (38.7 and 39.3%) and pearl millet equivalent yield and production efficacy to pearl millet and succeeding mustard respectively over the control and remained at par with 60 kg N + 40 kg P₂O₅/ha. However direct mustard gave significantly higher seed yield (37.9 and 9.2%), stalk yield (32.6 and 6.6%) protein content (15.3 and 5.8%) total N (53.7 and 13.6% and P (52.9 and 13.6%) uptake, net returns (18.9 and 22.6%) pearl millet equivalent yield production efficiency in pearl millet-mustard cropping system over the control and 30 kg N+20kg P₂O₅/ha respectively.

268. Kumar, Anil; CCS Haryana Agricultural University, Hisar (India). Hooda, R.S.; CCS Haryana Agricultural University, Hisar (India). Yadav, H.P.; CCS Haryana Agricultural University, Hisar (India). Chugh, L.K.; CCS Haryana Agricultural University, Hisar (India). Kumar, Manoj; CCS Haryana Agricultural University, Hisar (India). Gera, Rajesh; CCS Haryana Agricultural University, Hisar (India). Compensating nutrient requirement in pearl millet (*Pennisetum glaucum*)-wheat (*Triticum aestivum*) cropping system through manures and biofertilizers in semi arid region of Haryana. Indian Journal of Agricultural Sciences (India). (Oct. 2009) v.79(10) p.767-71 KEYWORDS: PENNISETUM GLAUCUM. TRITICUM AESTIVUM. CROPPING SYSTEMS. ORGANIC FERTILIZERS. BIOFERTILIZERS. COST BENEFIT ANALYSIS. ECONOMIC ANALYSIS. PROTEIN CONTENT. HARYANA. STEMS.

A field experiment was conducted for 4 years i.e. from rainy (kharif) season 2004 to winter season 2007-08 at Hisar to study compensating requirement in pearl millet (*Pennisetum glaucum* (L.) R. Br. Emend. Stultz)-wheat [*Triticum aestivum* (L.) emend. Fiori & paol.] using manures and biofertilizer. The recommended dose of 40 kg N + 20 kg P₂O₅/ha to pearl millet and 60 kg N + 30 kg P₂O₅/ha to wheat + 20 kg K₂O/ha (T1) and 50% of the recommended dose of nitrogen in both the crop + 5.0 tonnes farmyard manure before pearl millet sowing + seed inoculation with *Azospirillum* in pearl millet and *Azotobacter* in wheat + phosphate-solubilizing bacteria (PSB) (T4) resulted 54.1 and 46.6% higher grain yield than the control (no application of any fertilizer). In wheat the grain yield under treatment T1 being at par with 100% of the recommended dose of N and P in both the crops (T2) recommended N in both the crop (T3) T4 (3047 kg/ha) and T5, 50% of the RDN in both the crops + 2.5 tonnes farmyard manure before pearl millet sowing + seed inoculation with *azospirillum* in pearl millet/*Azotobacter* in wheat + PSB (3102 kg/ha) was statistically better than T6, 15.0 tonnes farmyard manure before pearl millet sowing + seed inoculation with *azospirillum* in pearl millet and *Azospirillum* in pearl millet and/*Azotobacter* in wheat + PSB (2664/kg/ha) T7 7.5 tonnes vermicompost before pearl millet sowing +seed inoculation with *Azospirillum* in pearl millet and/*Azotobacter* in wheat + PSB (2735 kg/ha) and control (2154 kg/ha) treatments. Maximum pearl millet equivalent yield was in the T1 (11991 kg/ha) which followed by T2 (11684 kg/ha) T5 (11096 kg/ha) and T4(10973 kg/ha) treatments. On mean basis, protein content was highest in T4 (11.14%). Followed by t3 (11.09%) and T (10.99%) and minimum value of 9.99% was recorded in control. The values of pH and electrical conductivity were almost similar in

T1, T2 and T3 treatments compared with the control and these values decreased in T4 to T7 treatments. In general organic carbon content was static where only chemical fertilizer were used but substantial increase was observed where pure organic and biofertilizer were used. Nitrogen and phosphate balance was higher in organic manure and biofertilizer treatments as compared to inorganic fertilizer treatments. However, potash content decreased compared to initial status in the soil after 4 years of crop sequence of pearl millet-wheat. Treatment T1 gave 54.1 and 110.6% higher gross and net returns over the control (T8) B:C ratio (2.29) system productivity (32.9 kg/ha/day) and profitability (Rs 155.3 ha/day) were quit higher in T1 treatment than the control (1.70, 21.3 and 73.7, respectively).

269. Billore, S.D.; Directorate of Soybean Research, Indore (India). Ramesh, A; Directorate of Soybean Research, Indore (India). Joshi, O.P.; Directorate of Soybean Research, Indore (India). Vyas, A.K.; Directorate of Soybean Research, Indore (India). Energy budgeting of soybean based cropping system under various tillage and fertility management.. Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.827-30 KEYWORDS: CROPPING SYSTEMS. ENERGY. ENERGY CONSUMPTION. FERTILITY. RENEWABLE ENERGY. TILLAGE.

The highest non renewable energy and total energy input was associated with conventional tillage. Renewable energy to non renewable energy ratio and renewable energy percentage to total energy input were the maximum in no till. The lowest energy intensiveness was associated with minimum tillage. The gross and net energy output and renewable energy use efficiency were the maximum in conventional tillage. Soybean-chickpea system had an edge over soybean-wheat in case of renewable energy productivity and intensiveness. The application of organic manure either alone or in conjunction with mineral fertilizer significantly increased the renewable energy share while just reverse with lone application of mineral fertilizers. The integration of organic and inorganic source of nutrients production highest energy outputs. The highest renewable and non renewable energy use efficiency was recorded with recommended dose of fertilizer and poultry manure alone respectively. Application of recommended dose of fertility showed the highest renewable energy productivity. The integration of organic manure with recommended dose of fertilizer showed higher energy intensiveness than their lone application of organic manure.

270. Kumar, Anil; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Kangra (India). Oilseeds Research Station, Thakur, K.S.; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Kangra (India). Oilseeds Research Station. Effect of intercropping in situ green manures and fertility levels on productivity and soil nitrogen balance in maize (*Zea mays*)-gobhi sarson (*Brassica napus*) cropping system.. Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 758-62 KEYWORDS: BRASSICA NAPUS. FERTILITY. GREEN MANURES. INTERCROPPING. MAIZE. PRODUCTIVITY.

The experiment was conducted during 2004-07 under rainfed conditions at Oilseeds Research Station, Kangra Himachal Pradesh to know the effect of legume intercropping and fertility levels on productivity and nitrogen balance in soil in maize-gobhi sarson sequence. Maize + cowpea (GM) maize + soybean and maize + crotalaria (GM) intercropping system being at par gave 31.9, 26.9 and 26.2% higher maize yield over maize sole system. Significantly highest gobhi sarson seed yield was obtained when preceded by maize + cowpea grain (1.33 tonnes/ha) and maize + soybean (1.23 tonnes/ha). Maize responded to 100% fertility level application (5.22 tonnes/ha); residual effect on succeeding gobhi sarson did not differ significantly. Direct application of recommended fertilizer in gobhi sarson increased the seed yield by 93.7%. Significantly highest system productivity (25.2 kg/ha/day) system profitability (Rs.141.3/ha/day) and B:C ratio (2.74) and uptake were observed in maize + soybean-gobhi sarson system (22.9 kg/ha/day and Rs 126.1/ha/day). The balance sheet of N showed that there was maximum gain of N in maize _ soybean-gobhi sarson sequence followed by maize + cowpea (GM)-gobhi sarson sequence. Application of 50% RDF in

Kharif showed the maximum gain of N in balance sheet, whereas the integrated treatment of 50%NPK + 50% organic showed the lowest.

271. Yadava, Anil Kumar; Soban Singh Jeena campus, Almora (India). Department of Forestry, Kumaun University. Carbon sequestration: underexploited environmental benefits of Tarai agroforestry systems. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.125-131 KEYWORDS: AGROFORESTRY. CARBON. BIOMASS. POPULUS DELTOIDES. POPULUS.

The experiment was initiated in October, 2005 under four different agroforestry systems, viz., *Populus deltoides* 'G-48' + wheat in block plantation, *Eucalyptus* hybrid + wheat in boundary plantation, *Populus deltoides* + wheat boundary plantation and *Populus deltoides* + lemon grass in block plantation under nine years old block and boundary plantations of *Populus deltoides* and *Eucalyptus* hybrid with wheat (*Triticum aestivum*) and lemon grass (*Cymbopogon flexuosus*). The present investigation deals with effect of structural composition of agroforestry system, number of woody perennial involved in the system and the management practices plays a major role in influencing the biomass level, carbon storage, CO₂ mitigation potential and total carbon sequestration (in trees) of 70.59 t ha⁻¹, 21.38 t ha⁻¹, 116.29 t ha⁻¹ and 18.53 t C ha⁻¹ in system *Populus deltoides* + wheat followed by 68.53 t ha⁻¹, 20.63 t ha⁻¹, 113.03 t ha⁻¹ and 17.60 t C ha⁻¹ in system *Populus Deltoides* + Lemon Grass, respectively. It was observed that *Populus deltoides* + wheat and *Populus deltoides* + lemon grass under block plantation have the maximum potential to sequester carbon than the boundary plantations of *Populus deltoides* and *Eucalyptus* hybrid.

272. Kumar, Manoj; Central Potato Research Institute, Shimla (India). Jatav, M.K.; Central Potato Research Institute, Shimla (India). Trehan, S.P.; Central Potato Research Station, Jalandhar (India). Lal, S.S.; Central Potato Research Institute, Shimla (India). Integrated Nutrient Management in potato based cropping systems for Eastern Indo-Gangatic Plains of India. Potato Journal (India). (Jul 2009) v.36(3-4) p.136-142 KEYWORDS: CROPPING SYSTEMS. SOLANUM TUBEROSUM. ORGANIC FERTILIZERS. RESIDUES.

In order to reduce the use of fertilizers and utilize residual fertility of potato crop, different integrated nutrient management options were examined in two most popular cropping systems viz., rice-potato-onion and maize-potato-green gram of eastern plains at Central Potato Research Station, Patna during 2004–2007. Besides, different recommended dose of fertilizers and 100% organic treatments (farm yard manure to replace recommended dose of N to all crops), other treatments included reduced doses of nutrients to subsequent crops, recycling of crop residue and application of FYM. The maize-potato-green gram sequence gave higher potato yield due to improved soil physical conditions. However, the net return and potato equivalent yield (PEY) was higher in rice-potato-onion system due to higher returns from their component crops. Results indicated the possibility to economize fertilizer in green gram crop but not in onion by replacing 50% NPK through FYM or potato crop residue, when grown on residual fertility of potato. Residue incorporation of leguminous crop had more beneficial effect on subsequent maize crop but same effect of onion residue was not observed on rice. In organic treatment, potato yield was least but steadily increased over the years in both the systems. Soil physical conditions improved in second system as indicated by decreased bulk density and increased organic carbon in sub soil.

F30 Plant Genetics and Breeding

273. Bhattacharya, C.; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept. of Plant Breeding. Karmakar, K.S.; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept. of Plant Breeding. Bakshi, Asis; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Dept. of Plant Breeding. Genetic variability studies in *Cajanus cajan* L. grown for two years under red and laterite zone of West Bengal: A comparative study. Journal of Interacademia (India). (Jul 2009) v. 13(3) p.247-254 KEYWORDS: PLANT

BREEDING. CAJANUS CAJAN. HERITABILITY. GENETIC GAIN. GENETIC VARIATION. WEST BENGAL.

In General the information available on various genetic variability components on different crops are based on single year's experimental data. When the result of those experimental data are assembled, wide differences among the values of those variability components are observed. The present experiment was designed in such way, with the expectation that the genotypic variability estimated at different population level for a particular character will be more or less identical in dimension and magnitude. Theoretically, it was expected that the differences in phenotypic variability values at different population level for a particular character, if observed, mainly be contributed due to the differences in environmental factors. But from this experiment, close correspondences were observed among environmental variability estimated at different population level for a particular trait. Comparatively wide differences in values both in magnitude and dimensions in some traits were observed in pooled population levels for different genotypic and phenotypic variability estimates. The results of the study clearly demand some modification or proposal of some new models for deduction of these variability components from the individual year as well as pooled population level to minimize the chance of such type of differences.

274. Sekhar, J.C.; Pusa Campus, New Delhi (India). Directorate of Maize Research. Rakshit, Sujay; CIMMYT India, ICRISAT, Hyderabad. Kumar, Pradyumn; CIMMYT India, ICRISAT, Hyderabad. Mehrajuddin; CIMMYT India, ICRISAT, Hyderabad. Anuradha, M; Directorate of Maize Research, ARI, Rajendranagar (India). Dass, Sain; CIMMYT India, ICRISAT, Hyderabad. Differential reaction of CIMMYT maize line and their hybrid combinations to pink stem borer, *Sesamia inferens* walker. *Annals of Plant Protection Sciences (India)*. (Sept 2008) v.16(2) p. 404-406 KEYWORDS: RESISTANCE TO CHEMICALS. *SESAMIA INFERENS*. ZEA MAYS.

Two trials were conducted involving twenty eight inbred lines, forty five and forty five single crosses, respectively from CIMMY India programme along with resistant and susceptible checks in rabi 2005-2006 at winter Nursery Experimental farm, Hyderabad. The germplasm was artificially infested by introducing 10-12 neonate larvae onto the whorl of the individual plants using larval dispenser. Four weeks after infestation plants were scored using a 9 point scale. Of the twenty eight lines screened, four lines were found to be moderately resistant. CML 421 recorded the lowest leaf injury rating of 4.40 and which was followed by CAO 3141 (4.60), CAO 3120 (4.60) and CAO 0106 (4.75). Among the forty five single crosses, two crosses CML 429 x CML 474 and CML 421 x CML 470 were found to be highly resistant. These two crosses recorded LIR less than the resistant check 1. Overall, the screening trial indicated the following inbred lines CML 421, CAO 3141, CAO 0106 and CAO 3120 and single crosses CML 429 x CML 474 and CML 421 x CML 470 could be effectively utilized in the Pink stem borer breeding programme.

275. Datta, D.; India Institute of Vegetable Research, Varanasi (India). Bhardwaj, S.C.; Directorate of Wheat Research, Flowerdale, Shimal (India). Prashar, M.; Directorate of Wheat Research, Flowerdale, Shimal (India). Anomalous behaviour of a wheat leaf rust resistance gene Lr32.. *Indian Journal of Agricultural Sciences (India)*. (Jan 2010) v.80(1) p.11-15 KEYWORDS: *PUCCINIA RECONDITA*. *TRITICUM AESTIVUM*. ENVIRONMENTAL TEMPERATURE. TEMPERATURE RESISTANCE. GENE INTERACTION.

The rust resistance gene Lr31 confers resistance to all leaf rust pathotypes reported from India. Anomalous segregation pattern was observed while studying inheritance of Lr32. The F₁'s of Lr32 were susceptible when TcLr32 was crossed with 5 *aestivum* cultivars, viz 'Agra Local', PBW 343, H1 077, HUW 234, and UP 2338 but the F₂ segregation ratio varied from one cross to other. Genetic background of the cross influenced the nature of resistance of Lr32. The expression of Lr32 shifted from recessive to dominance in certain genetic background. A single recessive gene was responsible for this shift in gene action and therefore, it induced dominance in Lr32 only in homozygous condition. The degree of expression of low infection type reaction of Lr32 was dependent

on microenvironment which sometimes gave wrong impression of enhanced resistance when present in combination with Lr32 or Lr26 in seeding as well as adult plant test. Differential gene action of Lr323 may pose problem in detecting the F2 genotype in genetic studies. However, this problem can be tackled through progeny testing.

276. Tyagi, J.P.; Indian Agricultural Research Institute, New Delhi (India). Singh, Tejbir; KPG College, Simbhaoli (India). Dept. of Agricultural Botany. Singh, S.; Central Rice Research Institute, Cuttack (India). Goel, Nitika; Central Rice Research Institute, Cuttack (India). Pradhan, S.K.; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics. Singh, V.P.; Central Rice Research Institute, Cuttack (India).. Identification of rice genotypes with high resistance to bacterial leaf blight caused by *Xanthomonas oryzae* pv *oryzae*.. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.63-68 KEYWORDS: RICE. LAND RACES. PATHOGENICITY. GENOTYPES. XANTHOMONAS ORYZAE.

Bacterial leaf blight, the second most devastating disease of rice causes substantial yield loss. Study of pathogenic variability and identification of resistance genes are key factors in breeding against this disease. Bacterial leaf blight is now a serious constraint for rice production in the irrigated and lowland ecologies in all rice-growing countries. 223 germplasms collected from different regions of Bihar and Jharkhand and were screened against bacterial blight. The result showed that 8 land races namely Bathani, Hardi, Muril, Sitwadhan, Jhulat, Lamb Asari, Karijiri, Swarna, Gora and Sita Gora were found to be highly resistant. All of above 8 landraces do not possess Xa13 and Xa21 genes which are also responsible for resistance to bacterial leaf blight.

277. Pandravada, S.R.; National Bureau of Plant Genetic Resources, Rajendranagar (India).Varaprasad, K.S.; National Bureau of Plant Genetic Resources, Rajendranagar (India).Reddy, K Janaradhan; Osmania University, Hyderabad (India). University College of Science.Rao, E.S.; National Bureau of Plant Genetic Resources, Rajendranagar (India).. Screening and identification of sources of resistance against root-knot nematode (*Meloidogyne javanica*) in chilli (*Capsicum annuum*) germplasm. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.92-94 KEYWORDS: CAPSICUM ANNUUM. CHILLIES. TESTING. GERMPLASM. DISEASE RESISTANCE.

Out of 172 accessions of chilli germplasm artificially screened against *Meloidogyne javanica* in the glass house conditions, the root-knot nematode infestation was observed in 161 accs. including the check varieties. The reaction of the germplasm varied from highly resistant to highly susceptible with the per cent gall index (PGI) ranging from 0 to 100. A total of 11 entries were found to be highly resistant, 3 entries as moderate susceptible, 36 entries as susceptible and 122 entries as highly susceptible. Conspicuously, there were no entries that reacted under moderate resistant or resistant categories in the germplasm. In the present investigation, a total of 11 accessions found free from the incidence of root-knot originated from India., Taiwan and Hungary were identified as promising. Out of these, EC 378632 and EC 402113 which were also found to be highly resistant to dieback and sunscald and having significant yield potential are sources for multiple resistances in chilli improvement programmes.

278. Chauhan, V.K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Sirmour (India). Regional Horticultural Research Station. Nursery performance of selected clones of poplar (*Populus deltoides* Marsh.). Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 395-397 KEYWORDS: POPULUS DELTOIDES. CLONES.

Study on nursery performance of selected clones of Poplar (*Populus deltoides* Marsh.) suggested that volume index, leaf area index and percent sprouting should be given greater consideration while carrying out selections amongst clones. Genotypic correlation were, in general higher than phenotypic correlation coefficients.

279. Shukla, Arun; Indian Grassland and Fodder Research Institute, Jhansi (India). GSM Division. Singh, D; Central Institute for Arid Horticulture, Bikaner (India). Shukla, Anil K.; Central Institute for Arid Horticulture, Bikaner (India). Performance of Indian

gooseberry (*Emblica officinalis*) cultivars under arid region of India.. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.849-52 KEYWORDS: VARIETIES. FRUITING. QUALITY. YIELDS. FRUIT PULPS.

An experiment was conducted during 2001-05 to evaluate the performance of different cultivars of gooseberry *Emblica officinalis* Gaertn, viz 'Krishna' 'Kanchan' 'Chakaiya' NA 7 NA 10 Anand 1 and Anand 2 under arid ecosystem. Observations on growth parameters, Time of fruit set and maturity fruit drop yields attributing traits, quality parameters were recorded. The plant height was varied from 2.10 to 3.45m. Canopy spread in east-west and north south direction varied from 2.75 m to 4.0 m and 3.0 to 4.20 m respectively. Fruit length was maximum in Krishna (4.30 cm) followed by NA 6 (3.85 cm) and Chakaiya (3.73 cm) minimum was found in in Anand 2 (2.97 cm). Fruit set was recorded maximum in NA 7 (49.2%) with minimum in Anand 1 (25.9%) and fruit retention was varied from 6.00 to 11.4% with maximum in NA 7 (49.2%) with minimum in Anand 2 (6.00%). The maximum fruit breath was observed in Krishna (4.26 cm) and minimum in Anand 2 (3.00 cm). Fruit yield/tree was recorded maximum. Fruit weight was maximum in Krishna (49.3 g) and minimum in Anand 2 (28.66 g). The fruit yield/tree was recorded maximum in NA 7 (105 kg) and minimum in Anand 1 (25.3 kg). Vitamin C was varied from 433.9 to 678.2 mg/100 fruit pulp and TSS varied from 14.9 to 19.3%.

280. Sarkar, R.K.; Central Rice Research Institute, Cuttack (India). Panda, D.; Central Rice Research Institute, Cuttack (India). Reddy, J.N.; Central Rice Research Institute, Cuttack (India). Patnaik, S.S.C.; Central Rice Research Institute, Cuttack (India). Mackill, David J.; Stress-tolerant rice for poor farmers in Africa and South Asia (STRASA), Ismail, Abdelbagi M; Central Rice Research Institute, Cuttack (India). Performance of submergence tolerant rice (*Oryza sativa*) genotypes carrying the Sub 1 quantitative trait locus under stressed and non stressed natural field conditions.. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.876-83 KEYWORDS: WATER TOLERANCE. RICE. GENOTYPES.

The experiment was conducted during rainy season of 2005-07 under favorable rainfed lowland and controlled submergence at Cuttack, as well as under natural farmer's field. Under flash flooded, genotypes with Sub1 survived complete submergence stress with turbid water for up to 12 days, whereas genotype without sub1 Did not survive. The submergence stress was not so severe in farmer fields. Yet Swarna Sub1 gave higher grain yield than Swarna at all sites with a yield advantage of up to 1.65 tonnes/ha (an average of 0.81 tonnes/ha over five sites). The result suggest that rice genotype with sub 1 have great potential for improvement the productivity if rainfed lowland rice prone to flash-flooding.

281. Shareefa, M; Indian Agricultural Research Institute, New Delhi (India). Singh, A.K.; Indian Agricultural Research Institute, New Delhi (India). Srivastav, Manish; Indian Agricultural Research Institute, New Delhi (India). Dubey, A.K.; Indian Agricultural Research Institute, New Delhi (India). Differentiation of nucellar and zygotic seedling in citrus using ISSR markers.. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.884-89 KEYWORDS: CITRUS. SEEDLINGS.

In the present study we propose the use of inter simple sequence repeat (ISSR) markers as an alternate methodology for early differentiation of zygotic and nucellar seedling in citrus. The DNA amplification profile of in vitro grown seedling was compared to that of respective mother plant. Nucellar seedling displayed a similar banding pattern as that of mother plants, whereas zygotic seedling were differentiated from other seedling by their different banding pattern. The primers P-7, I-9, I-10, I-13 and I-14 were able to identify the zygotic seedling based on polymorphic bands in Soh sarkar. In Attani zygotic seedlings were identified using the primers P-1, P-7, P-15, I-8, I-9, I-10, I-13 and I-14. Out of 8 primers tested only 2 primers I-8 and I-14 showed polymorphism in kinnow and could differentiate zygotic seedlings. The primer P-1, I-8, I-9, I-14 and P-15 generated polymorphism among Karna khatta seedlings enabling distinction between nucellar and zygotic seedlings. In most of the cases single ISSR

primer was not able to identify all the zygotic seedlings. However, a combination of ISSR primers identified almost all the zygotic seedling.

282. Singh, S.B.; Sher-e Kashmir University of Agricultural Sciences and Technology. Jammu (India). Sharma, M.M.; Regional Agricultural Research Station (SKUAST-J) Rajouri (India). Singh, A.K.; Regional Agricultural Research Station (SKUAST-J) Rajouri (India). Stability analysis for grain and yield contributing traits in maize (*Zea mays*) single cross hybrid under mid hills.. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.890-96 KEYWORDS: GENOTYPES. ENVIRONMENT. MAIZE. STABILITY. YIELDS.

A study was conducted during 2005-07 to identify the stable crosses of maize (*Zea mays* L.) hybrids for grain yield under diverse agro climate conditions. Sixty six single hybrids developed in line tester design were evaluated along with 3 standard checks over 9 environments under irrigated and unirrigated conditions for their yield performance. Data on 10 yield components (days to maturity, plant height, ears/plant, ear length, ear girth, kernel rows/ear, kernels/row 100-kernelsweight, grain yield/plant, and biological yield/plant) were used to investigate the effects of genotype, environment and GxE on these traits. Highly significant differences were detected among the genotypes and environments for each character. Significant g x E interaction indicated that evaluation of yield components must be taken for different environment. On partitioning these components into linear and non linear components, both were responsible for expression of the traits. However, the linear component was found large in magnitude than the non linear component suggesting that variation in the performance of different cultivars could be predicted. The hybrid combination L2xT3 and L22 x t2 were found to be stable across environment, whereas 2 hybrids L11 x T1, L16 x T1, and L16 x T1 were found suitable for irrigated environment for grain yield. For moisture stress environment five crosses L2 x T3, L3 X T2, L1 x T1, L19 x T2 and L21 x T3 were found stable for grain yield. For days to maturity only one hybrid L8 x T3 was found stable across environment. Thus these genotype could be used for commercial cultivation. The stability measures are useful in characterizing cultivars but showing their relative performance in various environments.

283. Bhardwaj, R.; Punjab Agricultural University, Ludhiana (India). Sandhu, J.S.; Punjab Agricultural University, Ludhiana (India). Gupta, S.K.; ICRISAT, Patancheru (India). Gene action and combining ability for yield and other quantitative traits in chickpea (*Cicer arietinum*). Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.897-900 KEYWORDS: CHICKPEAS. COMBINING ABILITY. GENES. YIELDS.

A diallel set of 6 parents and their 15 F1 hybrids were analyzed to understand the nature and magnitude of gene action and to identify the best combiners for yield and its components traits of chickpea (*Cicer arietinum* L.) the gca and sca components showed the predominance of additive gene action in governing days to flowering, days to podding. Plants height, number of pods, number of seeds/pod, plant biomass, harvest index, grain yield and 100 seed weight and non-additive gene action for number of branches. Estimates of gca effects showed that the parents GL 98010 was the best general combiner, followed by GL 69010 and GL 90168. Thus the ascochyta blight resistant parents GL 96010 G 98010 and GL 90168 should be involved in the hybridization programmes for making yield breakthrough in chickpea. The cross combination GL 98010 x GL90168 showed significant and desirable sca effects for most of the traits including grain yield.

284. Singh, Dinesh; Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni (India). Kumar, K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni (India). Sharma, Vikas Kumar; Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni (India). Evaluation of raspberry (*Rubus ellipticus*) genotype growing wild in North-eastern Himalayas. Indian Journal of Agricultural Sciences (India). (Nov. 2009) v.79(11) p.913-16 KEYWORDS: ACIDITY. RUBUS. WILD PLANTS. GENOTYPES.

An experiment was carried out in sub tropical to wet temperature of Himachal Pradesh, Jammu Kashmir and Uttarakhand (760 1950m amsl, 30 10' 159 to 33 04 693” N and 74 44 076” to 78 25 681” E). Out of 170 pre selected genotypes, 37 promising genotypes were observed to be horticulturally desirable for berry weight. TSS and colour variation in berry weight extended from maximum of 0.92g to a minimum of 0.37g. Highest value (18047 B) for TSS in pepari2 and lowest (9.70B) in was observed in Dedhgharat 7 (HP) while acidity percent ranged between 1.09% and 1.72%. Berry length was between 7.8 to 14.37 mm berry breadths 10.03 to 15.85mm. The reducing sugar varied is between 2.2% and 4.9% non reducing ugar were 5.9% to 11.5%mand the ascorbic acid cotent ranged from 3.0 to 5.1mg 100g. However genotypes, sarali 3 (HP) Sabali 4 (UK) and Kumarhatti 1 (HP) apperared overall promissing based on their horticulturally desirable traits, vi heavy berry weight and high TSS respectively. Three strain were also observed in uttarkhand.

285. Datta, S.; Uttar Banga Krishi Viswavidyalaya, West Bengal (India). Jana, J.C.; Uttar Banga Krishi Viswavidyalaya, West Bengal (India). Effect of seasons and fertility levels on yield and quality of chilli (*Capsicum annum*) genotypes in terai agro climatic region.. Indian Journal of Agricultural Sciences (India). (Nov. 2009) v.79(11) p.917-21
KEYWORDS: CHILLIES. GENOTYPES. NUTRIENT UPTAKE. SOIL FERTILITY. SEASONS. YIELDS. QUALITY.

Fifteen chili (*Capsicum annum* L.) genotypes (five genotypes each from local genotypes, improves verities and hybrids) were evaluated under five fertility levels vrteated artificially by applying 0, 50, 100, 150, and 200% of recommended dose of fertilizers (RDF) of 100:50:50 Kg N, P₂O₅ and K₂O/ha during Rabi 2006-7 and kharif season of 2007. mean performance reveled significant variation in different growth, yield and quality characters, like Vit C and capsaicin among genotypes, fertility levels and growing seasons (except Vit C). Considering yield performance; genotypes Ulks 686 F1 (24.9 tonnes/ha), Jwalan (20.0 tonnes/ha), CA 29 (19.3 tonnes/ha). CA 48 (18.1 tonnes/ha) and CA 47 (18.0 tonnes/ha) were selected for growing at 150% RDF in the rabi season. Similar, for kharif season genotypes Jwalan (12.2 tonnes/ha), Ulka 686 zF1 (11.3 tonnes/ha) at 100% RDF and Pusa Sadabahar at 150% RDF (10.4 tonnes/ha) were selected. Most genotypes recorded higher amount of N, P and K uptake in the rabi season than the kharif season. The high yielding genotypes required more nutrients for growth and yield. The highest benefit: cost ratio in the rabi season was recorded in Ulka 686 f1 at 150% RDF (2.94) whereas in the kharif season in Jwalan at 100% RDF (2.24).

