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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) Dairysoft: A computer programme for dairy farms. Indian Journal of Animal Sciences (India). (Mar 2006).v. 76(3) p. 260-262 KEYWORDS: DAIRY FARMS; COMPUTER SOFTWARE

2 → Paul, P.R.C.; Xavier, F.; Leena, A.

3 → Dairysoft: A computer programme for dairy farms.

4 → Indian Journal of Animal Sciences (India). (Mar 2006).v. 76(3) p. 260-262

5 → KEYWORDS: DAIRY FARMS; COMPUTER SOFTWARE

6 → (College of Veterinary and Animal Sciences, Trissur (India), Department, of Livestock Production Management)

To exploit the full potential of dairy sector, a computerizd 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

E10 Agricultural Economics And Policies

188. Garg, S.K.; College of Agriculture, Gwalior (India). Dept. of Extension. Badodiya, S.K.; College of Agriculture, Gwalior (India). Dept. of Extension). Shakya, S.K.; College of Agriculture, Gwalior (India). Dept. of Extension). Credit utilization through farmers' service society. Annals of Biology (India). (Dec 2010). v.26(2) p.183-186. KEYWORDS: CREDIT. FARMERS.

The study was conducted in the area of Farmers' Service Society of Gwalior district. The Gwalior district comprises four blocks, namely, Morar, Dabra, Bhitarwar and Ghatigaon. Six villages of each selected block were selected because these villages having Farmers' Service Society and five members of each selected village were selected randomly for the study. Thus, the sample comprised 120 members for the study. The study revealed that overall majority of 60.00% of respondents had complete knowledge about credit facilities 78.33% respondents used the society workers/employees as information source. 65.00% of the respondents used the credit for purchasing of seeds and fertilizers and the majority of the members (80.00%) suggested that finance should be made to society through the commercial banks for timely availability of seed and fertilizers.

189. Singh, Jitendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Deparment of Agricultural Economics. Saxena, H.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Deparment of Agricultural Economics. Singh, G.P.; SMMT PG College, Ballia (India). Deparment of Agricultural Economics. An economic analysis of sugarcane based cropping system in eastern plains of Uttar Pradesh. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.1-11 KEYWORDS: ECONOMIC ANALYSIS. CROPPING SYSTEMS. UTTAR PRADESH. SUGARCANE. SACCHARUM OFFICINARUM. COST BENEFIT ANALYSIS.

The present study was conducted in Faizabad district of U.P., during the year 2000-01, which revealed that the average size of holding was about 3.06 ha in the outside area as compared to 2.73 ha in the command area of sugar factories. The cropping pattern in the outside area was similar to that in the command area with a slight variation in Zaid season where maize replaced urd. The costs and returns showed that larger farm invests were more in case of sugarcane planted particularly in the command area of sugar factories. The returns from sugarcane planted were increasing with the increase in the size of farms in the command area of the sugar factories. The returns from sugarcane planted on the farms in outside area of sugar factories were much lower than on the farms in command area. On the medium farms, average command area of sugar factories related to contribution of employment days of all the crops taken for the study was higher. Thus, the command area was more employment generating in case of all the crops on the same farm size group. In the outside area of sugar factories the employment days were found increasing with the increase in the size group of farms in case of all the crops except ratoon. It was also observed during study period that the generation of family labour days was higher in outside area. The per farm analysis showed that paddy, sugarcane and wheat were such crops which generated maximum employment days on the larger farms in the command area. In outside area, same pattern of employment generation was also noticed in all the crops under study. Agriculture sector was the prime contributor to employment days in the command area. However, in outside area of sugar factories too, the same trend of employment generation was also there in the area under study. The present study suggests that the number of sugar factories must be installed in the area under study by the government. The extension agencies of the state government should arrange for their timely supply of seeds of suitable varieties to the concerned sugar factories.

190. Mittal, Rashi; G.B. pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Singh, S.P.; G.B. pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Economics of Lemongrass (Cymbopogon fluxuosus) cultivation, value addition and its

financial feasibility in the state of Uttarakhand. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.12-18 KEYWORDS: FEASIBILITY STUDIES. DRUG PLANTS. ECONOMICS. CYMBOPOGON. VALUE ADDED. CYMBOPOGON CITRATUS. TRADITIONAL MEDICINES.

The present study aims at examining the economics of cultivation of Lemongrass and its value added products and to study its financial feasibility. The study revealed that the per hectare cost of cultivation of Lemongrass was Rs. 75742 during first year and Rs. 29957, Rs. 30794, Rs, 32336 and Rs. 33170 in II, III, IV and IV year respectively. It indicates that the crop is highly capital intensive. The total cost of extraction of oil (cost of cultivation plus processing cost) accounted to Rs.87482 in the I year followed by Rs.46951, Rs.49569, Rs.51906, and Rs.50246 in the II, III, IV and V year respectively. The analysis of returns revealed that in the first year the crop had negative returns of Rs.(-)33402 per hectare over the cost of cultivation and Rs.(-)9956 over the cost of extraction of oil. The value addition due to oil extraction over the herbage was Rs.23446 during first year and varied within a range of Rs.32098 to Rs.34836 in subsequent years. The results on the production of lemongrass oil indicate that the investment in lemongrass is financially feasible.

191. Rawat, Ruchi; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Tewari, S.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Shukla, A.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Awareness of institutional credit and insurance programmes in Uttarakhand. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.1-6 KEYWORDS: CREDIT. INSURANCE. HIGHLANDS.

The study conducted in Chamba block of Tehri Garhwal district and Takula block of Almora district in Uttarakhand was based on data collected from 130 farmers for the agricultural year 2000-01 to 2005-06. The study aims at examining the extent of non-participation of farmers in formal agricultural credit and insurance programmes. Extent of non-participation in credit programme in Garhwal region (63.14 per cent) was found to be lower than in Kumaon region (70.37 per cent). Overall 67 per cent farmers were still out of fold of institutional credit programme. In the Garhwal region, around 50 per cent farmers were without any insurance while in Garhwal region this per centage was 46.15 per cent. Lack of awareness, complicated procedure, untimely assistance, improper input supply system and risk are reported to be major reasons for non-participation in institutional agricultural credit and insurance programmes.

E12 Labour and Employment

192. Shakya, S.K.; College of Agriculture, Gwalior (India). Dept. of Extension. Badodiya, S.K.; College of Agriculture, Gwalior (India). Dept. of Extension. Garg, S.K.; College of Agriculture, Gwalior (India). Dept. of Extension. Daipuria, O.P.; College of Agriculture, Gwalior (India). Dept. of Extension. Entrepreneurial and adoption behaviour of sugarcane growers. Annals of Biology (India). (Dec 2010) v.26(2) p.179-182 KEYWORDS: FARMERS. SUGARCANE. BEHAVIOUR.

Sugarcane is a very important cash crop of India and it plays a greater role in economic development. The present study was conducted in Dabra block of Gwalior district of M.P. The total sample consisted of 120 respondents spread over 10 villages of the block. Data were collected with the help of structured interview schedule. The majority 67.50% of the small, medium and large farmers had medium level of entrepreneurial behaviour and majority (54.17%) of the. sugarcane growers had medium adoption behaviour category. Out of 11 independent variables, nine variables viz., education, farming experiences, area under sugarcane, annual income, farm mechanization, information source utilization, mass media exposure, cosmopolitanness and knowledge about sugarcane production technology were found positive and significant relationship with the entrepreneurial behaviour of sugarcane growers.

193. Singh, G.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Singh, Jitendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Singh, S.K.; U.P. College, Varanasi (India). Department of Agricultural Economics. Income and employment structure on tribes and non- tribes farms in Vindhayan zone of Uttar Pradesh. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.7-12 KEYWORDS: INCOME. EMPLOYMENT. ETHNIC GROUPS. UTTAR PRADESH. RURAL DEVELOPMENT.

The study was aimed at working out the income and employment structure of tribes and non-tribes farms in Vindhayan zone of Uttar Pradesh. The data pertained to the agricultural year 2003-04. The study reveals that the crop income of non-tribes farm was 16 per cent which was more than the tribes farm as (7 per cent only). The total annual income from different sources of non-tribes farmers was Rs.84798 per farm which was higher than that tribes farmer (Rs.64076 per farm per annum). The milch animal contributed 42 per cent of total annual income followed by wage income (17 per cent) and crop income (16 per cent) on non-tribes farm. While wages labour was major sources of income on tribes farm and it is shows about 36 per cent of total annual income followed by milch animal (32 per cent) and piggeries (18 per cent). The main source of employment of non-tribes farmers was livestock rearing being 44 per cent (milch animal+goat+pig) followed by wage labour (31 per cent) and crop (17 per cent), while in the case of tribes farm, the major employment source were rearing of pig (39 per cent) followed by wage labour (37 per cent) and milch animal (14 per cent). Interestingly the non-crop income is dominating on both types farm due to poor productivity of crops and it was further limited by a number of biophysical and socio-economic situations prevailed in the study area. Efforts may be initiated to improve the productivity of various crops being cultivated by the farmers on sample farms by introducing the dry farming practices and use of moisture deficit crops such as pulses and oilseeds.

E14 Development Economics And Policies

194. Lal, B. Sinha; T.K. Kumar, T.K.; Pandit, Anil; Pandey, A. Constraints perceived by the farmers in adoption of potato technology. Potato Journal (India). (Jan 2011) v.38(1) p.73-77 KEYWORDS: CONSTRAINTS. FARMERS. TECHNOLOGY. POTATOES.

A study was conducted in Nalanda, Muzaffarpur and Patna districts of Bihar state on 270 randomly selected potato growers to assess the constraints perceived by them in adoption of potato technology. It was found that involvement of middle man, cheating by the traders, low sale price of potato, shortage of electricity, gluts, poor quality and adulterated fungicides, lack of cold storage facilities, low risk bearing ability of the potato framers, lack of motivation from SDA and State Department of Horticulture and unavailability of good quality potato seed to the farmers were the most serious constraints.

195. Manas, D.; G.B. pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Singh, S.P.; G.B. pant University of Agriculture and Technology, Pantnagar (India). Department of Agricultural Economics. Value addition processes and constraints in house hold production of bamboo products. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.19-22 KEYWORDS: VALUE ADDITION. CONSTRAINTS. HOUSEHOLDS. BAMBOOS. PLANT PRODUCTS. SOCIOECONOMIC DEVELOPMENT.

Kerala is a major diversity center of bamboo having 25 species spread over 57,000 hectares of area and about three lakh people depend on bamboo for their livelihood. Various value added products in the household production are baskets, winnowers, mats, stool etc. and their weaving is a traditional occupation of certain schedule caste and tribes. The study revealed that from an average sized bamboo culm with an average price of Rs.100, five large baskets or ten winnowers or one mat or one stool can be made. The net value addition per unit occurred for big baskets, winnower,

mats and stool were Rs.8, 6, 50 and 65 respectively. It was found that the major problem being faced by bamboo weaving families was unavailability of raw material. Unorganized marketing system, high cost of raw material, labour intensiveness, lack of remuneration and low social acceptability were the other important problems. Hence, efforts need to be made for promoting intensive cultivation and application of underutilized and valuable species. Development of an organized market is also very urgent. Technology intervention should be enhanced in value addition processes to make them competitive in the market by improving quality and productivity.

E16 Production Economics

196. Minhas, J.S.; Central Potato Research Institute, Shimla (India). Rawat, S.; Central Potato Research Institute, Shimla (India). Govindakrishnan, P.M.; Central Potato Research Institute, Shimla (India). Kumar, D.; Central Potato Research Institute Campus, Modipuram (India). Possibilities of enhancing potato production in non-traditional areas. Potato Journal (India). (Jan 2011) v.38(1) p.14-17. KEYWORDS: POTATOES. TUBERS. CLIMATE. WARM SEASON.

Potato cultivation is limited to relatively cooler areas and seasons throughout the world due to photo and thermo-sensitivity of the crop. Attempts to take potato to warmer areas have resulted in drastic reduction in tuber yield or even failure of tuberization. The mean night temperature in large parts of peninsular India are between 18–20°C and climate change is likely to lead to an overall temperature increase of 1–1.5°C, therefore, heat tolerant varieties which can tuberize and bulk well up to 20°C night temperature are needed for these areas. CPRI has developed a heat tolerant variety Kufri Surya. In the present study, potential areas for the deployment of this variety were identified by weather simulation studies. Sixteen locations in non-traditional potato growing areas of peninsular India were selected and an estimate of the available number of days in a year suitable for potato crop at different night temperature scenarios, viz. 18, 20 and 22°C were simulated. The results showed that heat tolerant varieties having 2–4°C advantage for tuberization were suitable for more number of locations and could grow for a longer duration as compared to existing high yielding varieties.

197. Pandit, Arun; Central Rice Research Institute, Cuttack (India). Chandran, K.P.; Hewlett Packard, Bangalore (India). Forecasting and Operations Research QAO-CSD. Growth of potato production in India: A Non-parametric analysis of time series data. Potato Journal (India). (Jan 2011) v.38(1) p.32-40 KEYWORDS: POTATOES. PRODUCTION. GROWTH. INDIA. OPTIMIZATION METHODS.

Growth rates of area, production and yield of potato in India including its major producing states were estimated. Kernel Weighted Local Linear Regression Smoother, a non-parametric regression technique was used for this purpose. The temporal and spatial structural changes of cost of cultivation and remunerativeness of potato cultivation were also analyzed. During the last 58 years, overall potato yield grew 1.5% at national level. After achieving spectacular growth during the seventies, the yield growth started to decline and in the recent past it became negative. Production also behaved similarly and reached a plateau. Cost of cultivation increased over the years. Farm harvest prices fluctuated greatly over the years leading to uncertainty of return from potato cultivation. During the last decade, share of seed in total cost of cultivation decreased in UP and Bihar and that of manure-fertilizers and machinery increased in all the states. Though the Himachal farmers received consistent good return over the years but West Bengal, UP and Bihar farmers incurred losses in many years when all the costs were considered. There is an immediate need to arrest the declining trend of yield. Concerted efforts to develop high yielding varieties with multiple disease-pest resistance, better post-harvest management technologies like latest innovative tools of biotechnology, agri-business, etc should be adopted to make potato cultivation a profitable enterprise.

198. Kushwah,V.S.; Central Potato Research Station, Gwalior (India). Singh, S.P.; Central Potato Research Station, Gwalior (India). Relative performance of low input and high input technology for potato production in India. Potato Journal (India). (Jan 2011). v.38(1) p.56-60 KEYWORDS: LOW INPUT AGRICULTURE. INPUT OUTPUT ANALYSIS. TECHNOLOGY. PRODUCTION. POTATOES.

The energy analysis at CPRS, Jalandhar farm revealed that among the various operations, irrigation consumed the maximum amount of energy, i.e. 6622.12 MJ/ha (44.4%) followed by seedbed preparation 3192.84 MJ/ha (21.4%). Total operation wise energy consumption for potato production was found to be 14902.77 MJ/ha. Amongst the indirect energy sources, the energy input derived through the seed material was maximum, i.e. 16320 MJ/ha (36.05%). Fertilizer contributed the next major share of energy input, i.e. 10870 MJ/ha (24.01%). The total energy requirement for potato production under mechanized system from all the sources including the direct and indirect sources was 45262.98 MJ/ha. Average output energy from potato was 62983.6 MJ/ha. The output to input energy ratio and average specific energy requirement for the crop was observed to be 1.4 and 2.6 MJ/kg, respectively.

E50 Rural Sociology and Social Security

199. Singh, Pratibha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Home Science Extension. Tewari, Poonam; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Sunita Rani; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Socio-economic status of rural households in Kumaon region of Uttarakhand. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.146-150 KEYWORDS: SOCIOECONOMIC ORGANIZATION. RURAL DEVELOPMENT. HOUSEHOLDS. SOCIOECONOMIC DEVELOPMENT.

A study was undertaken in two adjoining districts i.e. U.S.Nagar and Nainital to know the socio economic status of rural families. Out of these two districts one village was selected from hill area and four villages were from plain. The results showed that majority of the houses were pucca and more than 50% families belonged to upper caste. Main occupation of the families was agriculture, all villages had school, temple and semi-pucca roads and most of the families had electricity in their houses. Medium size families were more common in villages.

E80 Home Economics, Industies and Crafts

200. Deepa Vinay; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Chaudhary, Nidhi; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Importance of Ergonomics at Household Level: A Participatory Approach. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.139-143. KEYWORDS: ERGONOMICS. HOUSEHOLDS. ROLE OF WOMEN. HOME ECONOMICS.

It is beyond doubt that kitchen activities demand a high degree of physical effort, leading to fatigue. The major causative factors responsible for this are the static muscular effort and adopting unnatural postures, mainly resulting from bad design of kitchen layout. A standardization module in the form of flap book was developed for imparting training to housewives. Concept of ergonomics, ergonomic approach to workstation design, importance and contribution of ergonomics in work station design, importance and use of anthropometry, musculo-skeletal problems in standing, work surface dimension for standing kitchen and finally recommendation for different workstation designs along with right posture were included in the module. The reliability index for the same was calculated to 0.71. Results of pre-exposure of the knowledge tool revealed that most of the respondents (56.66 %) lie in the low level of knowledge category. They were not aware about the concept and role of ergonomics. Although all the respondents complained about musculo-skeletal disorders but they were unaware

about the hidden cause of musculo-skeletal disorders. When they were exposed to the developed training module it was found that knowledge level of all the respondents increased and 100 per cent respondents reached high level of knowledge category. The scores of retention of knowledge after 15 days of exposure to training media showed that 86.67 per cent had a high level of retention of knowledge. A significant relationship was also found in pre and post tests score.