286. Nair, Priya; Jawaharlal Nehru Krishi Vishwa Vidylaya, Jabalpur (India). Khare, Dharendra; Jawaharlal Nehru Krishi Vishwa Vidylaya, Jabalpur (India). Genetics of factors ascertaining transportability of pods of vegetable pea(*Pisum sativum*). Indian Journal of Agricultural Sciences (India). (Nov. 2009) v.79(11) p.939-40
KEYWORDS: PISUM SATIVUM. SWEETNESS. FRUIT.

Among the traits that may determine the transportability of green pod of vegetable pea, green pod weight, pod wall weight, seed weight/pod and pod thickness had high estimate for heritability and genetic advance, whereas low estimate for seed pod ratio, pod water content and seed water content. The water content was low in pod wall and seed of AP 1 E6 and VRP 6. The pod wall water content in Aekel (check) was low (27%) but seed water content was high (25.53%). Present investigation reveals that A 1 E6 and VRP 6 had better transportability than Arkel. High heritability and genetic advance for total sugar and reducing sugar indicate use of direct selection for improvement. Genotype Arkel Pusa Pragati and VRP6 had high total sugar (10%) with 80% part as reducing sugar.

287. Arya, Rajesh Kumar; CCS Haryana Agricultural University, Hisar (India). Yadav, H.P.; CCS Haryana Agricultural University, Hisar (India). Stability of grain yield and its contributing traits in white and grey grain hybrids of Perl millet (*Pennisetum glaucum*). Indian Journal of Agricultural Sciences (India). (Nov. 2009) v.79(11) p.941-44

KEYWORDS: PENNISETUM GLAUCUM. GENOTYPE ENVIRONMENT INTERACTION. STABILITY.

Sixteen white and 16 grey grain color hybrid of pearl millet along with check HHB 94 were evaluated under four environments for stability parameter, viz regression coefficient (b_i) and mean square deviation (S^2_{di0}) from linear regression along with per se performance. Data were recorded for five yield related character, viz grain yield number of effective tillers, ear length, ear girth, ear weight and 1000-grain weight. The significant linear and non-linear type of G x E interaction was observed for all the character, but the magnitude of linear type of G x E interaction was higher for most the character except ear length and ear girth. The two white and one grey grain colour hybrids, viz ICMA 94222 x H 77/833-2 and ICMA 94222 x 78/711 and HMS 6A x H77/833-2, respectively were ideal for the test environments; only one white grain hybrid (HMS 36A x 99) was ideal for favorable environments and two white grain hybrid, vi HMS 36A x ERC, ICMA 9711 x 99 and 1 grey (ICMA 9411 x ICR 159) were ideal for the poor environments.

288. Ram, Bakshi; Sugarcane Breeding Institute, Haryana (India). Regional Centre. Effect of season of ratooning and field position of seedling ratoon clumps on selection in sugarcane (*Saccharum officinarum*). Indian Journal of Agricultural Sciences (India). (Oct. 2009) v.79(10) p.790-93 KEYWORDS: CLONES. RATOONING. SUGARCANE. SEEDLINGS.

Field experiments were conducted during 2000-06 to study the position in the field (border and interior) and seasons of ratooning in the ground nursery using 12 cross of sugarcane (*Saccharum officinarum*). Two hundred sixty two seedlings in each cross were ratoon during winter (December) and spring (March). Seedling ratooned clumps were scored for number of millable canes (NMC), stalk diameter, stalk height and hand refractometer Brix (HR Brix) during next October. Selected clones were evaluated at different stage of selection (C1 to C4). Ratooning during winter season resulted in reduction in NMC and stalk length, whereas increase in HR Brix of the population in comparison to spring ratooning. There was no effect of ratooning seasons on stalk diameter. Border effects on winter ratooned clumps resulted in increase in mean performance of all the traits except HR Brix. In spring ratooning clumps border effect resulted in improvement in all traits except stalk length resulted that selection was more effective in spring ratooned and from interior field positioned seedlings. Sugarcane breeders should not be tempted to select vigorous border field positioned seedling.

289. Ghosh, M.K.; Central Sericultural Research and Training Institute, Berhampore (India). Das, N.K.; Central Sericultural Research and Training Institute, Berhampore (India). Nath, Shiv; Central Sericultural Research and Training Institute, Berhampore (India). Ghosh, P.K.; Central Sericultural Research and Training Institute, Berhampore (India). Datta, R.N.; Central Sericultural Research and Training Institute, Berhampore (India). Bajpai, A.K.; Central Sericultural Research and Training Institute, Berhampore (India). Heterosis for leaf yield and its components in mulberry. Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.804-807 KEYWORDS: HETEROSIS. MORUS. LEAVES. YIELDS.

Heterosis in mulberry was studied during 2005-07 for leaf yield and its attributing characters in 185 hybrid progenies developed from extensive crossing of Kajli (OP) (female) and V-1 (male). Analysis of variance showed significant differences among the parents and hybrids. Greater variability in the parents indicated the possibility of getting higher heterosis in the progenies. None o the progenies showed uniformity in the heterosis for yield components. However, significant heterosis to the magnitude of 56.84 to 364.56% over mid parent and 61.30 to 316.49% over better parent was observed among the progenies for leaf yield. The grain over ruling check S 1635 was observed between- 68-75 and 236.30%. Heterosis breeding in mulberry a highly heterosis plant, offers a great opportunity to developed new improves hybrid/genotypic recombinants. Hybrid No. 73 along with 14 others showing gain for leaf yield in excess of 100% over ruling check, seem to be highly promising for future utilization.

290. Singh, Tejbir; Kisan PG College, Simbhaoli (India). Sharma, Manoj Kumar; Kisan PG College, Simbhaoli (India). Tyagi, J.P.; Kisan PG College, Simbhaoli (India). Singh, Sanjay; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics. Effect of gibberellic acid (GA3) on yield, floral and morphological traits in rice (*Oryza sativa*). Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.831-34
KEYWORDS: RICE. SEED. YIELDS. CROSS POLLINATION. SEED PRODUCTION. SEED. SEED. CYTOPLASMIC MALE STERILITY.

The present investigation was aimed to study the effect of gibberellic acid (GA3) on yield, floral and morphological traits in rice. The dose of 70 g/ha of GA3 was found optimum for increased seed yield and seed setting. Further, an increase in morphological character such as plant height, panicle exertion, flag leaf angle and floral characters as stigma and style length, anther length and spikelet opening angle was observed with application of GA3. However, GA3 application had no effect on total number and productive tillers/plant. GA3 application improves the style and stigma length and stigma exertion of cytoplasmic-genetic male sterile (cms) parent: filament length anther length in male parent which ultimately favours pollination of seed parent. Good panicle exertion in cytoplasmic genetic male sterile (cm) parent expose higher number of spikelets to come out from flag leaf sheath to receive more pollens resulting in enhanced out crossing and seed set.

291. Chaudhary, Babita; IARI, New Delhi (India). Division of Genetics. Mani, V.P.; Kumaon University, Nainital (India). Inheritance studies on resistance to turicum leaf blight in semi temperate genotypes of maize (*Zea mays*). Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.835-37
KEYWORDS: GENOTYPES. MAIZE. SETOSPHAERIA TURCICA. GENE INTERACTION.

Turicum leaf blight (*Exserohilum turcicum*) is the most common and chronic problem of maize (*Zea mays* L.) causing considerable yield losses. Studies on inheritance of turicum leaf blight were conducted using 6 generations derived from 4 susceptible CM 128, V 327, V 128 and V 17 and 2 resistant inbred lines V33 and V 13. The 6 parents and their 15F1's, 15F2's 15BC1's and 15BC2's were evaluated for reaction to turicum leaf blight at 2 locations. The results showed that all types of gene effects viz additive, dominance and epistasis (additive x additive, additive x dominance and dominance x dominance) were operating in the cross in governing resistance. It is suggested that population improvement approach, preferably, reciprocal recurrent selection may be followed for exploiting all the 3 types of gene effect in order to develop early maturing, high yielding and resistance hybrid and synthetics of maize for plains, in general and for hilly areas, in particular.

292. Nallathambi, P.; Indian Agricultural Research Institute, New Delhi (India). Umamaheswari, C; Indian Agricultural Research Institute, New Delhi (India). More, T.A.; Central Institute for arid Horticultural, Bikaner (India). Phenolics and phenol oxidizing enzymes activity as index for screening ber (*Ziziphus mauritiana*) germplasm against powdery mildew (*Oidium erysiphoides*). Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.838-40
KEYWORDS: GENOTYPES. PEROXIDASES. PHENOLOGY. CATECHOL OXIDASE. MILDEWS.

The total phenol content and activity of phenol oxidizing enzyme, viz peroxidase (PO) and polyphenol oxidase (PPO) in healthy and powdery mildew colonized leaves and fruits of ber at different growth stages is reported in this paper. In response to partial colonization of the test pathogen *Oidium erysiphoides* f.sp. *ziziphi* in immature fruits of the resistant genotypes viz Banarasi Karaka, Saferchandi and Illaichi high level of total phenolics and activity of PO and PPO were recorded. In highly susceptible cv. Gola and Umran the infection could elicit lesser response. In general immature and mature fruits contain less quantity of phenolics as compared to different growth stage of leaves. The wild species (*Z. nummularia*) accumulated significantly high (2.98 mg/g) phenolics, followed by Saferchandi (1.949 mg/g) and Illaichi (1.901 mg/g). Similar was the case in elaboration of PO (327.29 units/min/g) and PPO (32.58 units/mg of protein) activity in

this particular genotype. In order to screen large number of ber genotypes in short span of time, random sampling of the immature leaves and fruits are appropriate for analyzing these biochemical molecules as demarcating indicate of ber powdery mildew resistance.

293. Bentur, J.S.; Directorate of Rice Rsearch, Rajendranagar (India). Lakshmi, P. Vijaya; Directorate of Rice Rsearch, Rajendranagar (India). Sama, Vsak; Directorate of Rice Rsearch, Rajendranagar (India). Padmavathy, Ch; Directorate of Rice Rsearch, Rajendranagar (India). Himabindu, K.; Directorate of Rice Rsearch, Rajendranagar (India). Sources of resistance to the new \$M biotype of rice gall midge (*Orseolia oryza*). Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.844-46
KEYWORDS: BIOTYPES. CECIDOMYIIDAE. ORYZA SATIVA. PEST RESISTANCE.

Evaluation of about 1800 rice germplasm, land races and breeding lines against 3 biotypes of the rice gall midge (*Orseolia oryzae*) under controlled greenhouse conditions in replicated tests identifies 17 land races and 18 breeding lines with high level of resistance against all the 3 biotypes. The new sources of resistance reported here against the most virulent biotype 4M will be useful in breeding gall midge resistant rice varieties.

294. Singh, B.K.; ICAR Research Complex for NEH Region, Mizoram (India). Sharma, S.R.; Indian Agricultural Research Institute, Katrain (India). Regional Station. Singh, B.; IARI, New Delhi (India). Nuclear Research Laboratory. Heterosis for antioxidants and horticultural traits in single cross hybrids of cabbage (*Brassica oleracea* var. *capitata*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p.703-08
KEYWORDS: ASCORBIC ACID. CABBAGES. CAROTENOIDS. HETEROSIS. ANTIOXIDANTS.

A study was conducted during 2005-07 to estimate the heterosis simultaneously for antioxidants and horticultural traits in cabbage (*Brassica oleracea* var. *capitata* L.). The significant differences of mean squares among parents and hybrids for various traits of economic importance indicated the presence of sufficient variation. The parents CMS-GA, Golden Acre 83-2, C 2 Pusa Mukta, C 4 and MR-1 had the potential for use in further breeding as they exhibited desirable hybrid effects for ascorbic acid earliness frame size net head weight and head compactness. All Savoy type genotype exclusively expressed the higher magnitude of heterosis for ascorbic acid per se performance of topmost 12 hybrid showed that golden Acre, CNS- GA and 83-2 as female line involved in the evaluation of 9 hybrids. The hybrid effects and heterosis for various traits indicated that there is need to involved more than two parents to develop productive and antioxidant potential cultivars and hybrid.

295. Singh, F.; Indian institute of Pulses Research, Kanpur (India). Singh, I.P.; Indian institute of Pulses Research, Kanpur (India). Majumder, N.D.; Indian institute of Pulses Research, Kanpur (India). Cytochemical analysis and stain development in pollen grains of parental lines and hybrids based on cytoplasmic genetic male sterility system in pigeonpea (*Cajanus cajan*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p.709-14
KEYWORDS: CAJANUS CAJAN. CYTOPLASMIC MALE STERILITY. POLLEN.

A study was conducted during 2006-8 to determine viability of pollen grains in cytoplasmic genetic male sterile lines of pigeonpea (*Cajanus Cajan* (L.) Millsp). Poor pollen formation and their degeneration in subsequent mitotic cell division were evident in male sterile lines. Application of various specific stains revealed the following (i) carmine, which is used very often for assessing pollen viability may not be very reliable because it is non-specific to nucleus, cytoplasm and other organelles (ii) iodine + potassium iodide (I₂ +KI) stain can precisely distinguish the fertile from sterile pollen grains and can also differentiate pollen grains in terms of chemical composition and (iii) the mixed stain (carmine + ferrous ammonium sulphate + haematoxyline) is very specific to fertile vs sterile pollen grains and can identify various pollen grains with more precision. Staining technique can also be used to detect the distortions in respiratory

mechanism and nucleic acid synthesis. Further the under sized pollen grains and their frequency significantly varied among the A B R lines and the hybrids synthesized there from.

296. Palve, S.M.; Central Institute for Cotton Research, Nagpur (India). Heterosis and combining ability for fibre properties in upland cotton (*Gossypium hirsutum*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 732-34 KEYWORDS: COTTON. COMBINING ABILITY. HETEROSIS. CRUDE FIBRE.

Estimate of combining ability and heterosis for fibre properties among cotton genotypes are necessary for efficient hybrid development work and in breeding programmes. This study was conducted to determine the heterosis and combining ability among 12 cotton (*Gossypium hirsutum* L.) genotypes. General combining ability (GCA) was more important than specific combining ability (SCA) effects. Combining ability analysis revealed that variance due to GCA was significant for 2.5% span length, micronaire and fibre bundle strength, indicating the preponderance of additive gene action. Parents H 1252, MCU 9 and Acala 1517 were the good general combiners for 2.5% span length. For micronaire the best combiner was PKV rajat and DHY 286. For fibre bundle strength DHY 286 was the good combiner with high mean values. Crosses GHS 2 x ACCLD 163 and ACCLD 163 x Sahana had significant SCA effect for 2.5% span length. Maximum mid parent heterosis was observed in ACCLD 163 x H 1252 (8.59%). The results indicated that for these fibre properties this set of parents could be more effectively used in a selection programme to produce a variety with better fibre quality.

297. Raiger, H.L.; National Bureau of Plant Genetic Resources, New Delhi (India). Dua, R.P.; National Bureau of Plant Genetic Resources, New Delhi (India). Sharma, S.K.; National Bureau of Plant Genetic Resources, New Delhi (India). Phogat, B.S.; National Bureau of Plant Genetic Resources, New Delhi (India). Rathi, R.S.; National Bureau of Plant Genetic Resources, New Delhi (India). Stability for seed yield and quality traits in kalingada (*Citrullus lanatus*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 745-47 KEYWORDS: GENOTYPES. STABILITY. CITRULLUS LANATUS.

The stability of 14 genotypes in kalingada [*Citrullus lanatus* Thunb.) Matsum & Nakaj] was tested at different centers in Rajasthan, Gujarat and Tamil Nadu during 2001-04. All the genotypes differed significantly for their seed yield in different environments. The environment (linear) as well as genotype x environment (linear) components of G x E interactions were significant. Among the higher yielding and stable genotypes SKNK 3 and SKNK 6 were most suited to better environment and SKNK 15 to poor environments. SKNK 2 was the most stable genotype with higher seed yield and suited to all the environments. In addition, SKNK 2 and SKNK 1 had higher oil (39%) as well as protein content (37%).

298. Meena, S.S.; Gobind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Sachan, J.N.; Gobind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Inheritance of essential fatty acids and correlation among different fatty acids in Indian mustard (*Brassica juncea*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 748-51 KEYWORDS: BRASSICA JUNCEA. FATTY ACIDS. INHERITANCE (ECONOMICS).

Three reciprocal cross between 3 quality lines and 2 varieties attempted and segregation pattern in F₂ and backcrosses generations were studied during 2003-05. The non-significant differences between F₁ and their reciprocals for both the fatty acids indicated absence of the maternal influence. The observed ratio was in agreement with expected ratio of 1:2:1 in F₂ generation indicated by non significant values of chi-square test. Further segregation pattern of F₂ was confirmed by the non significant χ^2 value in backcrossed generations and calculation of minimum number of effective factor pairs. Correlation studies among the fatty acids revealed that Erucic acid was negatively correlated with palmitic, stearic, oleic, linoleic and linolenic acids. The linoleic and linolenic acids had positively associated with each other as well as with oleic acid. From

the present findings it is quite obvious that linoleic and linolenic fatty acids in Indian mustard oil are governed by single gene which can be easily transferred by backcrossing.

299. Chakraborti, Mridul; IGFRI, Crop Improvement Division, Jhansi (India). Chandrashekar, Shanti; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics. Multiple roles of a PLC α regulator in olfaction, pupal development and synaptic vesicle recycling in *Drosophila melanogaster*. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.215-221 KEYWORDS: OLFACTION. EYES. RECYCLING. DROSOPHILA MELANOGASTER. DROSOPHILA.

G-protein coupled Phospholipase-C- α (PLC α) signaling and its various components are vital to the regulation of development and behaviour of *Drosophila*. The gene *stmA* (CG8739) was first characterized as a temperature sensitive paralytic mutant and recently identified as a regulator of PLC α in G-protein signaling. It alters membrane phospholipid levels and affects visual transduction. The present study establishes the role of *stmA* in olfaction, pupal development and synaptic vesicle recycling in *Drosophila*. Interaction between *stmA* and genes for the inositol triphosphate receptor (*itpr*) and for endocytosis and exocytosis in synaptic vesicles is also shown.

300. Hanamaratti, N.G.; University of Agricultural Sciences, Dharwad (India). Salimath, P.M.; University of Agricultural Sciences, Dharwad (India). Vijayakumar, C.H.M.; University of Agricultural Sciences, Dharwad (India). Ravikumar, R.L.; University of Agricultural Sciences, Dharwad (India). Kajjidoni, S.T.; University of Agricultural Sciences, Dharwad (India). Genotype X environment interaction of near isogenic introgression lines (NIILs) under drought stress and non-stress environments in upland rice (*Oryza sativa* L.). Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.222-228 KEYWORDS: GENOTYPE ENVIRONMENT INTERACTION. DROUGHT STRESS. DROUGHT. UPLAND RICE.

The superior NIILs selected for productivity under artificial drought condition were evaluated over three drought stress and three non-stress environments. AMMI based stability parameter; ASTABi and Rao's Index of stability were utilized to interpret the stability among the NIILs under stress and non-stress environments. The grain yield was much sensitive and highly influenced by environment resulting in higher G \times E interaction under stress environments. Pooled deviation was highly significant indicating the presence of non-predictable components for grain yield and yield related traits. Based on ASTABi, RF-55-254 was most stable genotype which was also the best for grain yield (6613 kg/ha) in non-stress environments, while it was unstable under stress environments. The genotype, RF-55-198 was superior for yield as well as stability in stress environments and for overall adaptability.

301. Khan, Hanif; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics. Tomar, S.M.S.; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics. Chowdhury, S.; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics. Inheritance studies on spot blotch of wheat caused by *Bipolaris sorokiniana*. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.229-233 KEYWORDS: GENETIC INHERITANCE. SPOTS. WHEATS. COCHLILOBOLUS SATIVUS. COCHLILOBOLUS. GENETICS. DISEASE RESISTANCE.

Spot blotch of wheat caused by *Bipolaris sorokiniana* (Sacc.) Shoem, is one of the most important disease constraints to wheat cultivation in the north-eastern and eastern plain zones of India. Genetics of resistance to spot blotch was studied in seven resistant wheat lines viz. Chirya-3, Mayoor, Shanghai-4, Suzhoe 128-OY, Suzhoe 158, Longmai and Chuanmai No.18, by crossing them with two susceptible varieties Sonalika and HD-2329. Studies under both artificial inoculation and natural epiphytic condition in F₁, F₂ and backcross generations indicated that resistance in Chirya-3 and Mayoor is governed by two dominant genes. The test of allelism showed that the resistance genes in the Chirya-3 and Mayoor are allelic. The continuous nature of frequency distribution for AUDPC of spot blotch reaction in F₂ generation involving resistant parents of Chinese

origin did not suggest any simple Mendelian inheritance. The type of resistance among the resistant parents of Chinese origin Shanghai4, Suzhoe 128-OY, Suzhoe 1-58, Longmai and Chuanmai No.18 appears to be additive with polygenic control as the F₂ populations of the susceptible × resistant crosses exhibited different degrees of disease reaction of all categories, viz., resistant, moderately resistant, susceptible and highly susceptible.

302. Sarkar, Basudeb; Directorate of Wheat Research, Karnal (India). R.P.S.; Directorate of Wheat Research, Karnal (India). Parsad, Rajender; Indian Agricultural Statistics Research Institute, New Delhi (India). Shoran, Jag; Directorate of Wheat Research, Karnal (India). Diversity among barley germplasm collection in India. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.234-239 KEYWORDS: HORDEUM VULGARE. GERMPLASM. INDIA. AGRONOMIC CHARACTERS.

A total of 5337 barley accessions were evaluated for a number of traits. The accessions included indigenous germplasm collected from various parts of India; exotics selected from trials and nurseries received from ICARDA/CIMMYT, Mexico and ICARDA, Syria; as well as materials received from different countries over the last four decades. Out of the total accessions, 2801 were indigenous and 2536 exotic. Only 290 accessions were naked type, the rest were hulled. This paper summarizes results on classification and characterization of these accessions for various agro-morphological traits, associations among these traits, and frequency distribution and donors for days to heading, plant height and 1000-kernel weight.

303. Reddy, P. Sanjana; International Crops Research Institute for the Semi-Arid Tropics, Hyderabad (India). Rao, D. Manohar; Osmania University, Hyderabad(India). Department of Genetics & Biotechnology. Reddy, V.S. Belum; ICRISAT, Hyderabad (India). Kumar, A. Ashok; ICRISAT, Hyderabad (India). Inheritance of male-fertility restoration in A1, A2, A3 and A4(M) cytoplasmic male-sterility systems of sorghum [*Sorghum bicolor* (L.) Moench]. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.240-246 KEYWORDS: SORGHUM. CYTOPLASMIC MALE STERILITY. SEGREGATION. FERTILITY.

Almost all the sorghum [*Sorghum bicolor* (L.) Moench] hybrids commercially exploited to date are based on A1 CMS (cytoplasmic-nuclear male-sterility) system. For genetic diversification and to produce more heterotic hybrids, all the available CMS systems are to be studied for genetics of male-fertility restoration preferably in iso-nuclear backgrounds. The A1, A2, A3 and A4(M) cytoplasmic present in three different nuclear backgrounds were crossed with two common restorers. The segregation of fertile and sterile plants observed in F₂ and BC₁ populations during rainy and post-rainy seasons of 2007 was tested with χ^2 for goodness of fit for monogenic, digenic and trigenic ratios. The fertility restoration of A1 CMS system was governed by one basic gene and two duplicate complimentary genes (45F:19S in F₂) all acting in dominant fashion while the fertility restoration of A2 and A3 CMS systems was governed by three genes where all of the three complimentary genes in dominant condition restore fertility (27F:37S in F₂). The fertility restoration in A4(M) CMS system was governed by three genes where any two of the three dominant duplicate-complimentary genes restored fertility (54F:10S in F₂) in post-rainy season while two complementary genes in dominant state restored fertility (9F:7S in F₂) in rainy season in the absence of expression of the third gene.

304. Kumar, R.; CCS Haryana Agricultural University, Hissar (India). Department of Plant Breeding. Sagar, P.; CCS Haryana Agricultural University, Hissar (India). Department of Plant Breeding. Effect of cytoplasm on combining ability and yield attributes in pearl millet [*Pennisetum glaucum* (L.) R. Br.]. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.247-256 KEYWORDS: COMBINING ABILITY. PENNISETUM GLAUCUM.

The effect of cytoplasm on productivity and combining ability for grain yield and its contributing traits was studied in 144 hybrids. Six male sterile (A) lines (81A and HMS

8A (A1), Pb3I3A (A2), Pb402A (A3), 81A4, 81A5 representing five different cytoplasm systems and their corresponding maintainer (B) lines were crossed with 12 restorer (R) lines in a line \times tester design. The 24 parents (A+B and R) and 144 crosses were grown separately in contiguous block in randomized block design with two replications in six environments, three each (E1, E2, E3) and (E4, E5, E6) during 2000 and 2001, respectively. Analysis of variance revealed significant differences among genotypes, parents, lines (A, B), testers, hybrids (A \times R, B \times R). The differences due to A vs. B and A \times R vs. B \times R crosses were highly significant for grain yield/plant (g), harvest index and growth rate (g/plant/day). Cytoplasmic effects were estimated by comparing A \times R and B \times R hybrids combination. Both positive and negative cytoplasmic effects were observed for all the four characters studied. The (A \times R vs. B \times R) \times E component of variance exhibited significance for all the four characters. The effects were modified by environment. These were more pronounced for grain yield, 500-grain weight and harvest index, and positive cytoplasmic effects exceeded than the negative ones. For growth rate negative cytoplasmic effects were preponderant and significant only in one environment which is due to cytoplasm and nuclear genome interaction. Effect of cytoplasm was more or less equally pronounced on general combining ability effects of parents and specific combining ability of crosses. Array mean performance of 81A cytoplasmic iso-hybrids indicated that all the three cytoplasms have same potential, therefore, any of these cytoplasms can be used in hybrid breeding.

305. Khanduri, Ashish; Garhwal Vishwavidyalaya, Srinagar (India). Prasanna, B.M.; CIMMYT, Nairobi (Kenya). Global Maize Program Hossain, Firoz; Indian Agricultural Research Institute, New Delhi (India). Division of Genetics Lakhera, P.C.; Garhwal Vishwavidyalaya, Srinagar (India). Genetic analyses and association studies of yield components and kernel sugar concentration in sweet corn. *Indian Journal of Genetics and Plant Breeding* (India). (Aug 2010) v.70(3) p.257-263 KEYWORDS: YIELD COMPONENTS. KERNELS. SWEET CORN. SUGAR. COMBINING ABILITY. HETEROSIS.

A set of sweet corn genotypes generated using line \times tester (7 \times 3) mating design, were evaluated at two locations (Hyderabad and Delhi) for estimating combining ability and heterosis of the genotypes and degree of association of sugar concentration with yield and its component traits. Genetic analyses revealed the importance of both additive and non-additive gene action for kernel sugar concentration, yield and its component traits, with relative predominance of dominance variance over additive variance. Significant effect of the environment on kernel sugar concentration and almost all the yield related traits indicated prominent role of environment in determining the extent of expression of these traits. L6 (RIL62) was identified as the best general combiner at both the locations for sugar concentration as well as yield traits. Some promising sweet corn genotypes, namely L6 (RIL62), L3 (DMR-2320) and L7 (RIL91) at Hyderabad and L4 (DMR 2322), L5 (RIL10), L6 (RIL62) and L7 (RIL91) were found to be promising general combiners for kernel sugar concentration at Delhi station only. Among the testers, T3 (Madhuri) was observed to be the best genotype for kernel sugar concentration and other agronomic traits. L6 \times T3 (RIL62 \times Madhuri) among the crosses was observed to be the best specific combiner for sweet corn trait at both the locations followed by L7 \times T3 (RIL91 \times Madhuri) and L5 \times T2 (RIL10 \times Winorange). Analysis of heterosis for sugar concentration over the popular sweet corn composites (Priya, WinOrange and Madhuri) identified L6 \times T3 (RIL62 \times Madhuri) as the best cross combination with a heterosis value of 48.47, 38.82 and 24.83 at Hyderabad and 74.30, 60.94 and 114.15 at Delhi over Priya, WinOrange and Madhuri, respectively. The analysis also showed that kernel sugar concentration was not significantly correlated with any of the grain yield and its component traits, suggesting the scope of genetic improvement of kernel sugar concentration independent of grain yield.

306. Agrawal, P.K.; Indian Institute of Pulses Research, Kanpur (India). Srivastava, A.; Indian Institute of Pulses Research, Kanpur (India). Assessment of genetic diversity among chickpea cultivars of India using RAPD markers. *Indian Journal of Genetics and*

Plant Breeding (India). (Aug 2010) v.70(3) p.264-270 KEYWORDS: GENETIC VARIATION. CHICKPEAS. RAPD.

Sixty eight chickpea cultivars of India belonging to both Kabuli and Desi types were studied for the diversity using 60 RAPD primers. Among them 50 were found to be polymorphic. On the average 3.55 loci per marker was found for the entire population of 68 cultivars. Based on the banding pattern, the cluster analysis was done using UPGMA and the dendrogram was prepared. The similarity coefficient ranged from 0.71 to 0.90 among the genotypes. The PCA analysis also supported the finding from the dendrogram. It was found that the desi and Kabuli types did not segregate into two distinct groups which indicated that perhaps very few genes were responsible for the differentiation of chickpea in to Desi and Kabuli types during their evolution. In order to broaden the genetic base of the chickpea germplasm of India, efforts should be made to utilize the exotic germplasm and the wild relatives.

307. Karimi, R.; Kenya Agricultural Research Institute, Machakos (Kenya). Owuoche, James O.; Egerton University, Egerton (Kenya). Department of Crops, Horticulture and Soil Science. Silim, S.N.; International Crops Research Institute for the Semi-Arid Tropics, Nairobi (Kenya). Inheritance of fusarium wilt resistance in pigeonpea [*Cajanus cajan* (L.) Millspaugh]. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.271-276 KEYWORDS: CAJANUS CAJAN. VENTURIA (FUNGUS). WILTS.