201. Singh, Poonam; C.S. Azad University of Agriculture and Technology, Kanpur (India). Department of Family Resource Management. Chaurasia, Ranjana; C.S. Azad University of Agriculture and Technology, Kanpur (India). Department of Family Resource Management. Postural profile and work stress in leather shoe industry workers engaged in moulding and stitching. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.144-147. KEYWORDS: MOULDING. LEATHER INDUSTRY. WORKING CONDITIONS. OCCUPATIONAL HAZARDS.

Postural profile and work stress of 100 workers engaged in moulding and stitching activities in a shoe-manufacturing unit of Kanpur were studied using observation technique. Workers spent a total of 8 hours 30 minutes working in the factory. Average time spent by moulding and stitching workers in a neck and shoulder posture, tense due to work, was 3 hours 50 minutes and 3 hours 40 minutes, respectively. Both the groups spent 6 hours 20 minutes with their legs in a poorly supported or unstable position. The back of the workers engaged in stitching remained in a stooped position for 5 hours 15 minutes. The position of elbow, with arms in tense or joints in an extreme position, of moulding and stitching workers, remained for 4 hours 35 minutes and 4 hours 30 minutes, respectively. Moulding involved much work above shoulder height, with the elbow(s) near/above shoulder height, just below elbow height, in the non-straight wrist position, involving standing and mechanical stresses. Stitching required much work in non-straight wrist position and involving mechanical stresses, bending and sitting. Moulding with a stress score of 47.2 proved much strenuous than stitching, having a stress score of 30.5 only. Workers' own perception of exertion too was higher under moulding.

202. Kashyap, Shewanti N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Sharma, P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. To study the satisfaction derived by the inmates from different categories of houses of Pantnagar. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.148-152 KEYWORDS: HOUSING. LIVING STANDARDS. HEART RATE.

Housing providers appear to agree over the importance of accountability to tenants and users, and believe that they should adjust their strategies and day-to-day practices to take account of such measures of performance. However, there is less certainty or consensus over how to do this. The complexity of attitudes and the variety of factors involved make measuring housing satisfaction a difficult task. Hence a satisfaction scale was developed. This scale concentrates on the underlying principles of developing a scale to assess satisfaction derived by the inmates from different categories of house (i.e., one-room, two-room and three-room) in Pantnagar campus. It was observed that majority of the respondents were satisfied with different areas and parts of living room, bedroom, dining room, kitchen and bathroom. The physiological cost of activities done in using sink in the kitchen was highest followed by ventilators and windows. The energy expenditure was highest (7.02 k.cal./minute) for performing activities in sink in the kitchen, while lowest in shelves of the room (5.4 k.cal./minute).

203. Singh, Poonam; C.S. Azad University of Agriculture and Technology, Kanpur (India). Department of Family Resource Management Chaurasia, Ranjana; C.S. Azad University of Agriculture and Technology, Kanpur (India). Department of Family Resource Management. Working conditions and job satisfaction of leather shoe industry workers of Kanpur. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.153-

157 KEYWORDS: UTTAR PRADESH. WORKING CONDITIONS. WORK SATISFACTION. LEATHER INDUSTRY.

A study of a leather shoe manufacturing unit at Kanpur revealed that most of the moulding workers (48%) were employed on daily wages and stitching workers (64%) on contract, with 24 per cent, under both the trades, on permanent basis. Working days per month ranged between 22-27 for 64 per cent of moulding and 76 per cent of stitching workers followed by 19-22 for 30 and 24 per cent workers in respective trades. Working hours per day were 8.5, with a single rest interval of 30 minutes. For most of the moulding workers (88%), wages were based on duration of work and for stitching (64%) quantum of work. Reverse was true for 12 per cent moulding and 35 per cent stitching workers. All the workers worked overtime Rs. 9.0 per hour and received bonus. Permanent workers had the benefit of casual, earned, and medical leave and were provided with provident fund, family pension, and group insurance. Factory premises were properly planned, kept neat, white washed annually had low humidity, sufficient light, proper ventilation, water supply and were used as work floor only. On the negative side, premises had high temperature, insufficient light for stitching, intolerable noise level, congestion and only one toilet for all the workers. Most of the moulding (60%) and stitching (50%) workers perceived their job as routine, with only 20 and 28 per cent, under respective trades, feeling satisfied. Most of them rated their management motivating (40% moulding and 30% stitching)/satisfactory (32 and 38%) but found their remuneration, opportunities for promotion, treatment from the supervisors and working conditions below par or plain workable. Most of the workers (30% moulding and 50 per cent stitching) perceived their colleagues as responsible and some (28 and 12% under respective trades) as intelligent.

204. Singh, Poonam; C.S. Azad University of Agriculture and Technology, Kanpur (India). Department of Family Resource Management Chaurasia, Ranjan; C.S. Azad University of Agriculture and Technology, Kanpur (India). Department of Family Resource Management. Musculo-skeletal and health problems of workers in a leather shoe manufacturing unit. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.139-142 KEYWORDS: MUSCULAR DISEASES. BONE DISEASES. HEALTH HAZARDS. LEATHER INDUSTRY. OCCUPATIONAL HAZARDS.

Musculo-skeletal and health problems of 100 workers engaged in moulding and stitching activities, in a shoe manufacturing unit, were studied using survey, observation and body map technique. Majority of the moulding workers reported severe pain in eyes, neck, shoulder joint, upper arm, lower arm and ankle/feet, whereas majority of stitching workers reported severe pain in eyes, neck, shoulder joint, lower arm, lower back, hand/wrist, buttock, upper leg/thigh and ankle/feet. Seventy-eight per cent problems in moulding and 80 per cent in stitching workers emerged during industry association. Over half of the workers engaged in both types of activities reported the problem of ruptured discs in neck and back. The reason behind these problems was found to be the number of hours spent in wrong posture. Only 40 per cent workers in moulding and 14 per cent in stitching work took medical treatment, that too on non-company cost.

205. Rana, Bindu; G. B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Foods and Nutrition Shukla, Pushpa; G. B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Foods and Nutrition. Dwivedi, Reeta; The Maharaja Sayajirao University of Baroda, Baroda (India). Department of Foods and Nutrition. Sensory and nutritional evaluation of high fibre sprouted oat chapatti. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.143-145 KEYWORDS: AVENA SATIVA. ORGANOLEPTIC ANALYSIS. OATS. NUTRITIONAL STATUS. SPROUTING. DIETARY FIBRES.

Oat contains soluble dietary fibre. It is easy to sprout and increases nutritive value. The present study was based on development of high fibre sprouted oat flour and incorporation of sprouted oat flour in chapatti at different levels. Nutritional and sensory qualities of developed chapatti were evaluated. The nutritional analysis of chapatti

revealed that soluble fibre, insoluble fibre and protein contents ranged from 12.68 to 12.88 per cent, 11.69 to 12.10 per cent and 6.78 to 8.13 per cent, respectively. Iron and calcium contents ranged from 1.51 to 1.93 and 15.63 to 15.87 mg/100g, respectively. The sensory evaluation of chapatti at different levels of incorporation of sprouted oat flour revealed that chapatti was acceptable at 25 or less than 25 per cent level and sensory scores ranged from 6.43 to 7.1.

206. Bisht, Lata Rani; G.B. Pant University of Agriculture and Technology, Pantnagar (india). Department of Foods and Nutrition Kulshrestha, Kalpana; G.B. Pant University of Agriculture and Technology, Pantnagar (india). Department of Foods and Nutrition Kushwaha, Archana; G.B. Pant University of Agriculture and Technology, Pantnagar (india). Department of Foods and Nutrition. Microbiological quality of fresh fruit and vegetable juices sold in mobile carts. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.101-104 KEYWORDS: QUALITY. VEGETABLE JUICES. MICROBIOLOGY. MOBILE UNITS. STREET FOODS. MICROBIOLOGICAL ANALYSIS. FRUITS.

Freshly squeezed juices of fruits and vegetables, sold in mobile carts were analyzed for their microbiological qualities. The sample of ingredients viz. peeled carrot, beet root, pineapple, pomegranate, mausami, tomato and aonla and the juices viz., carrot, pineapple, pomegranate and mausami juice were collected periodically and analyzed for total plate count (TPC), total coliform count (TCC) and yeast and mould count (YMC) by using standard pour plate method. The high microbial count was found in juices as compared to peeled fruits and vegetables. The swab samples from hand, serving glass, cutting board and machine wash had high TPC and TCC which showed poor personal hygiene and cleaning practices followed in mobile fruit juice units. The sample of ice and water used for washing utensils, fruits and vegetables were analyzed and it was found that all the samples contained high microbial load and were not potable to use indicating freshly prepared juices are unsafe for most of the population as they carry risk for various disease outbreaks.

207. Gupta, Sakshi; CSKHPKV, Palampur (India). Department of Food Science and Nutrition. Sood, Sangeeta; CSKHPKV, Palampur (India). Department of Food Science and Nutrition. Singh, Nageswar; CSKHPKV, Palampur (India). Department of Chemistry and Biochemistry. Gupta, Minakshi; CSKHPKV, Palampur (India). Department of Chemistry and Biochemistry. Effect of Neelkanthi (Ajuga bracteosa) and Plakhar (Ficus lacor) on physical work capacity of diabetic subjects. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.105-108 KEYWORDS: PHYSICAL ACTIVITY. DIABETES. FICUS. AJUGA. DRUG PLANTS. FOODS. HEALTH.

In the present study an attempt has been made to determine the efficacy of two medicinal plant species i.e. Neelkanthi (Ajuga bracteosa) and Plakhar (Ficus lacor) on physical work capacity of diabetic subjects by using Harvard step test. It was observed that average physical fitness index of all the subjects improved after putting on standard diet and supplementation with certain plant species viz. Neelkanthi and Plakhar for a period of three weeks The average rapid fitness index increased from 31.9 to 42.7 after three weeks which showed improvement in their physical work capacity through changing exercise time from 2.15 minutes at initial stage to 2.80 minutes. After three weeks, pulse rate decreased from 89 to 87 beats per minute. Physical fitness of all the subjects was poor at initial level but after 21 days the subjects attained the average fitness category.

208. Sunita Rani; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Department of Home Science Extension. Varma, Shashi Kanta; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Department of Home Science Extension. Involvement of men and women in agricultural operations in Haryana. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.109-114 KEYWORDS: AGRICULTURAL WORKERS. SOCIOECONOMIC DEVELOPMENT. HARYANA. RURAL DEVELOPMENT. AGRICULTURAL EXTENSION. ROLE OF WOMEN.

Women play a significant and crucial role in agricultural development of a country. The nature and extent of women's involvement in agriculture vary greatly from region to region, even with in a region, their involvement varies widely among different ecological sub zones, farming systems, castes, classes and socio-economic status of families. Therefore the present study was conducted to study the nature and extent of involvement of rural women and men in agriculture in terms of operations and time spent and to isolate the correlates of involvement in agriculture operations. The results regarding involvement of women in mustard cultivation, household and animal husbandry activities reveal that women devoted more time than men. In case of men, women and pooled sample, the variables viz., caste, family education, land holding and socio-economic status was found to be significant but negatively correlated.

209. Singh, Kanchan; C.C.S. Haryana Agriculture University, Hissar (India). Department of Foods and Nutrition. Khetrapaul, Neelam; C.C.S. Haryana Agriculture University, Hissar (India). Department of Foods and Nutrition. Development of baked and boiled products using guar gum. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.131-133 KEYWORDS: BAKING. BOILING. FOODS. GUAR GUM. FOOD INDUSTRY. NUTRITIVE VALUE. NUTRITIONAL STATUS. BISCUITS.

210. Nirmal Kaur; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Sharma, Promila; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Family Resource Management. Accidents among third age people due to the use of home-made toilet chair. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.216-219 KEYWORDS: ERGONOMICS. BIOMETRY. ADULTS. ELDERLY. AGING.

The world's population is ageing, with more developed regions leading the process, because of increasing survival to older ages as well as smaller numbers of births. Consequently, the support of this ever expanding elderly population has become increasing concern. In India approximately 20 per cent of people aged 70 years or older, and 50 per cent of people aged 85 and over, report difficulties in such basic activities of daily living as bathing and toileting. The increase in the number of old people is presumably also increasing the number of old people with disabilities specially related to joints which create hindrance or cause pain in using Indian toilets. The middle income group families in India are unable to construct European type toilets for their older parents due to reasons like space problem in their homes, financial problem and sometimes the family doesn't bother about elders to take so much pain for them. Thus, to overcome from this problem the family members of the third age people had arranged the home made toilet chairs for their older parents by using ordinary chairs and making a hole at the middle of the chair with a removable small bucket, but no consideration was given for the dimensions of those toilet chairs and the body dimensions of third age people, which results in the accidents during and after its use. This study was planned to sort out the dimensions for ergonomically designed toilet chair to reduce the cases of accidents among third age people. For this purpose anthropometric data of 200 people of 60-70 years of age as well as the dimensions of home- made toilet chairs were taken and also the cases of accidents were noted among third age people of Pantnagar and Rudrapur. Research design used for the study was descriptive as well as experimental and purposive sampling was used for data collection. Results showed that there was a great difference between the toilet chair dimensions and the body dimensions of third age people which caused accidents and with the help of anthropometric data the dimensions of ergonomic toilet chair was decided to overcome this problem.

F01 Crop Husbandry

211. Adak, Tarun; Central Institute for Subtropical Horticulture, Lucknow (India). Narjary, Bhaskar; Indian Agricultural Research Institute, New Delhi (India). Chakravarty, N.V.K.; Indian Agricultural Research Institute, New Delhi (India). Response of Brassica to microenvironment modification under semi-arid agroecosystem. Indian

Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.744–50 KEYWORDS: BRASSICA JUNCEA. BRANCHING. YIELD COMPONENTS. YIELDS. AGROECOSYSTEMS. ARID CLIMATE.

Field experiments were conducted during winter (rabi) season of 2005–06 and 2006–07 on a Typic Ustocrepts soils at research farm of Indian Agricultural Research Institute (IARI), New Delhi representing a semi-arid environmental condition, to evaluate the response of Brassica juncea under modified microenvironments. It was revealed that the possibility of increasing the seed yield in mustard cultivars, viz Pusa Jai Kisan and BIO169–96 (developed at National Research Centre Plant Biotechnology IARI, New Delhi) was possible. Modification of microenvironment through debranching, i.e. removal of lower branches at the flowering and pod-filling stages so as to increase the photosynthate flow to the economic parts is found to be promising yet cheaper way. This modified microenvironment has a positive impact on growth and yield in both the years of study. Removal of lower branches at the flowering stage was found to be an alternate practice of microenvironment modification in attaining statistically higher yield.

212. Rahman. A.; Assam Agricultural University, Jorhat (India). Deka, T.N.; Assam Agricultural University, Jorhat (India). Nesting and foraging behaviour of Xylocopa fenestrata and Xylocopa leucothorax on ridgegourd (Luffa acutangula) and cucumber (Cucumis sativus). Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.780–783 KEYWORDS: NESTING. FORAGING. BEHAVIOUR. POLLUTION. CUCUMBERS. LUFFA ACUTANGULA. CUCUMIS SATIVUS.

The nesting behaviour of X. fenestrata and X. leucothorax was studied in terms of nesting site, materials and architecture. X. fenestrata preferred dry bamboo top for making nest, whereas X. leucothorax made nest in dry wood. In bamboo, the nests were constructed in a linear pattern extending only one side from the entrance hole, i.e. in a straight line but in wood, the nests were found to be either branched or straight. The position of nest, diameter of entrance hole, number of cells per nest and the diameter of nesting materials varied with the species and materials. Thefemale nests of Xylocopa consisted of several cells whereas male nest devoid of such structure. Foraging activity of X. fenestrata and X. leucothorax on ridge gourd was observed from 5 AM to 7 PM of the day and showed that maximum number of visit at 5 AM to 6 AM of the day with pollen load 68±4.45 mg/trip for X. fenestrata and 65±2.32 mg/trip for X. leucothorax. Foraging activity on cucumber was recorded from 7 AM to 5 PM of the day with peak visit at 10 AM to 11 AM of the day having maximum pollen load 68±3.16 mg/trip and 67±3.99 mg/trip by X. fenestrata and X. leucothorax.

213. Shahid, Mohd; Singh, Anuradha; Srivastava, Mukesh; Mishra, R.P.; Biswas, S.K. Effect of temperature, pH and media for growth and sporulation of Trichoderma longibrachiatum and self life study in carrier based formulations. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.147-9 KEYWORDS: KEEPING QUALITY. TRICHODERMA LONGIBRACHIATUM.

The most favourable temperature for growth and sporulation of Trichoderma longibrachiatum was found in between 25–30^{o}C (60–70 mm dia.), followed by 20^{o}C. Similarly, most favourable pH ranged between 6.5 to 7.5 in which total dry weight of mycelium also varied between 198.61 to 223.00 mg, and PDA showed excellent in average colony dia. (8.57 cm), but excellent average mycelium weight (170 mg) was recorded in PDB medium. Shelf life of T. longibrachiatum in three different carrier materials (talc, lignite & charcoal) was determined at 30 days interval indicated that decline in number of propagules was started from 30 days onwards. Among the different formulations, talc based was found the best material to retain maximum number of viable propagules, which was 29.7 x 106 cfu/g against 8.3 x 106 cfu/g in charcoal powder at 60 days of storage. It was also found that the isolate can retain their viability up to 120 days in all the cases.

214. Pandey, Sunita T.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Bist, L.D.; G.B. Pant University of Agriculture and

Technology, Pantnagar (India). Department of Horticulture. Rajesh Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Singh, Sarnam; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Effect of planting techniques on the growth dynamics and root yield pattern of safed musli in Mollisol of Uttarakhand. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.34-35 KEYWORDS: SOIL CHEMICOPHYSICAL PROPERTIES. DRUG PLANTS. PLANTING. ROOTS.