Fusarium wilt caused by *Fusarium udum* Butler is the most important disease of pigeonpea worldwide. Objectives of this study were to determine the mode of genetic inheritance of Fusarium wilt resistance in different pigeonpea accessions and to determine different genes governing resistance that exists in pigeonpea accessions. F₁, F₂ and backcross populations were developed by crossing resistant accessions (ICEAP 00554, ICEAP 00557) with susceptible accessions (KAT 60/8, ICP 7035). The Parents, F₁, F₂, backcrosses (BC₁F₁ and BC₂F₁) populations were evaluated for Fusarium wilt resistance. F₂ populations derived from ICEAP 00554 × KAT 60/8, ICEAP 00557 × KAT 60/8, ICEAP 00554 × ICP 7035, ICEAP 00557 × ICP 7035 crosses exhibited a 3:1 ratio which indicated that resistance to Fusarium wilt was under the control of major gene, however, a recessive gene was detected from ICP 7035 × KAT 60/8 cross. The genes detected could be valuable for wilt resistance breeding.

308. Singh, M.N.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Dept. of Genetics and Plant Breeding. Singh, R.S.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Dept. of Genetics and Plant Breeding. Inheritance of pod setting under low temperature in pigeonpea. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.277-280 KEYWORDS: PIGEONS. CAJANUS CAJAN. INHERITANCE (ECONOMICS). COLD.

Six basic populations (P₁, P₂, F₁, F₂, B₁ and B₂) of 12 crosses involving four susceptible (MAL 17, NDA-1, BHU 96-13-3 and BHU 96-21-4) and three tolerant (MAL 19, NDA 99-1 and NDA 49-6) genotypes were analyzed to observe the inheritance of pod setting under low temperature in pigeonpea [*Cajanus cajan* (L.) millsp.]. All the F₁ s bore pods even under low temperature as was evident in tolerant parents indicating the dominance of pod setting over susceptibility. The F₂ segregation ratio of 3:1 (tolerant: susceptible) indicated that pod setting is governed by single dominant gene. The observations of segregation pattern of B₁ (F₁ × tolerant parents) further confirmed the F₂ ratio since all the plants bore pods under low temperature. Similarly B₂ (F₁ × susceptible parents) also exhibited 1:1 (tolerant: susceptible) segregation further confirmed the F₂ ratio.

309. Singh, Vrijendra; Nimbkar Agricultural Research Institute, Maharashtra (India). Akade, Jitendra H.; Nimbkar Agricultural Research Institute, Maharashtra (India). Nimbkar, Nandini; Nimbkar Agricultural Research Institute, Maharashtra (India). Inheritance of stem fasciation and twin/multi-embryonic seeds and genetic linkage between them in safflower. Indian Journal of Genetics and Plant Breeding (India). (Aug

2010) v.70(3) p.281-287 KEYWORDS: SAFFLOWER. EMBRYO CULTURE. SEED. GENES. CARTHAMUS TINCTORIUS. CARTHAMUS.

The derivatives of an interspecific cross between *Carthamus palaestinus* (wild species) X *Carthamus tinctorius* (cultivated species) showed exomorphic variations such as plants with flattened stems having a fasciated main capitulum forming a semi-circular structure of two to three capitula fused together. The other capitula of the fasciated plants were normal. Apart from the stem fasciation, these derivatives also produced twin/multiembryo seeds. The objective of the present study was to find the mode of inheritance, the number of genes controlling stem fasciation and twin/multiembryo seeds and linkage between the genes controlling the two traits. The results of the crosses made between fasciated derivatives and the normal genotypes revealed that F1s of all the crosses gave plants with normal stem and single embryo-seeds. The F2 segregation gave a ratio of 13:3 for plants with normal and fasciated stems respectively as also for plants with single-embryo seeds and twin/multiembryo seeds respectively. The F3 generation segregations further support the role of inhibitory gene action in the control of stem fasciation and twin/multi-embryo seeds in safflower. The stem fasciation and twin/multi-embryo seeds are designated by the gene symbols FpFp and FsFs respectively. The genic analysis exhibited close linkage between FpFp and FsFs genes in coupling phase. Linkage between the genes for stem fasciation and twin/multiembryo seeds is reported for the first time and its usefulness in identification of probable apomicts in safflower is discussed in the paper.

310. Marigoudra, R.M.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Laboratory. All India Coordinated Wheat Improvement Project. Desai, S.A.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Laboratory. All India Coordinated Wheat Improvement Project. Lohithaswa, H.C.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Laboratory. All India Coordinated Wheat Improvement Project. Kalappanavar, I.K.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Laboratory. All India Coordinated Wheat Improvement Project. Hanchinal, R.R.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Laboratory. All India Coordinated Wheat Improvement Project. New sources of resistance to spot blotch in emmer wheat developed through mutagenesis. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.288-291 KEYWORDS: SPOTS. DISEASE RESISTANCE. TRITICUM DICOCCUM. MUTATION.

311. Khare, D.; JNKVV, Jabalpur (India). Dept of Plant Breeding and Genetics. Shrivastava, A.M.; JNKVV, Jabalpur (India). Dept of Plant Breeding and Genetics. Shrivastava, M.K.; JNKVV, Jabalpur (India). Dept of Plant Breeding and Genetics. Bhale, M.S.; JNKVV, Jabalpur (India). Dept of Plant Breeding and Genetics. Pedigree analysis of soybean varieties. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.292-295 KEYWORDS: SOYBEANS. VARIETIES.

312. Sathyanarayana, N.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Department of Biotechnology. Vikas, P.B.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Department of Biotechnolog. Kumar, T.N. Bharath; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Department of Biotechnology. Rajesha, R.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Department of Biotechnology. RAPD markers for genetic characterization in *Mucuna* species. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.296-298 KEYWORDS: RAPD. GENETICS. MUCUNA.

313. Devarumath, R.M.; Vasantdada Sugar Institute, Pune (India). Genetic Engineering and Molecular Biology Division. Sheelavanthmath, S.S.; Vasantdada Sugar Institute, Pune (India). Genetic Engineering and Molecular Biology Division. Hiremath, S.C.; Vasantdada Sugar Institute, Pune (India). Genetic Engineering and Molecular Biology Division. Chromosome pairing analysis in interspecific hybrids among tetraploid species

of Eleusine (Poaceae). Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.299-303 KEYWORDS: CHROMOSOME PAIRING. INTERSPECIFIC STERILITY. TETRAPLOIDY. ELEUSINE.

314. Navjot; Punjab Agricultural University, Bathinda (India). Regional Research Station. Mittal, V.P.; Punjab Agricultural University, Bathinda (India). Regional Reserach Station. Brar, K.S.; Punjab Agricultural University, Bathinda (India). Regional Research Station. Thakur, Anirudh; Punjab Agricultural University, Bathinda (India). Regional Research Station. Dalal, R.P.; Punjab Agricultural University, Bathinda (India). Regional Research Station. Stability analysis for fruit yield and its components in Ber (*Ziziphus mauritiana* Lamk). Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.304-306 KEYWORDS: STABILITY. FRUIT. YIELDS. ZIZIPHUS.

315. Bradshaw, J. E.; SCRI, Scotland. (UK). A Genetic perspective on yield Plateau in potato. Potato Journal (India). (Jul 2009) v.36(3-4) p.79-94 KEYWORDS: GENETICS. POTATOES. YIELDS. SOLANUM TUBEROSUM. COMBINING ABILITY.

Average fresh-weight yields of potato vary tremendously by country from 2 to 50 t/ha with a global average of 16.8 t/ha in 2007. There is a need to increase harvestable and marketable yields of potatoes throughout the world, particularly in Asia, Africa and Latin America where increases in food production are required to match population growth, and where new land will not be readily available. Current yields are commonly less than half the potential set by cultivar, length of growing season and temperatures, because of failure to plant clean seed tubers, inadequate application of fertilizers and supply of water, and ineffective control of weeds, pests and diseases. Addressing all these factors would be of immediate benefit to farmers. In contrast, yield increases of more than 1% per annum are unlikely through new cultivars from conventional breeding, particularly when also selecting for stringent quality specifications. Faster progress may come from breeding for better adaptation to local growing seasons and conditions, base broadening, heterosis from crosses between Tuberosum and both Andigena and Phureja potatoes, and genetic modification of carbohydrate metabolism, as well as inbuilt resistance to reduce yield losses from pests and diseases. Increasing yields will remain a challenging objective for breeders during a period of climate change with water use a major issue, the need for heat and drought tolerant cultivars in a number of countries, and new priorities for resistance to pests and diseases.

316. Pandey, S.K.; Central Potato Research Institute. Shimla (India). Singh, S.V.; Central Potato Research Institute Campus. Modipuram (India). Marwaha, R.S.; Central Potato Research Station. Jalandhar (India). Pattanayak, D.; Central Potato Research Institute, Shimla, (India). Indian Potato processing varieties: Their impact and future priorities. Potato Journal (India). (Jul 2009) v.36(3-4) p.95-114 KEYWORDS: VARIETIES. POTATOES.

The concerted research efforts by the Central Potato Research Institute, Shimla resulted in the release of India's first two potato processing varieties christened as Kufri Chipsona-1 and Kufri Chipsona-2 in 1998 in a record time of eight years. This was followed by the release of an improved processing variety Kufri Chipsona-3 in 2005 for the Indian plains and first chipping variety Kufri Himsona for hilly region in 2007. These processing varieties produce high yield (30 t/ha), 21–24% dry matter, 0.1% reducing sugars on fresh tuber weight basis, low phenols and glycoalkaloids, 5% undesirable colour and 15% total defects in chips when grown at different locations in India. The availability of quality raw material of these varieties and standardization of storage techniques for processing potatoes at 10–12°C with sprout suppressant CIPC [Isopropyl N-3-chlorophenyl carbamate] has changed the entire scenario of potato utilization in India within a short span of 10 years. From the time when the farmers were often forced to throw potatoes on road to the present situation where the processors are ready to pay good premium for processing potatoes. All these varieties are most suitable for crisps and dehydrated products. However, Kufri Chipsona-1, due to its oblong tuber shape, is also utilized by the industry for the preparation of French fries in addition to crisps and

flakes. The future thrust aims at developing (i) varieties for French fries, (ii) varieties which are resistant to cold sweetening and (iii) short duration crisping varieties. To meet the demand of French fry industries, an advanced hybrid MP/98-71 has been just released as Kufri Frysona by the Institute. Both conventional breeding and biotechnological methods are being used to develop cold chipping varieties. The Institute has developed five short duration crisping hybrids viz., MP/2000-516, MP/01-916, MP/01-1006, MP/01-1142 and MP/02-105, which are under advanced stages of testing and have produced high yield in 75 days.

317. Luthra, S.K.; Central Potato Research Institute Campus, Meerut (India). Gopal, J.; Central Potato Research Institute, Shimla (India). Kumar, Dinesh; Central Potato Research Institute Campus, Meerut (India). Singh, B.P.; Central Potato Research Institute Campus, Meerut (India). Pandey, S.K.; Central Potato Research Institute, Shimla (India). *Solanum* wild and cultivated species as source of resistance to cold induced sweetening. *Potato Journal* (India). (Jul 2009) v.36(3-4) p.115-120 KEYWORDS: SOLANUM. COLD STORAGE. SWEETNESS. VARIETIES.

In order to identify the sources of resistance to cold induced sweetening, glucose estimation was done in 72 accessions of 15 wild and cultivated species along with seven released Indian potato varieties during two consecutive years before and after cold storage. Accessions namely SS1763-6, (*S. albicans*), SS1780-3 (*S. berthaultii*), SS1732, SS1735-2, SS1846 (*S. demissum*), SS1652-9 (*S. jamesi*), SS2044-5 (*S. tuberosum* ssp. *andigena*) maintained low glucose level (glucose content 50 mg/100 g fresh tuber weight) before and after cold storage over the years. These accessions may be useful for breeding varieties resistant to cold induced sweetening.

318. Trehan, S.P.; Central Potato Research Station, Jalandhar (India). Improving nutrient use efficiency by exploiting genetic diversity of potato. *Potato Journal* (India). (Jul 2009) v.36(3-4) p.121-135 KEYWORDS: GENETIC VARIATION. FERTILIZER APPLICATION. SOLANUM TUBEROSUM. NUTRITION PHYSIOLOGY. NITROGEN FERTILIZERS. GREEN MANURES.

Three separate field experiments were conducted to compare the nutrient efficiency indices, AUE (agronomic use efficiency), PUE (physiological use efficiency) and NUE (nutrient uptake efficiency) of ten Indian potato cultivars for the identification of nutrient efficient cultivars. Results showed wide variation in the nutrient efficiency of different potato cultivars. Kufri Pukhraj was the most N, P and K efficient cultivar among ten cultivars tested in the absence as well as presence of green manure. The efficient cultivars gave higher tuber yield under N, P and K stress (i.e. with less dose of N, P and K fertilizer) and had higher AUE than less efficient cultivars. Mean AUE of N of different cultivars varied between 62 and 97 kg tubers/kg N without green manure and between 68 and 100 kg tubers/kg N with green manure. Mean agronomic use efficiency of Kufri Pukhraj was 97 and 100 kg tubers per kg N without and with green manure, respectively which was significantly higher than all other cultivars. The main cause of higher nitrogen efficiency in the presence of green manure was the capacity of a genotype to use/absorb more N per unit green manured soil i.e. the ability of the root system of a genotype to acquire more N from green manured soil (NUE). Most P efficient cv. K. Pukhraj produced yield of 300 q/ha without P whereas K. Badshah and K. Ashoka needed 100 kg P₂O₅/ha to produce yield of 270 and 304 q/ha, respectively in the same field. Similarly most K efficient cv. K. Pukhraj produced yield of 364 q/ha without K whereas K. Badshah and K. Sutlej needed 80 kg K₂O/ha to produce yield of 361 and 370 q/ha, respectively in the same field. The variation in phosphorus and potassium efficiency of different potato cultivars was due to both their capability to use absorbed P and K to produce potato tubers (PUE) and to their capacity to take up more P and K per unit soil (NUE).

F40 Plant Ecology

319. Kumar, Suneel; G.B Pant University of Agri. and Tech., Pantnagar (India). Dept. of Entomology. Biological Control Laboratory. Khan, M.A.; G.B Pant University of Agri. and

Tech., Pantnagar (India). Dept. of Entomology. Biological Control Laboratory. Kumar, Arvind; G.B Pant University of Agri. and Tech., Pantnagar (India). Dept. of Entomology. Biological Control Laboratory. Sharma, Kuldeep; G.B Pant University of Agri. and Tech., Pantnagar (India). Dept. of Entomology. Biological Control Laboratory. Biodiversity of natural enemies in Paddy ecosystem and their seasonal dominance. *Annals of Plant Protection Sciences (India)*. (Sept 2008) v.16(2) p.381-383 KEYWORDS: BIODIVERSITY. ORYZA SATIVA. PREDATORS.

The most common and dominant predators observed were spiders, coccinellids, staphylinids, mirids, damsel flies and dragon flies. The result revealed that maximum population (no. per 10 hills) of spiders (3.00), coccinellids (2.50), staphylinids (2.50), mired (2.25), damsel flies 90.75) and dragon flies (0.75) was found in 2nd week of August followed by 3rd week, while the lowest population of spiders (1.25), coccinellids (1.50), staphylinids (1.00), mired (1.25), damsel flies (0.25) and dragon flies (0.50) was observed in 3rd week of October followed by 2nd week of same month. Similarly, the egg parasitoids had greater impact on the suppression of rice stem borer and the most important egg parasitoids observed were *Trlenomus* sp. And *Tetrastichus schoenobii* parasitizing up to 78.4 and 95.8 of October (95.8%) followed by 3rd week (90.9%), while lowest egg parasitization was found in 1st week of August (6.4%) followed by 2nd week (7.5%).

320. Chauhan, P.S.; Hemwati Nandan Bhauguna Garhwal University, Tehri Garhwal (India). Tree Biology Lab. Singh, S.S.; Guru Ghashidas University, Bilaspur (India). Dept. of Forestry. Radiosensitivity of *Populus deltoides* middle aged clones (12 months) to gamma rays and its synergistic effects with stik. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 361-368 KEYWORDS: POPULUS DELTOIDES. PLANT PROPAGATION. IRRADIATION. STEMS. RADIOSENSITIVITY.

The middle aged stem cuttings of *Populus del/aides* (chromosomes No. 38) were irradiated with different continuous and fractionated doses of gamma rays (500r, 01, 02, 04 krd.) during the month of September to observe sensitivity of sprouting and shoot growth behavior. Some irradiated cuttings were also treated with Stik 500ppm to observe its antagonistic and protagonistic effects on regeneration of cuttings. Maximum sprouting percentage was recorded under the IKR-C (83.3%) followed by 4KR-F (54.5%) while control sprouted only (43.7%). Continuous doses proved to be most promising for mutation breeding, having abnormal size of leaf, increased number of leaves and enhanced length of the lateral branch. Maximum length of lateral branch was recorded under the treatment of 500 R-F (4.5cm :f: .15). Stik 500ppm, showing protagonistic effects at all the lower continuous and fractionated does while higher C&F doses indicating antagonistic effects on different parameters i.e. sprouting percentage, length of the lateral branch, number of leaves per cutting and size of the leaves. The mortality percentage of sprouted buds was recorded and it was maximum 85.8% in 4 KRC treatment.

321. Negi, B.S.; Hemwati Nandan Bhauguna Garhwal University, Srinagar (India). Dept. of Forestry. Chauhan, D.S.; Hemwati Nandan Bhauguna Garhwal University, Srinagar (India). Dept. of Forestry. Todaria, N.P.; Hemwati Nandan Bhauguna Garhwal University, Srinagar (India). Dept. of Forestry. Comparative plant diversity between panchayat and adjoining reserve forests in Garhwal Himalaya. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 585-593 KEYWORDS: FOREST MANAGEMENT. TREES. PROTECTED FORESTS. SHRUBS. HERBACEOUS PLANTS.

A comparative study was conducted on plant diversity in Panchayat forests and their adjoining reserve forests of three Districts, viz, Pauri, Chamoli and Rudraprayag Districts of Garhwal Himalaya since April 2003 to December 2004. Total 15 sites were studied which were extending from 840 to 2000 msl. Extensive pure or mixed Oak and Pine forests characterized most of the sites:-major associations of *Quercus /eucotrichophora* were *Rhododendron*. *Myrica esculanta*, and *Lyonia ovalifolia*. The species slightly higher in Panchayat forests than adjoining reserve forests. Tree, shrub and herb density/ha was found almost higher in all the reserve forests among all the altitudinal ranges except

herb density/ha which was comparatively higher between 1300 to 1800 m asl in Panchayat forests. The species diversity was also higher in reserve forests and followed the trend as Herb>Tree> Shrub.

F50 Plant Structure

322. Sankhyan, H.P.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Mariappan, N.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Bawa, R.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Morphological variations in *Grewia laevigata* Vahl in Shiwalik hills of Himachal Pradesh. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 525-532 KEYWORDS: TILIACEAE. GREWIA. HIMACHAL PRADESH. FUNGAL MORPHOLOGY.

The present study on morphological variations in *Grewia laevigata* Vahl revealed that some of the traits viz., branch length, number of leaves per branch, branch nodal length, leaf length, leaf area and seed weight, exhibited variation between the sites but not among the trees. However, leaf width, number of seeds per fruit, seed length and seed width showed non-significant variations. Genotypic correlation coefficients were found greater - than phenotypic one for almost all the morphological traits.

323. Raina, A.K.; Forest Research Institute, Dehra Dun (India). Forest Soil and Land Reclamation Div. Morphology, mineralogy and classification of soils developed on different parent material in Mussoorie Forest Division, Uttarakhand, India. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 533-540 KEYWORDS: SOIL CLASSIFICATION. MINERALS. SOIL MORPHOLOGICAL FEATURES. INDIA.

Based on reconnaissance soil survey of Kempty Range of Mussoorie Forest Division, Uttarakhand, five soil profiles in different blocks were selected for determining their morphological, physicochemical and mineralogical characteristics. The morphological characteristics show considerable variation in the nature and degree of horizon development. Light and heavy mineral fractions constituted 70 and 30 per cent of total fine sand fractions respectively. Various minerals identified in the light sand fractions included quartz, feldspars and mica (muscovite). In all the pedons studied quartz was the dominating mineral. Heavy mineral fractions comprised opaque minerals, biotite, chloritized mica calcite, garnet, zircon, tourmaline, rutile, hornblende and Kyanite. The study, therefore, indicates the presence of low to moderate amount of weatherable minerals suggesting their podzolic nature. Clay fractions were characterized by micas and illite as the dominant clay mineral associated with appreciable amount of kaolinite and chlorite and the small amount of mixed layer silicate mineral, vermiculite, montmorillonite and quartz. Soils of the study area belonged to Typic Paleudoll (Kempty Block), Typic Argiudoll (Sainj Block), Typic Paleudult (Mailgarh Block), Typic Hapludult (Kheragarh Block) and Typic Argiudoll (Gandiyala Block). All these polypedons are members of fine loamy, mixed, mesic family. These soils developed from different parent materials are in equilibrium with geogenic factors. Mollisols occur on limestone, dolomite, quartzite and slate whereas Ultisols occur on phyllite, shale, sandstone, quartzite etc.

324. Sukumaran, S.; Nesamony Memorial Christian College, Marthandam (India). Dept. of Botany. Raj, A.D.S.; Scott Christian College, Nagercoil (India). Dept. of Botany and Research Centre. Rare endemic plants in the sacred groves of Kanyakumari district in Tamil Nadu. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 611-616 KEYWORDS: INDIGENOUS ORGANISMS. TAMIL NADU.

During the present study, a total number of 201 sacred groves were enumerated in Kanyakumari District and reported 329 plant species belongs to 251 genera under 110 families. Among the 329 species, 12 species of shrubs, herbs and climbers are listed as rare, endemic and threatened, belonging to 12 genera under eleven families. Species like, *Alpinia galanga*, *Gloriosa superba*, *Hemidesmus indicus*, *Kaempferia galanga* and *Rauvolfia serpentina* are endangered and threatened, *Justicia beddomei*, *Leea indica* and

Petiveria alliacea are rare, *Indigofera uniflora*, *Naregamia alata*, *Ochlandra scriptoria* and *Osbeckia aspera* var. *wightiana* are endemic to sacred groves of Kanyakumari District.

325. Pusalkar, P.K.; Botanical Survey of India, Dehra Dun (India). Northern Circle. Singh, D.K.; Botanical Survey of India, Kolkata (India).. *Cotoneaster garhwalensis* Klotz. Emend. A Kumar & Panigr. (Rosaceae) - a new synonym. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 633-635 KEYWORDS: GENERA. ROSACEAE.

Cotoneaster garhwalensis Klotz. emend. A. Kumar & Panigr. is reduced as synonym under *C. duthieanus* Klotz.

F60 Plant Physiology and Biochemistry

326. Das, H.; Annamalai University, Annamalainagar (India). Faculty of Science. Dept. of Botany (DDE). Sivakumar, K.; Annamalai University, Annamalainagar (India). Faculty of Science. Dept. of Botany (DDE). Anti-pyretic, analgesic and anti-microbial activity of *Pongamia pinnata* Vent. leaf extract. Journal of Interacademia (India). (Apr 2009) v. 13(2) p. 124-132 KEYWORDS: PONGAMIA PINNATA. ANALGESICS. PLANT EXTRACTS. DRUG PLANTS.

Pongamia pinnata Vent, commonly known as "Karanj" (also known as "Magz-E-Karanji" in the Unai system of medicine), belonging to the family Fabaceae was studied in the present investigation to evaluate the anti-pyretic, analgesic and anti-microbial properties of the leaf extract of *Pongamia pinnata*. Anti-microbial study was carried out against some human pathogenic bacteria viz, *Escherichia coli*, *Klebsiella pneumoniae*, *Citrobacter diversus*, *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Serratia marcescens*, *Enterobacter faecalis* and *Actinobacter* using commercially available antibiotic discs viz, Ampicillin, Ciprofloxacin, Cephalexin, Norflaxacin, Ofloxacin as standard control. Male albino rats were used for the anti-pyretic and analgesic test. Among the alcoholic and chloroformic extracts, alcoholic extract showed better result in the anti-pyretic activity but in case of analgesic activity both the extracts showed significant result. In antimicrobial study aqueous extract performed better than the other extracts and the study drug was effective and formed maximum inhibitory zone *Serratia marcescens* and *Streptococcus pyogenes*.

327. Ramesh, K.R.; Tamil Nadu Agricultural University, Coimbatore (India). Forest College and Research Institute. Khurana, D.K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Tree Improvement and Genetic Resources. Clonal provenance variation of *Populus alba* Linn. in nursery. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 599-610 KEYWORDS: HERITABILITY. POPULUS ALBA.

Cuttings were collected from different provenances of *Populus alba* in Himachal Pradesh and Jammu & Kashmir during 1999-2000. These were raised in the nursery of Dr. Y.S. Parmar University of Horticulture and Forestry, Solan as a mother nursery stock. From them cuttings were taken in the year 2001 and they were planted in nursery for this provenance trial. Analysis of variation revealed highly significant differences among different provenances for height, basal diameter, number of leaves, leaf area, internodal length, root fresh weight, root dry weight, shoot fresh weight and shoot dry weight under nursery conditions. For the seedling traits provenance, Tirth (P 17) excelled for height, basal diameter, leaf area, internodal length, root fresh weight, root dry weight, shoot fresh weight and shoot dry weight. Tabo provenance (P21) recorded minimum value for height, leaf area and internodal length whereas, Holdoo (P13) for number of leaves. Variability and genetic estimates revealed high heritability for seedling height, basal diameter, root fresh weight, and root dry weight. Heritability value was found low for number of branches. Divergence (D2) studies indicated remarkable diversity among 26 provenances of *P. alba*. Skibba (P 10) and Tarnot (P 12) were considered most diverse populations (D2 value 57771.20). Correlation studies illustrated significant positive correlation between different traits viz., height, basal diameter, number of leaves, internodal length, root fresh weight, root dry weight, shoot fresh weight and shoot dry weight.

328. Varalakshmi, L.R.; Indian Institute of Horticulture Research, Bangalore (India). Ganeshamurthy, A.N.; Indian Institute of Horticulture Research, Bangalore (India). Effect of cadmium on plant biomass and cadmium accumulation in amaranthus (*Amaranthus tricolor*) cultivars. Indian Journal of Agricultural Sciences (India). (Nov 2009) v.79(11) p.861-4 KEYWORDS: AMARANTHUS. VARIETIES. PLANT BIOTECHNOLOGY.

An experiment was conducted during 2006-08 to find out the effect of cadmium on plant growth and its accumulation in different amaranthus (*Amaranthus tricolor* L.) varieties. Three amaranthus cultivars, namely local, Arka Arrunima and Arka Suguna were evaluated for their Cd tolerance and accumulating capacity in greenhouse on sandy loam soil. Variable levels of Cd were created through the application of CdCl₂ (control), 50, 100 and 200 mg Cd/kg soil. Fresh and dry biomass yield of shoots and roots in all the cultivars decreased Cd levels. The relative reduction in fresh biomass yield of cultivars followed the order LocalArka SugunaArka Arunima. Significant reduction in the biomass of local was recorded at applied Cd level of 50 mg/kg where as percentage reduction in biomass was lower in Akra Arunima. The Cd content of foliage increased with increase in soil Cd levels in all the cultivars. However, the concentration of Cd in Akra Arunima was highest at all levels of applied Cd. This cultivar accumulated 43.5% more Cd than that in Local and 25.8% more Cd than that in Akra Suguna at soil Cd level of 50.0 mg/kg. At highest soil applied Cd level of 200 mg/kg the Cd concentration in Akra Arunima was 76.3 and 73.7% more than that in local and Arka Suguna respectively. Local cultivars accumulated relatively lower levels of Cd and this cultivar can be preferred for cultivation in high Cd soil.

329. Singh, A.K.; Narendra Deva University of Agriculture and Technology, Faizabad (India). Singh, Sanjay; IARI, New Delhi (India). Genetics Division. Singh, Anuradha; Narendra Deva University of Agriculture and Technology, Faizabad (India). Pradhan, S.K.; Central Rice Research Institute, Cuttack (India). Tyagi, J.P.; IARI, New Delhi (India). Genetics Division. Singh, Alok; Narendra Deva University of Agriculture and Technology, Faizabad (India). Physiological marker traits associated with submergence tolerance of lowland rice (*Oryza sativa*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p.687-93 KEYWORDS: ALDEHYDES. CATALASE. CHLORMEQUAT. ORYZA SATIVA. PEROXIDASES. PACLOBUTRAZOL. WATER TOLERANCE. SUPEROXIDE DISMUTASE.

A field experiment was conducted during 2005-06 to elucidate the possible pre and post emergence traits associated with injury and submergence tolerance of lowland rice (*Oryza sativa* L.). Ten replicate pots with 5 plants in each pot were maintained per treatment under completely randomized design, respectively. The total protein content though was not much variable among varieties before submergence but decreased appreciable during submergence showing much lower values in intolerant varieties. A strong positive correlation between survival and protein content of leaves just after de-submergence was observed ($R^2=0.90$ for 5d) and ($R^2=0.93$ for 10d) of complete submergence indicating a direct relationship of protein content with survival. Intolerant rice varieties accumulated 21 to 23 folds aldehyde on submergence against only 10 folds in tolerant ones showing a negative correlation ($R^2=0.9$) between survival and aldehyde accumulation which might prejudice the submergence tolerance of rice. Activities of superoxide dismutase, catalase and peroxidase enhanced on submergence in all the varieties though the induction was more in tolerant varieties. FR12A and vaidehi had 15 folds increase in super oxide dismutase activity against only 9 to 11 folds in Mahsuri and IR42 respectively with 10 days complete submergence. These traits could possible be looked into as markers for structuring submergence tolerant lowland rice.

F61 Plant Physiology - Nutrition

330. Bodake, P.S.; Indian Agricultural Research Institute, New Delhi (India). Rana, D.S.; Indian Agricultural Research Institute, New Delhi (India). Evaluation of jatropha (*Jatropha curcas*) and castor (*Ricinus communis*) cake as a source of nutrient and soil amendment in spring sunflower (*Helianthus annuus*)-maize (*Zea mays*) sequence. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 284-290 KEYWORDS: JATROPHA CURCAS. YIELDS. GROWTH. RICINUS COMMUNIS. HELIANTHUS ANNUUS. MAIZE. ZEA MAYS.