Planting methods affected the number, length and root yield of safed musli significantly. Maximum number of finger (10.10), length of finger (8.88 cm) and maximum yield (13.41 g/plant) was observed in the raised bed (60 cms) method of planting at 270 DAP, however, increase in root diameter remains non-significant in all the methods. Yield under various methods varied significantly and ranged from 3.28 q/ha (8.89 g/plant) in Flat bed to 4.90 q/ha (13.41 g/plant) in Raised bed (60 cms). Besides, in mollisol crop exhibited brown leaf spot and root rot.

F02 Plant Propagation

215. Singh, S.N.; Indian Institute of Sugarcane Research, Lucknow (India). SINGH, P.K.; Indian Institute of Sugarcane Research, Lucknow (India). SINGH, G.K.; Indian Institute of Sugarcane Research, Lucknow (India). SINGH, V.K.; Indian Institute of Sugarcane Research, Lucknow (India). Prakash, Om; Indian Institute of Sugarcane Research, Lucknow (India).Kumar, Rajesh; Indian Institute of Sugarcane Research, Lucknow (India). Comparative effect of polybag culture and conventional methods of planting at different dates on rapid multiplication of seed cane (Saccharum species complex) in sub-tropical India. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.751–755. KEYWORDS: PLANTING. SUGARCANE. SACCHARUM. POLYETHYLENE. SETS.

The conventional system of sugarcane planting is less efficient in rapidly multiplying the seed cane of newly released varieties due to higher seed rate (6 tonnes/ha) and low germination (35–40%) in sub-tropical climatic conditions of India. The present investigation was, therefore, carried out during 2005–06 and 2006–07 cropping seasons to assess the effect of poly-bag culture and conventional methods of planting at different dates on rapid multiplication of seed cane. One-month old single cane bud settlings grown in poly-bags were transplanted 45 cm apart in furrows of 90 cm spacing and the results compared with the usual practice of using three- bud seed pieces planted at the rate of 38000/ha. Results showed that the poly-bag culture raised sugarcane produced significantly higher germination of cane buds (87.72%), number of shoots (198000/ha) and millable canes (124000/ha) as against the corresponding values of 35.95%, 186000/ha and 116000/ha, respectively under conventional sett method, which is an advantage for seed cane multiplication. The cane yield obtained under both the methods was statistically at par, however, conventional sett method produced significantly higher seed cane yield than that of poly-bag culture in February planting but, it was statistically at par in March and April, and for May plantings, the reverse trend was noticed where poly-bag culture raised crop significantly out-yielded conventionally planted crop. The results further indicated that poly-bag culture raised sugarcane multiplied seed cane by 36 times as against 11 times observed under conventional method. The cost of cultivation of poly-bag culture crop versus the conventional method was nearly equal.

216. Satish Chand; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Rawat, S.S.; H.N.B. Garhwal University, Srinagar (India). Department of Horticulture. Mishra, K.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Use of plant growth regulator for Bougainvillea multiplication. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.171-176 KEYWORDS: PLANT GROWTH SUBSTANCES. ROOTING. CUTTINGS. PROPAGATION BY CUTTINGS. BOUGAINVILLEA.

Bougainvillea a popular garden plant is appreciated for its brightly colored bracts and profuse flowering round the year. Bougainvillea is propagated by cutting, layering, air-layering and budding. Some of the cultivars like Thima & Dr. Rao are difficult to root, need proper standardization of propagation technique, time and concentration of plant bioregulators. The present paper deals with the use of plant growth regulators for large multiplication of bougainvillea.

F03 Seep Production and Processing

217. Joseph, T.A.; Central Potato Research Station, Muthorai (India). Singh, B.P.; Central Potato Research Institute Campus, Meerut (India). Kaushik, S.K.; Central Potato Research Institute Campus, Meerut (India). Bhardwaj, V.; Central Potato Research Institute Campus, Meerut (India). Pandey, S.K.; Central Potato Research Institute Campus, Meerut (India). Singh, P.H.; Central Potato Research Institute, Shimla (India). Singh, S.V.; Central Potato Research Institute Campus, Meerut (India). Gopal, J.; Central Potato Research Institute, Shimla (India). Bhat, M.N.; Central Potato Research Institute Campus, Meerut (India). Gupta, V.K.; Central Potato Research Station, Shillong (India). Kufri Girdhari- A medium maturing, late blight resistant potato variety for cultivation in Indian hills. Potato Journal (India). (Jan 2011) v.38(1) p.26-31 KEYWORDS: POTATOES. BLIGHT. HIGHLANDS. INDIA.

Kufri Girdhari is a medium maturing potato variety suitable for cultivation in Indian hills. It has a high level of resistance to late blight both in foliage and in tubers. It has medium sized, oval-oblong, white-cream tubers with pale-yellow flesh and excellent cooking quality. It yields higher than the varieties presently under cultivation in the hills and also has better keeping quality. The cultivation of this variety will not only result in stable potato production in the hills but will also be a boon to farmers.

218. Dalvi, S.G.; Vasantdada Sugar Institute, Pune (India). Gudhate, P.P.; Vasantdada Sugar Institute, Pune (India). Tawar, P.N.; Vasantdada Sugar Institute, Pune (India). Prasad, D.T.; Vasantdada Sugar Institute, Pune (India). Low cost support matrix for potato micro-propagation. Potato Journal (India). (Jan 2011) v.38(1) p.47-50 KEYWORDS: MICROPROPAGATION. POTATOES. APPROPRIATE TECHNOLOGY. STABILIZERS.

Potato quality seed is supplied through minitubers produced by micropropagation technique. Lowering cost of production without loosing the quality is the major bottleneck in potato micropropagation. Agar is most widely used gelling agent in plant tissue culture. Agar as gelling agent not only limits the growth and cause vitrification of cultures but also adds to the cost of production. Various alternative gelling agents were tried earlier for lowering the production cost in potato micropropagation but hardly any of them was used in large scale micropropagation. In the present study, a successful attempt has been made to find out cotton as low cost plant support matrix in plant tissue culture. In comparison with agar as support matrix, there was an early shoot initiation followed by vigorous growth when cotton is used as a support matrix. Shoot height, number of nodes and biomass accumulation increased significantly in cotton incorporated cultures. The explant establishment was 97%, with 55% increase in number of internodes followed by 30% increase in shoot height and two-fold increase in dry matter content; increases production efficiency considerably in terms of producing significantly more number of nodes per shoot(4.6±0.23) which results in more number of explants for further subcultures. This ultimately results in increased subculture efficiency. Cotton is very cheap than agar and there is a saving of twenty rupees per litre of media, which had high impact on economics in the cost of production in plant micropropagation. The results put together indicate that cotton can be used as low cost support matrix in potato micropropagation.

219. Jadli, Sandeep; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, J.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Effect

of seed extraction methods on seed quality of tomato (Solanum lycopersicum L.). Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.127-130 KEYWORDS: TOMATOES. SEED EXTRACTION. QUALITY. LYCOPERSICON ESCULENTUM.

F04 Fertilizing

220. Yesh Pal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, R.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Sharma, N.L.; A.S. College, Lakhaoti, Bulandshahr (India). Department of Agricultural Chemistry and Soil Science. Sachan, R.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Effect of integrated nutrient management practices on rice (Oryza saliva L.) in a Mollisol. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.23-28 KEYWORDS: NUTRIENT UPTAKE. ORYZA SATIVA. RICE. SOIL CHEMICOPHYSICAL PROPERTIES. SOIL FERTILITY.

Field experiment was conducted during Kharif season of 2002 and 2003 to study the response of rice to INM practices in Mollisol. The yield attributes and yield in rice were studied with application of FYM 5 and 10 t ha-1, paper mill Bagasse 5 and 10 t ha-1 and inoculation with Blue green algae 10 kg ha-1 in a field experiment on a Typic Hapludolls. Application of FYM, Bagasse and BGA along with the recommended, 75 and 50 per cent of recommended fertilizer doses had positive effect on yield and yield attributing parameters over recommended fertility alone. Highest values were recorded in the treatment where 10 t FYM ha-1 was applied with recommended fertility levels and the average extent of increase in panicle (m-2), panicle length (cm), spikletets/panicle, 1000 grain weight and grain yield was 2.16, 5.34, 4.80, 1.81 and 9.0 per cent respectively.

221. Yesh Pal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of AgronomySingh, R.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Sharma, N.L.; A.S. College Lakhaoti, Bulandshahr (India). Department of Agricultural Chemistry and Soil Science. Sachan, R.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Effect of integrated nutrient management practices on yield, N, P, K uptake and economics of rice (Oryza sativa L.) in a Mollisol. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.29-33 KEYWORDS: SOIL CHEMICOPHYSICAL PROPERTIES. SOIL FERTILITY. NUTRIENT UPTAKE. RICE. ORYZA SATIVA. NPK FERTILIZERS. ECONOMICS.

An experiment was conducted during Kharif seasons of 2002-03 and 2003-04 to study the effect of various combinations of organic, inorganic and biological sources on plant nutrient contents, total nutrient uptake, grain yield, economics of different treatments and cost benefit ratio in rice crop. Significantly higher contents of nitrogen, phosphorus and potassium (in both grain and straw), total nutrient uptake, grain yield and net returns were recorded significantly higher with the application of N120P60K40 + Farmyard manure l0 t ha-1 and 75% of N, P, K (90:45:30 kg ha-1) + 10 t FYM ha-1 over recommended fertility level alone. While 50 per cent of RF (N60P30K20 kg ha-1) + FYM had no significant effect over RF alone but yielded significantly higher over 50 per cent of RF alone. Inoculation with BGA 10 kg ha-1 alongwith recommended fertilizer level recorded highest (1.12) cost benefit ratio during both the years.

222. Krishna, D.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Ram, S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Nand Ram; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Response of long term use of NPK fertilizers and manure to P-fractions, soil properties and their relationship to yields of rice in rice-wheat-cowpea cropping system on a Mollisol of Tarai. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.108-113 KEYWORDS: NPK FERTILIZERS. FARMYARD MANURE. SOIL CHEMICOPHYSICAL

PROPERTIES. RICE. WHEATS. COWPEAS. ORGANIC AGRICULTURE. CROPPING SYSTEMS.

The study was undertaken with rice during 2002-03 in a long term fertilizer experiment, which is being carried out since 1971. The obtained results indicate that application of 100% recommended NPK fertilizers + FYM 15 t ha-1 produced maximum grain and straw (4.6 and 5.6 t ha-1) and nutrients uptake by rice and it was followed by 100%NPK+Zn. Whereas, continuous use of optimal and super optimal dose of 100 and 150% NPK fertilizers without zinc gave 18.63 and 21.63% lower grain yield respectively as compared to 100%NPK+ FYM. However, 100% phosphorus application with nitrogen and zinc shows superiority over optimal and super optimal doses of NPK fertilizers without zinc and alone nitrogen with zinc. Remarkable decrease in organic carbon from initial (1.48%) to control (0.57%) was observed up to 30th cycle of rice-wheat-cowpea and it was maintained with 100%NPK+ FYM treatment (1.52%). This shows that organic manure application 15.0 t ha-1 in combination with optimal dose of NPK fertilizers retained initial soil fertility level and produced maximum yields. Highest saloid-P and Ca-P in soil was recorded with 150%NPK treatment but 100%NPK+FYM gave maximum available phosphorus and lowest saloid-P. Significant and positive correlation coefficients were found with Al-P and Ca-P Vs grain yield and available phosphorus was significantly correlated with all P-fractions whereas, negative correlations were recorded by saloid-P with CaCO3 in surface and subsurface soils after rice.

223. Singh, B.P.; G.B. Pant University of Agriculture and Technology, Ranichauri (India). Department of Horticulture. Dimri, D.C.; G.B. Pant University of Agriculture and Technology, Ranichauri (India). Department of Horticulture. Singh, S.C.; G.B. Pant University of Agriculture and Technology, Ranichauri (India). Department of Horticulture. Efficacy of NPK management through fertigation on growth characteristics of apple (Malus domestica Borkh.) plant. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.50-53 KEYWORDS: NPK FERTILIZERS. FERTIGATION. GROWTH RATE. APPLES. MALUS PUMILA. CHLOROPHYLLS. NUTRIENT UPTAKE.

The present investigation was carried out during the year 2004-05 at experimental Block of Department of Horticulture, G.B. Pant University of Agriculture & Technology, Hill Campus, Ranichauri, Tehri Garwhal, Uttarakhand. The NPK fertilizers were applied through fertigation as well as soil application in five treatment combinations to test various attributes of 3-yr-old spur type apple cv. Red Chief. The investigation indicated the highest vegetative growth of plants under full dose of NPK through drip irrigation in terms of shoot length (111.43 cm), plant diameter (2.87 cm), number of leaf per plant (223.50), leaf area (43.19 cm2), fresh weight (2.33 g), and dry weight (62%), while the minimum shoot length (84.48 cm), plant diameter (1.97 cm), no. of leaves per plant (178.25), leaf area (27.43 cm), fresh weight (1.10 g), and dry weight of leaves (35%), were noticed under full dose of NPK applied through soil. The full dose of NPK through fertigation also resulted in maximum leaf N (2.565%), P (0.282%) and K (1.685%), and gave maximum chlorophyll (0.51 mg/g tissue), (0.40 mg/ g tissue) and total chlorophyll (0.92 mg/g tissue), while minimum leaf NPK and chlorophyll content was found under full dose of NPK applied through soil. On the basis of overall effect of fertigation on vegetative growth, leaf nutrient and soil nutrient status of apple plants, the application of full dose of NPK through fertigation was most effective in improving the plant growth as well as leaf and soil nutrient status.

224. Srivastava, Ranjan; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Vishen, Vizender Singh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Satish Chand; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Effect of Azotobacter and organic manures on post harvest characteristics of tuberose (Polianthes tuberosa l.) cv. Double. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.54-55 KEYWORDS: AZOTOBACTER. ORGANIC MATTER. ORGANIC FERTILIZERS. ORGANIC AGRICULTURE. POLIANTHES. KEEPING QUALITY.

225. Chander Pal; G. B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, H.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Ram, S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Nand Ram; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Response to potassium fractions and their relationship with physico-chemical properties under different nutrient management systems in long-term fertilizer experiment on a Mollisol. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.81-87 KEYWORDS: SOIL CHEMICOPHYSICAL PROPERTIES. POTASH FERTILIZERS. SOIL FERTILITY. NUTRIENTS. CROPPING SYSTEMS. SEQUENTIAL CROPPING.

The present study was undertaken during 1998-99 in a long term fertilizer experiment on a Mollisol to evaluate the effect of continuous cropping system and fertilizers application on potassium fractions and physico-chemical properties of soil. The obtained results indicate that chemical fertilizers application (N, P and K) and intensive cropping had negative effect on soil pH and CaCo3 and positive with electrical conductivity and CEC. 100%NPK+ FYM treatment showed superiority over all other nutrient management treatments viz; 100%NPK, 100%NP+Zn, 100%N+Zn etc., in improvement of soil properties and potassium fractions in post harvest soils whereas intensive fertilization without manure in mono cropping deteriorated the soil properties viz; pH, EC, CEC and organic carbon. However, water soluble, exchangeable and available potassium are negatively correlated with pH and $CaCo_3$ in surface (0-15 cm) soils after rice in rice-wheat-cowpea cropping system under all the nutrient management treatments but non-significant correlation coefficients were found with fixed and lattice potassium. For sustaining soil health and crop productivity under such set of conditions, integrated nutrient management coupled with intensive cropping could be a better choice to the farmers.

226. Uniyal, S.P.; G.B. Pant University of Agriculture and Technology, Hill Campus, Ranichauri (India). College of Forestry and Hill AgricultureMishra, Akhilesh Chandra; Birsa Agricultural University, Ranchi (India). Krishi Vigyan Kendra, Garhwa. Management of inorganic fertilizers in vegetable pea under rainfed temperate hills. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.64-68 KEYWORDS: NPK FERTILIZERS. HILL SOILS. RAINFED FARMING. TEMPERATE ZONES. INORGANIC FERTILIZERS. PEAS. HIGHLANDS.

Present investigation was conducted on vegetable pea cv.Arkel by applying five levels phosphorus viz., 0,15,30,45 & 60 kg/ha through Mussoorie Rock Phos along with nitrogen 25 kg/ha, Diammonium Phosphate along with and without potassium 25 kg/ha and Single Super Phosphate and five levels of nitrogen viz., 0,25,50,75 & 100 kg/ha through urea. Results indicated that application of 60 kg P/ha through all the sources gave maximum pod yield per hectare. However, DAP appeared as the best source of supplementing phosphorus as it resulted in highest pod yield at 60 kg P/ha (119.26 q/ha). The response of the crop to lower levels of P applied through all three sources was more obvious which was decreased down beyond 30 kg/ha and appeared as uneconomical beyond 45 kg/ha. An additional application of K 25 kg/ha with lower doses of P viz., 15 and 30 kg/ha and N5 kg/ha with higher levels of P viz., 45 and 60 kg/ha had favourable effects on the pod yield. Nitrogen doses exhibited non-significant differences on pod yield and application of 25 kg/ha nitrogen was appropriate. Therefore, 25 kg N/ha+45-60 kg P/ha and 15-30 kg P/ha+25 kg K/ha was found to be economical for pod yield in vegetable pea under rainfed mid hills.

227. Raghav, M.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Shashi Kamal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Effect of organic sources of nutrients on potato production in Tarai region of Uttarakhand. Pantnagar

Journal of Research (India). (Jan-Jun 2009) v.7(1) p.69-72. KEYWORDS: POTATOES. NUTRIENTS. ORGANIC AGRICULTURE. ORGANIC FERTILIZERS. PLANT PRODUCTION.

A field experiment was conducted to study the effect of organic sources of nutrients alone or in combination on growth and yield of potato and soil health at Vegetable Research Center, Pantnagar during 2004-05 to 2006-07 (three years). The trial was laid out in randomized block design with four replications. Five treatment combinations resulting from three organic sources i.e. T1-farmyard manure+ biofertilizers, T2-poultry manure+ biofertilizers, T3-vermicompost+ biofertilizers, T4-combination of farmyard manure, poultry manure, vermicompost along with biofertilizers and T5-recommended dose of chemical fertilizers were tested. The vegetative growth of plants in term of number of haulms and number of leaves per hill were maximum in treatment T4 having combination of farmyard manure, poultry manure, vermicompost along with biofertilizers. Whereas, recommended dose of fertilizers (T5) gave maximum height of plant. The maximum uptake of nutrient and higher total tuber yield of potato (269.84 q/ha) was recorded under the treatment T4 which was 7.03 per cent higher than the treatment having recommended dose of fertilizers (T5). It was also noticed that all the combination of organic manures improved the soil health.

228. Uniyal, S.P.; G.B. Pant University of Agriculture and Technology, Ranichauri (India). Department of Vegetable Science. Mishra, Akhilesh Chandra; Birsa Agricultural University, Ranchi (India). Krishi Vigyan Kendra, Garhwal. Effect of different levels of nitrogen and phosphorus on performance of vegetable pea in rainfed hills. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.184-186. KEYWORDS: DRY FARMING. VEGETABLES. PEAS. PISUM SATIVUM. TEMPERATE CLIMATE. HILL SOILS.

Present investigation was conducted in rainfed temperate hills of Uttarakhand during spring-summer of 2001 and 2002 by applying three levels of nitrogen (0, 30 & 60 kg/ha) and four levels of phosphorus (0, 40, 80 & 120 kg/ha) in all possible combinations on vegetable cv. Arkel. The results indicated that N30P120 and N30P80 were the suitable doses of fertilizer in relation to the plant growth and pod yield in rainfed temperate hills of Uttarakhand.

229. Awasthi, Priya; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Shant Lal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Effect of calcium, boron and zinc foliar sprays on the yield and quality of guava (Psidium guajava L.). Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.223-225. KEYWORDS: FOLIAR APPLICATION. GUAVAS. PSIDIUM GUAJAVA. CALCIUM. BORON. ZINC.

F06 Irrigation

230. Antil, S.K.; Haryana State Cooperative Apex Bank Limited, Chandigarh (India). Jhorar, R.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil and Water Engineering. Sidhpuria, M.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil and Water Engineering. Rainfall intensity-duration-return period equation for Hisar district of Haryana. Annals of Biology (India). (Dec 2010) v. 26(2) p. 173-175. KEYWORDS: EROSION. HARYANA. RAIN.

Rainfall intensity- duration- return period equations are required for design of soil conservation and runoff disposal structure and for planning flood control projects. An attempt was made to develop the rainfall intensity-duration-return period equation for Hisar region situated in Haryana. The autographic rain gauge data over a period of 16 years for Hisar region were analyzed in the form of annual maximum series of various durations viz., 15, 30, 45 and 60 min. The various constants required for rainfall intensity durations and frequency relationship were calculated and the values for K a, band d were obtained as 7.8469, 0.1190, 0.85 and 0.5092, respectively.

231. Mondal, T.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Mishra, H.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, N.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Response of potato to irrigation and nutrition on a Mollisol under cool weather Tarai region of northern India. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.114-119. KEYWORDS: MICRONUTRIENT FERTILIZERS. SOIL CHEMICOPHYSICAL PROPERTIES. IRRIGATION. NUTRIENTS. INDIA. POTATOES. WEATHER.

Field experiments were conducted during winter season of 2003-2004 and 2004-2005 to study the response of potato to irrigation and nutrition. The response of irrigation and nutrition on shoot number, leaf number, shoot length, tuber number hill^{-1} and tuber yield was found significant. Irrigation given at 30 and 50 days after planting (DAP) along with application of N200 P100 K100 Cu20 Mn20 Zn25 B5 kg ha^{-1} significantly increased shoot and leaf numbers, shoot length and tuber yield of potato as compared to control. Tuber yield of potato had positive and significant correlation with shoot and leaf numbers hill^{-1}, shoot length and tuber number hill^{-1}. Highest positive and significant correlation was observed between shoot number hill^{-1} and tuber yield of potato.

232. Singh, P.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Singh, K.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Sharma, H.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Water requirement of mango crop under drip irrigation in different mango growing belts of Uttarakhand. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.131-134. KEYWORDS: WATER REQUIREMENTS. MANGOES. TRICKLE IRRIGATION. EVAPOTRANSPIRATION. SEASONAL VARIATION.

Two representative stations namely Dehradun and Pantnagar, lying in two main mango-growing belts, were selected for the estimation of reference evapotranspiration under per-humid and moist sub-humid, agro-climatic regions of Uttarakhand. FAO Penman-Monteith model was used for the estimation of reference evapotranspiration on weekly meteorological data of ten years. The estimated reference evapotranspiration values were further used for the determination of water requirement of different age groups of mango crop under drip irrigation. The weekly average value of water requirement of mango crop under drip irrigation varied from 2.11 litre/day/plant to 139 litre/day/plant in per-humid and 2.45 to 197 litre/day/plant in sub humid climatic conditions of Uttarakhand. On an average, it was found that average annual value of water requirement varied from 2.11 to 197 litre/ day/plant. It was also found that the water requirement of mango crop increases with the increase in the age of mango tree and becomes constant when the full canopy has been developed at the age of about 30 to 35 years of mango trees.

233. Dhandare, K.M.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Singh, K.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Singh, P.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Singh, M.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Bayissa, Gonfa; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Irrigation and Drainage Engineering. Response of capsicum (Capsicum annum L.) under cyclic irrigation in polyhouse condition. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.135-138. KEYWORDS: CAPSICUM ANNUUM. TRICKLE IRRIGATION. ENVIRONMENTAL CONTROL. VENTILATION. GREENHOUSES.

A field experiment was conducted at experimental field of Department of Irrigation and Drainage Engineering to study the response of cyclic irrigation on biometric and yield parameter of capsicum (Capsicum annum L.) in environmental controlled and naturally ventilated polyhouse. The treatment consists of two irrigation levels (100 % of water requirement and 75 % of water requirement) and three cycles level (One cycle per day, three cycles per day and six cycles per day). The results revealed that the plant height, number of primary branches, number of secondary branches and canopy perimeter was higher in environmental controlled polyhouse than naturally ventilated polyhouse, also the yield and yield attributes was higher in environmental controlled polyhouse than naturally ventilated polyhouse. The irrigation treatment with three cycles per day performed better than six cycles and one cycle in both the polyhouses. The water use efficiency was high in treatment of three cycles per day with combination of 75 per cent of water requirement in both polyhouse. The cyclic irrigation increased the water-use efficiency.

234. Mondal, T.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Mishra, H.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, N.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Effect of nutrition and irrigation on soil properties and yield of potato on a Mollisols in Tarai region of Uttarakhand. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.107-112. KEYWORDS: POTATOES. SOLANUM TUBEROSUM. SOIL CHEMICOPHYSICAL PROPERTIES. IRRIGATION. IRRIGATION SCHEDULING.

Field experiments were conducted during winter season of 2003-2004 and 2004-2005 to study the effect of nutrition and irrigation on soil properties and yield of potato. Irrigation given at 30 and 50 days after planting (DAP) and application of N200, P100 K100 Cu20 Mn20 Zn25 B5 Kg ha^{-1} significantly increased the yield of potato. Effect of nutrition and irrigation treatments on pH, EC and organic carbon of soil was non-significant, but the effect was significant on N P K Zn Cu Mn B over control. Tuber yield of potato had positive and significant correlation with organic carbon, N P K Zn Cu Mn except B. Higher significant positive correlation of tuber yield was found with P (r=0.892*).

F07 Soil Cultivation

235. Singh, I.S.; Central Institute for Arid Horticulture, Bikaner (India). Awasthi, O.P.; Indian Agricultural Research Institute, New Delhi (India). Sharma, B.D.; Indian Agricultural Research Institute, New Delhi (India). More, T.A.; Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Meena, S.R.; Indian Agricultural Research Institute, New Delhi (India). Soil properties, root growth, water-use efficiency in brinjal (Solanum melongena)production and economics as affected by soil water conservation practices. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.760–3. KEYWORDS: AUBERGINES. PRODUCTION ECONOMICS. SOIL FERTILITY. SOIL WATER DEFICIT. SOLANUM MELONGENA.

A field experiment was conducted during 2004–09 to study the effect of soil water conservation practices on soil properties, root growth, water-use efficiency, production, and economics of brinjal (Solanum melongena L.) under irrigated condition in loamy sand soil of hot arid environment. Application of mulch treatments was found superior with respect to moderation of hydrothermal regimes of soil. The moisture retention capacity and hydraulic conductivity of soil were enhanced by 7.6 to 28% due to FYM mulch as compared to control. FYM mulch, generally, increased the soil chemical fertility status (available N, P and K, exchangeable Ca, and K) by 39 to 87%. The root length density, root mass density and root volume were higher by 370, 392 and 198%, respectively under FYM mulch treatment as compared to the control. These treatments also increased water use efficiency and fruit yield by 24.16 to 34.79 kg/hamm and 15 to 19 tonnes/ha, respectively over control. Results indicated that application of soil water

conservation practices in arid tropical soils improved soil properties, root growth, water use efficiency and crop yield of brinjal.

236. Singh, Shailendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, Govindra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Evaluation of different methods of establishment in wheat (Triticum aestivum) after different methods of rice (Oryza sativa) establishment. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.36-40. KEYWORDS: ZERO TILLAGE. WHEATS. RICE. CROPPING SYSTEMS. TRITICUM AESTIVUM. ORYZA SATIVA. PLANT ESTABLISHMENT.

Zero tilled wheat (ZTW) had definite advantage (10-15 days) of early crop establishment resulting into higher yield (2.5%) than conventionally tilled wheat (CTW) after direct seeded rice (DSR) because of its early maturity, which facilitated timely planting of wheat. It also saved water during first irrigation (ZTW-322560 liters ha^{-1} as compared to CTW-381120 liters ha^{-1}), due to reduced infiltration rate (1.09 mm h^{-1}) with higher bulk density (1.52 Mg m-3 and 1.68 Mg m^{-3} in 0-7.5cm and 12-19cm, respectively) in ZT as compared CT with higher infiltration rate (2.39 mm h^{-1}) with lower bulk density (1.46 Mg m^{-}3, 1.66 Mg m^{-3} in 0-7.5 cm and 12-19 cm, respectively).

F08 Cropping Patterns And Systems

237. Subhashini, D.V.; Central Tobacco Research Institute, Rajahmundry (India). Padmaja, K.; Central Tobacco Research Institute, Rajahmundry (India). Population dynamics and screening of phosphate-solubilizing bacteria isolated from tobacco (Nicotiana tabacum)-based cropping systems. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.740–3. KEYWORDS: NICOTIANA TABACUM. BACTERIA. PHOSPHATES. RHIZOSPHERE. CROPPING SYSTEMS. POPULATION DYNAMICS.

A study was conducted during 2005 to 2008 to isolate phosphate-solubilizing bacteria (PSB), their distribution pattern and population density from the rhizosphere of different field crops in tobacco (Nicotiana tabacum L.) growing soils. PSB isolates were assessed for phosphate-solubilizing capacity, production of growth regulators, phosphatase activity, pH changes and titrable acidity. There was a significant difference on the population density. It is found to be higher in the rhizosphere soils of Bengalgram (15.3 105/g soil dry wt.), followed by redgram 14.1 105 and least in the soils of rice 7.05 105 and followed by maize 7.81 105. The distribution pattern of PSB in the rhizosphere soils showed that the population levels decreased with the distance of soil sampling from the plants. Among the 10 strains, MP07 was the best in solubilizing phosphate (41.06 ppm/ml of culture filtrate) while SOP 12 was the least (19.90). A wide variation in the phosphate-solubilizing efficiency (51 to 72%) by the PSB isolates was observed. Further, all the isolates were able to secrete phytohormones like indole acetic acid (IAA) and acid phosphatase under in vitro condition. The isolate BePO6 produced higher of amount of IAA (44.36 ppm), followed by the strain MaPO3 and least in RPO5 (32.14 ppm). phosphatase activity showed that The strain BePO6 isolated from Bengalgram soil showed highest activity of phosphotase (38.2 moles/g/hr), followed by the strain MaPO3 isolated from maize soil (34.01 moles/g/hr) with the least activity by the strain RP05 (16.02 moles/g/hr) isolated from rice soil.

238. Abraham, Thomas; Agronomy Amar Singh (PG) College, Bulandshahar (India). Thenua, O.V.S.; Agronomy Amar Singh (PG) College, Bulandshahar (India). Sharma, U.C.; Indian Council of Agricultural Research, New Delhi (India). National Agricultural Innovation Project. Evaluation of performance of chickpea (Cicer arietinum) and mustard (Brassica juncea) intercropping system vis-a-vis their sole crops as influenced by irrigation regimes and fertility gradients. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.772–5. KEYWORDS: CICER ARIETINUM. BRASSICA JUNCEA. ECONOMICS. HARVEST INDEX. INTERCROPPING. IRRIGATION. YIELDS. FERTILITY.

The system of intercropping of chickpea and mustard in 4:1 row ratio is significantly superior to sole crops of either chickpea or mustard. Among chickpea and

mustard, cultivation of chickpea was better in comparison to mustard from the economic point of view. From the practical point of view, the findings revealed that when the two irrigations are expected to be available, their application during pre-flowering and pod-filling stage of chickpea would result in higher yield. Further, the recommended dose of fertilisers (20N:60P_2O_5: 20S kg/ha) application to both the crops was found superior in comparison to either 20N:40P_2O_5:10S kg/ha or 40N:60P_2O_5:20S kg/ha. The biomass production and the nutrient uptake by chickpea and mustard crops were found well tuned with the irrigation regimes and fertility gradients.

239. Ahlawat, P.; Apeejay College of Engineering, Gurgaon (India). Lata, S.; M.A. College for Women, Jhajjar (India). Bioaccumulation of cadmium and zinc by water Hyacinth, Eichhornia crassipes. Annals of Biology (India). (Dec 2010) v.26(2) p.121-127. KEYWORDS: CADMIUM. EICHHORNIA CRASSIPES. BIOACCUMULATION.

The investigation was undertaken to study the cadmium and zinc uptake by Eichhornia crassipes from water under laboratory conditions. Experiments showed that these plants accumulated high levels of cadmium and zinc. Higher metal accumulation was observed in roots of the plants in comparison to the shoots. Metal accumulation by the plants was increased with the initial concentration as well as with increase in exposure period. The data showed that the bio-concentration factor both the metals increased with the increase in exposure period but showed decreasing trend as the initial metal concentration increased above 2 ppm. E. crassipes has been found to be effective in removal of cadmium and zinc at low concentrations from water as indicated by the metal uptake data.

240. Maan, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Behl, R.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Kumar, A.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Punia, M.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Callus development and plant regeneration from different explants of soybean [Glycine max (L.) Merr.]. Annals of Biology (India). (Dec 2010) v.26(2) p.129-132. KEYWORDS: GLYCINE MAX. CALLUS. EXPLANTS. PLANT TISSUES. CELL CULTURE.

Selection of genotype and explant has a definite role in callus formation. Explants of hypocotyl resulted in a high percentage of callus formation as compared to the cotyledon among all the genotypes but regeneration was found better in case of cotyledonary explants in different regeneration medium. The results indicated that genotypic differences existed for regeneration ability of callus which can further be utilized for gene transfer.

241. Maan, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Kumar, A.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Sangwan, R.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Devi, R.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Sheoran, R.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Inheritance of male fertility restoration gene(s) in sunflower (Helianthus annuus L.). Annals of Biology (India). (Dec 2010) v.26(2) p.137-139 KEYWORDS: HELIANTHUS ANNUUS. FERTILITY. GENES.

Fertility restoration in the cross between two cytoplasmic male sterile lines viz. CMS84A and CMS338(C)A and three restorer lines (RHA271, RHA297 and P35R) dominant in F1 and segregated in a 3:1 ratio in F2 generation and 1:1 ratio in BC generation suggested the action of one dominant gene controlling the fertility restoration.

242. Badolay, A.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Genetics and Plant Breeding. Hooda, J.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Genetics and Plant Breeding.

Malik, B.P.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Genetics and Plant Breeding. Phenotypic variability in fababean (Vicia faba Linn.). Annals of Biology (India). (Dec 2010) v.26(2) p.141-144 KEYWORDS: VICIA FABA.

Hundred genotypes of fababean were evaluated for their yield and component traits. A substantial amount of genetic variability was Observed for all the traits under study. The highest genotypic and phenotypic coefficient of variation was observed. for seed yield per plant followed by pods per plant, clusters per plant, branches per plant, plant height and lOO-seed weight. Likewise high heritability and genetic advance were also observed for above mentioned traits.

243. Kumar, A.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Seed Science and Technology. Kashyap, R.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Seed Science and Technology. Punia, R.C.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Seed Science and Technology. Maan, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Seed Science and Technology. Standardization of substrate and temperature for germination test in Jatropha (Jatropha curcas L.) seed. Annals of Biology (India). (Dec 2010) v.26(2) p.145-148 KEYWORDS: JATROPHA. TEMPERATURE. SEEDS. GERMINATION.

An experiment was conducted to find out the suitable substrata and temperature requirements for germination testing in Jatropha seed, collected from six different locations of Haryana. The seed lots were tested on sufficient moistened three substrata viz., sand, B.P. and T.P. and at fuur different temperatures 20, 25, 20-30 and 30°C with 90-95% RH in seed germinator. Highest germination was observed in sand followed by between paper (BP). Among various temperatures, maximum germination was recorded at 30°C followed by 25°C. No germination was recorded in top of paper at 20°C and 20-30^0C temperature. Based on the above parameters recorded, 30°C temperature and sand substrata were found best for germination test for Jatropha seed.