A fixed plot field experiment was conducted during 2007 and 2008 at New Delhi to find out the effect of de-oiled seed cake of jatropha (*Jatropha curcas* L.) and castor (*Ricinus communis* L.) as a source of nutrient alone I and in various combination with inorganic sources in spring sunflower (*Helianthus annuus* L.)-maize (*Zea mays* L.) sequence. Nine combinations of three organic sources viz. jatropha cake (JC), castor cake (CC) and FYM 100%, 50% and 25% recommended dose of nitrogen (RDN) and three inorganic levels viz. 0%, 50% and 75% recommended dose of fertilizer (RDF) were tested in sunflower along with RDF through inorganic (80, 26.2 and 30 kg N, P and K/ha) and control. Residual effects of treatments were evaluated on the succeeding maize along with RDF to fallow-maize (120, 26.2 and 33.3 kg N, P and K/ha). In first year of experiment, RDF to sunflower produced significantly the highest seed yield (2.64 t/ha) over other fertility levels barring the treatment of 75% RDF + 25% RDN either through JC (2.61 t/ha) or CC (2.52 t/ha). In the next season, 50% RDF + 50% RDN through JC (3.43 t/ha) being on par with 50% RDF + 50% RDN either through CC (3.36 t/ha) or FYM (3.22 t/ha) produced marked increase in seed yield over remaining fertility combinations. Grain yield of succeeding maize due to residual effect of 50% RDF + 50% RDN through JC (2.72 and 2.89 t/ha in respective year) was significantly higher than other residual fertility treatments, followed by 50% RDF + 50% RDN through CC (2.45 and 2.62 t/ha) in both the years. The highest system productivity in terms of sunflower seed equivalent (3.52, 4.75 t/ha) and net returns (Rs 45,418, 69,407/ha) were recorded with the application of 50% RDF + 50% RDN through JC, followed by 50% RDF + 50% RDN through CC during both the years. Nutrient uptake followed trend similar to yield. Compared to control and RDF, pH and bulk density decreased with increase in the quantity of organics and reverse trend was recorded with respect to organic carbon content.

331. Dodamani, B.M.; Indian Agricultural Research Institute, New Delhi (India). Das, T.K.; Indian Agricultural Research Institute, New Delhi (India). Interference of common lambsquarter (*Chenopodium album*) in wheat (*Triticum aestivum*) as influenced by nitrogen levels. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 310-314 KEYWORDS: TRITICUM AESTIVUM. NITROGEN. CHENOPODIUM.

A field experiment was conducted during 2006-07 and 2007-08 at, New Delhi to study the effect of different levels of common lambsquarter (*Chenopodium album* L.) infestation 0,8,16,32,64,128 plants/m², un-weeded control with common lambsquarter (CL), and un-weeded control without CL at different nitrogen levels (0, 60 and 120 kg/ha) on growth, yield and nitrogen uptake of wheat. Increase in CL density from 0 to 128 plants/m² resulted in a significant reduction in wheat yield by 31 and 36%, respectively in first and second year. Increase in nitrogen level from 0 to 120 kg/ha, on the contrary, recorded an improvement in wheat yield by 13.9 and 18% and N uptake by 29.4 and 27.7%, respectively in the first and second year. Higher the infestation of CL, greater were the quantity of N removed and reduction in wheat yield. The highest N level (120 kg/ha) and at density (128 plants/m²) resulted in a great reduction in wheat yield (8.3 to 9.9%). Therefore, under high density of CL in wheat, the nitrogen dose should be reduced to 60 kg/ha.

332. Sammauria, R.; Maharana Pratap University of Agriculture and Technology, Bhilwara (India). Dryland Farming Research Station. Yadav, R.S.; Rajasthan Agricultural University, Bikaner (India). Nagar, K.C.; Maharana Pratap University of Agriculture and Technology, Bhilwara (India). Krishi Vigyan Kendra. Performance of cluster bean (*Cyamopsis tetragonoloba*) as influenced by nitrogen and phosphorus fertilization and

biofertilizers in Wesatern Rajasthan. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 319-323 KEYWORDS: NITROGEN. PHOSPHORUS. BIOFERTILIZERS. FERTILIZATION. CYAMOPSIS.

A field experiment was conducted to assess the effect of Rhizobium and phosphorus solubilizing bacteria (PSB) alone and in combination with different recommended NP levels i.e. RDF (20-17.4 kg N-P/ha) on perfor-mance of rain fed cluster bean (*Cyamopsis tetragonoloba* L. Taub.) at Bikaner. Increasing NP levels resulted in significant increase in growth, yield attributes, and yield. The increase in seed yield was significant up to 50% RDF in 2004 (1.01 t/ha) and up to 75% RDF in 2005 (1.15 t/ha). However biological yield (mean 4.66 t/ha) in-creased significantly upto 75% RDF during both the years. Unfertilized control recorded the least seed and bio-mass yields. However, P uptake increased significantly up to application of 100% RDF N, K uptake and B:C ratio increased only up to 75% RDF. The highest net returns (Rs 22,393 /ha) were recorded with 100% RDF. The growth, yield attributes, and yield increased significantly due to inoculation of cluster bean with biofertilizers. Combined inoculation of Rhizobium and PSB was more promising from productivity and profitability point of view as compared to their sole inoculation. Integrated use of 75% RDF with Rhizobium + PSB inoculation was the best for cluster bean.

333. Krishna, S.K.; Central Tobacco Research Institute, Rajanundry (India). Effect of organic and inorganic sources of nitrogen on productivity, quality and economics of FCV tobacco (*Nicotiana tabacum*). Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 336-341 KEYWORDS: PRODUCTIVITY. QUALITY. ECONOMICS. NITROGEN. NICOTIANA TABACUM. FERTILITY.

A field experiment was conducted during 2001-02 and 2002-03 at Rajahmundry, Andhra Pradesh to evaluate the response of FCV tobacco (*Nicotiana tabacum* L.) to doses of N fertilizer (20, 40 and 60 kg/ha) and its inte-gration with organic N i.e. farmyard manure (FYM), groundnut [*Arachis hypogaea* (L.)] cake (GNC) and green leaf manuring (GLM) with Pillipesara [*Vigna trilobata* (L.) Verde.]} in organic: fertilizer N of ° : 100, 25 : 75 and 50 : 50. Results showed that the net returns were higher by Rs 2,330 and Rs 850/ha with GLM when compared with GNC and FYM, respectively. Application of organic: inorganic N in 25: 75 ratio increased mean yields of cured leaf by 0.14 t/ha, and net returns by Rs 3,000/ha over fertilizer N alone. However, 50% each of organic: inorganic N registered higher soil fertility status (OC%, available N, P and K) after crop harvest. The highest mean leaf yields, leaf production efficiency and net returns (Rs 24,450) were recorded with 60 kg N/ha. Leaf lamina con-centrations of N and nicotine increased while sugars, and sugars: nicotine ratio decreased with increase in the level of N from 20 to 60 kg/ha. Application of 60 kg N/ha, 25% through FYM or GLM and 75% through fertilizers improved the productivity, quality, economic returns of tobacco and soil fertility status. GLM with Pillipesara is a suitable alternative to FYM whenever its supply is limited in vertisols of Andhra Pradesh.

334. Rawat, B.S.; Hemwati Nandan Bhauguna Garhwal University, Srinagar (India). Dept. of Botany. Sharma, C.M.; Hemwati Nandan Bhauguna Garhwal University, Srinagar (India). Dept. of Botany. Ghildiyal, S.; Hemwati Nandan Bhauguna Garhwal University, Srinagar (India). Dept. of Botany. Nature of variability in cone and seed characteristics and germination behaviour of different seed sources of silver fir (*Abies pindrow* Spach.). Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 651-658 KEYWORDS: ABIES ALBA. SEED CHARACTERISTICS. CONES. GERMINATION.

Five seed sources of *A. pindrow*, collected from Garhwal Himalaya were studied for cone and seed characteristics and germination behaviour. Three different sizes of cones (large, medium and small) were observed in all the seed sources. The dimensions of large (14.25x4.76 - 16.04x4.56 cm), medium (11.45x4.17 - 12.28x 4.43 cm) and small (9.01x4.05 - 9.68x4.08 cm) sized cones in 5 different seed sources of *A. pindrow* oscillated greatly. The maximum cone moisture content also varied significantly (45.22-55.37%) in the cones. The largest seed observed was 1.17 cm long x 0.87 cm wide and the smallest was 0.56 cm long x 0.19 cm wide. The seed mass was heaviest with wings

(7.35 gml/100 seeds) and without wings (6.84 gml/100 seeds) in Tapovan seed source on fresh weight basis. The highest (56.0%) germination was observed in Dudhatoli seed source at 10°C and the lowest (10.0%) at 25°C in Tapovan seed source. Dudhatoli seed source was recorded to be the best seed source, which may give highest productivity if tried on other sites. This seed source may be used to establish Seedling Seed Orchards due to additive genetic gain and higher germination percentage of seeds.

335. Datt, Chander; ICAR Research Complex for NEH Region, Tripura (India). Singh, N.P.; ICAR Research Complex for NEH Region, Tripura (India). Chhabra, Aruna; ICAR Research Complex for NEH Region, Tripura (India). Dhiman, K.R.; ICAR Research Complex for NEH Region, Tripura (India). Nutritional evaluation of cultivated fodder crops grown under agro-climate of Tripura. *Indian Journal of Animal Sciences* (India). (Nov 2009) v.79(11) p.1143–1148 KEYWORDS: FEED CROPS. AGROCLIMATIC ZONES. TRIPURA. NUTRITION PHYSIOLOGY.

The study was conducted to assess forage yield and nutritional characteristics of various crops including graminaceous (maize, sorghum, pearl millet, oat, job's tears, napier hybrid, para grass, congo signal, signal grass, guinea grass, thin napier and broom grass) and leguminous (cowpea, rice bean, berseem, cluster bean/guar, soybean, stylo and perennial ground nut) introduced at the ICAR Research Complex, Tripura Centre. The average fresh forage yields of different forage crops were satisfactory and in the range reported elsewhere in the country with the exception of berseem and cluster bean which yielded lesser quantity of herbage. There were significant differences among the crops (graminaceous or leguminous) in terms of proximate principles, cell wall constituents, in vitro DM and OM digestibility (IVDMD and IVOMD) and metabolisable energy (ME) values. Leguminous fodders possessed higher level of CP, EE, IVDMD/IVOMD and ME compared to graminaceous fodders while a reverse trend was observed for CF and cell wall components except ADL. Overall, CP and EE were positively correlated with IVDMD, IVOMD and ME values, however, CF, NDF, ADF and cellulose showed negative relationship with these parameters. ME value had a strong positive correlation with IVDMD and IVOMD levels in the fodders. Considering their herbage yield under tilla land (upland) conditions, they hold good potential for increasing the forage production and thus bridge the gap between demand and supply of nutrients particularly for ruminants and to raise their productivity in the state.

F62 Plant Physiology – Growth and Development

336. Khan, A.; Bidhanchandra Krishi Viswavidyalaya, Mohanpur (India). Faculty of Horticulture. Dept. of Floriculture and Landscaping. Pal, P.; Bidhanchandra Krishi Viswavidyalaya, Mohanpur (India). Faculty of Horticulture. Dept. of Floriculture and Landscaping. Effect of paclobutrazol and time of spraying on growth, flowering and bulb production of tuberose (*Polianthes tuberosa* L.)cv. double. *Journal of Interacademia* (India). (Apr 2009) v. 13(2) p.133-137 KEYWORDS: POLIANTHES. ORNAMENTAL BULBS. PACLOBUTRAZOL. FLOWERING.

A field experiment was conducted for 2002-2003 comprising 3 levels of paclobutrazol (50, 100 and 200 ppm) and three times of application (60, 70 and 80 days after planting). The result indicates that foliar sprays with 100 ppm paclobutrazol significantly influenced the number of leaves/clump and rachis length. Plant treated with 200 ppm paclobutrazol recorded maximum spike diameter, number of florets/spike, diameter and weight of individual florets, spike weight and self-life of spike in field. Spraying of paclobutrazol at 70 days after planting significantly influenced all the characters under studies, except plant height, irrespective of level of paclobutrazol.

337. Kikon, Noyingthung; Nagaland University, Medziphema (India). Gohain, T.; Nagaland University, Medziphema (India). Effect of tillage and weed management practices on growth and yield of direct seeded upland rice (*Oryza sativa* L.). *Journal of Interacademia* (India). (Apr 2009) v. 13(2) p.148-155 KEYWORDS: ORYZA SATIVA. UPLAND RICE. TILLAGE. WEED CONTROL. GROWTH.

To test the effect of tillage and weed management practices on growth and yield of direct seeded upland rice (*Oryza sativa* L.), a field experiment was conducted at NU: SASRD, Medziphema campus, Nagaland, during the kharif season of 2007. Results revealed that tillage and weed treatment had marked effects on weed density and weed dry weight production in rice. Summer ploughing twice followed by pre-plant application of glyphosate 1.0 kg a.i ha⁻¹ 15 days after weed emergence (T1) was found superior in reducing weed population as well as dry weight and also recorded the highest weed control efficiency. Among the different tillage treatments, maximum grain yield was also recorded from T1. Lower weed density as well as dry weight were recorded with application of butachlor 2.0 kg a.i ha⁻¹ 4 DAS (W4) however, at 90 DAS and at harvest hand weeding twice at 20 and 40 DAS (W2) was observed to be statistically comparable with it. Highest weed control efficiency was recorded under W4. The highest grain yield was obtained under W4 and W2 which were at par with each other and significantly superior over the rest of the weed control treatments. The cultivation practice involving treatments. T1 and W4 was found to be most economically feasible, providing the highest gross return as well as net return and also recording the highest benefit cost ratio.

338. Sharanabasappa; University of Agricultural Sciences, Dharwad (India). College of Agriculture. Dept. of Agril. Entomology. Kulkarni, K.A.; University of Agricultural Sciences, Dharwad (India). College of Agriculture. Dept. of Agril. Entomology. Mallapur, C.P.; University of Agricultural Sciences, Dharwad (India). College of Agriculture. Dept. of Agril. Entomology. Goud, K. Basavana; University of Agricultural Sciences, Dharwad (India). College of Agriculture. Dept. of Agril. Entomology. Population dynamics of sugarcane woolly aphid, *Ceratovacunna lanigera* Zehntner and its natural enemies. *Annals of Plant Protection Sciences* (India). (Sept 2008) v.16(2) p.384-388 KEYWORDS: POPULATION DYNAMICS. NATURAL ENEMIES.

The study revealed that the peak incidence of sugarcane woolly aphid was observed during fourth week of October (4.64 pest grade) and then, onwards the pest population gradually decreased during fifth week of January. *Micromus* activity reached its peak during second week of November (3.31 graubs/ leaf) and later population gradually declined till third week of January whereas *Dipha aphidivora* population reached its peak during fourth week of November (3.06 larvae/ leaf). *Eupeodes contractor* population varied from 0.04 to 1.25 maggots/ leaf from second week of August to third week of November with a mean of 0.23 maggots/ leaf. The correlation studies revealed that, the pest grade was significant and was positively correlated with evening relative humidity whereas, highly significant negative correlation was observed with maximum temperature. The population of natural enemies viz. *Micromus igorotus*, *D. aphidivora* and *E. contractor* was negatively correlated and significant with maximum temperature.

339. Sharma, R.P.; Rajendra Agricultural University, Sabour (India). Raman, K.R.; Rajendra Agricultural University, Sabour (India). Singh, A.K.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Gwari (India). Regional Horticulture Research Sub-Station. Fodder productivity and economics of pearl millet (*Pennisetum typhoides*) with legumes intercropping under various row proportions. *Indian Journal of Agronomy*. (Sep 2009) v. 54(3) p. 301-305 KEYWORDS: ECONOMICS. PRODUCTIVITY. PENNISETUM. INTERCROPPING. FEED CROPS. LEGUMES.

A field experiment was conducted during the summer seasons of 2007 and 2008 at Sabour to assess the productivity and economics of intercropping of forage pearl millet [*Pennisetum typhoides* (L.) R. Sr. Emend & Stuntz.] with cowpea [*Vigna unguiculata* (L.) Walp.], clusterbean [*Cyamopsis tetragonoloba* (L.) Taub.] and rice bean [*Vigna umbel/ata* (Thumb) ohwi and ohashi] under 4 row proportions, viz., 1: 1, 1: 2, 2: 1 and 2: 2. Fodder yields of both the component crops were substantially reduced under intercropping system compared with their sole stands. Pooled analysis of 2 years showed that pearl millet + cowpea (2: 2) recorded significantly higher total green (52.8 t/ha), dry fodder (13.24 t/ha), crude protein yield (1.36 t/ha), as well as net returns (Rs 24,060/ha) compared with the other treatments. The highest land-equivalent ratio

(1.42), relative crowding coefficient (6.54) and lowest value of competitive ratio (1.29) also indicated superiority of pearl millet + cowpea system. Among the component crops, pearl millet was more competitive and aggressive to legume intercrops. However, maximum aggressivity index (0.55) and competitive ratio (3.42) were obtained with pearl millet + clusterbean (1: 2). Thus, in-tercropping of pearl millet and cowpea in 2: 2 row ratio may be adopted for higher fodder productivity, quality and profitability during summer.

340. Pramanik, S.C.; Indian Institute of Pulses Research, Kanpur (India). Singh, N.B.; Indian Institute of Pulses Research, Kanpur (India). Singh, K.K.; Indian Institute of Pulses Research, Kanpur (India). Yield, economics and water use efficiency of chickpea (*Cicer arietinum*) under various irrigation regimes on raised bed planting system. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 315-318 KEYWORDS: YIELDS. CICER ARIETINUM. IRRIGATION. ECONOMICS. EFFICIENCY. WATER USE.

A field experiment was conducted at Kanpur during rabi seasons of 2005-06 and 2006-07 to elucidate the effect of raised bed planting on growth, yield, water use efficiency and economics of chickpea (*Cicer arietinum* L.) under various irrigation depths. Results revealed that raised bed planting increased nodulation significantly by 30.0% and nodule dry weight by 44.4% over flat bed planting. Raised bed planting also encouraged comparatively more root growth than flat bed as evident through higher root: shoot ratio. Branching and podding were significantly higher in raised bed by 52.1% and 23.6%, respectively. Chickpea recorded maximum grain yield (average 2.24 t/ha), water use efficiency (11.69 kg/ha-mm) and net return (Rs 20,810/ha) under raised bed planting system. Among depths, though 30 and 45 mm irrigation recorded significantly higher nodulation, root growth, branching and podding, the maximum grain yield was recorded with 30 mm irrigation (av. 2.22 t/ha) which was at par with 45 mm but significantly higher than 15 and 60 mm irrigations. Thus, on an average, raised bed planting increased grain yield by 17.3% and saved 37.5 to 50% irrigation requirement in chickpea.

341. Kumawat, R.N.; Central Arid Zone Research Institute, Jaisalmar (India). Regional Research Stn. Mahajan, S.S.; Central Arid Zone Research Institute, Jodhpur (India). Mertia, R.S.; Central Arid Zone Research Institute, Jaisalmar (India). Regional Research Stn. Growth and development of groundnut (*Arachis hypogaea*) under foliar application of panchgavya and leaf extracts of endemic plants. Indian Journal of Agronomy (India). (Sep 2009) v. 54(3) p. 324-331 KEYWORDS: LEAVES. PLANT EXTRACTS. INDIGENOUS ORGANISMS. ARACHIS HYPOGAEA.

A field experiment was conducted at Regional Research Station, CAZRI, Jaisalmer during kharif 2006 and 2007 to evaluate the efficacy of foliar applied panchgavya on the physiological growth, nutrient uptake, yield and economics of groundnut (*Arachis hypogaea*) with and without mixing leaf extracts of neem (*Azadirachta indica*), datura (*Datura metel*) and tumba (*Citrullus colocynthis*). The results of the experiment revealed that foliar application of panchgavya + neem leaf extract (NLE) recorded significant improvement in chlorophyll content, nitrate reductase activity, root nodule weight, leaf area index, dry matter accumulation, nutrient content and uptake of groundnut when compared with control and panchgavya alone. Yield attributes (pod weight, pod index, kernel index, shelling per cent) and harvest index were also recorded significantly higher with panchgavya + NLE. The pod, haulm and biological yield increased by 54, 25 and 39% with foliar application of panchgavya + NLE over the control. Maximum net return (Rs 45,399/ha) and B: C ratio (2.19) was recorded with foliar application of panchgavya + NLE over other sources. Foliar application at branching (35 DAS) and flowering (55 DAS) re-corded significantly higher growth and yield of groundnut, net return (Rs 42,880/ha) and benefit: cost (2.06) than foliar application of the sources either one of these two stages.

342. Kader, S.A.; Kerala State Council for Science, Technology and Environment, Thiruvananthapuram (India). Seethalakshmi, K.K.; Kerala Forest Research Institute,

Peechi (India). Structure of mahogany (*Swietenia macrophylla* King) fruit, seed and their characteristics. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 413-316
KEYWORDS: SWIETENIA MACROPHYLLA. FRUIT. SEED CHARACTERISTICS. GERMINATION.

The fruit is a large (12.90-15.40 cm length x 8.74-10.64 cm diameter, excluding the capsule stalk), erect woody capsule. There are five outer thick and five inner thin valves. There is a central axis, the columella, which is typically 5-angled to which the seeds are attached pendulously by their wings. The mean weight of a capsule was 369.47 (s.d.: 54.01) g, ranging between 231.13 (s.d.: 25.67) g and 565.55 (s.d.: 72.82) g. On average a capsule contains 43 germinable seeds. One thousand fresh seeds (with wings) weigh from 607.06 g to 919.15 g. Significant differences existed between locality. Capsules collected from Karulai were found to be larger in size when compared to those collected from other localities. Seeds are winged and dark brown coloured. Longitudinal section of a seed revealed that the seed consists of a minute embryo embedded peripherally at one side within the massive cotyledons which is surrounded by a white thin testa which is again covered by dark brown coloured spongy tail-like wing. The variation in seed weight, germination percentage and germination period could be due to provenance differences, size of capsules, crown size of parent trees, level of seed maturity, site fertility, health condition of parent trees and environmental factors of a locality. The selection of parent trees having larger capsules appears to be most promising for seed collection.

343. Thakur, I.K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Tree Improvement and Genetic Resources. Chauhan, K.C.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Tree Improvement and Genetic Resources. Improvement of white mulberry (*Morus alba* Linn.) 1. Variation, estimates of genetic parameters and correlation in different accessions. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 423-428
KEYWORDS: MORUS ALBA. VARIETIES. GENETIC CORRELATION.

Magnitude of variability among various traits alongwith their inter-relationship were investigated in 32 genotypes of *Morus alba*. Moderate to high genetic coefficient of variation (GCV), heritability and genetic gain were noticed for leaf yield, shoot height, shoot diameter and number of leaves indicating that these characters can be reliable for effecting selection in future. Shoot height showed significant and positive correlation with shoot diameter, internodal length, number of leaves, leaf width and leaf yield. Shoot diameter exhibited positive association with internodal length and number of leaves with leaf yield. Leaf length also revealed significant and positive correlation with leaf width and leaf yield whereas leaf width exhibited positive association with leaf yield. Hence at first instance study revealed that shoot height, number of leaves, leaf length and width could be important for selection in White Mulberry.

344. Manickam, V.S.; St. Xavier's College, Palayamkottai (India). Centre for Biodiversity and Biotechnology. Kalidass, C.; St. Xavier's College, Palayamkottai (India). Centre for Biodiversity and Biotechnology. A note on twin seedlings in *Filicium decipiens* Thw. (Sapindaceae), an important ornamental tree species. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 441-442
KEYWORDS: SEEDLINGS. SAPINDACEAE. POLYEMBRYONY. SEED TESTING.

345. Singh, B.; Hemwati Nandan Bhauguna Garhwal University, Srinagar Garhwal (India). Dept. of Forestry. Bhatt, B.P.; ICAR Research Complex for North Eastern Hill Region, Barapani (India). Agroforestry Div. Germination behaviour of *Dalbergia sissoo* as affected by seed source and temperature. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 565-570
KEYWORDS: DALBERGIA SISSOO. SEED. GERMINATION. TEMPERATURE.

The results of present investigation reveals that seed germination of *Dalbergia sissoo* is temperature depends and seed were collected from different sources showed variability in germination. On the basis of germination behavior on different temperature

it can be recommended that seed of *D. sissoo* should be sown nursery beds in the months of March-April because optimum and uniform germination was recorded at 25-35°C temperature regimes.

346. Nair, Sujatha A; Indian Institute of Horticulture Research, Bangalore (India). K, Sujatha; Indian Institute of Horticulture Research, Bangalore (India). Venugopalan, R; Indian Institute of Horticulture Research, Bangalore (India). Influence of pruning time on enhancing the yield and quality of *Jasminum sambac* flower during off- season. *Indian Journal of Agricultural Sciences (India)*. (Nov 2009) v.79(11) p.857-60 KEYWORDS: FLOWERS. QUALITY. JASMINUM. YIELDS. OUT OF SEASON PRODUCTS.

A study was made during 2005-08 established the effect of pruning time on flower induction in winter by pruning the plants at monthly intervals from August to November. The pooled data indicated highest flower yield in September pruned plants (72.99 g/plant) with good quality flower buds as compared to November pruned plants which produced only 25.51g/plant of marketable flower buds. The peak season yield was not affected by advancing the pruning time. Hence, September pruning enhances the yield and profitability due to higher realized in winter season.

347. Kumar, Deva K; CPCRI, Biotechnology Section, Kasaragod (India). Prabakaran, J; Tamil Nadu Agricultural University, Coimbatore (India). Syncytial nuclei formation and development in palmyrah (*Borassus flabellifer*) fruits. *Indian Journal of Agricultural Sciences (India)*. (Nov 2009) v.79(11) p.934-38 KEYWORDS: BORASSUS. ENDOSPERM. PALMAE.

The palmyrah fruits are among the few fruits of the family palmaceae in which the fruit kernel development is initiated by liquid syncytial phase. The liquid syncytium of this fruit forms the gelatinous solid endosperm until the second month of fruit development. The gelatinous solid endosperm then cellularizes to form mature fruit in another two months. The syncytial nuclei formation takes place as early in a 10-15 days old fruit itself. The three locules continued in the palmyrah fruit were in successive stage of development. A maximum volume of 5 ml of liquid syncytium could be extracted from each the locules of 20-25 days old fruit. The syncytial nuclei count varied million between the 20 days and 1 month of fruit development and reduced to a few hundred during the late syncytial stage at 2 months. The palmyrah fruits were found to be excellent sources of high-density syncytial nuclei.

348. Birbal; CAZRI, RRS, Bikaner (India). Singh, R.K.; NRC on Seed Spices, Ajmer (India). Kumar, Vinod; IGFRI, RRS, Dharwad (India). Kushant, V.S.; Central Potato Research Station, Gwalior (India). Effect of foliar application of plant growth regulators on growth, yield and post harvest losses of potato (*Solanum tuberosum*). *Indian Journal of Agricultural Sciences (India)*. (Sept 2009) v.79(9) p.684-86 KEYWORDS: DRY MATTER CONTENT. PLANT GROWTH SUBSTANCES. POTATOES. FOLIAR APPLICATION. POSTHARVEST LOSSES. STORAGE.

A field experiment was conducted during the winter (rabi) season of 2002-2003 to find out the suitable plant growth regulators for foliar spray to maximize seed potato yield. A total of 7 treatments including control were tested in randomized block design with 3 replication on Kufri Ashoka potato (*Solanum tuberosum* L.). The results indicated that plant growth regulators like GA₃, NAA, TIBA and ethephol significantly increased seed size (25-75 g) tubers yield as well as total tuber yield. Significantly maximum total tuber yield (37.0 tonnes/ha) was achieved with GA₃ 200 ppm treatment, followed by ethephol (35.0 tonnes/ha) in comparison to control (30.4 tonnes/ha). The multiplication rate also varied from 12.8 to 14.6 with different plant growth regulators. The minimum rotting losses were observed with NAA treatment when tubers were kept for short term storage after harvest at ambient conditions. At the end of the storage, significantly dry matter increased was also observed with treatment ethephol, TIBA and NAA.

F70 Plant Taxonomy and Geography

349. Rasingam, L.; Botanical Survey of India, Port Blair (India). Pandey, R.P.; Botanical Survey of India, Port Blair (India). Diwakar, P.G.; Botanical Survey of India, Pune (India). Two new additions to the orchid flora of Andaman Islands. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 429-430 KEYWORDS: FLORA. ANDAMAN AND NICOBAR ISLANDS.

Two orchid species viz., *Tropidia angulosa* (Lindl.) Blume and *Zeuxine officin* (Lindl.) Benth ex. Hook. f. are reported as new additions to the flora of Andaman Islands.

350. Swain, P.K.; Andhra University, Visakhapatnam (India). Wood Biodegradation Centre (Marine). Rao, N.R.; Andhra University, Visakhapatnam (India). Wood Biodegradation Centre (Marine). Mohan, S.; Institute of Wood Science and Technology, Bangalore (India). New mangrove habitats and additions to the flora of Srikakulam district, Andhra Pradesh, India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 431-434 KEYWORDS: MANGROVES. FLORA. HABITATS. ANDHRA PRADESH.

This paper deals with two mangrove habitats reported for the first time from the East Coast of Andhra Pradesh. Four mangroves species, four mangrove associates and two Seagrasses are reported here for the first time from these habitats. These species form additions to the flora of Srikakulam District, Andhra Pradesh.

351. Pradeep, S.V.; SVR NSS College, Kottayam (India). Dept. of Botany. Balan, A.P.; SVR NSS College, Kottayam (India). Dept. of Botany. Prasad, V.P.; Botanical Survey of India, Pune (India). *Senna uniflora* (Mill.) Irwin & Barneby (Fabaceae-Caesalpinioideae) - a new record to Kerala. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 435-436 KEYWORDS: LEGUMINOSAE. KERALA.

Senna uniflora, a native of tropical South America is newly recorded from the state of Kerala. The plant is already known from Maharashtra and Karnataka in India. Description, nomenclature, illustration etc. are provided to facilitate identification.

352. Saxena, D.K.; Bareilly College, Bareilly (India). Bryology Lab., Dept. of Botany. Singh, S.; Bareilly College, Bareilly (India). Bryology Lab., Dept. of Botany. Srivastava, K.; Bareilly College, Bareilly (India). Bryology Lab., Dept. of Botany. Taxonomy of *Rhodobrym* from Kumaon and Garhwal region of Uttarakhand, India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 437-440 KEYWORDS: TAXONOMY. BRYOPHYTA. HIMALAYAN REGION.

The present study is focused on the distribution and taxonomy of beautiful rose moss *Rhodobrym roseum* (Hedw.) Limpr. and *Rhodobrym giganteum* (Schwaegr.) Par. from Kumaon and Garhwal hills respectively. These species of moss *Rhodobrym* grows in the form of green rosette patches on soil of usually reasonable nutrient rich status. The moss species remains green in summer but devoid of moisture. It is also observed that seasonal environmental factors do not much influence distribution of *R. roseum* however *R. giganteum* found sensitive as evident by change in colour and its restricted distribution.

353. Narain, S.; University of Allahabad, Allahabad (India). Duthie Herbarium, Dept. of Botany. Lata, K.; University of Allahabad, Allahabad (India). Duthie Herbarium, Dept. of Botany. Singh, J.; University of Allahabad, Allahabad (India). Duthie Herbarium, Dept. of Botany. A new species of *Blumea* DC. (Asteraceae) from Uttar Pradesh, India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 443-446 KEYWORDS: ASTERACEAE. HABITATS. FLORA. UTTAR PRADESH.

A new species of *Blumea* viz. *Blumea sonbhadrensis* (Asteraceae) is collected from the Sonbhadra of Uttar Pradesh in India, is described and illustrated.

354. Gopalan, R.; Botanical Survey of India, Coimbatore (India). Murugan, C.; Botanical Survey of India, Coimbatore (India). *Pavetta badullensis* Ridsd. (Rubiaceae)-a Sri Lankan element and an addition to India from Western Ghats of Tamil Nadu. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 447-448 KEYWORDS: RUBIACEAE. TAMIL NADU. SRI LANKA.

Pavetta badul/ensis Ridsd. (Rubiaceae) is a Sri Lankan element and so far restricted to Sri Lanka, a new distributional record for India from the Southern Western Ghats of Tamil Nadu. For the easy identity and further collection in field, a short description with an illustration and other details are provided here.

355. Murugan, C.; Botanical Survey of India, Coimbatore (India). Chithra, V.; Botanical Survey of India, Coimbatore (India). Murthy, G.V.S.; Botanical Survey of India, Coimbatore (India). Two additions to the Asteraceae (Compositae) of India. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 449-450 KEYWORDS: ASTERACEAE. FLORA. HABITATS. INDIA.

Cyanthillium hookerianum (Am.) H. Rob. and *Vernonia pectiniformis* DC. subsp. *puncticulata* (DC.) Grierson (Asteraceae) are reported for the flora of India from the Southern Western Ghats. Short descriptions with illustrations and other details are provided here.

356. Khanna, K.K.; Botanical Survey of India, Allahabad (India). Kumar, A.; Botanical Survey of India, Allahabad (India). Endemism in the flora of Madhya Pradesh. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 451-454 KEYWORDS: FLORA. TAXUS. MADHYA PRADESH.

The paper deals with the status of endemic plants in Madhya Pradesh. An analysis has indicated that 12 taxa are endemic in the state, out of which 4 taxa are endemic in Hoshangabad district, 3 in Betul District, 2 in unreported locality of Central Province and one each in Balaghat, Tikamgarh and Ujjain Districts. The nature and causes of endemism and their conservation have been discussed in the paper.

357. Bhat, K.G.; Poornaprajna College, Udupi (India). Taxonomy Research Centre, Dept. of Botany. *Oxygonum sinuatum* (Hochst. & Steud. Ex. A. Rich.) Dammer (Polygonaceae) - a new record for Karnataka. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 455 KEYWORDS: POLYGONACEAE. HABITATS. KARNATAKA.

Oxygonum sinuatum (Hochst. & Steud. ex A. Rich.) Dammer (Polygonaceae), an exotic species so far reported in India only from Kerala, is reported as a new record for Karnataka.

358. Tewari, V.; National Botanical Research Institute, Lucknow (India). Lichenology Lab. Upreti, D.K.; National Botanical Research Institute, Lucknow (India). Lichenology Lab. A new record and a new combination of Lichen genus *Platygramme* Fee (Graphidaceae) from India. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 457-460 KEYWORDS: FLORA. LICHENES. INDIA.

Platygramme wattiana (Mili. Arg.) V. Tewari and Upreti described as new combination and *Platygramme australiensis* Staiger & Matthes-Leicht is described as new record for Indian lichen flora.

359. Murugesan, M.; Kongunadu Arts and Science College, Coimbatore (India). P.G. & Research Department of Botany. Balasubramaniam, V.; Kongunadu Arts and Science College, Coimbatore (India). P.G. & Research Department of Botany. *Ambrosia artemissifolia* L. (Asteraceae)-A new record for the flora of Southern India. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 461-462 KEYWORDS: ASTERACEAE. FLORA. INDIA.

Ambrosia artemissifolia L. (Asteraceae) collected from Velliangiri hills, Western Ghats, Tamil Nadu, India is described with illustrations as a new record for Southern India.

360. Tomar, A.; Meerut College, Meerut (India). Dept. of Botany. Singh, H.; Meerut College, Meerut (India). Dept. of Botany. Singh, V.; Chaudhary Charan Singh University, Meerut (India). Exotic elements in the flora of Baghpat district, Uttar Pradesh. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 463-471 KEYWORDS: FLORA. UTTAR PRADESH.

In the present paper 76 exotic angiospermic plant species belonging to 34 families and 67 genera have been enumerated from Baghpat District, with focus on their origin, habit form, distribution, habitat and locality. 9.05% flora is exotic in Baghpat District. 44.74% (34 out of 76 species) exotic plants come from America alone. The maximum number of exotic plants (9 species) belongs to the family Euphorbiaceae.

361. Das, K.; Botanical Survey of India, Gangtok (India). Sikkim Himalayan Circle. Miller, S.L.; University of Wyoming, Wyoming (United States of America). Botany Dept. Sharma, J.R.; Botanical Survey of India, Dehra Dun (India). Northern Circle. Hemenway, J.; University of Wyoming, Wyoming (United States of America). Botany Dept.. Two new species of *Russula* from western ghats in India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 473-478 KEYWORDS: RUSSULA. GENERA. INDIA.

Two new species, viz., *Russula Isoleggiensis* and *R. netrabaricus* has been proposed in the present communication. Their phylogenetic positions within the genus *Russula* are supported by macroscopic, microscopic characters and rDNA sequences in the ITS gene region.

362. Upadhyay, G.K.; Botanical Survey of India. Howrah (India). Central National Herbarium. Ansari, A.A.; Botanical Survey of India, Gangtok (India). Sikkim Himalayan Circle. Dalai, A.K.; Ravenshaw University, Cuttack (India). Post Graduate Department of Botany. *Dorstenia bahiensis* Klotzsch Ex Fisch. & C.A. Mey. (Moraceae) - first naturalised record for India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 479-482 KEYWORDS: MORACEAE. GENERA. FLORA. INDIA.

Dorstenia bahiensis Klotzsch ex Fisch. & C.A.Mey. introduced in India is recorded in wild for the first time from Kerala. Detailed description along with distribution, ecological observation, illustration, photoplates, etc. are provided herewith to facilitate easy identification of the species in the field.

363. Mathad, P.; Gulbarga University, Gulbarga (India). Dept. of Post Graduate Studies and Research in Botany. Shrishail, C.; Gulbarga University, Gulbarga (India). Dept. of Post Graduate Studies and Research in Botany. Floristic diversity of a famous historic Barid-shahi fort of Bidar in Karnataka, India. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 577-580 KEYWORDS: BRYOPHYTA. FLORA. ANGIOSPERMS. LICHENES. KARNATAKA.

A survey on the flora of Barid-Shahi, a famous heritage Fort of Bidar in Northern part of Karnataka was carried out from August 2006 to July 2007. The Fort was built by Ahmedshah Walli in 1436 AD. The surrounding area of the Fort is 5.5 km and irregular in shape. The Fort area with semi arid conditions has dry deciduous vegetation. In the present study, 105 plant species belonging to 48 families of Angiosperms, 04 species of Pteridophytes (Ferns), 04 species of Bryophyte. (Mosses) and two species of Lichens were recorded from the study area. The variation in the floristic diversity of a Fort may be due to the topography of the soil or the climatic conditions of the study region.

364. Antony, R.; Tropical Botanic Garden and Research Institute, Thiruvananthapuram (India). Frond proliferation in *Asplenium phyllitidis* D. Don - A rare fern of South India. *Indian Journal of Forestry*. (Dec 2008) v. 31(4) p. 617-618 KEYWORDS: FERNS. INDIA.

Frond proliferation in *Asplenium phyllitidis* D. Don is reported for first time. Observation and brief Taxonomic description are provided.

365. Bhellum, B.L.; Government College for Women, Jammu (India). *Nervilia gammieana* (Hook.F.) Schltr.-an addition to the flora of Jammu and Kashmir State. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 619-620 KEYWORDS: ORCHIDACEAE. JAMMU AND KASHMIR.

The paper gives taxonomic account of *Nervilia gammieana* (Hook. f.) Schltr. an Orchid a new record for J&K State collected from Kalidar in Tehsil Sunderbani of District Rajouri (Jammu and Kashmir).

366. Thakur, I.K.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Tree Improvement and Genetic Resources. Kumar, D.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Tree Improvement and Genetic Resources. Singh, C.; Central Soil and Water Conservation Research and Training Institute, Dehra Dun (India). Studies on variation and correlation among leaf dry matter and mineral nutrients in *Grewia optiva* Drummond. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 621-624 KEYWORDS: MINERAL NUTRIENTS. SPECIES. PHENOTYPES.

Variation and correlation among leaf dry matter and mineral nutrients were studied in three diameter classes on three sites located at three different altitude in Himachal Pradesh. Leaf dry matter and mineral nutrient content viz.; nitrogen (N), phosphorus (P) and potassium (K) among different diameter classes ranged between 42.29-57.26%, 2.40-2.95%, 0.14-0.33% and 2.37-2.64%, respectively. Significant correlations were observed for different character pairs indicating the possibility of indirect selection in the species.

367. Bhattacharyya, D.; Botanical Survey of India. Howrah (India). Central National Herbarium. Sanjappa, M.; Botanical Survey of India, Kolkata (India). *Rhododendron callimorphum* Balf. F. & W.W.SM. (Ericaceae) - an addition to the flora of India. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 625-628 KEYWORDS: FLORA. RHODODENDRON. ERICACEAE.

Rhododendron callimorphum Balf. f. & W.W. Sm. (Ericaceae), a taxon so far known ITom China, is described here as a new record to India from Arunachal Pradesh. Two varieties are known under this species. The Indian specimens belong to typical variety (var. *callimorphum*). A detailed description, photograph and distribution map are provided for its easy identification.

368. Agrawala, D.K.; Botanical Survey of India, Dehra Dun (India). Northern Circle. Chowdhery, H.J.; Botanical Survey of India, Dehra Dun (India). Northern Circle. *Euophia epidendrea* (J. König Ex Retz.) C.E.C. Fisch. - an addition to the orchid flora of Himalayan region. Indian Journal of Forestry. (Dec 2008) v. 31(4) p. 629-632 KEYWORDS: ORCHIDACEAE. EUOPHIA. HIMALAYAN REGION.

Euophia epidendrea (1. König ex Retz.) C.E.C. Fisch. (Orchidaceae), so far known in India from peninsular regions is being reported for the first time from the Himalayan region. The same is described and illustrated here.

369. Daniels, A.E.D.; Scott Christian College Autonomous, Nagercoil (India). Botany Dept. Daneil, P.; Manonmaiam Sundaranar University, Rajakkamangalam (India). Centre for Marine Science and Technology. *Frullania ceylanica* Nees (Frullaniaceae) - new to the Hepatic flora of India. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 637-639 KEYWORDS: FLORA. HABITATS. TAXONOMY. INDIA.

Frullania ceylanica, earlier known to be endemic to Ceylon (Sri Lanka), is added here to the bryoflora of India from the Western Ghats of Tamil Nadu. Based on earlier literature its taxonomy and nomenclature are discussed and a detailed description is provided along with an-illustration and information on habitat.

370. Gopalan, R.; Botanical Survey of India, Coimabtoe (India). Southern Circle. Murugan, C.; Botanical Survey of India, Port Blair (India). Andaman & Nicobar Circle. *Eugenia agasthiyamalayana* (Myrtaceae) - a new species from the Southern Western Ghats of India. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 641-642 KEYWORDS: MYRTACEAE. EUGENIA. GENERA. INDIA.

Eugenia agasthiyamalayana (Myrtaceae) allied to *E. discifera* Gamble is described and illustrated as a new species ITom the Agasthiyamalai, Southern Western Ghats of India.

371. Brijithlal, N.D.; Scott Christian College Autonomous, Nagercoil (India). Botany Dept. Mabel, J.L.; Scott Christian College Autonomous, Nagercoil (India). Botany Dept.

Daniels, A.E.D.; Scott Christian College Autonomous, Nagercoil (India). Botany Dept. Additions to the moss flora of peninsular India from the Neyyar wildlife sanctuary, Kerala, India. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 643-646
KEYWORDS: FLORA. HABITATS. INDIA. KERALA.

Three mosses viz., *Acroporium baviense*, *Cyathophorum adiantum* and *Lindbergia koelzii*, earlier known to be distributed in the Khasia Hills, Western Himalaya and Northeast India and Western Himalaya respectively are recorded for Peninsular India. Each species is described in detail and illustrated.

H01 Protection of Plants – General Aspects

372. Acharya, M.F.; Junagadh Agricultural University, Junagadh (India). Dept. of Entomology. Vyas, H.J.; Junagadh Agricultural University, Junagadh (India). Dept. of Entomology. Gedia, M.V.. Junagadh Agricultural University, Junagadh (India). Dept. of Entomology. Patel, P.V.; Junagadh Agricultural University, Junagadh (India). Dept. of Entomology. Biometrical Analysis of *Helicoverpa armigera* (Hubner) on different hosts.. *Annals of Plant Protection Sciences (India)*. (Sept 2008) v.16(2) p.360-362
KEYWORDS: BIOMETRY. HELICOVERPA ARMIGERA. HELICOVERPA. HOSTS.

To study the applicability of Dyar's principle to the larval stage of *Helicoverpa armigera*, when the larvae reared on pigeon pea, Indian bean and chick pea, biometrical analysis were carried out during kharif 2005-2006. The measurements of head capsule, width of the larvae fall into six well defined group each indicating an instar, when larvae reared on different hosts at a constant temperature of 28No.1C. The mean value of the observed (0.240 to 2.654 mm) and calculated head widths (0.230 to 2.780 mm) and progression factors were close to each other, which indicated that the width of head capsule of *H. armigera* was more or less constant for that particular instar. The observed and estimated progression factors were sufficiently close to indicating the increase in head width that follows Dyar's Law. The progression factors determined from body length and width indicated the great deviation. The values of R² between the variables viz. head capsule width, larval body length and larval body width ranged from 0.9713 to 0.9859 on these hosts. This indicated a very high predictability of head capsule width through larval body length and larval body width.

H10 Pests of Plants

373. Gautam, C.P.N.; Indian Agricultural Research Institute, New Delhi (India). Division of Entomology. Plant Health Clinic. Verma, R.A.; C.S.A.U.A & T., Kanpur (India). Dept. of Entomology. Gautam, R.D.; Indian Agricultural Research Institute, New Delhi (India). Division of Entomology. Plant Health Clinic. Khan, Md. Aslam; Indian Agricultural Research Institute, New Delhi (India). Division of Entomology. Plant Health Clinic. Comparative efficacy of insecticides, bio-pesticides and botanicals against *Leucinodes orbonalis* Guenee infesting brinjal. *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.309-311
KEYWORDS: PESTICIDES. LEUCINODES ORBONALIS. SOLANUM MELONGENA.

The insecticides endosulfan, malathion and quinalphon proved most effective in reducing shoot infestation by 90.00, 87.5 and 80.0%, respectively. Among botanicals, neemarin and achool were significantly on par and effective by 78.5 and 77.6% followed by bioneem 69.6% respectively in reducing shoot infestation over control. Bio-pesticides, however, register 60.8% and 59.6% reducing in shoot infestation in case of dipel and diolep, respectively. The maximum fresh fruit yield (21.778t/ha) was obtained in endosulfan treated plot followed by malathion (19.222 t/ha) and quinalphos (17.722 t/ha) The fruit yield losses in case of endosulfan and malathion were (4.4%) and (5.5%) followed by quinalphos (6.9%). Neemarian and achool were significantly on par and registered 9.2 and 10.6% yield loss, respectively followed by bioneem 14.6%.

374. Shivankar, S.B.; Vasantdada Sugar institute, Pune (India). Dept. of Entomology. Magar, S.B.; Vasantdada Sugar Institute, Pune (India). Dept. of Entomology. Shinde, V.D.; Vasantdada Sugar Institute, Pune (India). Dept. of Entomology. Yadav, R.G.; Vasantdada Sugar Institute, Pune (India). Dept. of Entomology. Patill, A.S.; Vasantdada Sugar Institute, Pune (India). Dept. of Entomology. Field bio-efficacy of chemical, botanical and bio-pesticides against *Spodoptera litura* Fab. in sugarbeet. *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.312-315 KEYWORDS: PESTICIDES. SPODOPTERA LITURA. TRICHOGRAMMA.

The efficacy of neonicotinoid, nereistoxin analogue, organophosphorus, carbamate insecticides, neem derivatives and an egg parasite, *Trichogramma chilonis* were studied for the control of *Spodoptera litura* in sugar beet (var. Posada and HI 0064) during winter season in 2004-2005 and 2006-2007. The pooled and significant data indicate that the spraying of quinalphos 25EC 0.05% recorded the maximum (97.2%) reduction of *Spodoptera* larvae followed by chlorpyrifos 20EC 0.1% (94.1%). Imidacloprid 17.8 SL 0.008% also gave 80.2% reduction in larval population. *T. chilonis* 50000/ha and spraying of azadiractin 3000 ppm (5ml/lit) gave 89.7 and 89.3% reduction of larval population of *Spodoptera* and found effective and safe treatment to combat the sugar beet pests. Granular insecticides were found to be ineffective. Spraying to quinalphos (0.05%) yielded maximum of 75.5 t/ha beet root followed by chlorpyrifos (0.1%) and imidacloprid spraying with 70.33 and 71.51 t/ha. The treatment quinalphos, chlorpyrifos and imidacloprid were proved the most economical with ICBR ratio of 1.63, 1.57 and 1.56, respectively. Azadiractin and *Trichogramma* release resulted more root yield than control.

375. Elanchezian, J.; T.N.A.U., Coimbatore (India). Dept. of Entomology. Regupathy, A.; T.N.A.U., Coimbatore (India). Dept. of Entomology. Krishnamoorthy, S.V.; T.N.A.U., Coimbatore (India). Dept. of Entomology. Bio-efficacy of Lambda cyhalothrin against *Niliapayvata lugens* (Stal.) and safety to green mirid bug. *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.325-328 KEYWORDS: PEST CONTROL. NILAPARVATA LUGENS.

A field trial was conducted to evaluate lambda cyhalothrin new capsule suspension formulation, indicated that lambda cyhalothrin applied at 50 25 and 12.5g. a.i.ha-1 were more effective against brown plant hoppers as compared to the standard checks. In terms of cumulative reduction of pest incidence lambda cyhalothrin treatment were found to be superior to the standard checks. Lambda cyhalothrin at 50 and 25g. a.i.ha-1 were slightly harmful to the green mired bugs in the rice ecosystem. Lambda cyhalothrin at 12.5g. a.i.ha-1 exhibited significant pest control and also not harmful to the natural enemy. Hence, this dose can be recommended for the brown plant hopper management in rice.

376. Ansari, M. Shafiq; Aligarh Muslim University, Aligarh (India). Faculty of Agricultural Sciences. Dept. of Plant Protection. Ahmed, Tufail; Aligarh Muslim University, Aligarh (India). Faculty of Agricultural Sciences. Dept. of Plant Protection. Ali, Haidar; Aligarh Muslim University, Aligarh (India). Faculty of Agricultural Sciences. Dept. of Plant Protection. Gulrez, Hasan; Aligarh Muslim University, Aligarh (India). Faculty of Agricultural Sciences. Dept. of Plant Protection. Effect of imidacloprid on development of *Plutella xylostella*. *Annals of Plant Protection Sciences (India)*. (Sept 2008) v.16(2) p.341-346 KEYWORDS: INSECTA. BRASSICA OLERACEA. BRASSICA. PLUTELLA XYLOSTELLA.

Laboratory studies were conducted to find the total effect of imidacloprid on development of *Plutella xylostella*. LC 0 of imidacloprid on 3rd instar larvae was ascertained and larvae were then, fed on cauliflower leaves impregnated with 0.002% of imidacloprid. Life table was constructed on the surviving adults obtained from treated 3rd instar. The net reproductive rate (R₀) of surviving adults was 8.47 females in comparison to 10.99 in untreated control. The potential fecundity (Pf) was significantly decreased to 166.5, whereas intrinsic rate of increase (r_m) was 0.073 females/ female/ day as compared to 0.09 in untreated controls. Mean length of generation (T_c) and

corrected generation time was prolonged to 28.90 and 29.26 days, respectively. While doubling time (DT) was increased to 9.49 days in comparison to 7.7 days in untreated control.

377. Patil, S.K.; Mahatma Phule Vidyapeeth, Rahuri (India). Pulses Improvement Project. Jamadagni, B.M.; Mahatma Phule Vidyapeeth, Rahuri (India). Pulses Improvement Project. Efficacy and ecinimics of some insecticides against Pod Borers in black gram. *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.347-349
KEYWORDS: INSECTA. VIGNA MUNGO.

Field testing of thiodicarb 75 WP 375.00, 468.75 and 562.50g. a.i./ha, endosulfan 35 EC 750g. a.i./ha, chlorpyriphos 20 EC 400g. a.i./ha and quinalphos 25 EC 500g. a.i./ha, was done for their efficacy against pod borers in black gram. The minimum larval population of 0.83 and 0.58 larvae/5plants was recorded with endosulfan 35 EC 750g. a.i./ha followed by thiodicarb 75 WP 562.50g. a.i./ha (1.00 and 0.75 larvae/ 5 plants) at 3 and 7 days after spraying which was on par with it. The lowest pod amage of 0.5% was recorded in thiodicarb 75 WP 562.50g. a.i./ha followed by chopyrirphos (5.3%) and endosulfan (5.6%). The maximum grain yield of 1114 kg/ha was noticed with the treatment of chlorpyriphos 20 EC 400g. a.i./ha followed by endosulfan 35 EC No. 750g. a.i./ha (985 kg/ha) and thiodicarb 75 WP 562.50g. a.i./ha (966 kg/ha). However, the highest per Rs. Return gained with chlorpyriphos (7.86) followed by endosulfan (4.19) and quinalphos (2.72).

378. Yadav, Adbhut; N.D. University of Agriculture & Technology, Kumarganj (India). Dept. of Entomology. Ali, Shamshad; N.D. University of Agriculture & Technology, Kumarganj (India). Dept. of Entomology. Bio-efficacy and economics of neem based formulations aganist *Dasyneura lini barnes*. *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.350-352
KEYWORDS: DASINEURA. LINUM USITATISSIMUM. AZADIRACHTA INDICA. INSECTA.

Bio-efficacy of six neem based formulations i.e. neemarin 0.15%, neem India 0.5%, econeem 0.5%, nimbicidine 0.5, neemoil 0.5%, NSKE 5% along with endosulfan 0.07% were tested against budfly on linseed cv. Neelim. Results revealed that endosulfan 0.07 gave significant lowest incidence of bud fly (1.9, 3.1, 7& 4.0 %) at 3rd 5th and 7th day after spray as compared to test of the treatments. However, NSKE 5% was the best among neem based formulations. The lower incidence of budfly (3.5, 4.1 & 6.0%) was recorded with spray of NSKE 5 % on 3rd, 5th and 7th day after treatments, followed by nimbicidine 0.5% (4.3, 4.3 & 6.1%), respectively. The highest yield (19.23 q/ha) was obtained in endosulfan 0.07% treated plots followed by NSKE 5% (17.07 q/ha). The highest BC ratio was obtained (20.31q/ha) in endosulfan follwed by nimbicidine, NSKE, neem oil, econeem, neemarin and neem India.

379. Raghav, Dushyant K.; S.V.B. Patel University of Agriculture & Techonology, Meerut (India). Dept. of Entomology. Sharma, R.K.; Indian Agricultural Research Institute, New Delhi (India). Rajvanshi, S.K.; M.S. (P.G) College, Saharanpur (India). Screening of Maiza germplasms against *Trogoderma granarium* (Everts). *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.377-380
KEYWORDS: TESTING. ZEA MAYS. TROGODERMA GRANARIUM.

Different parameters viz. adult emergence (%), weight loss(%), kernel damage were taken as indicator for varietal resistance in 30 maiza germplasms against *Trogoderma garnarium*. The least % loss in weight was in Varun (505) followed by Sheetal (609), GM-41(9.5), HQPM-2 (10.46), JM-12 (11.25) and HQPM-1 (11.51), while maximum % loss was recorded in Madhuri (43.7), bio-9681 (28.7), CM-500 (23.9), HM-1 (22.2), HHM-6 (20.1) and GM-1 (19.8). Maximum mean number of progeny was recorded in Madhuri (6.4) followed by Gujarat Sweet corn (5.9), Bio-9681 (5.2), CM-50 (4.9) and minimum mean number of progeny were recorded in Varun (1.4) followed by Sheetal (1.5). HQPM-1 (1.8) Win pop corn (1.9) and Amber pop corn (1.9). The size of grain was negatively correlated and highly significant with % weight loss and % grain damage.

Positive correlation between emergence of progeny beetles with % weight loss and grain damage revealed that higher adult emergence caused more weight loss.

380. Savaliya, S.D.; National Reserach Centre for Grundnut (ICAR), Junagadh (India). Butani, P.G.; Junagadh Agricultre University, Junagadh (India). Gedia, M.V.; National Reserach Centre for Grundnut (ICAR), Junagadh (India). Prasad, T.V.; National Reserach Centre for Grundnut (ICAR), Junagadh (India). Post-embryonic observations on striped mealy bug *Ferrisia virgata* (cockerell)-A major pest of custard apple.. *Annals of Plant Protection Sciences (India)*. (Sep 2008) v.16(2) p.389-392 KEYWORDS: ANNONA SQUAMOSA. BIOLOGY. FERRISIA VIRGATA. PEST CONTROL.

The egg period was 28.14No.4.69 minutes. The male had four nymphal instars, while the female had three nymphal instars. The developmental periods of first to fourth male nymphal instar were 8.07 No.1.46, 8.53 No.2.16, 4.40 No.1.22 and 4.10 No.1.18 days, respectively whereas, in case of female, it was found to be on an average of 7.67 No.1.58, 7.57 No.1.63 and 7.87 No.1.57 days for first to third instar, respectively. Male and female adults lived for 25.10 No.3.29 and 23.10 No.2.04 days respectively. Pre-oviposition, ovipositionand post-oviposition periods were observed to be 6.4331.98, 8.131.75 and 1.53 No.0.86 days, respectively. The total life span of male and female was 26.8 No.3.26 and 49.10 No.2.71. The reproduction took place both sexually as well as parthenogenetically and female laid an average of 155.53 eggs during its life period. Male: female sex ratio was 1:1.87. Morphomrtrics of each development stage were given.

381. Srivastava, C.P.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Joshi, Nitin; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Dept. of Entomology and Agricultural Zoology. Trivedi, T.P.; Indian Council of Agricultural Reseach, New Delhi (India). Directorate of Information and Publication of Agriculture. Forecasting of *Helicoverpa armigera* populations and impact of climate change. *Indian Journal of Agricultural Sciences (India)*. (Jan 2010) v.80(1) p.3-10 KEYWORDS: FORECASTING. HELICOVERPA ARMIGERA. MONITORING. PHEROMONE TRAPS.

Helicoverpa armigera (Hubner) is a polyphagous insect pest and has been reported to feed on at least 181 plant species belonging to 45 botanical families in India. This insect pest has become of national importance because of huge losses caused to the high value crop such as cotton, soybean, tobacco, pulses, vegetables and cereals etc. forecasting of the pest occurrence and peak activity periods is the prerequisite for an economically viable, environmentally sound and easily adaptable pest management programme. Adult population of *H.armigera* has been monitored successfully throughout India with the help of pheromone trap. By using the pheromone trap data, egg and larval count in the fields damage caused to the crop and meteorological data, especially rainfall and temperature, region-specific prediction models have been developed and validated for Andhra Pradesh, Karnataka, Uttar Pradesh and Punjab. Rainfall has been found to be important factor in forecasting. *H. armigera* in Andhra Pradesh and Karnataka. Temperature played the major role in the prediction model developed and validated for Uttar Pradesh. Whereas in Punjab, the peak population of *H. armigera* during March-April is dependent on temperature and humidity in February, while the high population during October depended on the rainfall during the rainy season.

382. Karthikeyan, K; Kerala Agricultural University, Pattambi (India). Regional Agricultural Research Station. Jacob, Sosamma; College of Horticulture, Vellanikara (India). Beevi, Pathummal; Kerala Agricultural University, Pattambi (India). Regional Agricultural Research Station. Purpushothaman, S.M.; Kerala Agricultural University, Pattambi (India). Regional Agricultural Research Station. Evaluation of different integrated pest management modules for the management of major pests of rice (*Oryza sativa*). *Indian Journal of Agricultural Sciences (India)*. (Jan 2010) v.80(1) p.59-62 KEYWORDS: INTEGRATED PEST MANAGEMENT. ORYZA SATIVA. COST BENEFIT ANALYSIS. PEST CONTROL.