244. Kaliramana, R.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science. Pannu, B.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science. Effect of wetting and drying cycles on potassium fixation with sulphate and nitrate anions. Annals of Biology (India). (Dec 2010) v.26(2) p.149-154 KEYWORDS: ANIONS. POTASSIUM. SOIL TEXTURE.

The studies were carried out to study the effect of wetting and drying cycles on potassium fixation with anions i.e. sulphate and nitrate in some soils of Haryana. The most of the soils were light in texture and ranged from sand to clay loam. The soils were alkaline in reaction. The amount of K fixed increased with the increasing days of wetting and drying cycles at different levels K from 20 to 1000 pg/ml in soil upto a depth of 25 cm. The highest amount of fixed K was observed after seven days then followed by 14 and 28 days as compared to the wet fixed K. It appeared that a period of 7 to 28 days of wetting and drying cycles was sufficient for transfer of K ions from the non-exchangeable K pool to the available K pool. The amount of K fixed was observed maximum in the Palwal soil and minimum in Chautala soil with different levels of K.

245. Gulati, Sunil; Central Potato Research Station, Jalandhar (India). Singh, Manjit; Central Potato Research Station, Jalandhar (India). Energy requirement and management in a potato production system. Potato Journal (India). (Jan 2011) v.38(1) p.61-66 KEYWORDS: POTATOES. PRODUCTION. ENERGY MANAGEMENT.

The energy analysis at CPRS, Jalandhar farm revealed that among the various operations, irrigation consumed the maximum amount of energy, i.e. 6622.12 MJ/ha (44.4%) followed by seedbed preparation 3192.84 MJ/ha (21.4%). Total operation wise energy consumption for potato production was found to be 14902.77 MJ/ha. Amongst the indirect energy sources, the energy input derived through the seed material was maximum, i.e. 16320 MJ/ha (36.05%). Fertilizer contributed the next major share of energy input, i.e. 10870 MJ/ha (24.01%). The total energy requirement for potato

production under mechanized system from all the sources including the direct and indirect sources was 45262.98 MJ/ha. Average output energy from potato was 62983.6 MJ/ha. The output to input energy ratio and average specific energy requirement for the crop was observed to be 1.4 and 2.6 MJ/kg, respectively.

246. Mehra, Menka; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, Sobaran; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Effect of INM on the growth, yield and nutrient uptake by wheat under Brahmi-Wheat cropping system. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.105-107 KEYWORDS: BIOFERTILIZERS. ORGANIC AGRICULTURE. NUTRIENT UPTAKE. WHEATS. CROPPING SYSTEMS. DRUG PLANTS.

Field experiment was conducted during Rabi season of 2003-04 at Pantnagar on sandy loam soil to study the effect of INM on the growth, yield and nutrient uptake by wheat under Brahmi-Wheat cropping system. Integrated nutrient management involving the combination of FYM, green manure, crop residue and biofertilizer (Azotobacter) with inorganic sources resulted in highest plant height (98 cm), no of tillers/m^2 (349), grain yield (41.36 q ha^{-1}) and straw yield (82.32 q ha^{-1}) of wheat and also highest N (144.99 kg ha^{-1}), P(36.40 kg ha^{-1}) and K (145.40 kg ha^{-1}) uptake by wheat. Thus, it was concluded that integrated nutrient sources are better for sustaining growth, yield and nutrient uptake by wheat crop under Brahmi-Wheat cropping system.

247. Joshi, Y.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Panwar, U.B.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, Kuldeep; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Production potential and economies of different cropping systems under Tarai condition of Uttarakhand. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.13-16 KEYWORDS: PRODUCTION POSSIBILITIES. CROPPING SYSTEMS. AGRICULTURAL ECONOMICS. COST BENEFIT ANALYSIS. PROFITABILITY.

The experiment was conducted from Rabi season of 2000 to Khairf 2005 to evaluate different cropping systems in randomized block design with 4 replications. Pooled data of five years showed that under Tarai condition of Uttarakhand; wheat(grain)– Maize+Cowpea – Paddy(grain) cropping sequence recorded highest green forage yield equivalent (2603.6 qt/ha/year) and net return (49191 Rs./ha/year) followed by Wheat–Paddy (grain).

248. Kushwaha, M.L.; G.B. Pant University of Agriculture and Technology, Bharsar (India). V.C.S.G. College of Horticulture. Effect of spacing and various levels of nitrogen on seed crop of carrot (Daucus carota L.). Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.73-76 KEYWORDS: SPACING. NITROGEN. SEED CROPS. CARROTS. DAUCUS CAROTA.

The present investigation was undertaken to study the effect of spacing and various level of nitrogen on growth and seed yield of carrot var. Nantes during 2004-05 and 2005-06 at V.C.S.G. College of Horticulture Bharsar, Pauri Garhwal. It was concluded that the characters i.e. plant height, number of branches per plant, number of umbels per plant and number of seeds per umbel increased significantly with increasing level of nitrogen from 0 to 100 kg/ha. As far as the row spacing concerned, the above growth characters showed different responses. The medium row spacing (45x45 cm) in combination with 100kg N/ha gave significantly higher yield during both the years of investigation. The spacing 45x45cm with 100kg N/ha was found to be best combination for increasing the seed production of carrot.

249. Rajesh Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, R.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Yesh Pal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Yield and

quality of Brassica species as influenced by different dates of sowing and varieties. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.6-11 KEYWORDS: BRASSICA. SOWING DATE. HYBRIDS. CROPPING SYSTEMS. HIGH YIELDING VARIETIES.

The field experiment comprised of four dates of sowing with six varieties of four Brassica species was conducted at the crop Research Centre of GBPUA&T Pantnagar during 2000-01 to 2002-03. Delay in sowing from 30 September to 14 November increased the number of days to 50% flowering but drastically reduced the number of days to maturity. Late sowing resulted in significant reduction in growth, yield and yield attributing parameters over 30 September sown crop. Similarly, dates of sowing had effect on quality parameters and significant reduction in oil and eurcic acid contents was recorded while protein, saturated fatty acids and glucosinolate contents in meal were significantly higher in later dates. Among the species, B. carinata took significantly more days to 50% flowering (112.0) and maturity (173.0) with highest dry matter accumulation/plant (50.5 g). Similarly, except seeds per siliqua, which were higher in NDYS –2 (B. campestris var. yellow sarson), rest all the yield contributing parameters were significantly higher in B. carinata var. Kiran. The seed and oil yield was also significantly higher in this variety followed by B. napus var. Hyola –401. The highest oil content (39.8%), saturated fatty acids (4.34%) and lowest glucosinolate (25.90 g/g fat free meal) and Erucic acid content (0.84%) were also recorded in B. napus var. Hyola-401 but the protein content was significantly higher in B. campestris var. NDYS-2.

250. Dwivedi, Rama; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Srivastava, P.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Effect of cereal straw incorporation and zinc sulphate application on soil properties and available nutrients under rice-wheat rotation. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.66-71 KEYWORDS: CEREALS. CROP ROTATION. CROPPING SYSTEMS. STRAW. ZINC SULPHATE. SOIL CHEMICOPHYSICAL PROPERTIES. CROP RESIDUES.

Application of 0, 6.25, 12.5 and 25.0 kg zinc sulphate ha^{-1} to first year rice crop with or without cyclic incorporation of 1.5, 3.0 and 6.0 t ha^{-1} wheat straw for rice and rice straw for wheat crop for two years influenced organic carbon content, available N, available P and available K significantly. EC and pH of soil were not affected. In general, after rice harvest the content of soil organic C was higher than after wheat harvest. Incorporation of straw 6.0 t ha^{-1} with Zn application helped accumulation of available soil N. After two crop cycles, available P content of soil increased significantly with the incorporation of straw 3.0 t ha^{-1}. Available K content in soil increased significantly with the conjunctive use of straw and $ZnSO_4$.

251. Chandra, Ruchi; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Physiology. Singh, Munna; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Physiology. Singh, Dheer; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Saini, Sonia; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Verma, A.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Influence of delayed sowing in wheat (T. aestivum L.) genotypes: plant growth and yield attributes. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.86-95 KEYWORDS: SOWING DATE. WHEATS. TRITICUM AESTIVUM. GENOTYPES. CROPPING SYSTEMS. YIELD COMPONENTS.

Wheat (Triticum aestivum L.) is a major cereal crop of north India, usually sown after rice harvesting under rice- wheat, and after harvesting of sugarcane ratoon in sugarcane based cropping systems in late Nov.-Dec., and even goes upto January. It grows well under low temperature (10-20°C) while anthesis occurs during the on-set of continuous warm temperature (25-30°C) coupled with hot and dry air (RH 45-50%) in late Jan. and Feb. The genotypes viz., PBW-396, Raj-3765, UP-2382, UP-1109, PBW-373, C-306, VL-802 and VL- 738 were sown at two different dates abbreviated as D1

and D2 keeping 30 days time interval (25 Nov-25 Dec.). The leaf area was recorded with the view that it has got tremendous role for intercepting photosynthetic irradiance linked with light use efficiency to transform photochemical energy for carbon economy based on photosynthesis. The loss in leaf surface area was observed 10-16% in late sown cultivars. The optimal value of Chl content was found 4.6 mg/g fresh mass with Chl a/b ratio 3.8 in VL-802. Chl content and Chl a/b ratio were found decreased in delayed sown cultivars. The flag leaf senescence also occurred faster in delayed sown cultivars with reduction in total life span linked with down-regulation of plant performance and plant productivity.

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252. Singh, Kalyan; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Singh, Yogeshwar; Rajendra Agricultural University, Pusa (India). Upadhyay, A.K.; Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur (India). Mori, S; University of Tokyo, Tokyo (Japan). Phytosiderophore-based molecular approach for enhanced iron acquisition to increase crop production under high pH calcareous soils. Indian Journal of Agricultural Sciences (India). (Aug 2011) v. 81(8) p. 679–89 KEYWORDS: CALCAREOUS SOILS. MOLECULAR HYBRIDIZATION. SIDEROPHORES. PLANT PRODUCTION. FERROXIDASE.

In the plant kingdom, two different Fe-deficiency chlorosis induced root strategies exist. Strategy I typical for dicots and monocots, with exception of grasses, is characterized by increased root reducing capacity (plasma membrane bound reductase), lowering the pH of the medium and in some instances enhanced release of phenolics. Strategy II iron acquisition mechanism of graminaceous monocots release iron-chelating mugineic acid family phytosiderophores (MAs in response to Fe deficiency) which solubilize inorganic Fe III compounds by chelation to form Fe3+-MA. These Fe3+- MAs are passed through a highly specific Fe transporter (yellow strip – YS I) present in the root plasma membrane. Further, notification of the key enzymes such as nicotianamine synthase (NAS) and/or nicotianaimine aminotransferase (NAAT) as well as deoxygenase gene IDS3 paved the way for the development of transgenic rice plants with enriched DMA both in shoot and root of chlorotic plants. Therefore, it is established that the genetic engineering can transfer traits from plants tolerant to adverse conditions to field crops for sustained productivity. Introduction of NAS, NAAT and IDS3 genes, respectively in rice has been found very effective in producing higher amount of phytosiderophores (MAs). Introduction of linearly combined genes NAS, NAAT and IDS3.Two cis-elements (iron deficiency-responsive elements) IDE 1 and IDE 2 have also been identified.

253. JINDAL, S.K.; Central Arid Zone Research Institute, Jodhpur (India). Tak, Amit; Central Arid Zone Research Institute, Jodhpur (India). Singh, S.K.; Central Arid Zone Research Institute, Jodhpur (India). Pancholy, Anjly; Central Arid Zone Research Institute, Jodhpur (India). Pathak, Rakesh; Central Arid Zone Research Institute, Jodhpur (India). Raturi, Aparna; Central Arid Zone Research Institute, Jodhpur (India). Molecular assessment of genetic diversity in Acacia senegal. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.695–9 KEYWORDS: ACACIA SENEGAL. GENETIC VARIATION. POLYMORPHISM. RAPD. POPULATION DISTRIBUTION.

Acacia senegal is well adapted to arid environment of western Rajasthan and has a potential to restore soil fertility and sand dune stabilization. There is a scope of improvement by exploiting geographical genetic diversity. It is a drought- tolerant multipurpose leguminous African tree species and also an important forest resource for gum Arabic, fuel, food and fodder. Thirteen selected plants showing significantly high and low seed yields from Rajasthan and exotic locations, viz Niger, Mali, Senegal and Sudan, transplanted in 1988 at Central Arid Zone Research Institute (CAZRI), Jodhpur, were subjected to randomly amplified polymorphic DNA (RAPD) analysis. Six random primers generated a total of 86 scorable loci and exhibited 77.77 to 94.73% polymorphism. Unweighed pair group method using arithmetic averages (UPGMA)

dendrogram obtained from cluster analysis using Jaccard s similarity coefficient delineated all the 13 population samples representing seven geographical populations. The results clearly revealed existence of genetic diversity within and among geographical populations of A. senegal. The Indian population exhibited the maximum genetic diversity from rest of the African populations.

254. Prasanna, B.; Mazumdar, S.; Project Directorate on Farming System Research, Meerut (India). Chakraborti, M; IGFRI, Jhansi(India). Hossain, F.; Indian Agricultural Research Institute, New Delhi (India). Manjaiah, K.M.; Indian Agricultural Research Institute, New Delhi (India). Agrawal, P.K.; VPKAS, Almora (India). Division of Crop Improvement. Guleria, S.K.; CSKHPKV, Palampur (India). Bajaura Centre. Gupta, H.S.; Indian Agricultural Research Institute, New Delhi (India). Genetic variability and genotype× environment interactions for kernel iron and zinc concentrations in maize (Zea mays) genotypes. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.704–11 KEYWORDS: ENVIRONMENT. MAIZE. ZINC. IRON. GENETIC VARIATION.

Micronutrient enrichment in the major staple food crops is an important breeding goal in view of the extensive problem of hidden hunger caused by micronutrient malnutrition. Kernel iron (Fe) and zinc (Zn) concentrations were evaluated in a set of 30 diverse maize genotypes during rainy (kharif) season of 2006, 2007 and 2008. The ranges of kernel Fe and Zn concentrations were 11.28–60.11 mg/kg and 15.14–52.95 mg/kg, respectively, across the three years. Based on the performance of the entries across the years, four highly promising inbreds and three landrace accessions were identified as highly promising for kernel Fe concentration, including a HarvestPlus line, HP2 (42.21 mg/kg). Similarly, for kernel Zn concentration, three inbreds and one landrace were identified as highly promising, including V340 (43.33 mg/kg). No significant association was found between kernel Fe and Zn concentrations indicating the need for independent selection for enhancing the concentration for these traits. Stability analysis revealed significant role of environment and genotype×environment (G×E) interaction in determining the levels of kernel Fe and Zn. The study also identified HP2 and BAJIM 06-17 for kernel Fe concentration and IML467 for kernel Zn concentration as the most stable genotypes across the environments.

255. Yadava, D.K.; Indian Agricultural Research Institute, New Delhi(India). Giri, S.C.; Indian Agricultural Research Institute, New Delhi(India). Vignesh, M.; Indian Agricultural Research Institute, New Delhi(India). Vasudev, Sujata; Indian Agricultural Research Institute, New Delhi(India). Yadav, Anil Kumar; Indian Agricultural Research Institute, New Delhi(India). Dass, B.; Indian Agricultural Research Institute, New Delhi(India). Singh, Rajendra; Indian Agricultural Research Institute, New Delhi(India). Singh, Naveen; Indian Agricultural Research Institute, New Delhi(India). Mohapatra, T.; Indian Agricultural Research Institute, New Delhi(India). Prabhu, K.V.; Indian Agricultural Research Institute, New Delhi(India). Genetic variability and trait association studies in Indian mustard (Brassica juncea). Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.712–6 KEYWORDS: BRASSICA JUNCEA. HERITABILITY. STATISTICAL METHODS. GENETIC VARIATION.

Thirty released varieties of Indian mustard [Brassica juncea (L.) Czern and Coss.] were evaluated during winter (rabi) 2006–07 and 2007–08 under irrigated and rainfed environments. Analysis of variance on 14 quantitative traits was carried out and pooled analysis over the environments was conducted. The mean, range, phenotypic, genotypic and environmental variance, genotypic and phenotypic coefficient of variation, heritability in broad sense and genetic advance were calculated. Path coefficient analysis was carried out using correlation coefficients to know the yield- contributing traits having true associations with seed yield. Improvement in seed yield can be achieved by selection using the correlation and path analysis data generated in this study. 1000-seed weight was positively correlated with siliqua length. 1000-seed weight and total siliquae/plant also had higher phenotypic and genotypic direct effects on seed yield/ plant, revealing that indirect selection for these traits would be effective in improving

seed yield. The high heritability coupled with high genetic advance for 1 000-seed weight would also be of great use for indirect selection for improvement in seed yield. The material used in the study is of diverse nature and can be used in the breeding programme for development of improved genotypes in mustard.

256. Singh, Anjani Kumar; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Singh, S.B.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Kohli, Anshuman; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Singh, A.P.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Performance of wheat (Triticum aestivum) genotypes as influenced by low moisture and temperature regimes under mid-hill conditions of Jammu and Kashmir. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.776–9 KEYWORDS: GENETIC VARIATION. ALTITUDE. COLD. TRITICUM AESTIVUM. JAMMU AND KASHMIR. WHEATS.

The performance of seven improved wheat cultivars were examined on field trials under cool climatic conditions of mid hills (950m above mean sea level) under water deficit stress and stress-free condition during 2007–08 and 2008–09. Results revealed that genotype which exhibited highest yield potential under non-stress condition has failed to produce the same level of yield under stress situation and vice-versa. Biomass production showed equivalent estimates of heritability (0.83, 0.94) and genetic gain per cycle of selection (0.03, 0.26) between treatments. In this investigation less variability between PCV and GCV of biomass under stress environment coupled with high heritability, genetic advance and genetic gain from selection suggested the influence of additive gene effect on the expression of these characters under stress environment. The possible control of non-additive gene effect was observed for plant height and grain yield in non-stress environment and seed weight in stress condition. This indicated thatindirect selection through characters would be moreeffective when exploited under favourable environment while constituted significant relation with desired characters. Therefore, three genotypes viz VL 900, HS 295 and VL 738 should be preferred for cultivation as they performed well both in stress and non-stress conditions under mid hills.

257. Navjot; Punjab Agricultural University, Bathinda (India). Regional Research Stn.). Mittal, V.P.; Punjab Agricultural University, Bathinda (India). Regional Research Stn.). Brar, K.S.; Punjab Agricultural University, Bathinda (India). Regional Research Stn.). Thakur, A.; Punjab Agricultural University, Bathinda (India). Regional Research Stn.). Dalal, R.P.; Punjab Agricultural University, Bathinda (India). Regional Research Stn.). 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: YIELDS. STABILITY. ZIZIPHUS.

258. Kaliramana, R.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science). Pannu, B.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science). Effect of potassium concentrations with chloride and sulphate on potassium fixation in Haryana soils. Annals of Biology (India). (Dec 2010) v.26(2) p.155-161 KEYWORDS: SULPHATES. CATIONS. ANIONS. POTASSIUM CHLORIDE.

The amount of K fixation varied from 49.89 to 18.15% in respect of potassium chloride and 75.29 to 23.56% in potassium sulphate when K was applied 20 to 1 000 g/ml. The relative fixation was highest when potassium was applied 20 mg/ml and least was observed when applied I 000 mg/ ml indicating more availability of K in the soil. The Chautala soil showed the lowest degree of fixation irrespective of potassium forms. The mechanism of potassium fixation in soil through clays is believed to be the result of precipitation of potassium in the interior of the lattices or due to the concentration of the sheet of clay in consequence entry of K ions. The fixation of potassium at 20 g/ml level was the lowest in potassium chloride and highest in potassium sulphate. The different levels of the KCI showed the lowest degree of fixation in the soil suggesting more availability of added K. It was observed that the fixation of potassium in different soil

profiles with different anions of potassium was positively and significantly correlated with clay, Sill, organic carbon and CEC. The fixation of K was negatively correlated with sand and positively with different levels of applied potassium.

259. Garhwal, O.P.; S.K.N. College of Agriculture, Jobner (India). Dept. of Horticulture). Fageria, M.S.; S.K.N. College of Agriculture, Jobner (India). Dept. of Horticulture). Mukherjee, S.; S.K.N. College of Agriculture, Jobner (India). Dept. of Horticulture). Effect of nitrogen and biofertilizer on yield and quality of okra hybrids. Annals of Biology (India). (Dec 2010) v. 26(2) p. 163-168 KEYWORDS: NITROGEN. YIELDS. QUALITY. BIOFERTILIZERS. OKRAS.

A field experiment was conducted during rainy seasons of 2003 and 2004 on okra [Abelmoschlls esculentus (L.) Moench] at Horticulture Farm, S.K.N. College of Agriculture, Jobner, Rajasthan to study the effect of nitrogen fertilization and biofertilizers on yield attributes, yield and quality of okra. Hybrid Varsha produced higher leaf area at 1st and last picking, branches/plant, fruit/plant, fruit yield, protein and crude fibre content compared to Barkha Bahar but remained on par with Hybrid Ganga. Inoculation of okra seed with Azospirillllm significantly increased leaf area, branches/plant, fruit/plant, fruit yield, nitrogen, protein content in okra seed and available soil N over no inoculation. Application of 25% N through urea + 75% through vermicompost produced significantly higher leaf area, branches/plant, fruit/plant, fruit yield, nitrogen and protein content over control. However, maximum available N was recorded in 100% vermicompost followed by 25% N through urea+75%'N through vermicompost over control, farmers' practice, 100% N through urea and 75% N through urea+25% N through vermicompost.

260. Antil, S.K.; Haryana State Cooperative Apex Bank Limited, Chandigarh (India). Baloda, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Horticulture). Singh, G.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agricultural Economics). Status of household, population and education in the watershed area of shivalik region, Haryana. Annals of Biology (India). (Dec 2010) v.26(2) p.169-171 KEYWORDS: LITERACY. EDUCATION. HARYANA. POPULATION CENSUSES. WATERSHEDS.

The rate of change in literacy in the project and non-project areas, the literacy rate was highest being 114.36% followed by 13.36 and 12.62% in the upper, lower project area and non-project area, respectively. In watershed area the rate of population growth was found less as compared to controlled area. It was disappointing to note that in both the upper and lower project areas of Shivalik watershed, the percentage of female population decreased widening the gap between male and female population.

261. Waghmode, B.D.; Regional Agricultural Research Station, Raigad (India). Mehta, H.D.; Navsari Agricultural University, Navsari (India). Regional Rice Research Stn.). Genetics of fertility restoration of diverse cytosterile sources in rice (Oryza sativa L.). Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.1-8 KEYWORDS: FERTILITY. GENETICS. ORYZA SATIVA. ECONOMICS. RICE.

The availability of stable cytoplasmic male sterility and fertility restoring system is vital for commercial exploitation of heterosis in rice. Inheritance study using four effective fertility restorers (BL-184-AR, IR-54742-22-19-3, NVSR-20 and Pusa Sugandha-5) and five diverse cytosterile sources (KJTCMS-6A-WA, RTN 2A-ARC, RTN 3A-Mutant of IR 62829B, RTN 13A-Gambiaca and RTN 17 A Dissi), their F1, F2 and BC, populations revealed that the fertility restoration was governed by two independent genes, one of which appeared to be stronger in action than other. Crosses KJTCMS-6A X IR-54742-22-19-3, RTN-2A X BL-184-AR and RTN-2A X NVSR-20, RTN-3A X BL-184-AR and RTN-13A X NVSR-20, showed segregating ratio of 12 (fertile):3 (partially fertile + partially sterile):1 (completely sterile plants) and 2 (fertile):1 (partial sterile! fertile):1 (sterile) in F2 and BC, generations respectively, for pollen and spikelet fertility indicating two major genes with dominant epistasis. In case of crosses KJTCMS-6A X BL-184-AR and KJTCMS-6A X NVSR-20, RTN-13A X BL-184-AR, RTN-17A X BL-184-AR segregated in

the ratio of 9:6:1 and 1:2:1 in F2 and BC, generations respectively, for pollen and spikelet fertility indicating two major genes with epistasis and incomplete dominance. While crosses, KJTCMS-6A X Pusa Sugandha-5, RTN-2A X IR-54742-22-19-3 and RTN-2A X Pusa Sugandha-5, RTN-3A X IR-54742-22-19-3, RTN-3A X Pusa Sugandha-5 and RTN-3A X NVSR-20, RTN-13A X IR-54742-22-19-3, RTN-13A X Pusa Sugandha-5 and RTN-17A X IR-54742-22-19-3, RTN-17A X Pusa Sugandha-5, RTN-17A-X NVSR-20, exhibited the restoration pattern fitted well in a segregation ratio of 9:3:4 and 1:1:2 in F2 and BC, generations respectively, for pollen and spikelet fertility displaying an epistasis with recessive interaction. The mode of action of these genes were different in different restorer combinations with five different sources of cytoplasmic genetic male sterility. Change in fertility restoration by same restorer With CMS line of same source and of different source could either due to cvtoplasmic genetic interactions of CMS line and fertility restoring genes or may be affected by modifier genes.

262. Auna, C.; Directorate of Sorghum Research, Hyderabad (India). Padmaja, P.G.; Directorate of Sorghum Research, Hyderabad (India). Subbarayudu, B.; Directorate of Sorghum Research, Hyderabad (India). Seetharama, N.; Directorate of Sorghum Research, Hyderabad (India). Genetics of traits associated with shoot fly resistance in post-rainy season sorghum (Sorghum bicolor L.). Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.9-16 KEYWORDS: GENETICS. SORGHUM BICOLOR. SHOOT PRUNING. DROUGHT RESISTANCE.

Generation mean analyses were carried out to study genetics of traits associated with shoot fly resistance in three crosses using male sterile susceptible female and resistant male parents (104B x 1518551, 104B x 152312 and 1048 x RSE03) during 2006-07 at two locations. The mean performance of families showed that resistance as indicated by lower deadheart percentage is governed by recessive genes. Both additive and non-additive gene actions were important for resistance, and this trait is influenced by environment. The line RSE 03 was a better source of resistance with relatively simple genetics for shoot fly resistance and component traits. Indirect selection through the component traits such as glossiness and seedling height which were under the control of additive genes would be effective for developing sorghum varieties resistant to shoot fly infestation.

263. Rajarajan, K.; Tamil Nadu Agricultural University, Coimbatore (India). Dept. of Millets. Ganeshamurthy, K.; Tamil Nadu Agricultural University, Coimbatore (India). Dept. of Millets. Genetic diversity analysis of sorghum [Sorghum bicolor (L.) Moench] genotypes for drought tolerance using SSR markers. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.17-24 KEYWORDS: SORGHUM BICOLOR. GENOTYPES. DROUGHT RESISTANCE. BIODIVERSITY.

Sorghum (Sorghum bicolor(L.) Moench) is considered as a model species for drought tolerance due to its inherent drought tolerant characteristics. The accessions were grouped into 27 major clusters elucidating a high level of genetic diversity which will be useful for identifying suitable genotypes for drought tolerance breeding. The best characterized form of drought tolerance during crop growth is the non-senescence or stay-green trait. Genetic diversity analysis carried out with 100 sorghum genotypes for drought tolerance using 13 stay-green specific polymorphic SSR markers revealed high level of polymorphism among the genotypes. A total of 56 scorable alleles were generated of which 55 were polymorphic. The number of alleles produced by different primers ranged from two to seven with an average of 4.0 alleles per primer. The polymorphic loci clearly discriminate all the genotypes. The similarity coefficients based on 13 SSR markers ranged from 0.02 to 1.00 Among the 100 accessions three genotypes viz., IS9389, IS29393 and IS29496 and two other genotypes IS23392 and IS23397 showed the highest similarity index (1.00) and the genotypes IS22005 and IS24693, showed the least similarity index (0.02). The dendrogram, which classified the hundred sorghum accessions into twenty-seven major clusters and discriminated the drought tolerant genotypes with susceptible genotypes. Cluster analysis categorized the drought resistant and drought susceptible genotypes into separate clusters. Most pi the

genotypes in the cluster IV had the better stay-green score. The stay-green specific genes may be present in most of these genotypes and classified as drought tolerant. In general, the genotypes B35, IS22212, IS22335, IS22697; IS29323, IS22243, IS23418, IS22794, IS21756 and IS22339 exhibited drought tolerance phenomenon and were grouped as drought tolerant under molecular level of genetic diversity.

264. Joshi, D.C.; Indian Grassland and Fodder Research Institute, Jhansi (India). Shrotria, P.K.; Gobind Ballabh Pant Unviersity of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding. Singh, R.; Gobind Ballabh Pant Unviersity of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding. Srivastava, M.K.; Indian Grassland and Fodder Research Institute, Jhansi (India). Chawla, H.S.; Gobind Ballabh Pant Unviersity of Agriculture and Technology, Pantnagar (India). Dept. of Genetics and Plant Breeding). Assessment of RAPD and ISSR marker systems for establishing distinctiveness of forage sorghum (Sorghum bicolor L. Moench) varieties as additional descriptors for plant variety protection. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.25-36 KEYWORDS: SORGHUM BICOLOR. RAPD.

Twenty six varieties of forage sorghum which included 20 released or notified and 6 indigenous local varieties were characterized with 40 morphological DUS descriptors as prescribed by DUS guidelines of PPV&FR Authority and ICAR. RAPD and ISSR markers were also studied to complement the morphological DUS descriptors for establishing distinctiveness of a variety. When all the 33 morphological descriptors of PPV&FR Authority and 7 J1 morphological descriptors of ICAR were studied distinct morphological profiles could be obtained only for 11 out of a total of 26 varieties. Thirteen primers out of a total of 14 RAPD primers were able to establish unique molecular identification profiles (MIPs) for a total of 14 varieties. Fourteen primers out of a total of 20 ISSR primers were able to establish distinctiveness of 19 varieties by the amplification of different genotype specific bands in these varieties. Both the molecular markers revealed a very high level of polymorphism, enabling genetic discrimination of the varieties analyzed by using 121 informative RAPD and 178 ISSR bands. UPGMA cluster analysis of both the markers could distinguish all the twenty six varieties. Higher Mean polymorphic information content (PIC), average expected gene diversity, average resolving power (Rp) and diversity index (DI) were higher for ISSR marker as compared to RAPD one which reflected that ISSR marker is more efficient tool to establish distinctiveness amongst the present set of experimental material. Out of a total of 26 varieties unique1 identification profiles were developed for 25 varieties by a combination of morphological DUS descriptors and both the RAPD and ISSR markers. However, the variety Pusa Chari 121 was not delineated by any of the morphological and molecular markers. Thus from the present study it could be concluded that in situations where the morpho-physiological DUS descriptors are not able to establish distinctiveness of a variety, then unique molecular fingerprints generated by molecular markers may be used as additional or complement descriptors for resolving distinctiveness of varieties.

265. Dey, S.S.; Indian Agricultural Research Institute, Katrain (India). Regional Stn.). Sharma, S.R.; Indian Agricultural Research Institute, Katrain (India). Regional Stn.). Bhatia, R.; Indian Agricultural Research Institute, Katrain (India). Regional Stn. Kumar, P.R.; Indian Agricultural Research Institute, Katrain (India). Regional Stn. Prakash, C.; Indian Agricultural Research Institute, Katrain (India). Regional Stn. Development and characterization of Ogura based improved CMS lines of cauliflower (Brassica oleracea var. botrytis L.). Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.37-42 KEYWORDS: HYBRIDS. BRASSICA OLERACEA.

For the first time, three Ogura based improved cytoplasmic male sterile (CMS) lines of cauliflower (Brassica oleracea var. botrytis L.) viz., Ogu1A, Ogu2A and Ogu3A were developed following seven generations of backcrossing with snowball group. These lines were evaluated and compared with their respective fertile maintainer(B) line for various agronomic traits like curd yield and size, floral traits like size of petals and style, shape of style and seed setting traits like number of seeds per pod and seed yield per

plant. Nuclear-cytoplasmic interaction played an important role in determining various agronomic, floral and seed setting related traits. All the three CMS lines were similar with fertile maintainer lines for agronomic traits like days to curd maturity. The curd yield of Ogu1 A and Ogu3A were similar with their respective maintainer lines. However, introgression of alien Ogura cytoplasm in the background of snowball cauliflower significantly reduced the petal size, filament length, style and stamen length. Number of pods per plant 1II(as significantly lower in all three CMS lines, when compared with their respective B lines. Number of seeds per pod and seed yield per plant in Ogu3A and its respective B line was at par but reduced significantly in Ogu1A and Ogu2A after introgression of Ogura cytoplasm.

266. Alarmelu, S.; Surgarcane Breeding Institute, Coimbatore (India). Shanthi, R.M.; Surgarcane Breeding Institute, Coimbatore (India). Incompatibility studies in sugarcane (Saccharum spp.). Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.43-48 KEYWORDS: SACCHARUM. POLLEN. GYNOECIUM.

The study was undertaken during the period 2001-2004 to investigate the behaviour of the pollen tubes in the stigmatic tract of pistil parents utilized in inter-varietal hybridization. Among the 173 breeding material screened for occurrence of incompatibility, 36 parents were identified self incompatible and among them nine incompatible parents were further studied for their cross compatibility. Pollen germination was normal in Co86011, Co91004 and Co62198 and slightly inhibited in a cross with Co99002. Fertilization was accomplished within 4 hr of pollination in crosses Co8371 x Co86011, Co88028 x Co86011. The presence of Co86011 and Co91004 pollen tubes in the ovary 8h after pollination indicated the possibility of normal fertilization, while in cross with Co94008, restricted pollen tube growth was observed. Pollen tube in the clone 2000-147 did not penetrate the ovary even 10h after pollination. Self pollen did not support the development of pollen tubes in Co88028, Co91004, Co99002, Co62198 and Co86011. In the crosses of Co88028 x Co91004, Co88032 x Co99002 and Co88028 x Co86011 pollen germination and entry of pollen tube was normal. The study indicated that there is no hurdle at the pollen germination stage and delayed/restricted growth of pollen tubes indicated that the barrier operates in the stylar region of the parent. Thus, from our study it could be inferred that i) cross-incompatibility systems are responsible for the failure to produce successful crosses among Co88028 x Co91004, Co88028 x Co99002.ii) self incompatible parents could be used as safe pistU (Co837, Co8371, Co88028, Co88025) and pollen parents (Co62198, Co86011, Co94008, Co91004).

267. Rani, N.; Ranchi University, Ranchi (India). Dept. of Botany. Kumar, K.; Ranchi University, Ranchi (India). Dept. of Botany. Karyomorphological studies in the genus Catharanthus. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.55-60 KEYWORDS: CATHARANTHUS.

Karyomorphological studies of Catharanthus pusil/us and six varieties of Catharanthus roseus (L.) G. Don showed same diploid chromosome number i.e. 2n=2x=16. There was uniformity in the chromosome complement in all the types investigated. Based on total chromatin length feature, C. pusil/us and white with red eye flowered variety of C. roseus revealed to be primitive and advanced respectively. Overall, white flowered variety of C. roseus was considered most advanced on account of its lower Symmetry Index percent value, Total Form percentage and Form percent value.