Field experiments were conducted in farmers' rice field in Karakkad village, pattambi, Kerala during 2006-07 to 2008-2009 with 3 rice IPM modules (IPM I, PIM II and IPM III) in comparison with farmers' practices to validate and popularize the IPM modules in rice. The results showed that the IPM III module comprised alternate spraying with neem- based formulation and newer safe insecticide (cartap hydrochloride and spinosad) coupled with release of egg parasitoids against leaf folder and monitoring of stem borer with sex pheromone traps resulted in significant reduction of stem borer (3.88% dead heart, 1.95% white ear), whorlmaggot (4.10% damaged leaves), and leaf folder (2.73% damage leave). It has recorded highest grain yield (4 489 kg.ha) and C:B ratio (1: 30). Stem borer incidence was reduced by 61.6% in IPM III modules as compared with farmers' practices. Leaf folder damage ha showed a reduction of 64.8% and whorl maggot infestation indicated 61.03% reduction in IPM III module over farmers' practices which has also shown the lowest C:B ratio.

383. Mushtaq, Tahmina; Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar (India). Khan, Akhtar Ali; Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar (India). Functional response of *Chrysoperla carnea* larva (Neuroptera: Chrysopidae) to *Aphis pomi* and *A. craccivora* (Homoptera: Aphididae). Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.95-98 KEYWORDS: APHIS POMI. CHRYSOPERLA CARNEA. CORCYRA CEPHALONICA.

Functional response of IInd and IIRD instar larve of *Chrysoperla Carnea* (stephens) were evaluated on the aphid prey *Aphis pomi* De. Geer, *A. craccivora* Koch at prey density 2, 4, 8, 16, 32, 64 and 128 aphids/larvae/day. The studies revealed that behavior of both the larval instars matched Holding's Type II functional response. The consumption of IIRD instar larvae of *C. carnea* was higher than IInd instar larvae on *A. craccivora* as compared to *A. pomi*. The consumption rate of larvae responded to increasing prey densities with increasing food consumption with decreasing consumption rate and IIRD instar larvae displayed a higher rate of predation against the 2 aphid species. The maximum attack rate (A) with lowest handling time (Th) is determined by r2 value which was found to be highest for IIRD instar larvae (r2=0.78) against *A. craccivora* followed by IInd instar larvae (r2=0.75) against same aphid species.

384. Luna, R.K.; Working Plant, M & E and Research, Chandigarh (India). Chief Conservator of Forests. Sharma, A.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Regional Centre, National Afforestation and Eco-Development Board. Sehgal, R.N.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Regional Centre, National Afforestation and Eco-Development Board. Kumar, R.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Regional Centre, National Afforestation and Eco-Development Board. Gupta, R.; Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Regional Centre, National Afforestation and Eco-Development Board. Bioefficacy of Drek (*Melia azedarach*) seeds against red pumpkin beetle, *Aulacophora foveicollis* Lucas (Coleoptera:Chrysomelidae). Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 357-360 KEYWORDS: AULACOPHORA. ETHANOL. CUCUMBERS. AZADIRACHTA INDICA.

Red pumpkin beetle *Aulacophorafoveicollis* is a serious pest of cucurbitaceous vegetables. It feeds on the leaves of Cucumber (*Cucumis sativus*), Ridge gourd (*Luffa acutangula*) Pumpkin (*Cucurbita moschata*), Bottlegourd (*Langeneria siceraria*) etc. Ethanol extract and aqueous extract of Drek (*Melia azedarach*) seeds was tested against this pest on Cucumber in Punjab. Ethanol extract 1% and aqueous extract 3% were found effective in managing this pest. These were found to be at par with commercial formulations of Neem (*Azadirachta indica*) viz. Econeem and Nimbecidine in the field trials in managing the insect. In another trial ethanol extract 4ml/1 was found to be at par with Econeem against red pumpkin beetle on Cucumber, Ridgegourd and Bottlegourd. As seeds of *Melia azedarach* are found in considerable quantities, the study has a great scope for promotion of seeds of *Melia azedarach* as biopesticide.

385. Sasidharan, K.R.; Institute of Forest Genetics and Tree Breeding, Coimbatore (India). Verma, R.V.; Kerala Forest Research Institute, Peechi (India). Insects associated with nurseries and plantations of *Casuarina equisetifolia* L. in Tamil Nadu, India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 389-393 KEYWORDS: SUCKING INSECTS. CASUARINA EQUISETIFOLIA. TAMIL NADU.

A study of the insects associated with *C. equisetifolia* in Tamil Nadu revealed that, altogether 40 species of insects infested this tree species of which 28 species of insects were new records. The bark caterpillar, *1. quadrinotata* Walker was found to be the key pest, while other insects like *Icerya purchasi* Maskell and *Nipaecoccus vastator* (Maskell) caused only moderate damage. The need for monitoring the insects associated with *Casuarina* plantations to identify the emerging pest problems is highlighted.

386. Choubey, V.; Government Model Autonomous Science College, Jabalpur (India). Dept. of Zoology. Kulkarni, N.; Government Model Autonomous Science College, Jabalpur (India). Dept. of Zoology. Bhandari, R.; Tropical Forest Research Institute, Jabalpur (India). Forest Entomology Div. Status of sal (*Shorea robusta*) seed insect pests in six sal dominating regions of central India, Madhya Pradesh. *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 595-598 KEYWORDS: INSECTA. SEED DAMAGING INSECTS. OILSEEDS. SHOREA ROBUSTA.

The paper reports field status of insect pests damaging Sal seeds in six Sal dominating regions of Madhya Pradesh, recorded during three consecutive seed setting seasons from 2000 to 2002. Observations with field collected seed samples revealed that three insect pests were infesting Sal seeds, viz., *Dichocrocis /eptalis* Ramp., *Pammne theristis* Mey. and *Sitophi/us rugico//is* Casey. Their level of incidence based on percentage seeds damaged and population of individual insect species was recorded in all the selected forest areas. The information given on comparative status of pest incidence may be useful for traders and industries involved in extracting oils from the seeds for decision-making.

387. Stanley, J; Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Chandrasekaran, S; Tamil Nadu Agricultural University, Coimbatore (India). Preetha, G; Tamil Nadu Agricultural University, Coimbatore (India). *Conogethes punctiferalis* (Lepidoptera:Ptoralidae) its biology and field parasitization.. *Indian Journal of Agricultural Sciences (India)*. (Nov. 2009) v.79(11) p.906-09 KEYWORDS: BIOLOGY. CARDAMOMS. HOST PLANTS. PARASITOIDS.

Conogethes punctiferalis guenee was found to complete its life cycle within a shorter period in castor, followed by cardamom guva and ginger under laboratory conditions. The number of days taken by the neonate larva to become adult was 27.76 in castor and 30.69 days in cardamom, while it was 32.05 in ginger. Parasitoids, like *trathala flavorbitali* Cameron, *Brachymeria atteviae* JNJ *Chelonus blackburni* Cameron, *Anthrocephalus decipiens* (Masi), *Epitranus erythrogaster* Cameron and Phorids were found to parasitise *C. punctiferalis* larva in castor crop. A unit increase in relative humidity resulted in 2.73% increase in damage by *C. punctiferalis* in castor, thus favouring the pest. A unit increase in rainfall resulted in 2.79% increase in parasitization by *T. flavor-orbitalis*, the major parasitoid on *C. punctiferalis*.

388. Venkatesan, T; National Bureau of Agriculturally Important Insects, Bangalore (India). Jalali, S.K.; National Bureau of Agriculturally Important Insects, Bangalore (India). Murthy, K.S.; National Bureau of Agriculturally Important Insects, Bangalore (India). Rabindra, R.J.; National Bureau of Agriculturally Important Insects, Bangalore (India). Lalitha, Y.; National Bureau of Agriculturally Important Insects, Bangalore (India). Occurrence of insecticide resistance in field populations of *Chrysoperla zastrowi arabica* (Neuroptera: Chrysopidae) in India.. *Indian Journal of Agricultural Sciences (India)*. (Nov. 2009) v.79(11) p.910-12 KEYWORDS: CHRYSOPERLA. CORCYRA CEPHALONICA. MONOCROTOPHOS. INSECTICIDES. INDIA.

The green lacewing (*Chrysoperla zastrowi Arabica* Henry et al.) was evaluated during 2006-08 using the bioassay technique developed by IOBC/WPRS working group. Based on the mortality response with different field populations to the field recommended dosage of monocrotophos (ppm) different concentration viz 1728.00, 864.00, 432.00, 216.00, 108.00, 54.00, 27.00, 13.50, 6.75, 3.38 and 1.69 ppm were tested against five days larvae of *C. zastrowi Arabica* under laboratory conditions. Twenty four hour bio assay revealed that was variation among different populations. The population collected from sriganganagar had highest resistance (1819.72) followed by Delhi (1564.05 ppm). Population collected lab reared to monocrotophos with LC50 of 4.02 ppm and 5.86 ppm respectively. Of the 9 field populations sriganganagar population exhibited 452.66 folds resistance compared to laboratory population, however, Shimla was found to be most susceptible (1.46 fold resistance). The study revealed the occurrence of insecticide resistance to monocrotophos in field population of *C. zastrowi Arabica* for the first time in India.

389. Ahuja, D.B.; NCIPM, New Delhi (India). Rajpurohit, T.S.; Rajasthan Agricultural University, Mandor (India). Agricultural Research Station. Singh, Malam; Rajasthan Agricultural University, Mandor (India). Agricultural Research Station. Solanki, Z.S.; Rajasthan Agricultural University, Mandor (India). Agricultural Research Station. Kalyan, R.K.; Rajasthan Agricultural University, Mandor (India). Agricultural Research Station. Ahuja, Usha Rani; National Centre for Agricultural Economics and Policy Research, New Delhi (India). Dhandapani, A; National Academy of Agricultural Research Management, Hyderabad (India). Sundria, M.M.; Rajasthan Agricultural University, Mandor (India). Agricultural Research Station. Development of integrated pest management technology for sesame (*Sesamum indicum*) and its evaluation in farmer participatory mode. Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.808-12 KEYWORDS: ANTIGASTRA CATALAUNALIS. MACROPHOMINA PHASEOLINA. SESAME.

Field studies were conducted from 2001 to 2002 on development of integrated pest management (IPM) technology in rainfed sesame (*Sesamum indicum* L.) at Agricultural Research Station, Mandor, Jodhpur, and the same were later validate during 2003-04 in farmer's participatory mode at 2 locations in Osiana tehsil of Jodhpur district in arid zone 1a of western Rajasthan, Adoption of IPM technology comprising intercropping of sesame with green gram and spray of 9 ppm azadirachtin at flowering stage reduced the percent incidence of major pests such as *Antigastra catatlaunalis* and *Macrophomina phaseolina* from 24.79 and 16.88 in unprotected treatment to 13.04 and 6.25 in IPM module, respectively. IPM technology was found economically viable as indicate by incremental cost: benefit ratio ranging from 1:1.93 to 1:2.70 that was at par with non-IPM (1:1.53 to 1:2.71) beside sesame seed was produce without any application of toxic synthetic pesticide.

390. Gautam, R.D.; Indian Agricultural Research Institute, New Delhi (India). Suroshe, Sachin; Indian Agricultural Research Institute, New Delhi (India). Mahapatro, G.K.; ICAR Research Complex, Barapani (India). Division of Entomology. Unique record of chloropid pest in rice (*Oryza sativa*). Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.841-43 KEYWORDS: CHLOROPIDAE. RICE. TAXONOMY.

A new insect pest attacking rice is documented from district (Ghaziabad Bulandshahr, Aligarh and Mathura) of Uttar Pradesh in July-September 2008. This is a dipteran fly, *Anatrichus erinaceus* Loew- under Chloropidae family, and the first report of its kind from Indian sub continent. Dispute on this grass fly's pest/parasitic status is highlighted herein. The damage symptoms, morphometrics and taxonomic characters are described. A field survey based on 12 farmer respondent was carried out in these localities. Possible ad hoc recommendation for management is outlines. This needs further concerted research on biology, bionomics and management aspects. Careful monitoring and timely reporting this chloropid pest in necessary to avoid any upcoming outbreak, particularly in the most popular rice basmati variety 'Pusa 1121' in the northern belt.

391. Shakil, Najam Akhtar; Indian Agricultural Research Institute, New Delhi (India). Usharani, Pathipati; IICT, Hyderabad (India). Kumar, Jitendra; Indian Agricultural Research Institute, New Delhi (India). Singh, Manish Kumar; Indian Agricultural Research Institute, New Delhi (India). Pandey, Alka; Indian Agricultural Research Institute, New Delhi (India). Kundu, Aditi; Indian Agricultural Research Institute, New Delhi (India). Ahluwalia, Vivek; Indian Agricultural Research Institute, New Delhi (India). Bioefficacy evaluation of novel N-alkyl-2 hydroxyketimines (schiff bases). Indian Journal of Agricultural Sciences (India). (Sep 2009) v.79(9) p.699-702 KEYWORDS: ANTIFEEDANTS. MICROWAVE TREATMENT. SPODOPTERA LITURA.

Twelve new ortho-hydroxyketimines were synthesized during 2006-07 by conventional as well as microwave method and evaluated for their antifeedant activity against the lepidopteran insect pests, *Achea janata* (L.) and *Spodoptera litura* (L.), conventional methods for synthesis of schiff bases require refluxing at 140 C of the reactions in different solvents for at least 24 hr or more, whereas the microwave-assisted synthesis has brought down the reaction time from 24 hr to 1 min. the procedure does not require any organic solvents and the time has been reduced to only 1 min. Comparative yields of all compounds by different methods revealed that the yield was low in conventional methods (79-87%) as compared to microwave assisted synthesis (94-97%). The bioassay revealed that all the test compounds exhibited promising insect antifeedant activity; N-hexyl-2-hydroxyacetophenoneimine being the most effective with antifeedant index value of 100 followed by N-hexyl-2-hydroxyprophenoneimine with antifeedant index value of 81.32 against *A. janata* and antifeedant index value of 100 of hexyl-2-hydroxyprophenoneimine against *S. litura*. The results obtained from bioassay indicated that this class of compounds has not only given a lead with regards to potential of schiff bases in pest control, but has suggests that a carbon chain length of 6 atoms in the side chain is optimum on the basis of structure activity relationship (SAR).

392. Singh, J.P.; Indian Institute of Natural Resins and Gums, Namkum (India). Jaiswal, A.K.; Indian Institute of Natural Resins and Gums, Namkum (India). Monobrullah, M.D.; Indian Institute of Natural Resins and Gums, Namkum (India). Bhattacharya, A.; Indian Institute of Natural Resins and Gums, Namkum (India). Response of some selected insecticides on neuropteran predator (*Chrysopa lacciperda*) of lac insect (*Kerria lacca*). Indian Journal of Agricultural Sciences (India). (Sep 2009) v.79(9) p. 727-31 KEYWORDS: INSECTICIDES. KERRIA LACCA. LAC INSECTS. PREDATORS.

Laboratory bioassay was carried out during 2008 to evaluate some insecticides against larval instar of lac insect predator (*Chrysopa lacciperda* Kimmins) to develop suitable strategy for management of this serious neuropteran pest of Indian lac insect [*Kerria lacca* (Kerr)]. Seven safer insecticides viz lambda-cyhalothrin, carbosulfan, spinosad, indoxacarb, fipronil, alphamethrin and ethofenprox against lac insect, were evaluated for their bioefficacy against *C. lacciperda* Kimmins by topical application and exposing the insect on residual film of insecticides. Topical application of lambda-cyhalothrin (0.005 and 0.008%), carbosulfan (0.02 and 0.03%), fipronil (0.005 and 0.01%), alphamethrin (0.005 and 0.01%), spinosad (0.02%), indoxacarb (0.02%) and ethofenprox (0.02%) exhibited 100% mortality of *C. lacciperda* within 24 hr of treatment. Fipronil (0.005 and 0.01%) and indoxacarb (0.02%) were found to be equally effective as cent mortality was observed within 24 hr of treatment with both modes of treatment. In most of the treatment topical application of insecticides was found to be more effective as compared to exposure of insect on residual films. Hence, lambda-cyhalothrin, carbosulfan, indoxacarb, spinosad, fipronil, alphamethrin and ethofenprox can be incorporated in IPM programmes while formulating strategy for effective management of this neuropteran predator of lac insect without having any adverse effect on lac insect. Fipronil is highly water soluble and hence may be cautiously used. Supervisory control of predators of lac generally recommended.

393. Sharma, Anupam; Central Potato Research Institute, Shimla (India). Thakur, Desh Raj; HPU, Shimla (India). Biosciences Department. Chandla, V.K.; Central Potato Research Institute, Shimla (India). Use of *Steinernema* and *Heterorhabditis* nematodes

for control of white grubs, *Brahmina coriacea* hope (Coleoptera: Scarabaeidae) in potato crop. *Potato Journal (India)*. (Jul 2009) v.36(3-4) p.160-165 KEYWORDS: STEINERNEMA. HETERORHABDITIS. NEMATODA.

The efficacy of the entomopathogenic nematodes (EPN) *Steinernema carpocapsae* and *Heterorhabditis indica* against different developmental stages of *Brahmina coriacea* Hope (Coleoptera: Scarabidae) were evaluated under laboratory and field conditions. In laboratory studies, significant mortality by *S. carpocapsae* (68–93%) and *H. indica* (39–71%) after 7 days of treatment was observed at three dosages viz.; 500, 1000 and 2000 infective juveniles (ij)/100g soil. In field (Fagu and Shimla), all the three dosages of *S. carpocapsae* and *H. indica* (1, 3 and 6×10^5 ij/m²) were effective in reducing the grub population, percent plant damage as well as percent tuber damage. Percent reduction in grub population was 66–80% due to *H. indica* and more than 83% due to *S. carpocapsae* at Fagu. There was more than 60 and 50% reduction in grub population due to *S. carpocapsae* and *H. indica* treatment in 2007 and more than 80% in 2008 at Shimla in plots treated with both the EPN spp. at normal harvesting time. The least number of grubs and damaged tuber were recorded in case of treatment with *S. carpocapsae* 6×10^5 ij/m² during both the years at Fagu as well as Shimla.

H20 Plant Diseases

394. Baghel, Ashwarya; Indira Gandhi Krishi Viswavidyalaya, Raipur (India). Dept. of Plant Pathology. Dantre, R.K.; Indira Gandhi Krishi Viswavidyalaya, Raipur (India). Dept. of Plant Pathology. Verma, K.P.; Indira Gandhi Krishi Viswavidyalaya, Raipur (India). Dept. of Plant Pathology. Efficacy of different edible oils, medicinal oils and the concentrations effective oil used against fruit rot of Aonla (*Penicillium citrinum*). *Journal of Interacademia (India)*. (Apr 2009) v. 13(2) p. 142-147 KEYWORDS: DRUG PLANTS. *PENICILLIUM CITRINUM*. POSTHARVEST CONTROL. POSTHARVEST DECAY. FUNGAL DISEASES. OILS.

A set of experiment was conducted under controlled condition at the Department of Plant Pathology, Indira Gandhi Krishi Viswavidyalaya, Raipur (C.G.) during 2006 to select the effective oil and their concentration against fruit rot pathogen. Five edible oils viz. sesamum, mustard, groundnut, linseed and coconut; five medicinal oils viz., karanja, mahua, neem, eucalyptus and pinus and their 2, 4 and 6 percent concentration were taken as treatments. All the treatments were significantly effective in reducing the fruit rot over control. Application of mustard oil and linseed oil were found significantly superior in reducing the fruit rot severity over control followed by groundnut oil (20.71), with per cent reduction of 79.29, which is at par with mustard and linseed oil in their potential. Among the remaining medicinal oils, neem oil gave the better performance in reducing the fruit rot severity (17.36) and showed maximum per cent performance in reducing (82.64) followed by mahua oil (18.38 and 81.62). Disease severity was significantly inhibited in 6 concentrations of neem oil (0.00) and maximum per cent reducing (100) followed by all the concentration of linseed oil (10.13, 10.59 and 8.55 respectively) and 89.87, 89.41 and 91.53 reduction.

395. Verma, K.P.; Indira Gandhi Krishi Viswavidyalaya, Raipur (India). College of Agriculture. Dept. of Plant Pathology. Thakur, M.P.; Indira Gandhi Krishi Viswavidyalaya, Raipur (India). College of Agriculture. Dept. of Plant Pathology. Dantre, R.K.; Indira Gandhi Krishi Viswavidyalaya, Raipur (India). College of Agriculture. Dept. of Plant Pathology. Occurrence of Sunflower mosaic virus and its effect on yield contributing characters of Sunflower. *Journal of Interacademia (India)*. (Apr 2009) v.13 (2) p.245-246 KEYWORDS: *HELIANTHUS ANNUUS*. PLANT DISEASES. VIROSES. YIELDS. MORBIDITY.

The effect of Sunflower mosaic virus (SMV) on the yield contributing characters were evaluated in Chhattisgarh region. SMV infected reduced the plant height, stem girth, head diameter, seed weight of the head and 100 grain weight of filled grain.

396. Sharma, Sapana; Kurukshetra University, Kurukshetra (India). Dept. of Botany. Aggrawal, Ashok; Kurukshetra University, Kurukshetra (India). Dept. of Botany. Kumar, Aditya; Kurukshetra University, Kurukshetra (India). Dept. of Botany. Bio-control of wilt of *Albizia lebbek* by using AM fungi and *Trichoderma viride*. Annals of Plant Protection Sciences (India). (Sept 2008) v.16(2) p.422-424 KEYWORDS: ALBIZIA. MYCORRHIZAE. TRICHODERMA VIRIDE. TRICHODERMA.

The interaction between two arbuscular mycorrhizal fungi i.e. *Clonus mosseae* and *Acaulospora laevis* and a known bio-control agent. *Trichoderma viride* in reaction to disease control and plant growth in *Albizia lebbek* was studied. Maximum % seed germination (89.6+1.5) and minimum % disease infection (8.9+1.90) was recorded in seed treated with *Fusarium oxysporum* + *T. virid* + *A.laevis* + *Rhizobium leguminisarum*. All inoculated plants yielded greater biomass as compared to non-mycorrhizal and plants infected with *F.oxysporum*. Root biomass 94.28+0.15) and shoot biomass (19.51+0.77) were maximum in plants treated with *F.oxysporum* + *T.virid* + *A.laevis*.

397. Kishore, Ram; C.S. Azad University of Agri. & Tech., Kanpur (India). Dept. of Plant Pathology. Singh, Jyoti; C.S. Azad University of Agri. & Tech., Kanpur (India). Project coordinating Unit (Linseed). Pandey, Manjul; C.S. Azad University of Agri. & Tech., Kanpur (India). Dept. of Plant Pathology. Management of Wilt disease caused by *Fusarium oxysporum* f.sp. *lini* in linseed through cultural practices. Annals of Plant Protection Sciences (India). (Sept 2008) v.16(2) p.425-427 KEYWORDS: WILTS. FUSARIUM OXYSPORUM. LINUM USITATISSIMUM. SOIL SOLARIZATION.

The effect of solarization and date of sowing were carried out against wilt disease in linseed (*Fusarium oxysporum* f.sp. *lini*.) The average reduction in wilt incidence was 58.7% in 4 weeks soil solarization followed by three weeks (41.0%), two weeks (25.5%) and one week (18.5%). The incremental yield was 109.0, 66.9, 58.0 and 18.4%, respectively. The disease incidence was significantly influenced by planting dates. The maximum incidence of wilt was recorded in 20th October sowing (70.0%, which reduced in subsequent sowing dates with minimum (34.0%) in 10th December sowing. However, maximum yield (661.0 kg/ha) was recorded in 20th November, which was statistically on par with 10th Nov. and 30th November sown crop.

398. Naik, V. China Babu; Agricultural College, Bapatla (India). Dept. of Entomology. Rao, P. Arjuna; Agricultural College, Bapatla (India). Dept. of Entomology. Krishnayya, P.V.; Agricultural College, Bapatla (India). Dept. of Entomology. Rao, V. Srinivasa; Agricultural College, Bapatla (India). Dept. of Entomology. Seasonal incidence and management of *Leucinodes orbonalis* Guenee on brinjal. Annals of Plant Protection Sciences (India). (Sep 2008) v.16(2) p.329-332 KEYWORDS: INSECTICIDES. INFECTION. LEUCINODES ORBONALIS. SOLANUM MELONGENA.

Incidence of *leucinodes orbonalis* in terms of shoot infestation was observed during third week of February 2006 and the incidence had non-significant relationship with temperature, relative humidity and rainfall but significant relationship with coccinellids and spiders. The results of chemical control trial indicated that profenofos 0.1% and spinosad 0.015% were most effective in reduction of shoot infestation of *L. orbonalis* besides recording higher brinjal fruit yield. Among the 15 treatments tested, profenofos was the most effective followed by spinosad individually and their combination with novaluron and azadirachtin were highly effective in reducing the population as well as in giving higher yields.

399. Bhagat, Someshwar; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur (India). Division of Field Crop. Pan, Stansu; Central Agricultural Research Institute, Port Blair (India). Dept. of Plant Pathology. Biological management of root and collar rot (*Rhizoctonia solani*) of frenchbean (*Phaseolus vulgaris*). Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.42-50 KEYWORDS: PHASEOLUS VULGARIS. TRICHODERMA. ROOT ROTS. RHIZOCTONIA SOLANI.

Twelve isolates of *Trichoderma* were screened in vitro during 2006-08 against *Rhizoctonia solani* Kuhn. Causing root and collar rot of Frenchbean *Phaseolus vulgaris* L.)

by dual culture tests and production of volatile and non-volatile antibiotics and it was found that all the isolate significantly inhibited the mycelial growth of *Rhizoctonia solani*. The isolate The AN-5 was most effective in suppression of mycelial growth of test pathogen, followed by TvAN-3, Thr An-7, ThrWB-1 and ThrWB2. TheAN-5 was most effective in view of percentage inhibition of mycelial growth of *R. solani* (73.8 and 83.9%) by production of non-volatile substance at variable concentrations (7.5 and 15.0% respectively). Highest per cent germination (91.0%) vigour index (1287.0) and seedling biomass (772.5 mg) of Frenchbean seeds were recorded when the seeds were primed with TvAN-5 followed by ThrAn-5 and TheWB-1. The bacterial antagonist *Ps. Fluorescens* was also very effective in inducing germination behaviors of Frenchbean seeds. The collar rot of Frenchbean (*c.o.-R solani*) was most effectively controlled in greenhouse test by seed and soil application of TheWB-1 (79.0%), followed by ThrAn-5 and ThrAN-5 (78.2% each), TvAN-3 (77.6%) while the isolate TvAN-10 was the least effective isolate with only 67.4% reduction in disease incidence. The highest germination (%), per cent reduction in disease incidence and increase in green pod yield of Frenchbean was recorded with combination of seed and soil application of ThrWB-1 (348.2%) over control under *R. solani* sick field condition, followed by T1 (TvAN-5, 345.8%), T6 (ThrAN-5, 343.4), T12 (TvAN-3, 339.7%) while lowest (239.7%) increase in yield was noted seed application of TvAN-10 (T16 treatment).

400. Singh, A.K.; Reginal Agricultural Research Station, SKUAST-J, J&K (India). Singh, V.K.; College of Agriculture, JNKVV, Tikamgarh (India). Shukla, D.N.; University of Allahabad, Allahabad (India). Dept. of Botany. Effect of plant extracts against *Pythium aphanidermatum*- the incident of fruit rot of muskmelon. Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.51-53 KEYWORDS: PYTHIUM APHANIDERMATUM. PLANT EXTRACTS. ROTS. CUCUMIS MELO.

An experiment was conducted during 2005-7 to utilize plant extract as bio-fungicides for suppression of *Pythium aphanidermatum* causing fruit rot of muskmelon. Maximum inhibition of fungal growth was recorded with extracts (25%) of *Allium sativum* (82.01%), followed by *Azadirachta indica* (79.90%), *curcuma longa* (79.88%) and *Zingiber officinale* (79.82%), in ethanol solvent. The least inhibition was recorded at 10% concentration of *A. cepa* (36.87%), followed by *Ocimum sanctum* (37.00%) in distilled water under field conditions. *A. sativum* extract (25%) showed lowest disease severity (5.97%), followed by *A. indica* (6.13), and *C. longa* (6.56%); *Z. officinale* (ginger) (8.00%) *Datura stramonium* (*Datura*) (9.07%) *A. cepa* and *O. sanctum* also gave significant lower disease severity. Significantly highest disease severity was recorded in control in control [at 9th day post inoculation (25.50%), followed by 9th day pre-inoculation (20.09%)].

401. Chandel, Sunita; Dr. Y S Parmar University of Horticulture and Forestry, Nauni (India). Chandel, Vinita; Advance centre of Virology, Indian Agriculture Research Institute, New Delhi (India). Correlation of disease with meteorological factors and management of *Septoria* leaf spot of chrysanthemum (*Chrysanthemum grandiflorum*). Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p.54-58 KEYWORDS: CHEMICAL CONTROL. CHRYSANTHEMUM. EPIDEMIOLOGY. BIOLOGICAL CONTROL. SEPTORIA.

Leaf spot severity was high at 25 C and lowest at 35 C temperatures. Relative humidity more than 96% influenced the spread of the disease to maximum by causing 57.2 % disease severity. In field, the disease usually appears in June and reaches to maximum in August with rise in relative humidity and rainfall in both the years (2003-04). The simple, partial and multiple correlations, indicated a positive correlation of disease concerning rainfall and relative humidity while temperature had a negative effect on disease development. The co-efficient of multiple determinations signifies 66.03 and 67.40% variation with the positive weather factors of disease development. In *in vitro* studies, 7 fungicides three from each systemic (contaf, roverol and bavistin) and non-systemic SAAF, dithane M4 and dithane Z78) category arrested the mycelial growth of the pathogen up to 73% generally at higher concentrations. In field contaf, SAAF, roverol

were found equally good in controlling the disease, followed by dithane M45, dithane Z78 and benomy1.

402. Mohanan, C.; Kerala Forest Research Institute, Peechi (India). Rajeshkumar, K.C.; Kerala Forest Research Institute, Peechi (India). Ganoderma root and butt rot of *Acacia mangium* plantations in Kerala, India. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 375-378 KEYWORDS: ACACIA MANGIUM. GANODERMA LUCIDUM. EUCALYPTUS TERETICORNIS.

A severe root and butt rot disease in *Acacia mangium* plantations caused by *Ganoderma lucidum* was recorded from different parts of the Kerala State. The disease affected 2 to 5-year-old plantations raised in clear-felled *Eucalyptus tereticornis* poorly stocked stands in high rainfall areas and caused up to 16 percent tree mortality within a span of one year.

403. Thakur, R.K.; Forest Research Institute, Dehra Dun (India). Div. of Entomology. *Angulitermes bhagsunagensis*, a new species from India (Oriental region) (Isoptera: Termitidae: Termitinae). *Indian Journal of Forestry (India)*. (Dec 2008) v. 31(4) p. 581-585 KEYWORDS: ISOPTERA. TERMITIDAE.

This paper gives an account of a new species of the termite genus, *Angulitermes Sjostedt* from India. Necessary comparison with the closely related species is given.

404. Singh, Narendra; SD Agricultural University, Deesa (India). AICRP on Potato, Potato Research Station. Verma, O.P.; Rajasthan Agricultural University, Jobner (India). SKN College of Agriculture,. Epidemiology of *Alternaria* blight of *Adhatoda vasica* caused by *alternaria alternata*.. *Indian Journal of Agricultural Sciences (India)*. (Nov. 2009) v.79(11) p.945-48 KEYWORDS: ADHATODA. CROP ROTATION. BLIGHT. EPIDEMIOLOGY.

405. Bhai, Suseela R.; India Institute of Spices Research, Calicut (India). Anandaraj, M.; India Institute of Spices Research, Calicut (India). Srinivasan, V.; India Institute of Spices Research, Calicut (India). Validation of farmer's practice of issue sodium chloride for controlling foot rot disease of black pepper (*Piper nigrum*). *Indian Journal of Agricultural Sciences (India)*. (Sep 2009) v.79(9) p.722-26 KEYWORDS: ELECTRICAL CONDUCTIVITY. PHYTOPHTHORA CAPSICI. PHYTOTOXICITY. SODIUM CHLORATE. DISEASE CONTROL. FOOT ROT.

An innovative field observation by a indicated that common salt (sodium chloride) is effective in controlling phytophthora foot rot of black pepper (*piper nigrum* L.) caused by *phytophthora capsici*. This is validated through a series of in vitro and in vivo experiments. Initially mycelial growth, sporangial formation and zoospore germination of *P. capsici* were studied on a range of concentrations from 0.01 M to 3.0 M of NaCl. It was found that mycelial growth is inhibited by 1 M, sporangial production by 0.75 M and zoospore germination by 0.5 M sodium chloride respectively. But, in vivo studies by challenges inoculations with *P. capsici* showed that the maximum inhibitory concentration under in vitro (1 M) is insufficient to inhibit *P. capsici* in the soil. Hence, higher concentrations viz 2 M to 8 M were tested in soil. The result showed that 3 to 4 M concentrations of sodium chloride are the maximum required to destroy the soil inoculum but was found phytotoxic. Modification of the treatment by washing off the soil amended with salt resulted in nullifying the phytotoxic effect without affecting the total microbial biomass, nutrient status pH or electrical conductivity of the soil. This method can be used as a pre planting practice while rejuvenating a diseased or while gap-filling or while raising nursery plants in potting mixture.

406. Upadhyay, Priti; Indian Institute of Vegetable Research, Varanasi (India). Singh, Prabhash C; Indian Institute of Vegetable Research, Varanasi (India). Sinha, B; Indian Institute of Vegetable Research, Varanasi (India). Singh, M; Indian Institute of Vegetable Research, Varanasi (India). Kumar, Rajesh; Indian Institute of Vegetable Research, Varanasi (India). Pandey, K.K.; Indian Institute of Vegetable Research, Varanasi (India).

Rai, Mathura; Indian Institute of Vegetable Research, Varanasi (India). Sources of resistance against early blight (*Alternaria solani*) in tomato (*Solanum lycopersicum*). Indian Journal of Agricultural Sciences (India). (Sept 2009) v.79(9) p. 752-53
KEYWORDS: ALTERNARIA SOLANI. BLIGHT. TOMATOES. DISEASE RESISTANCE.

Fourteen tomato genotypes, representing two *Solanum* species were screened for resistance against early blight disease. Evaluations were conducted in growth chamber for disease severity and host resistance of the plants. EC520061 (*S. habrochaites*) showed resistance against infection 3 genotype NCEBR 4 FEB 4 and VRT2 were moderately susceptible, while other genotype were found either susceptible or highly susceptible. The resistance material found in this study is useful in the tomato improvement programme especially for early blight disease.

407. Joshi, Deeksha; Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Hooda, K.S.; Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Bhatt, J.C.; Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (India). Integration of soil solarization with bio-fumigation and *Trichoderma* spp for management of damping-off in tomato (*Lycopersicon esculentum*) in the mid altitude region of north western Himalayas.. Indian Journal of Agricultural Sciences (India). (Sep 2009) v.79(9) p. 754-57
KEYWORDS: DAMPING OFF. INTEGRATED PEST MANAGEMENT. SOIL SOLARIZATION. TOMATOES. TRICHODERMA.

The effect of soil solarization (30 and 40 days) alone as well as in combination with organic amendments (farmyard manure or poultry manure) and a biocontrol agent (*Trichoderma* varied) was studied for the management of damping-off disease in tomato (*Lycopersicon esculentum* L.Mill.non.cons.) nurseries under the mid hill conditions of north-western Himalayas. Soil solarization alone was found significantly effective in reducing the incidence of pre and post emergence damping-off in both years. Also increasing the solarization period from 30 to 40 day significantly improved disease control. However the results revealed that this problem could be offset by integrating solarization with organic manure amendment and biocontrol agents like *T. viride*. Solarization nursery beds with farmyard manure or poultry manure amendment and/or *T. viride* treatment showed significantly lower pre-and post emergence damping off compared to beds with solarization alone. Solarization also resulted in a significant reduction in the population of fungi bacteria and actinomycetes in soil. This reduction was considerably higher in solarized soils amended with organic manures as compared to non amended solarized soils. A combination of all the three techniques viz, physical control (soil solarization), cultural methods (organic amendments) and biological control (*T. virid* seed treatment) was found to be the most effective approach for reducing pre and post emergence damping-off. Fungi were observed to be the most thermal sensitive microbial group.

408. Somani, A.K.; Central Potato Research Station, Madhya Pradesh (India). Management of Black scurf (*Rhizoctonia solani*) of potato through seed treatment with botanicals. Potato Journal (India). (Jul 2009) v.36(3-4) p.155-159
KEYWORDS: POTATOES. RHIZOCTONIA SOLANI. SEED TREATMENT. BOTANICAL PESTICIDES.

In search of eco-friendly, non-hazardous way of managing black scurf (*Rhizoctonia solani*) disease of potato, experiments were conducted with fresh leaf extracts of 20 botanicals in water 1:5 W/V (16.7%) and 5th year 1:3 W/V (25.0%) for 30 min dip treatment of naturally infected tubers and then planted in naturally *R. solani* infected field at Central Potato Research Station, Gwalior (Madhya Pradesh) from 2004–05 to 2008–09. *Vinca rosea* (Sadabahar), *Withania somnifera* (Ashwagandha) and *Ocimum canum* (Tulsi) were very effective in the management of black scurf when seed tubers were treated in their fresh leaf extracts (:5 W/V) for 30 min. In freshly harvested produce (daughter tubers) disease incidence of 50.5 to 54.3% and disease index of 0.59 to 0.71% were recorded as compared to 90.8% incidence and 1.66 index in diseased tuber control treatment during 2008–09 (1:3 W/V). In diseased tubers, black scurf intensity reduction was 64.5% with *W. somnifera*, 58.4% with *O. canum* and 57.2% with *V. rosea*. There were no difference in efficacy of the above three botanicals among

themselves. Botanicals viz., *Azadirachta indica* (neem), *Eucalyptus globulus* (Eucalyptus) and *Allium sativum* (onion) also gave good control of black scurf. However, increase in concentration of botanical extracts from 1:5 to 1:3 W/V increased the efficiency of *W. somifera* by 14% in case of disease incidence and 7% in disease index but 10% incidence only in *O. canum*. Plant emergence and yields were not affected due to the treatment with botanicals. Study revealed that these eco-friendly botanicals have the potential to control black scurf and their continuous use may help in better management of the disease.

H50 Miscellaneous Plant Disorders

409. Michaelraj, S.; Indian Agricultural Research Institute, New Delhi (India). Division of Entomology. Sharma, Kriti; Indian Agricultural Research Institute, New Delhi (India). Division of Entomology. Sharma, R.K.; Indian Agricultural Research Institute, New Delhi (India). Division of Entomology. Fumigant Toxicity of essential Oils against key pests of stored Maiza. *Annals of Plant Protection Sciences (India)*. (Sept 2008) v.16(2) p.356-359
KEYWORDS: ESSENTIAL OILS. FUMIGANTS. TOXICITY. ZEA MAYS.

Adults of *Sitophilus oryzae* and *Rhyopertha dominica* and adults and eggs of *Corcyra cephalonica* were exposed to essential oils of geranium, lemongrass and peppermint in the fumigation chamber. At 48 hrs exposure, complete mortality of adults of *S. oryzae* was recorded at 100 and 150 ul/250 ml of peppermint oil. Whereas, in case of *R. dominica*, 100% mortality was observed in all the doses (50, 100, 150 & 200 ul/250 ml). *C. cephalonica* was not sensitive to peppermint at 5 ul/ 250 ml. In the case of eggs (0-24 hrs old) of *C. cephalonica*, after 48 hrs of exposure, complete inhibition in hatching was recorded in all the doses of peppermint (25, 50, 100, & 150 ul), 50, 100, & 150 ul of lemongrass and 150 ul of geranium.

H60 Weeds and Weed Control

410. Suresh, G.; Directorate of Oilseed Research, Rajendranagar (India). Reddy, B.N; Directorate of Oilseed Research, Rajendranagar (India). Effect of weed control practices on weed dry matter, production potential and nutrient uptake of sunflower (*Helianthus annuus*) in Vertisols. *Indian Journal of Agricultural Sciences*. (Jan 2010) v.80(1) p.33-37
KEYWORDS: HELIANTHUS ANNUUS. VERTISOLS. OIL CROPS. NUTRIENT UPTAKE.

Field experiments were conducted during rainy (kharif) season of 2007 in Vertisols of semi-arid tropics, Hyderabad to evaluate the performance of sunflower (*Helianthus annuus* L.) for different weed control treatments. Preemergence application of pendimethalin (91.0 kg) in combination with interculturing at 21 days after sowing, followed by hand weeding was found as good as that of weed-free treatment in reducing weed growth and recorded higher seed yield and higher nutrient uptake of sunflower in vertisols. On an average, weeds removed 39 kg N/ha, 8 kg P/ha and 53 kg K/ha in unweeded control. The activity of soil enzymes (urease, dehydrogenase and phosphatase) were enhanced/maintained with application of pendimethalin at lower doses followed by intercultivation.

411. Chopra, Nisha; Indian Agricultural Research Institute, Karnal (India). Chopra, N. K.; Indian Agricultural Research Institute, Karnal (India). Sinha, S.N.; Indian Agricultural Research Institute, Karnal (India). Chand, Khem; Krishi Vigyan Kendra, Bhilwara (India). Effect of weed stress on seed yield and quality of onion (*Allium cepa*).. *Indian Journal of Agricultural Sciences (India)*. (Jan 2010) v.80(1) p.69-71
KEYWORDS: ONIONS. QUALITY. SEEDS. PLANT COMPETITION.

The field experiment was conducted during 2003-05 at seed production farm of regional station, Indian Agricultural research Institute, Karnal to assess the effect of weed competition on seed yield and quality of onion (*Allium cepa* L.). Significantly higher seed yield was registered when crop was kept free for initial 60 days after planting

compared to 20 and 40 days after planting where weeds reemerged at later stages, accumulated higher weed dry matter and reduced the yield. Seed yield remained at par between weed-free check and when weeds were allowed to grow with the onion crop up to 40 days after planting, however weedy period beyond 40 days was detrimental to seed yield. Yield reduction to the extent of 53.8, 34.1 and 63.3% was observed in initial weed-free periods of 20 and 40 days after planting and season long unwedded period of crop weed competition was found to be 40-60 days after planting. Seed quality in terms of 1000- seed weight, per cent germination, and vigour index was maximum with weed free season long and weedy 20 days compared to weed free 20 and 40 days, weedy 100 days and weedy check season long. Higher seed yield and quality of onion seed crop can be realized under the treatment when the crop is kept weed free for first 60 days with higher benefit: cost ratio compared to weed free 80, 100 and weed free season long treatment.

412. Meena, S.S.; National Research Centre for Seed Spices, Ajmer (India). Mehta, R.S.; National Research Centre for Seed Spices, Ajmer (India).. Integrated weed management in coriander (*Coriandrum sativum*). Indian Journal of Agricultural Sciences (India). (Oct 2009) v.79(10) p.824-26 KEYWORDS: CORIANDRUM SATIVUM. HERBICIDES. WEED CONTROL. YIELDS.

A field experiment was conducted at National Research Centre on Seed Spices, Ajmer (Rajasthan), during the rabi 2005-07 to study the integrated weed management in coriander (*Coriandrum sativum* L.). The resulted reveled that pre-emergence application of ixadiargy15 g/ha + 1 hand weeding at 45 days after sowing resulted into significantly maximum vegetative growth and seed yield (1340 kg/ha) of coriander, followed by pre-emergence application of pendimenthalin 1 kg/ha + 1 hand weeding at 45 days after sowing. Among the weed management practices, weed free treatment was most effective in reducing the dry weight of weeds and recorded the highest weed control efficiency (85.94%) followed by pre emergence application of oxadiargy1 5 g/ha + 1 hand weeding at 45 days after sowing (78.31%). However, the maximum net returns (Rs 46861/ha) and highest benefit: cost ratio (3.22:1) were obtained under pre emergence application of oxadiargy1 75 g/ha + 1 hand weeding at 45 days after sowing among all the treatment including weed free treatments.

J10 Handling, Transport, Storage and Protecion of Agricultural Products

413. Ded, P.; Uttar Banga Krishi Viswavidyalaya, Pundibari (India). Dept. of Pomology and Post harvest technology. Das, A.; Uttar Banga Krishi Viswavidyalaya, Pundibari (India). Dept. of Pomology and Post harvest technology. Suresh, C.P.; Uttar Banga Krishi Viswavidyalaya, Pundibari (India). Dept. of Pomology and Post harvest technology. Influence of different post harvest treatments on fruit quality and shelf life of Litchi.. Journal of Interacademia (India). (Apr 2009) v. 13(2) p. 138-141 KEYWORDS: POSTHARVEST CONTROL. LITCHI CHINENSIS. QUALITY. FRUIT.

present investigation was undertaken to find out the best post harvest treatment which can reduce the moisture loss and degradation of fruit of litchi (*Litchi chinensis* Sonn.) in the ambeint storage condition. The result of the investigation revealed that the treatment of litchi fruit by dipping them in AgNO₃ 0ppm soulation was best in respect to low PLW, highest TSS and low acidity during the storage life under ambient environment.

414. Agarwal, Suman; National Research Center for woman in Agriculture, Bhubaneswar (India). Patra, Dhairitri; National Research Center for woman in Agriculture, Bhubaneswar (India). Bhue, Anil Kumar; National Research Center for woman in Agriculture, Bhubaneswar (India). Paddy parboiling unit an appropriate post hatvest technology for farmwomen. Indian Farming (India). Mar 2009 v.58(12) p.19-21 KEYWORDS: POSTHARVEST TECHNOLOGY. RICE. AGROINDUSTRY. COST BENEFIT ANALYSIS.

Paddy parboiling is a tedious, time consuming and drudgerous activity. Thus, it reduces the drudgery of farmwomen. The technology developed by the ICAR scientist

was used for this purpose. For the use of this technology by the farmwomen, skill development training were organized for them. The responses of the farmwomen regarding the suitability and efficiency of this technology revealed that the technology saves their time, money and energy and at the same time gives more output. The product obtained is of better quality thus, fetches more economic return. They found more economic return. They found it suitable in village situation. Hence, the technology not only reduces the drudgery of farmwomen but at the same time provide scope for taking up income generation activity in agro processing.

415. Singh, Dinesh; IARI, New Delhi (India). Division of Plant Pathology. Sharma, R.R.; IARI, New Delhi (India). Division of Post Harvest Technology. Post-harvest behaviour of peaches (*Prunus persica*) pre-treated with antagonist *Debaryomyces hansenii* and calcium chloride. Indian Journal of Agricultural Sciences (India). (Sep 2009) v.79(9) p.674-78 KEYWORDS: CALCIUM CHLORIDE. DEBARYOMYCES. PEACHES. POSTHARVEST TECHNOLOGY. ANTIMETABOLITES.

A study was conducted during 2004-05 to determine the combined effect of *Debaryomyces hansenii* and calcium chloride on post harvest spoilage and fruit quality of sharbati peaches (*Prunus persica* (L.) Batsch) during storage. Initially *Rhizopus stolonifer* and *R. macrosporus* were isolate from infected fruit and healthy fruits were inoculated with these strains. The infected fruits were treated either with calcium chloride (2.0%), *D. hansenii* (10 cfu/ml), calcium chloride + *D. hansenii*, and untreated fruit served as control. The fruits were then packed in HDPE bags (200 gauges, 1.0% perforation and stored in cool chamber (5+1C) for 42 days. Observations were recorded on disease incidence, lesion diameter, and fruit spoilage, physiological loss in weight and fruit quality parameters. Our studies indicated that disease incidence was maximum in untreated fruit and minimum in calcium chloride + *D. hansenii* treated fruit. Calcium chloride + *D. hansenii* treated fruits were not spoiled up to 35 days under cool chamber, whereas spoilage started after 21 days in control samples. Minimum spoilage of fruit was recorded in *D. hansenii* + calcium chloride (1.37%) as compared to untreated fruit (33.5%) after 42 days of storage. *D. hansenii* - calcium chloride reduced the physiological loss in weight significantly over control after 42 days of storage. Firmness of the fruit was reduced in all the treatments and had no significant variation among the treatments. Total soluble solid content of the fruits increased and acidity decreased in all the treatment during storage. TSS:acid ratio increased initially, but after 28th day, it started that declining in all the treatments except in fruits pre-treated with *D. hansenii* + calcium chloride. Thus our study indicated that although pre treatment of Sharbati peaches either with calcium with chloride or *D. hansenii* alone reduced the spoilage and enhanced their shelf life significantly, their combination was much more effective in doing so.

J11 Handling, Transport, Storage and Protection of Plant Products

416. Sharma, Akhilesh; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Sharma, K.C.; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Singh, Yudhvir; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dept. of Vegetable Science and Floriculture. Pathania, N.K.; Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dept. of Vegetable Science and Floriculture. Effect of pre-harvest treatments and indigenous practices on enhancing storage life of garlic (*Allium sativum*). Indian Journal of Agricultural Sciences (India). (Jan 2010) v.80(1) p. 72-75 KEYWORDS: KEEPING QUALITY. ALLIUM SATIVUM. BORAX. ECONOMICS.

A suitable storage technique for enhancing shelf-life of garlic bulbs can help in reducing oversupply and stabilize prices. This can further provide an opportunity to the growers to sell their produce during lean period which results in high net returns, Therefore, to study the storage life of recommended garlic cultivar CGH1 an experiment consisting of 17 treatment combinations was evaluated at 2 different locations of

Himachal Pradesh, namely Palampur and Kullu. treatment comprised knotting tops one month prior to harvesting (indigenous practice) and general practice of no knotting of top, followed by application of iron sulphate and borax 500, 1000 and 1500 ppm and maleic hydrazide 200 ppm (check) each 2 weeks prior to harvesting of bulbs, indigenous practice of hanging bulbs and no chemical spray on both knotting and no knotting plots under ambient temperature storage conditions in a dark room. the indigenous practice of hanging bulbs in storage significantly resulted in minimum loss of weight and incidence of sprouting, rotting and drying of bulbs compared to all other treatments. On the other hand application of borax 1000 ppm was effective in reducing physiological loss of weight up to October to the extent of 25 over no chemical application and also recorded low incidence of sprouting, rotting and dry of bulbs. The use of borax could be a beneficial for minimizing the storage losses for large scale storage of garlic bulbs, while indigenous practice could be a suitable proposition for small scale storage compared to no chemical spray by selling the bulbs during October end.

K10 Forestry Production

417. Lavania, S.K.; Gobind Ballabh Pant University of Agriculture and Technology, Ranichauri (India). Dept. of Forestry. Singh, R.P.; Kumaun University, Nainital (India). Dept. of Forestry. Singh, V.; Gobind Ballabh Pant University of Agriculture and Technology, Ranichauri (India). Dept. of Forestry. Influence of growing media on seed germination and early seedling growth in blue pine (*Pinus wallichiana* A.B. Jackson). Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 501-504 KEYWORDS: GERMINATION. SEEDS. QUALITY. SEED LONGEVITY. HUMUS.

This study was carried out to find out the most suitable growing medium for maximum germination and higher seedling growth in Blue pine. The seed germination and seedling growth was assessed in six different growing media. Out of these growing media, humus medium resulted in maximum seed germination, higher seedling growth and more seedling vigour index followed by humus and soil (2:1) medium. Therefore, the first preference should be given to humus medium and second to humus and soil (2:1) in order to get maximum seed germination, higher seedling growth and quality seedling production.

418. Rawat, R.S.; Indian Council of Forestry Research and Education, Dehra Dun (India). BCC Division. Kapoor, K.S.; Himalayan Forest Research Institute, Shimla (India). Ecology and Biodiversity Conservation Division. Growth performance and biomass production in *Populus deltoides* Marsh. Clones in lower Shiwaliks of Himachal Himalayas. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 505-508 KEYWORDS: POPULUS DELTOIDES. CLONES. CLONAL VARIATION. ECOLOGY. HIMALAYAN REGION.

Studies to assess the clonal variations towards growth performance and biomass production amongst twenty different clones of *Populus deltoides* Marsh, were carried out under nursery conditions in lower Shiwaliks of Himachal Himalayas. Significant clonal variations with respect to their sprouting, survival, height, collar diameter and biomass production were recorded amongst the clones under trial. Overall, clones namely L-12/82, L-165/84, L-13/82, L-14, 8262 and 22 were found to be the best performers in nursery stage; those can now be tested under field conditions for their enhanced productivity and yields in the lower Shiwaliks of Himachal Himalayas.

419. Rawat, L.R.; Forest Research Institute, Dehra Dun (India). Forest Ecology and Environment Division. Kamboj, S.K.; Forest Research Institute, Dehra Dun (India). Forest Ecology and Environment Division. Kholiya, D.; Forest Research Institute, Dehra Dun (India). Forest Ecology and Environment Division. Kandwal, A.; Forest Research Institute, Dehra Dun (India). Forest Ecology and Environment Division. Biomass/productivity and nutrient retention in some *Dalbergia sissoo* Roxb. plantations of Punjab, India. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 509-516

KEYWORDS: BIOMASS. BIODIVERSITY. NUTRIENT AVAILABILITY. DALBERGIA SISSOO. NUTRIENT UPTAKE.

The biomass and nutrient distribution in *Dalbergia sissoo* Roxb. plantations of different ages (25-33 years) has been studied at six sites at Nara, Chaksadhu, Dhirowal, Kharkan, Dharamkot and Kamalpur of Hoshiarpur, Ferozpur and Amritsar Forest Divisions of Punjab. The biomass ranged from 83.56 kg tree⁻¹ to 1516 kg tree⁻¹ and from 85.42 to 1226.94 t ha⁻¹ in all these sites. Productivity ranged from 2.59 t ha⁻¹ yr⁻¹ (at 33 yrs.) to 9.28 t ha⁻¹ yr⁻¹ (at 25 yrs). The contribution of individual tree components to total biomass varied as: leaf 0.65 to 3.86%; twig 1.62 to 5.64%, branch 10 to 24.88%, bark 8.49 to 12.27%, root 14.98 to 20.58% and bole 42.98 to 58.76%. The percent contributions of all tree components in all the sites were in the order of bole root branch bark twig leaf. Prediction models have been worked out by using allometric regressions. Among prediction variables tried D2H were found the most reliable parameters for prediction of biomass. The amount of various nutrients varied from N- 691.12 to 2087.24 kg ha⁻¹, P- 26.33 to 98.05 kg ha⁻¹, K- 470.2 to 1305.4 kg ha⁻¹, Ca - 725.05 to 3306.38 kg ha⁻¹ and Mg - 58.33 to 141.20 kg ha⁻¹, respectively. The percentage contribution of different nutrients to total nutrients were as; N (24.57 to 42.41%), P (1.28 to 2.1%), K (16.69 to 31.95%), Ca (28.25 to 54.79%) and Mg (1.51 to 4.27%), respectively. Nutrient losses through complete harvesting have also been discussed and some suggestions have been made to replenish the nutrient loss and improve the site productivity.

420. Chaudhuri, S.; Silviculture South Forest Division, Midnapore (India). Current advancement in silviculture of *Terminalia arjuna* (Roxb.) wight and ARN in South West Bengal. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 517-518 KEYWORDS: SILVICULTURE. TERMINALIA ARJUNA. CLONAL VARIATION.

Due to emerging potentially of *Terminalia arjuna* in profitable Agroforestry practices in forest fringe areas, special emphasis has been laid on stock improvement programme, which has been taken up in the Silviculture South Forest Division, Midnapore, West Bengal. Improved quality seeds duly certified collected from existing SPA is being supplied to the planting divisions. Research on clonal propagation through rooting responses is still going on. Application of IBA to the cuttings has been found to be effective in successful rooting response.

421. Bakshi, M.; Forest Research Institute, Dehra Dun (India). Plant Physiology (Botany Division). Effect of leaf area on rooting and growth of single nodal cuttings of *Dalbergia sissoo* Roxb. (Shisham). Indian Journal of Forestry. (Dec 2008) v. 31(4) p. 519-523 KEYWORDS: CUTTINGS. DALBERGIA SISSOO. GROWTH. LEAF AREA. ROOTING.

Single nodal softwood cuttings of *Dalbergia sissoo* obtained from vegetative multiplication garden (VMG) with 100%, 50% and 0% leaf area representing full leaf, half leaf and leafless cuttings were propagated under mist chamber following treatment with Indole butyric acid (IBA) 2000 ppm. After six weeks of planting, data on rooting, sprouting and allied parameters was noted. The best rooting and sprouting was observed in 100% (Full) leaf area in almost all clones followed by 50% (Half) leaf area. Cuttings without leaf showed poor response in some clones or died in others. Analysis of variance revealed significant variation among clones and leaf areas.

422. Qaisar, K.N.; Sher-e-Kashmir University of Agricultural Science and Technology, Srinagar (India). Div. of Forestry. Khan, P.A.; Sher-e-Kashmir University of Agricultural Science and Technology, Srinagar (India). Div. of Forestry. Khan, M.A.; Sher-e-Kashmir University of Agricultural Science and Technology, Srinagar (India). Div. of Forestry. Container type and growing media for raising quality seedling stock of *Cedrus deodara*. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 383-388 KEYWORDS: QUALITY. CEDRUS DEODARA. SEEDLINGS.

A Nursery study has been done on *Cedrus deodara* with four containers (normal polybag, bottom perforated polybag, root trainer 150 cc and root trainer 250 cc) and three growing medium (Soil, Sand, FYM- 1 : 2 : 3, Soil, Sand, FYM, Dalweed - 1 : 2 : 3 :

2, and Soil, Sand, FYM, Rice husk- 1 : 2 : 3 : 2). Deodar seedlings raised in bottom perforated polybag recorded best morphological parameters and Dickson quality index. The root trainer raised seedlings depicted better seedling quality parameters viz, sturdiness, root/shoot ratio and ratio of fibrous + lateral root to total root. Among the growing medium tried the best growth and quality parameters of Deodar seedlings were observed in M2 (soil, sand, FYM, Dalweed - 1 : 2 : 3 : 2). The combination of C2M2 (Bottom perforated polybag + Soil, Sand, FYM, Dalweed) resulted in maximum Dickson quality index.

P01 Nature Conservation and Land Resources

423. Tiwari, R.; The Natural History Museum, South Kensington (London). Dept. of Botany. Using brahms to compile and produce collection guides for ex-situ conservation. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 547-552 KEYWORDS: DRUG PLANTS. PHENOLOGY.

Using herbarium as a resource for ex-situ conservation is an important tool. The author has shown how the data from herbarium sheets and GIS can be used for targeting seed collections by using Brahms. The author has compiled and produced over 30 collection guides for the Millennium Seed Bank Enhancement Project whilst working at Kew. These guides serve a good indicative tool in collecting seeds from the field. The author shares the methods and process involved in compiling and producing the collection guides.

424. Ghildiyal, J.C.; Dr. P.D.B.H. Government Post Graduate College, Kotdwara (India). Dept. of Botany. Bhist, S.; Dr. P.D.B.H. Government Post Graduate College, Kotdwara (India). Dept. of Botany. Jadli, R.; Dr. P.D.B.H. Government Post Graduate College, Kotdwara (India). Dept. of Botany. Life - forms and biological spectrum of Tarkeshwar scared grove in Garhwal Himalaya. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 343-356 KEYWORDS: CLIMATE. SOIL. VEGETATION. FOREST TREES. HIMALAYAN REGION.

Tarkeshwar a sacred grove in Garhwal Himalaya, is traditionally protected forest with its rich plant diversity; It occupies 825.5 ha area in Pokhra Range in Garhwal Forest Division. The biological spectrum of this sacred grove reveals that the vegetation of this area is thero-phanerophytic. The life-forms observed were Phanerophytes (29.12%), Chamaephytes (13.00%), Hemicryptophytes (9.25%), Cryptophytes (6.07%), Therophytes (42.5%).

425. Suryanarayana, V.; College of Forestry, Sirsi (India). Dept. of Forest Biology and Tree Improvement. Hareesh, T.S.; College of Forestry, Sirsi (India). Dept. of Forest Biology and Tree Improvement. Reddy, K.V.V.; College of Forestry, Sirsi (India). Dept. of Forest Biology and Tree Improvement. Raj, V.M.; Sirsi Forest Division, Sirsi (India). Deputy Conservator of Forests. Kumar, H.P.; College of Forestry, Sirsi (India). Dept. of Forest Biology and Tree Improvement. Enumeration of floristic composition in JFM managed and adjoining national forests in Guddada Budihal area of Gadag division, Karnataka. Indian Journal of Forestry (India). (Dec 2008) v. 31(4) p. 571-575 KEYWORDS: REGENERATION. DEFORESTATION. DEGRADATION. FORESTATION. KARNATAKA.