268. Honrao, B.K.; Agharkar Research Institute, Pune (India). Surve, V.D.; Agharkar Research Institute, Pune (India). Khade, V.M.; Agharkar Research Institute, Pune (India). Misra, S.C.; Agharkar Research Institute, Pune (India). Inheritance of leaf rust in synthetic hexaploid wheat. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.61-63 KEYWORDS: LEAVES. GENETIC INHERITANCE. RUSTS. FUNGAL DISEASES.

269. Bhagwat, M.D.; Agharkar Research Institute, Pune (India). Honrao, B.K.; Agharkar Research Institute, Pune (India). Khade, V.M.; Agharkar Research Institute, Pune (India). Oak, M.D.; Agharkar Research Institute, Pune (India). Tetali, S.; Agharkar Research Institute, Pune (India). Misra, S.C.; Agharkar Research Institute, Pune (India). Chavan, A.M.; Agharkar Research Institute, Pune (India). Surve, V.D.; Agharkar Research Institute, Pune (India). Rao, V.S.; Agharkar Research Institute, Pune (India). Genetics and linkage studies of free threshing and grain type traits in Triticum dicoccum L. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.64-66 KEYWORDS: THRESHING. TRITICUM DICOCCUM. GRAIN. GENETICS.

270. Brar, B.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Biotechnology. Jain, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Biochemistry. Singh, R.; Chaudhary Charan Singh Haryana Agricultural University, Kaul (India). Rice Research Stn. Jain, R.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Biotechnology. Genetic diversity for iron and zinc contents in a collection of 220 rice (Oryza sativa L.) genotypes. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v. 71(1) p. 67-73 KEYWORDS: IRON. ZINC. ORYZA SATIVA. GENOTYPES. BIODIVERSITY.

271. Kamal, S.; Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Vegetable Science. Variability and association studies for morphological and biochemical traits in potato (Solanum tuberosum L.). Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.74-77 KEYWORDS: SOLANUM TUBEROSUM. POTATOES. MOLECULAR GENETICS.

272. Singh, V.V.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Singh, M.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Chauhan, J.S.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Kumar, S.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Development and evaluation of full sib progenies of Indian mustard (Brassica juncea L.) for moisture stress conditions. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.78-81 KEYWORDS: BRASSICA JUNCEA. EVALUATION. MOISTURE CONTENT.

273. Sawardekar, S.V.; Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (India). Plant Biotechnology Centre. Gokhale, N.B.; Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (India). Plant Biotechnology Centre. Mote, M.S.; Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (India). Plant Biotechnology Centre. Joshi, S.N.; Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (India). Plant Biotechnology Centre. Sawant, S.S.; Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli (India). Plant Biotechnology Centre). Sex detection of kokum (Garcinia indica Choisy) by RAPD markers. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.82-83 KEYWORDS: GARCINIA.

274. Pal, J.K.; Indian Institute of Vegetable Research, Varanasi (India). Biotechnology Lab. Kumar, S.; Indian Institute of Vegetable Research, Varanasi (India). Biotechnology Lab. Singh, M.; Indian Institute of Vegetable Research, Varanasi (India). Biotechnology Lab. Genetic transformation of Vigna unguiculata tissue by Agrobacterium tumifaciens. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.84-86 KEYWORDS: VIGNA UNGUICULATA. TISSUE CULTURE. GENETIC TRANSFORMATION. AGROBACTERIUM TUMEFACIENS.

275. Sandigawad, A.M.; Karnatak Science College, Dharwad (India). Dept. of Botany. Patil, C.G.; Karnatak Science College, Dharwad (India). Dept. of Botany. Genetic diversity in some south-Indian Cinnamomum Scha. species revealed by RAPD markers. Indian Journal of Genetics and Plant Breeding (India). (Feb 2011) v.71(1) p.87-90 KEYWORDS: GENETIC RESOURCES. CINNAMOMUM. GENETIC MARKERS. DNA. RAPD.

276. Chakraborti, M.; Indian Grassland and Fodder Research Institute, Jhansi (India) Crop Improvement Div.). Chankrashekaran, S.; Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics. Multiple roles of a PLB 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: DROSOPHILA. GENETICS. OLFACTION. RECYCLING.

G-protein coupled Phospholipase Ca(PLCa) 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 PLCa 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 (itpfJ and for endocytosis and exocytosis in synaptic vesicles is also shown.

277. 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: ORYZA SATIVA. AMMI. RICE. DROUGHT. HIGHLANDS. UPLAND CROPS.

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; ASTABj and Rao's Index of stability were utilized to interpret the stability among the NIlLs under stress and non-stress environments. The grain yield was much sensitive and highly influenced by environment resulting in higher GxE 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 ASTABj, 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 over all adaptability.

278. Khan, H.; Central Institute for Arid Horticulture, Bikaner (India). Tomar, S.M.S.; Indian Agricultural Research Institute, New Delhi (India) Div. of Genetics. Chowdhury, S.; Indian Agricultural Research Institute, New Delhi (India) Div. of Genetics. Inheritance studies on spot biotech of wheat caused by Bipolaris sorokiniana. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.229-233 KEYWORDS: GENETICS. WHEATS. DEFENCE MECHANISMS. BIPOLARIS. COCHLIOBOLUS SATIVUS.

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 128-0Y, Suzhoe 1-58, 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 Shanghai-4, Suzhoe 128-0Y, Suzhoe 1-58, Longmai and Chuanmai No.18 appears to be additive with polygenic control as the F2 populations of the susceptible x resistant crosses exhibited different degrees of disease

reaction of all categories, viz., resistant, moderately resistant, susceptible and highly susceptible.

279. Sarkar, B.; Directorate of Wheat Research, Karnal (India). Verma, R.P.S.; Directorate of Wheat Research, Karnal (India). Prasad, R.; Indian Agricultural Statistics Research Institute, New Delhi (India). Shoran, J.; 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: BARLEY. INDIA. GERMPLASM COLLECTIONS. HORDEUM VULGARE.

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.

280. Reddy, P.S.; International Crops Research Institute for the Semi-Arid Tropics, Patancheru (India). Rao, D.M.; Osmania University, Hyderabad (India). Dept. of Genetics and Biotechnology. Reddy, V.S.B.; International Crops Research Institute for the Semi-Arid Tropics, Patancheru (India). Kumar, A.A.; International Crops Research Institute for the Semi-Arid Tropics, Patancheru (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: FERTILITY. SORGHUM BICOLOR. CYTOPLASMIC MALE STERILITY. GENES.

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) cytoplasms 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 X2 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:1 OS 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.

281. Kumar, R.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding. Sagar, P.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. 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: YIELDS. PENNISETUM GLAUCUM. COMBINING ABILITY. HETEROSIS. CYTOPLASM. PEAS.

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), Pb313A (A2), Pb402A (Aa), 81A4, 81As representing five different cytoplasm systems and their corresponding maintainer (B) lines were crossed with 12 restorer (R)

lines in a line x 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 x R, B x R). The differences due to A vs. B and A x R vs. B x 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 x R and B x R hybrids combination. Both positive and negative cytoplasmic effects were observed for all the four characters studied. The (A x R vs. B x R) x 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 81 A cytoplasmic iso-hybrids indicated that all the three cytoplasms have same potential, therefore, any of these cytoplasms can be used in hybrid breeding.

282. Khanduri, A.; Hemwati Nandan Bhauguna Garhwal Vishwavidyalaya, Srinagar (India). Prasanna, B.M.; CIMMYT, Nairobi (Kenya). Global Maize Program. Hossain, F.; Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics. Lakhera, P.C.; Hemwati Nandan Bhauguna 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: SWEET CORN. YIELDS. SUGAR. HETEROSIS. COMBINING ABILITY.

A set of sweet corn genotypes generated using line x tester (7 x 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 (RIL 10), 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 x T3 (RIL62 x Madhuri) among the crosses was observed to be the best specific combiner for sweet corn trait at both the locations followed by L7 x T3 (RIL91 x Madhuri) and L5 x 12 (RIL10 x Winorange). Analysis of heterosis for sugar concentration over the popular sweet corn composites (Priya, WinOrange and MadhUri)identified L6 x T3 (RIL62 x 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, I WinOrange and Madhuri, respectively. The analysis also showed that kernel sugar. concentration was not significantly correlated w.ith any of the grain yield and its component traits, suggesting the scope of genetic improvement of kernel sugar cbncentration independent of grain yield.

283. Agrawal, P.K.; Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora (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: CHICKPEAS. RAPD. BIODIVERSITY. GENETIC RESOURCES. GENETIC RESOURCES.

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 des; 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 Des; 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.

284. Singh, M.N.; Banaras Hindu University, Varanasi (India). Dept. of Genetics and Plant Breeding. Singh, R.S.; Banaras Hindu University, Varanasi (India). 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: PIGEON PEAS. COLD. SEED FILLING.

Six basic populations (P1, P2, F1, F2, 81 and 82) of 12 crosses involving four susceptible (MAL 17, NDA-1, 8HUA 96-13-3 and 8HUA 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 dominancy 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 81 (F1 x tolerant parents) further confirmed the F2 ratio since all the plants bore pods under low temperature. Similarly 82 (F1 x susceptible parents) also exhibited 1:1 (tolerant: susceptible) segregation further confirmed the F2 ratio.

285. Singh, V.; Nimbkar Agricultural Research Institute, Phaltan (India). Akade, J.H.; Nimbkar Agricultural Research Institute, Phaltan (India). Nimbkar, N.; Nimbkar Agricultural Research Institute, Phaltan (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: SEEDS. GENETICS. SAFFLOWER. STEM EATING INSECTS. CARTHAMUS TINCTORIUS.

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/multi-embryo seeds. The objective of the present study was to find the mode of inheritance, the number of genes controlling stem fasciation and twin/multi-embryo 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/multi-embryo 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/multi-embryo seeds is reported for the first time and its usefulness in identification of probable apomicts in safflower is discussed in the paper.

286. Marigoudra, R.M.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab. Desai, S.A.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab. Lohithaswa, H.C.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab. Kalappanavar, I.K.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab. Hanchinal, R.R.; University of Agricultural Sciences, Dharwad (India). Dr. Sanjaya Rajaram Wheat Lab. 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: MUTATION. WHEATS. TRITICUM AESTIVUM. FUNGICIDES.

287. Khare, D.; Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). Dept. of Plant Breeding. Shrivastva, A.M.; Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). Dept. of Plant Breeding. Shrivastva, M.K.; Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). Dept. of Plant Breeding. Bhale, M.S.; Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). Dept. of Plant Breeding. Pedigree analysis of soybean varieties. Indian Journal of Genetics and Plant Breeding (India). (Aug 2010) v.70(3) p.292-295 KEYWORDS: BREEDS (ANIMALS). SOYBEANS.

288. Sathyanarayana, N.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Dept. of Biotechnology. Vikas, P.B.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Dept. of Biotechnology. Kumar, T.N.B.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Dept. of Biotechnology. Rajesha, R.; Sir M. Visvesvaraya Institute of Technology, Bangalore (India). Dept. 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.

289. Devarumath, R.M.; Karnataka University, Dharwad (India). Cytogenetic Lab. Dept. of Botany. Sheelavantmath, S.S.; Sihagad College of Science, Pune (India). Hiremath, S.C.; Karnataka University, Dharwad (India). Cytogenetic Lab. Dept. of Botany. 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: HYBRIDS. ELEUSINE.

290. Navjot; Punjab Agricultural University, Bathinda (India). Regional Research Stn. Mittal, V.P.; Punjab Agricultural University, Bathinda (India). Regional Research Stn. Brar, K.S.; Punjab Agricultural University, Bathinda (India). Regional Research Stn. Thakur, A.; Punjab Agricultural University, Bathinda (India). Regional Research Stn. Dalal, R.P.; Punjab Agricultural University, Bathinda (India). Regional Research Stn. 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: YIELDS. STABILITY. ZIZIPHUS.

291. Sharma, Shilpa; Central Potato Research Institute, Shimla (India). Venkatasalam, E.P.; Central Potato Research Institute, Shimla (India). Patial, Rishu; Central Potato Research Institute, Shimla (India). Latawa, Jyoti; Central Potato Research Institute, Shimla (India). Singh, Sarjeet; Central Potato Research Institute, Shimla (India). Influence of gelling agents and nodes on the growth of potato microplant. Potato Journal (India). (Jan 2011) v.38(1) p.41-46 KEYWORDS: STABILIZERS. GROWTH. POTATOES. GENOTYPES.

The objective of this study was to identify the suitable gelling agent and size of nodal segment in order to enhance in vitro multiplication rate of different Indian potato genotypes. The results showed that MS medium solidified with agar increased the number of leaves, nodes and roots as well as root length, whereas phytagel enhanced the microplant height, internodal length, fresh and dry weight of microplants of potato. Media solidified with agar enhanced the in vitro multiplication rate in Kufri Bahar, Kufri Chandramukhi, Kufri Chipsona-1, Kufri Giriraj, Kufri Himsona, Kufri Kanchan, Kufri Lauvkar, Kufri Pukhraj and Kufri Sutlej, whereas phytagel was better for Kufri Anand and

Kufri Chipsona-3. However, genotypes Kufri Badshah and Kufri Himalini performed equally in both the gelling agents. It is clear from the present findings that agar is better than phytagel for increasing the in vitro multiplication rate in majority of Indian potato cultivars. Though there was a significant difference among type of nodes, double node significantly enhanced the microplant height, number of roots and fresh as well as dry weight. But there was no significant difference on morphological character like number of nodes and internodal length which would influence the multiplication rate. Hence, single node can be used for accelerating the multiplication rate.

292. Madheshia, S.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pandey, I.D.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Mani, S.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Bajpai, G.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Characterization of cowpea [Vigna unguiculata (L.) Walp.] genotypes using protein markers. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.62-64 KEYWORDS: COWPEAS. ELECTROPHORESIS. VIGNA UNGUICULATA. GENOTYPES. GERMPLASM. STORAGE PROTEINS.

293. Narayan, Ashish; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Shrotria, P.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Genetic divergence over environments in sorghum [Sorghum bicolor (L.) Moench]. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.70-74 KEYWORDS: SORGHUM. GENETIC DISTANCE. GENOTYPE ENVIRONMENT INTERACTION. GENOTYPES.

Twenty-four sorghum genotypes were studied in three environments, viz., early sowing (E1), timely sowing (E2) and late sowing (E3), to know the influence of Genotype × Environment (G × E) interaction over genetic diversity. Considerable genetic diversity was recorded in the material. The environment influenced clustering pattern of the genotypes. The mean values for different traits varied from environment to environment, which indicated the impact of different environments on the gene expression and ultimate effect on phenotypic expression for producing diversity among the genotypes. The intra and inter cluster distances also varied in magnitude with different environments. Average was higher in E1 (early sown) and E2 (timely sown) as compared to E3 (late sown) environment. Some genotypes were found to be occupying consistently the same cluster in two different environments indicating their stability. It is revealed that for better understanding of genetic diversity present among the genotypes, they should be tested in variable environments.

294. Sachan, J.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Dhirendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, S.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pant, D.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Inheritance of flower colour in Brassica rapa var. yellow sarson. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.75-76 KEYWORDS: BRASSICA CAMPESTRIS. GENETIC MARKERS. FLOWERS. GENOTYPES. BREEDING METHODS.

295. Narayan, Ashish; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Verma, Sitar Singh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Phenotypic stability for yield and other characters in quality protein

maize (Zea mays L.). Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.77-81 KEYWORDS: PHENOTYPES. STABILITY. PROTEIN QUALITY. MAIZE. GENOTYPE ENVIRONMENT INTERACTION.

The main objective of any maize breeding programme is to develop high yielding varieties/hybrids with better degree of stability over a wide range of environments. A set of ten quality protein maize (QPM) parental lines with their forty-five single crosses and two standard checks were evaluated in three different environments, viz., Pantnagar (E1), Gorakhpur (E2) and Kashipur (E3) in order to examine their yield stability across changing environmental conditions. Results indicated significant G × E interaction mean squares for all the traits suggesting impact of variable environments on the performance of the genotypes. Crosses having desired stability for grain yield may be released as hybrids.

296. Saxena, Payal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Rawat, R.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Verma, J.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Meena, B.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Variability and association analysis for yield and quality traits in wheat. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.85-92 KEYWORDS: STATISTICAL METHODS. GENETIC GAIN. GENETIC DISTANCE. GENETIC CORRELATION. WHEATS. YIELD COMPONENTS.

Analysis of variance revealed highly significant genetic differences among the genotypes for all the characters under study. The GCV, PCV were estimated as high in comparison to ECV, which indicated that variability was influenced by the environment. High heritability (75%) was estimated for biological yield per plant, grain yield per plant, harvest index, plant height, number of grains per ear, tillers per plant, 1000-kernel weight, days to maturity and protein content and it was moderate (50 to 75) for total number of spikelets per ear, wet gluten and days to heading and low heritable character observed as spike length and zeleny. Genetic advance was also highest for the character biological yield per plant. Low genetic advance was shown by zeleny, days to maturity, wet gluten, days to heading, total number of spikelets per ear, spike length and protein content. Biological yield per plant, tillers per plant, harvest index, days to heading had strong positive and significant correlation with grain yield per plant. Protein content, wet gluten and zeleny showed positive correlation among themselves and these three traits had significant negative correlation with 1000-kernel weight and spike length. Wet gluten exhibited a highly significant positive correlation with protein content. Positive direct effects of biological yield per plant, number of grains per ear, tillers per plant, 1000-kernel weight, days to heading and days to maturity on grain yield was observed.