The floristic composition of JFM managed forest and adjoining natural scrub forest in Guddada Budihal areas of Gadag Division was studied. The study has inferred the higher species diversity in the JFM managed forests compared to the natural forests. There was 19 species in JFM managed forests, among them *Hardwickia binata* possessed higher IVI value of 120.41. It was followed by *Steropermum personatum* and *Anogeissus latifolia*. The data on regeneration indicated that, *Hardwickia binata* was most ecologically success species constituting IVI value of 74.7 of the total regenerating individuals. The data has clearly indicated a high diversity and more species composition among regenerated individuals in JFM managed forests compared to adjoining natural forests. The results indicated that an urgent need for taking enrichment works in many of the

patches with indigenous local species and protecting the forests from grazing by involving local people.

426. Sehgal, D.; Botanical Survey of India, Dehra Dun (India). Northern Circle. Sharma, J.R.; Botanical Survey of India, Dehra Dun (India). Northern Circle. Hembrom, M.E.; Botanical Survey of India, Dehra Dun (India). Northern Circle. A rare polypore from western Himalaya, Uttarakhand. *Indian Journal of Forestry*. (Dec 2008) v. 31(4) p. 659-660 KEYWORDS: HIMALAYAN REGION. POLYPORUS.

P05 Energy Resources Management

427. Majumder, U; Visva-Bharati, Shantiniketan (India). Dept. of Geography. Ghosh, D.C.; Visva-Bharati, Sriniketan (India). Institute of Agriculture (Pali Siksha Bhavana). Dept. of ASEPAN. Energy distribution through material belongings to the human trophic levels in rural India.. *Journal of Interacademia (India)*. (Apr 2009) v. 13(2) p.159-167 KEYWORDS: ENERGY. ECONOMIC DISTRIBUTION. TROPHIC LEVELS. RURAL AREAS. INDIA.

The results of the study reveal that the quality of the habitats of the autotrophs differ from that of the heterotrophs. This confirm our hypothesis that the autotrophs occupy inferior areas and other facilities in terms of their resource base (defined by the degree of its accessibility, availability of water and fertile agricultural lands) as compared to the heterotrophs who occupy areas of superior in qualities and better facilities. The distribution of different categories of land among the different caste groups shows that the superior categories of landholdings are in the possession of the heterotrophs even in the cluster where almost all the resident (98) are tribal (social autotrophs). This indicates that the heterotrophs are the virtual possessors of the best quality of land unlike the autotrophs. The economic status of the autotrophs is externally low or negligible, whereas, almost all except two heterotrophs are under moderate to relatively rich economic status. Only three schedule tribes households in general caste dominated village attain relatively rich economic status that too due to government aid subsidies. hence, the schedule tribes continue to work as agricultural labourers under the study area. The practice of livestock keeping at the domestic scale is already prevalent in this area and offer the advantage for the further development of this sector.

P10 Water Resources and Management

428. Haque, Fazlul; Visva-Bharati, Shantiniketan (India). Centre for Environment Studies. Patra, Pulak Kumar; Visva-Bharati, Shantiniketan (India). Centre for Environment Studies. Rain water harvesting in rainfed Bhatina watershed area in Birbhum district of West Bengal.. *Journal of Interacademia (India)*. (Jul 2009) v. 13(3) p.273-276 KEYWORDS: WATER HARVESTING. RAINWATER. COST BENEFIT ANALYSIS.

In India about 90 million hectare of land depends upon rainfall for cultivation and provide livelihood to the 70% of the population. Rain water harvesting in that area may use for supplemental irrigation at the critical stages of crop growth like, seed germination (pre-sowing irrigation), at tillering, flowering etc. for sustainable agriculture. Rainwater harvesting is crucial even in high rainfall area, as the rain comes only for two to four months or less in a year and dry spell exist in rest of the year. Water harvesting is not a new method in India, irrigation tank, khadins, beach terraces were constructed to trap rain water in ancient India. But, in modern agriculture harvesting of underground water causes arsenic and fluoride problem in underground water and depletion of water table. In this moment, soil and water conservation measure is crucial. Old ponds need desiltation, silt may be used as manure, old irrigation and village tanks are to be renovated in addition to building new one. (Bali, 1980) From an economic view point, a pond should be located where the largest volume can be obtained with least amount of earth fill. This condition will generally occur at a site where the valley is narrow, side slopes are relatively steep and slope of valley floor will permit a large deep basin. Ponds with a large area of shallow water should be avoided due to excessive evaporation losses

and the growth of noxious aquatic plants. where water must be used for irrigation. ponds should be located as close to the point of use as is possible (singh et al., 1981). A field study was done on construction of water harvesting structure in Bhatina watershed which is located between latitude 24 08'25" to 24 10'53" n and longitude 87 42'00" E in Eastern plateau and hill Zone (late rite zone of west bengal). the water harvesting structure was constructed to preserve run-off water for supplying life saving irrigation at critical stage the benefit cost ratio were analysed which is more than 1.5 and so the WHS is taken up in Bhatina watershed area may be considered feasible as per soil and water conservation works.

429. Kumar, Ambrish; Central Soil & Water Conservation Research & Training Institute. Dehradun (India). Pal, Ram; Central Soil & Water Conservation Research & Training Institute. Dehradun (India). Sharma, H.C.; Central Soil & Water Conservation Research & Training Institute. Dehradun (India). Singh, Ramesh; Central Soil & Water Conservation Research & Training Institute. Dehradun (India). Assessment of non-point source nitrate pollution of groundwater in gangetic alluvial plain using bayesian model. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.75-79 KEYWORDS: ALLUVIAL SOILS. NITRATES. GROUNDWATER TABLE. GROUNDWATER.

Hydro-geological data along with water table and nitrate concentration were collected from 100 observation wells located in Budaun district of Uttar Pradesh in order to assess the groundwater pollution vulnerability of Budaun district lying under Gangetic alluvial plain using Bayesian model. The study area was divided into 43 nodes depending on the similar hydro-geological conditions. The Bayesian weight of evidence model was used for validating the DRASTIC (Depth of groundwater, net Recharge, Aquifer media, Soil media, Topography, Impact of vadose zone and hydraulic Conductivity) factors as tools for developing nitrate vulnerability map of the study area. The accuracy of the DRASTIC results was compared with the observed data of water quality of wells recorded across the district. Analysis revealed that out of 43 nodes, 34 were under very high vulnerable while rest 9 were accounted under high vulnerable zone. This regional scale analysis shows that the DRASTIC model has been a significant potential as a screening tool for planning and decision making in management of groundwater.

430. Meshram, D.T.; College of Technology and Engineering, Rajasthan (India). Mittal, H.K.; College of Technology and Engineering, Rajasthan (India). Gorantiwar, S.D.; College of Technology and Engineering, Rajasthan (India). Reference crop evapotranspiration of western part of Maharashtra, India. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.80-85 KEYWORDS: CROPS. EVAPOTRANSPIRATION. SEMIARID ZONES. MAHARASHTRA.

Reference crop evapotranspiration is a basic parameter required in design of irrigation systems. Six reference crop evapotranspiration methods were studied based on their daily performances under the given climatic condition in the Western part of Maharashtra state. The Penman-Monteith equation standardized by Food and Agricultural Organization (FAO56- PM) was used to compare with the Modified Penman, Hargreaves-Samani, Pan Evaporation, Blaney-Criddle and FAO Radiation methods using meteorological data for 33 years (1975–2007). Performance of these methods was evaluated on the basis of the least root mean square error and regression analysis. Radiation method gave higher values followed by modified Penman, Blaney-Criddle, Pan evaporation, Hargreaves-Samani and Penman- Monteith. Of six methods, Modified Penman gave minimum value of root mean square error and higher correlation coefficient under climatic conditions of Ahmednagar district of Maharashtra.

431. Singh, A.K.; College of Technology and Engineering, Udaipur (India). Department of Soil and Water Engineering. Kothari, Mahesh; College of Technology and Engineering, Udaipur (India). Department of Soil and Water Engineering, Kumar, Virendra; College of Technology and Engineering, Udaipur (India). Department of Soil and Water Engineering. Adhikari, R.N.; College of Technology and Engineering, Udaipur (India). Department of Soil and Water Engineering. Singh, Meenakshi; College of Technology and Engineering,

Udaipur (India). Department of Soil and Water Engineering. Development of a tilting hydraulic flume for runoff and soil loss studies in laboratory. *Indian Journal of Soil Conservation (India)*. (Aug 2010) v.38(2) p.86-88 KEYWORDS: RUNOFF. LOSSES FROM SOIL. HYDRAULIC STRUCTURES.

Concentrated overland flow and percolation are important aspects in the hydraulic process, which affect the soil and nutrient losses through runoff and deep percolation. A tilting flume was installed at CSWCRTI, RC, Bellary (Karnataka) for study of soil erosion, deep drainage and related hydraulic processes. The hydraulic flume can be tilted by adjusting four screw jacks in the range of 0 - 5%. There are equally spaced perforations in flume bed for collecting the deep drainage, and that of runoff and soil loss through equipped measuring units. A water recirculating system with adjustable gate at inlet and outlet was also provided to regulate the discharge in the flume. This tilting flume can be used to study the process of runoff, infiltration, soil loss and nutrient losses under varying discharge, slopes, soil depths, soil types and land management practices. Laboratory studies on runoff, soil loss and percolation with and without a barrier were conducted in vertisol (black soil).

432. Rao, S.S.; Central Arid Zone Research Institute, Pali-Marwar (India). Regional research Station. Regar, P.L.; Central Arid Zone Research Institute, Pali-Marwar (India). Regional research Station. Singh, Y.V.; Central Arid Zone Research Institute, Pali-Marwar (India). Regional research Station. In-situ rainwater conservation practices in sorghum (*Sorghum bicolor*) under rainfed conditions in arid regions. *Indian Journal of Soil Conservation (India)*. (Aug 2010) v.38(2) p.105-110 KEYWORDS: RAINWATER. STORAGE. SORGHUM BICOLOR. ARID ZONES.

A field experiment was conducted during kharif seasons 2003–2005 at Pali, Rajasthan, India to study the effects of rainwater conservation practices in sorghum [*Sorghum bicolor* (L.) Moench] under rainfed conditions. The experiment comprised of a field bunding and no bunding (Control) and four rainwater conservation practices. Sorghum growth and yield attributes significantly increased with adoption of rainwater conservation practices. Field bunding significantly increased mean sorghum grain by 10.5% and stover yield by 10.7% over control in two years. In situ rainwater conservation practices significantly increased sorghum grain and stover yields over control. Inter paired row water harvesting (IPRWH) proved significantly superior over other treatments. Highest mean grain yield of 1320 kg ha⁻¹ and stover yield of 4.71 t ha⁻¹ was recorded with IPRWH and was significantly higher by 63 and 25% over flat bed. Significantly higher harvest index, water use efficiency, net returns and B: C ratio were also observed with IPRWH over other insitu rainwater conservation practices. Field bunding and pair row sowing coupled with in situ rainwater conservation practice found promising for successful cultivation of dual purpose sorghum in this region.

433. Regar, P.L.; Central Arid Zone Research Institute, Pali-Marwar (India). Regional Research Station. Rao, S.S.; Central Arid Zone Research Institute, Pali-Marwar (India). Regional Research Station. Joshi, N.L.; Central Arid Zone Research Institute, Pali-Marwar (India). Regional Research Station. In-situ rainwater conservation practices on productivity of chickpea (*Cicer arietinum*) in the rainfed conditions of arid Rajasthan, India. *Indian Journal of Soil Conservation (India)*. (Aug 2010) v.38(2) p.111-115 KEYWORDS: RAINWATER. STORAGE. PRODUCTIVITY. CICER ARIETINUM. CICER. RAJASTHAN. SOIL WATER. BUNDLING. STRAW MULCHES.

A field experiment was conducted at Central Arid Zone Research Institute, Regional Research Station, Pali-Marwar during winter seasons (rabi) of 1997–98 to 2001–02 to study the effect of bunding, tillage and straw mulch on chickpea yield and water productivity. Field bunding significantly increased mean chickpea grain yield by 18% and biological yield by 14% over no bunding and has attributed to increased availability of soil water in the profile. Water use efficiency increased to 9.1 kg ha⁻¹mm⁻¹ from 8.5 kg ha⁻¹mm⁻¹ over in no bunding. The effect of deep tillage on crop growth and yield varied with total rainfall and its distribution. Deep tillage during intermittent drought period effectively conserved the rainwater and increased the grain yield of chickpea.

Straw mulching @ 5 t ha⁻¹ significantly increased mean grain yield of chickpea by 18% over no mulch with increased water use efficiency by 1.4 kg ha⁻¹mm⁻¹. Field bunding, deep ploughing during monsoon and straw mulching @ 5 t ha⁻¹ after germination during winter is recommended for increased chickpea grain yield and water productivity through in-situ rainwater conservation practices in arid fringes where kharif crop fails.

434. Manivannan, S.; ICAR Research Complex for Goa, Old Goa (India). Rajendran, V.; ICAR Research Complex for Goa, Old Goa (India). Ranghaswami, M.V.; Tamil Nadu Agricultural University, Coimbatore (India). Department of Soil and Water Conservation,. Effect of in-situ moisture conservation measures on fruit and nut quality of cashew (*Anacardium occidentale*) in lateritic soils of Goa. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.116-120 KEYWORDS: MOISTURE CONTENT. STORAGE. FRUIT. NUTS. QUALITY. CASHEWS. ANACARDIUM OCCIDENTALE. ANACARDIUM.

A field experiment was conducted on lateritic soils in hilly region of Goa State to study the effect of different in-situ soil and water conservation measures on quality and production of cashew (*Anacardium occidentale*). The study reveals that an increase of 0.2 to 1.3 g in individual nut weight was due to the effect of in-situ soil and water conservation measures. Continuous contour trenches with live vegetative barriers increased the apple weight by 13.2 g and staggered contour trenches with vegetative barriers increased by 11.3 g as compared to control. An increase in TSS was recorded due to the in-situ soil and water conservation measures, which ranged from 0.90B to 2.90B over control. Continuous contour trenches with live vegetative barriers increased the juice content by 6.7% followed by staggered contour trenches with vegetative barriers (4.4%). The result showed that better quality and yields of nuts and cashew apple could be produced by adopting continuous contour trenches and staggered contour trenches with combination of vegetative barriers.

435. Rana, R.S.; CSK HPKV, Dhaulakuan (India). Hill Agricultural Research & Extension Centre. Gupta, Manoj; CSK HPKV, Dhaulakuan (India). Hill Agricultural Research & Extension Centre. Impact assessment of rainwater harvesting tanks in hilly areas: A case study of NWDPR micro watershed in Himachal Pradesh. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.137-141 KEYWORDS: IMPACT ASSESSMENT. RAINWATER. HARVESTING. WATERSHEDS. HIMACHAL PRADESH.

Off-season vegetable cultivation is a lucrative farming option in Himachal Pradesh. However, lack of irrigation facilities has emerged as the major bottleneck for the expansion of area under off-season vegetable cultivation. Rainwater harvesting remains only feasible option to meet out the minimal irrigation needs of the crops. Various rainwater harvesting mechanisms were tried in NWDPR funded project and successful ones were demonstrated to the farmers in Sarahan watershed in district Sirmour of Himachal Pradesh. By adopting the tomato-garlic crop rotation, the farmers of the watershed could earn up to Rs. 2.50 lakh ha⁻¹ annum⁻¹. With the construction of tanks in the fields itself, the drudgery of farming families in transporting the irrigation water reduced considerably. Comparison on various parameters have shown that silpaulin tanks are most suitable for hilly conditions as they can be constructed with lower initial cost and also offered flexibility on maintenance and longevity aspects. Therefore, rainwater harvesting can become effective technology for uplifting the socio-economic conditions of the hilly population.

P30 Soil Science and Management

436. Rawat, R.S.; Indian Council of Forestry Research and Education, Dehra Dun (India). Kapoor, K.S.; Himalayan Forest Research Institute, Shimla (India). Ecology and Biodiversity Conservation Div. Natural regeneration of *Alnus nitida* Endl. as affected by biotic disturbances in Kullu valley of Himachal Himalayas. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 337-341 KEYWORDS: REGENERATION. STRESS. FLORA. FAUNA. TREES. DENSITY. HIMACHAL PRADESH.

For analyzing the effect of biotic disturbances on natural regeneration of *Alnus nitida* at various locations representing each stratum of the species were surveyed both in disturbed and undisturbed sites across the Solang Nallah - a tributary of river Beas-in the Kullu valley of the Himachal Himalayas. Various parameters considered for the assessment at each site included distribution pattern, species diversity and dominance. Maximum density of trees was recorded on disturbed site compared to the undisturbed site, whereas maximum density of saplings and seedlings was observed in the undisturbed site. The study indicated that the biotic disturbance normally checks/retards the natural regeneration of this fast growing species.

437. Reza, S.K.; NBSS&LUP, Regional Centre, Jorhat (India). Ahmed, Nayan; Indian Agricultural Research Institute. New Delhi (India). Division of Soil Science and Agricultural Chemistry. Pal, Sharmistha; CSWCRTI, Research Centre. Chandigarh (India). Evaluation of pedological development of soils developed on lower reaches of Siwalik hills through field morphology rating system. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.101-104 KEYWORDS: SOIL SCIENCES. PHYSIOGRAPHY. SOIL MORPHOLOGICAL FEATURES.

The field morphology rating scale was used to compare adjacent horizons with each other to give a comparison of the relative distinctness of horizons or to compare horizons in the solam with the C-horizon to give a relative profile development in soils occurring on alluvial landscape of Siwalik Hills. Relative horizon distinctness (RHD) in soil ranged from 1-14. The RHD of young undifferentiated soils varied according to consistence, coarse fragments and the nature of horizon boundary in the solum, whereas the same for older well developed soils varied according to colour, texture, structure and consistence in the profile. Relative profile development (RPD) of the younger soil developed on unstable landforms were low and maximum values were observed in A-horizon, while the values were higher in the soils developed on stable landforms and maximum values were in B-horizon.

P31 Soil Surveys and Mapping

438. Gupta, M.K.; Forest Research Institute, Dehradun (India). Forest Soil Land Reclamation Div. Pandey, R.; Forest Research Institute, Dehradun (India). Soil organic carbon pool under different plantations in some districts of Uttarakhand and Haryana. Indian Journal of Forestry (India). (Sep 2008) v. 31(3) p. 369-374 KEYWORDS: DEFORESTATION. PLANTATIONS. AFFORESTATION. HIMALAYAN REGION.

A study was conducted to estimate the soil organic carbon pool under Eucalyptus, Poplar, Shisham and Teak plantations in Haridwar and Dehra Dun, districts of Uttarakhand and Yamunanagar District of Haryana State. Overall sac pool under Eucalyptus, Shisham and Teak plantations was higher in the study area in Uttarakhand except Poplar plantation where sac pool, in the study area in Haryana was higher. It indicated that soils under Eucalyptus, Shisham and Teak plantations were better enriched by soil organic carbon in Uttarakhand as compared to Haryana. The sac pool in all the plantations in Uttarakhand was statistically different while in Haryana sac pool among Poplar, Eucalyptus and Shisham were non significant. Sac pool in Shisham, Teak and Eucalyptus grown in Uttarakhand was significantly different from similar plantation grown in Haryana. Variations in sac pool in plantation and barren land was also statistically significant in study area of both the states.

P32 Soil Classification and Genesis

439. Das, Pratibha T.; North Eastern Space Applications Centre. Meghalaya (India). Study of the soils of Deepor beel catchment in relation to soil forming factors using remote sensing and GIS. Indian Journal of Soil Conservation (India). (Aug 2010) v.38(2) p.94-100 KEYWORDS: LAND COVER. PHYSIOGRAPHY.

In order to understand the effect of physiographic features, parent material and slope on soil genesis, a detailed investigation was carried out in the soils of deepor Beel

catchment. Eight pedons representing alluvial plain on level to gently slope, highly dissected residual hills on granitic gneiss with moderately steep slope, moderately dissected hills on Grey Porphyritic Granite and granitic gneiss with moderately dissected hills on grey porphyritic granite and granitic gneiss with moderately sloping to moderately steep slope and piedmont area were studied in detail. Soils developed on highly dissected residual hills and moderately dissected hill on granite gneiss are well developed, deep to very deep, well drained, red in color and clay in texture throughout the profile. The soil of hilly region of the study area is Alfisol with udic moisture regime. Alfisols with aquic and udic moisture regime and Inceptisols with aquic moisture regime are found in alluvial plains. About 62.2% area of alluvial plains is Alfisols which is developed in the very gently (1–3%) to gently sloping (38%) foot hills. The soils are very deep, dark reddish brown to reddish yellow in colour, sandy clay texture in surface horizon and clay in subsurface horizons. Presence of mottles in different horizons indicates that the soils are poorly drained. In the alluvial plain, 1361 ha area in Inceptisols that are developed on recent alluvium with level to nearly level slope (01%). The soil of the surface horizon is pale brown, and lower horizons are gray in colour. The soil texture is clay throughout the profile except the lower most horizons which is sandy clay. The soil is poorly drained and saturated with water for a longer period which results in presence of mottles in different horizon of the profiles. Dense forests are found in highly dissected hilly areas. Paddy cultivation is found in the alluvial whereas open forest and scrubs are found in the moderately dissected hills. The soil map units of the study area were grouped into 3 land capability classes (i.e. III, IV and VI) and 7 sub classes. The study shows that maximum area (i.e. 71%) of the catchment is under capability class IV whereas Class III and class VI occupies 20% and 9% of the study area respectively. The major limitation of the study area is topography, wetness and soil texture.

P33 Soil Chemistry and Physics

440. Panda, M.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Dept. of Soil Science and Agril. Chemistry. Sinha, A.K.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Dept. of Soil Science and Agril. Chemistry. Biswas, S.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Krishi Vigayn Kendra. Mukhopadhyay, P.; Uttar Banga Krishi Viswasvidyalaya, Pundibari (India). Dept. of Soil Science and Agril. Chemistry. Different forms of Boron in relation to the properties of some soils of West Bengal. *Journal of Interacademia (India)*. (Jul 2009) v. 13(3) p.260-265 **KEYWORDS:** BORON. SOIL CHEMICAL PHYSICAL PROPERTIES. WEST BENGAL.

Result of the experiment conducted in eight identified soil series of Puruliya and Coochbehar in the state of West Bengal to study the influence of relative proportion of Boron fractions on its availability revealed that the readily soluble fraction, being the most labile form and constituted of solution plus adsorbed B exhibited the least (3.6%) out of the cumulated average of four form of boron, while the oxide bound accounted for the maximum (47.5). The pH, organic carbon content of the soils influenced the readily soluble B, specifically adsorbed B, organically bound boron, and oxide bound boron.

441. Banerjee, Tapati; NBSS & LUP, Regional Centre, Kolkata (India). Dutta, D.; NBSS & LUP, Regional Centre, Kolkata (India). Sarkar, Deepak; NBSS & LUP, Regional Centre, Kolkata (India). Das, Debabrata; NBSS & LUP, Regional Centre, Kolkata (India). Soil moisture based crop planning for farmers' land - A case study from Silai subwatershed of West Bengal. *Indian Journal of Soil Conservation (India)*. (Aug 2010) v.38(2) p.89-93 **KEYWORDS:** PLANT PRODUCTION. GROWTH PERIOD. SOIL WATER CONTENT.

Soil moisture studies were done in farmers' land of Silai subwatershed for better crop planning. The watershed lies in rainfed area and monocrop is practiced which can be changed by introducing some other crops using residual soil moisture. Based on soil profile moisture in different landforms length of growing period was calculated as 145–155 days, 150–160 days, 155–165 days and 170–180 days in tanr, baid, kanali and bahal lands respectively. Accordingly the crop planning has been suggested with suitable varieties in the respective landforms.

P34 Soil Biology

442. Kumar, J.; Sampurnanand Sanskrit University, Varanasi (India). Dept. of Science. Litter production in two age groups of nitrogen fixing *Acacia auriculiformis* A. Cunn. Ex. Benth plantations. *Indian Journal of Forestry (India)*. (Sep 2008) v. 31(3) p. 329-335
KEYWORDS: ACACIA. CYCLING. NITROGEN FIXATION. FORESTATION.

In a forest ecosystem, nutrient storage and cycling are effectively balanced by long-term retention in the bole and short-term retention in the twig and leaf. There is a continuous release of nutrients into the soil by the decomposition of fallen litter. Litter production of forest floor is the result of fall of leaves either seasonally or continuous throughout the annual cycle. Periodic collection and quantification of different litter components of 3 years old (Site I) and 6 years old (Site II) monoculture plantations of *Acacia auriculiformis* have been carried out at Varanasi for two consecutive years. The litter has been separated into phyllode, twig+wood and .c fruit+inflorescence. The Site I had 5.27 to 6.80 t ha⁻¹yr⁻¹ of which phyllode contributed 72 to 78% and at Site II it was 9.56 to 11.78t ha⁻¹yr⁻¹ where phyllode account for 75-78%.

P35 Soil Fertility

443. Singh, Rajesh Kumar; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences, Department of Agronomy. Singh, Y.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences, Department of Agronomy. Singh, Amitesh Kumar; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences, Department of Agronomy. Kumar, Rakesh; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences, Department of Agronomy. Singh, V.K.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences, Department of Agronomy,. Productivity and economics of mustard (*Brassica juncea*) varieties as influenced by different fertility levels under late sown condition. *Indian Journal of Soil Conservation (India)*. (Aug 2010) v.38(2) p.121-124
KEYWORDS: FERTILITY. MUSTARD. BRASSICA JUNCEA. VARIETIES.

A field experiment was carried out at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP) during rabi season of 2007 and 2008 to study the fertility levels on performance of Indian mustard under late sown condition. The treatments were comprised of four fertility levels viz; 75% RDF (F1), 100% RDF (F2), 125% RDF (F3), and 150% RDF (F4), where RDF was 80, 40, 30 kg N,P, K and ha⁻¹ in main plot and five varieties viz; 'Kranti' (V1), 'Vardan' (V2), 'Varuna' (V3), 'NRCHB-101' (V4), and 'Ashirwad' (V5), insplit plot design with three replications. Plant height, number of leaves, dry matter, leaf area index and chlorophyll content and branches plant⁻¹ were increased with increasing fertility levels. Treatment with 150% RDF (F4) which was significantly superior but closely followed by 125% RDF (F3), 100% RDF (F2) and 75% RDF (F1). Among the varieties 'NRCHB-101' (V4) performed significantly better growth, yield parameters and yield of mastard which was significantly superior to other varieties except 'Ashirwad' (V5).

P40 Meteorology and Climatology

444. Jat, M.L.; Maharana Pratap University of Agriculture and Technology, Dryland Farming Research Station, Rajasthan (India). Sammauria, R.; Maharana Pratap University of Agriculture and Technology, Dryland Farming Research Station, Rajasthan (India). Balyan, J.K.; Maharana Pratap University of Agriculture and Technology, Dryland Farming Research Station, Rajasthan (India). Sharma, R.K.; Maharana Pratap University of Agriculture and Technology, Dryland Farming Research Station, Rajasthan (India). Crop planning in semi arid tracts of Udaipur region based on analysis of weekly rainfall. *Indian Journal of Soil Conservation (India)*. (Aug 2010) v.38(2) p.69-74
KEYWORDS: FORECASTING. RAIN. PLANT PRODUCTION.

Analysis of rainfall offers a better scope for predicting the minimum assured rainfall helping in crop planning in rainfed regions. Incomplete gamma distribution is used to predict the minimum assured rainfall at different probabilities of exceedence in all weeks of the whole year. The study reveals that chances of drought are more at critical stages of maize but there is a scope for in-situ moisture conservation and runoff collection in tanks for supplemental irrigation. Rabi crops are found to be grown under moisture stress.

Q70 Processing of Agricultural Wastes

445. Barik, T.; Orissa University of Agriculture and Technology. Bhubaneswar (India). Barik, K.C.; Orissa University of Agriculture and Technology. Bhubaneswar (India). Vermicomposting practices for its quality maintenance. Indian Farming (India). Mar 2009 v.58(12) p.22-25 KEYWORDS: COMPOSTING. VERMICULTURE.

For maintained of proper quality of vermicompost half of partly decomposed dung (by weight) and half of organic substrates should be used. The substrates should contain around 5% by weight of leguminous plant material. Tank should not be exposed to direct sunlight or rain water. Forty to 60% moisture is maintained in the tanks. There should be provision for drainage of excess water. Over dumping may kill the worms. Over dumping and addition of non-veg material may develop foul odour which are to be avoided. Proper mixing of the substrates is done at an interval of one month to check if the worms are well inside and the lower parting is well ventilated. After harvesting and separation of worms, drying the quality of the growth promoting hormones and microorganisms present in it.

T01 Pollution

446. Chatterjee, T.; University of Burdwan, Burdwan (India). Dept. of Environmental Science. Das, S.; University of Burdwan, Burdwan (India). Dept. of Environmental Science. Gupta, S.; University of Burdwan, Burdwan (India). Dept. of Environmental Science. Comparative physico-chemical characterization of fly ash from two different coal fired power station in West Bengal. Journal of Interacademia (India). (Jul 2009) v. 13(3) p.266-272 KEYWORDS: POLLUTION. FLY ASH. CHEMICO-PHYSICAL PROPERTIES. COAL.

In India annually around 60 million tones of fly ash is being produced by thermal power plants located at different places huge quantity of fly ash product in thermal power plant station not only pollutes the environment. Its disposal and storage are also a problem. Fly ash as a soil amendment to field crop has been reported. Safe disposal and fruitful utilization of fly ash is yet to be achieved. In this context, two types of fly ash collected from Kolaghat Thermal Power Plant and Durgapur Project Limited, West Bengal, India, and their chemical characterization have been carried out. Between the two types (i.e. black and white) black type has higher concentration of organic matter, low bulk density, moderate pH, potassium and phosphate. From the chemical characterization, it can be suggested that admixing of different ratios of fly ash such as 5, 10, 20 and 25 with wasteland soil may alter non-productive wasteland soil into a productive one.

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