297. Pankaj Kumar; V.C.S.G. College of Horticulture Bharsar, Pauri Garhwal (India). Krishi Vigyan Kendra. Dimri, D.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). College of Forestry and Hill Agriculture. Petwal, Anita; G.B. Pant University of Agriculture and Technology, Pantnagar (India). College of Forestry and Hill Agriculture. Varietal variation in vegetative growth, leaf senescence and pollen behaviour among spur and colour mutant cultivars of apple (Malus domestica Borkh.). Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.93-95 KEYWORDS: MALUS PUMILA. MUTANTS. APPLES. VEGETATIVE PROPAGATION. LEAVES. SENESCENCE. POLLEN. SPURS.

298. Anubha Rani; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Lal, R.L.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Shukla, Pavan; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Evaluation of litchi cultivars under Tarai conditions of Uttarakhand. Pantnagar Journal of

Research (India). (Jul-Dec 2007) v.5(2) p.96-99 KEYWORDS: EXPORTS. PRODUCTION POSSIBILITIES. LITCHI. GERMPLASM.

The present investigation was carried out at Horticulture Research Centre, Patharchatta, G. B. Pant University of Agriculture & Technology, Pantnagar during the year 2004-05 to find out suitable cultivars of litchi on the basis of yield and quality attributes. Ten cultivars of litchi were taken to conduct the experiment. Sex ratio was observed highest in Maharaj Singh Pasand (3.54). Fruit cracking percentage was found lowest in cultivar Culcuttia (14.50%). Rose Scented is early, Calcuttia is mid season and Late Seedless is categorized as late season variety. Yield was maximum in cultivar Rose Scented (40 kg/tree). In contrast to quality characters TSS was maximum in Rose Scented (19.66 0B). Total sugars were the maximum in Late Large Green (15.39%). On the basis of the study, Rose Scented, Calcuttia and Late Seedless are suitable cultivars for Tarai region. Orcharding of litchi with these three varieties will ensure the availability of fruits in the market for a longer period.

299. Shashi Kamal; G. B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Rajkumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Raghav, M.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, Y.V.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, N.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Correlation and path analysis of yield determinants in potato (Solanum tuberosum L.) hybrids. Pantnagar Journal of Research (India) . (Jul-Dec 2007) v.5(2) p.120-124 KEYWORDS: GENETIC CORRELATION. STATISTICAL METHODS. POTATOES. HYBRIDS. YIELD COMPONENTS.

The study on phenotypic and genotypic correlation and path coefficient analysis was conducted in twenty-five hybrids of potato during Rabi 2003-04 and 2004-05. Pooled analysis for the correlation coefficients among the various traits revealed that maximum and significantly positive genotypic and phenotypic correlation of tuber yield was recorded with average tuber weight and number of tubers per hill. Negative correlation of significant value with tuber yield was exhibited by shoot girth. Protein content showed negative correlation with all growth and quality characters except number of tubers per hill. Path coefficient analysis revealed that tuber weight, plant height, number of tubers per hill, number of stolon per hill, number of leaves per haulms and number of haulms per hill have positive effect on tuber yield. Keeping in view high negative direct effect on tuber yield of total soluble solids, phosphorus content, specific gravity of tuber and total chlorophyll content, it is suggested that important yield determining traits viz., tuber weight, plant height and number of tubers per hill should be given due importance during selection for improvement of yield in potato.

300. Singh, Seema K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biochemistry. Mishra, D.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biochemistry. Joshi, Pankaj K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biochemistry. Saxena, S.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biochemistry. Arora, Sandeep; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Molecular Biology and Genetic Engineering. An efficient protocol for regeneration in Indian mustard Brassica juncea (L.) Czern and Coss. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.9-13 KEYWORDS: BRASSICA JUNCEA. REGENERATION. ORGANOGENESIS. GENOTYPES.

An efficient protocol for plant regeneration from hypocotyl explants has been developed in two Brassica juncea cultivars, namely Pusa Jai Kisan and Varuna. The two cultivars are among the top ten cultivars used in India. Different combinations of NAA and BAP were used to obtain optimal regeneration response. The cultivars showed a varied shoot regeneration response. Regeneration frequency was slightly higher in the

Pusa Jai Kisan (85.71%) than Varuna (83.3%). Ninety per cent of the regenerated plantlets showed rooting response and 65 per cent of the rooted plantlets were successfully transferred to pots.

301. Singh, Satendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Sachan, J.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Line × Tester analysis over planting dates for seed yield and its component traits in low erucic lines of Indian mustard (Brassica juncea (L.) Czern & Coss). Pantnagar Journal of Research (India). (Jan-Jun 2007) 5(1) p.1-11 v.5(1) p.33-37 KEYWORDS: SELECTION. PLANTING DATE. SEED PRODUCTION. YIELD COMPONENTS. ERUCIC ACID. HIGH YIELDING VARIETIES. BRASSICA JUNCEA.

302. Sharma, B.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pandey, M.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Screening of NILs and inheritance of resistance to bacterial blight in rice, Oryza sativa (L.). Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.38-42 KEYWORDS: GENETIC INHERITANCE. DISEASE RESISTANCE. BACTERIOSES. BLIGHT. RICE. GERMPLASM. ORYZA SATIVA. TESTING.

Screening of 80 lines comprising elite breeding lines, landraces, cultivars, wild species and some near-isogenic lines for bacterial blight resistance against four isolates viz., Dx020 (DRR1), Dx0025 (CHN-A2), Dx001 (PNT-A) and Dx002 (FZB) in screen house under epiphytotic conditions at DRR, Hyderabad indicated eight lines with resistant reaction against at least two isolates including PNT-A (Pantnagar) isolate. Resistant reaction of five NILs (IRBB13, IRBB51, IRBB53, IRBB56 and IRBB60) indicate major genes Xa4, xa5, xa13 and Xa21 responsible for highly resistant reaction against PNT-A isolate. Reaction of NILs indicated that lines possessing xa13 gene either in single or in combination with xa5, xa5+Xa4, xa5 + Xa4 + Xa21 give highly resistant score. The resistant lines were UPR 2869-98-121 (P1), BBL 180-5-1-4-1 (P2), UPR 2442-28-4-2 (P3), UPR 2393-5-2 (P4), RP 2151-224-4 (P5), UPR 2508-6-3-3 (P6), UPR 2508-9-4-1 (P7) and IR 4442-46-3-3-3 (P8). Inheritance study using parental, F1, F2 and both the backcross generations of crosses with susceptible T(N)1 revealed resistance of P4 was digenic in nature with inhibitory gene interaction. In case of P1, P2, P3, P5, P6 and P7 inheritance was monogenic in nature with dominance of susceptibility over resistance, while in P8 resistance was conferred by single dominant gene. These genes are independently inherited and are being exploited in breeding programme to develop varieties with durable resistance against bacterial blight.

303. Sharma, B.; G.B. Pant University of Agriculture and Technology, Pantnagar (India).Department of Genetics and Plant Breeding. Singh, B.V.; G.B. Pant University of Agriculture and Technology, Pantnagar (India).Department of Genetics and Plant Breeding. Singh, Kamendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India).Department of Genetics and Plant Breeding. Pushpendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India).Department of Genetics and Plant Breeding. Gupta, M.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India).Department of Genetics and Plant Breeding. Selection criteria for improvement of grain yield in soybean (Glycine max (L.) Merrill). Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.43-44 KEYWORDS: SELECTION CRITERIA. BREEDING METHODS. SOYBEANS. GLYCINE MAX. HERITABILITY.

304. Shashi Kamal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, N.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Assessment of potato genotypes for quality traits under Tarai conditions of Uttarakhand. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.99-103 KEYWORDS:

POTATOES. GENOTYPES. BREEDING METHODS. SOLANUM TUBEROSUM. GERMPLASM. QUALITY CONTROLS. GENETIC ENGINEERING.

The quality performance of twenty-five genotypes was evaluated over a period of two years. The pooled data for various traits indicated that tuber of MS/91-1326 exhibited maximum tuber protein and nitrogen content (1.91% and 304.67 mg/100 fresh wt., respectively); dry matter and potassium content by Kufri Chipsona-2 (23.54% and 270.17 mg/100 fresh wt., respectively). The maximal value for specific gravity of tuber was recorded in J/93-139 (1.078 g/cm3) whereas, highest total soluble solids were observed in J/92-159 (7.390B). The genotypes Kufri Bahar showed maximum ascorbic acid content (27.18 mg/100 fresh wt.) while J/93-86 showed highest vitamin A (48.69 I.U.).

305. Bhushan, K.B.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, B.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Dubey, R.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Hari Har Ram; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Correlation analysis for seed yield in French bean (Phaseolus vulgaris L.). Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.104-106 KEYWORDS: GENETIC CORRELATION. SEED PRODUCTION. PHASEOLUS VULGARIS. VEGETABLES.

Simple correlation coefficient was calculated for seven characters in four hundred and forty one exotic genotypes of french bean (Phaseolus vulgaris L.) during January-March 2004. Seed yield per plant showed positive and significant correlation with number of pods per plant, pod length and 100-seed weight. However, number of pods per plant exhibited positive and significant correlations with pod length, days to maturity and plant height. Days to maturity showed positive and significant correlation with plant height.

306. Upadhyay, Megha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Hari Har Ram; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Hybrid vs pureline breeding in bottle gourd [Lagenaria siceraria (Mol) Stand]. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.113-118 KEYWORDS: HETEROSIS. HYBRIDIZATION. LAGENARIA SICERARIA. GERMPLASM.

Ten purelines and ten F1 hybrids of bottle gourd were evaluated at Vegetable Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar. Standard heterosis (%) was worked out using Pusa Naveen as check. It was found that none of the hybrids showed significant negative heterosis for flowering characters. For fruit length, in kharif PBOG 113 X Pusa Naveen (26.7%) showed significant positive heterosis. While in summer season, PSPL X PBOG 61 and PBOG 22 X PBOG 40 showed positive and significant heterosis of 16.5 and 14.9 per cent, respectively. For fruit diameter, PBOG 74 X PSPL (33.2 and 20.7%) showed a highly significant and positive heterosis over check parent for both the seasons. For total yield, none of the ten F1 hybrids could out perform the check parent Pusa Naveen that had the total yield of 238.1 q/ha and 825.1 q/ha in kharif and summer season, respectively.

307. Bhartiya, Anuradha; G.B. Pant University of Agriculture and Technology,Pantnagar (India). Department of Genetics and Plant Breeding. Mani, S.C.; G.B. Pant University of Agriculture and Technology,Pantnagar (India). Department of Genetics and Plant Breeding. Johri, Tanu; G.B. Pant University of Agriculture and Technology,Pantnagar (India). Department of Genetics and Plant Breeding. Pande, Kamal K.; M.B. Government P.G. College, Haldwani (India). Department of Biotechnology. Use of RAPD markers for characterization of rice (Oryza sativa L.) varieties. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.33-37 KEYWORDS: RAPD. RICE. ORYZA SATIVA. STABILITY. GENETIC VARIATION.

Characterization of nineteen rice varieties was undertaken using twelve RAPD markers. A total of 68 amplicons were obtained with an average of 5.6 bands per primer. Of these, 48 were found to be polymorphic and the level of polymorphism was 70.58. The number of bands generated were more primer dependent than on the genotype and ranged from 1 to 11. The per centage of polymorphic bands ranged from 50% (EO 1598, EO 1594) to 100 % (EO 1600, EO 1596). Though all the genotypes were discriminated in the present study still the identification of genotypes was not possible with a limited number of primers. A few of the primers generated very specific bands for only a limited number of genotypes. Jaccard s pair wise similarity coefficients of values for 19 genotypes were calculated and the range of genetic similarity was found to be 0.65 to 0.92 with an average of 0.75 + 0.05. A dendrogram was generated by UPGMA cluster analysis based on Jaccard s similarity coefficients which showed poor grouping of genotypes because of the similarity among the varieties.

308. Saxena, Payal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Jaiswal, J.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Khanna, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Assessment of genetic diversity at molecular level in wheat and its wild relatives with DNA markers using RAPD. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.38-43 KEYWORDS: GENETIC MARKERS. GENETIC VARIATION. WHEATS. RAPD. DNA. POLYMORPHISM. WILD PLANTS.

The RAPD technique was used to assess the genetic diversity at the molecular level in wheat and its wild relatives. Thirteen random oligodeoxy nucleotide decamer primers were used, all of which gave consistent results. Use of these primers resulted in the amplification of 199 bands with 100 per cent polymorphism. All these primers gave unique bands, the maximum being amplified by UBC-18.

309. Bhadana, Vijaipal; ICAR Research Complex for NEH Region, Manipur Centre, Lamphelpat, Imphal (India). Division of Plant Breeding. Khanna, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Interspecific hybridization of Gossypium arboreum and G. hirsutum with wild species using ovule culture. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.44-49 KEYWORDS: WILD PLANTS. INTERSPECIFIC HYBRIDIZATION. GOSSYPIUM HERBACEUM. GOSSYPIUM ARBOREUM. OVULE CULTURE.

The plant materials used in the present investigation comprised of four Indian varieties, two each of allotetraploid cotton Gossypium hirsutum (2n=52) i.e. Vikas and LH-900 and diploid cotton Gossypium arboreum i.e. Lohit and BD-5 and three wild species of cotton i.e. Gossypium australe, Gossypium bickii and Gossypium sturtianum. The broad objectives were to get interspecific hybrid production via in vitro fertilization followed by in ovulo embryo culture and to confirm hybridity by isozymes. The effect of smearing stigmas with modified Taylors (1972) medium was found to be significant in in-vitro fertilization as it enhanced the frequency of hybrid embryos. Hybrid plants were obtained between Lohit x G. australe and BD-5 x G. australe crosses. The hybrids showed vigorous growth. They showed more similarities with the female parents in leaf shape and size, though flower characters were observed to be more close to the male parent (G. australe). Hybrids were completely sterile.

310. Pramila; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, Duresh Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Jain, Suresh Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Evaluation of exotic and indigenous genotypes of chilli (Capsicum annuum L.) under foot hills of himalayas during summer season. Pantnagar Journal of Research (India) . (Jan-Jun 2009) v.7(1) p.77-80 KEYWORDS: INTRODUCED

VARIETIES. LAND RACES. CHILLIES. HIGHLANDS. HIMALAYAN REGION. SUMMER. CAPSICUM ANNUUM.

Under the agro-climatic conditions of Uttarakhand 43 genotypes were evaluated for growth, yield and yield attributes. The plant height ranged from 46.50 to 87.00 cm. It was higher in Pant sel-13 and lower in Phule Mukta. Similarly number of branches per plant was recorded maximum in Pant sel-13. Stem diameter ranged from 1.42 to 2.39 cm. The Stem diameter was maximum in EC519630. Two genotypes, namely, EC519645 and EC519646 were earliest in fruit maturity. They took minimum days to fruit ripening. The fruit length ranged 3.96 to 12.62 cm. The longest fruits were recorded in EC519630 followed by EC519640 and EC519652. The periphery of fruits was measure higher in EC519640 (5.25 cm). The number of fruits per plant varied from 38.82 to 238.48. More number of fruits per plant was recorded in EC519649 and minimum number of fruits per plant observed in Phule Mukta as compared to check cultivar JCA-283. Out of all the genotypes, EC519637 (262.64 q/ha), Pant Sel-20 (260.52q/ha) and EC519640 (258.60 q/ha) were found most suitable and high yielding genotypes. They produced 173.58,171.40 and 169.40 per cent higher fruit yield (red ripen) over standard cultivar Pant C-1 (06.0 q/ha) and 212.60, 210.30 and 207.80 per cent higher yield over National check cultivar JCA- 283 (84.03q/ha), respectively.

311. Singh, Anita; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Hari Har Ram; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Standard heterosis for yield and its attributing characters in cucumber (Cucumis sativus L.). Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.81-84 KEYWORDS: HETEROSIS. YIELD COMPONENTS. CUCUMBERS. CUCUMIS SATIVUS.

Standard heterosis for yield and its component traits in nine F1 hybrids developed from nine parents and two checks indicated that some outstanding F1 hybrids as compared to Pant Khira 1 were PCUC 202 × PCUC 101 (number of fruits per plant 40.00% heterosis); closely followed by PCUC 208 × PCUC 45 (37.27% heterosis) and PCUC 202 × PCUC 45 (22.17% heterosis) over both the seasons. The crosses PCUC 202 × PCUC 45 (146.96 q/ha, 17.91% heterosis), PCUC 202 × PCUC 101 (144.71 q/ha, 44.26% heterosis) and PCUC 208 × PCUC 45 (122.69, 13.11% heterosis).

312. Padiyar, Sweta; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, D.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Evaluation of genetic diversity in different genotypes of bottlegourd [Lagenaria siceraria (Mol.) Standl.] by SDS-PAGE. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.124-126 KEYWORDS: GENETIC VARIATION. GENOTYPES. ELECTROPHORESIS. LAGENARIA SICERARIA.

313. Prabhat Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Molecular Biology and Genetic Engineering. Khanna, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Assessment of genetic diversity in cultivated sorghum (Sorghum bicolor L. Moench) accessions using microsatellite markers. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.143-149 KEYWORDS: SORGHUM BICOLOR. GENETIC RESOURCES. BIODIVERSITY. GENETIC VARIATION. MICROSATELLITES. RAPD.

SSR markers were used to study genetic diversity in sorghum. Ten diverse sorghum accessions were used for the present study. A set of 12 SSR specific primers were used for PCR amplification. A total of 35 bands were amplified out of which 32 were polymorphic, 3 were monomorphic and there were 4 unique bands. Accessions O4K700R and SP55609A were very similar with a value of 0.762 whereas ICSA 467 and SSG59-3 showed the lowest similarity value of 0.261. Accession ICSA 467 was entirely different from all others. Accessions from ICRISAT and Pantnagar were related to each other with a similarity value of 0.581 on an average whereas those from Pantnagar and Hisar were

distantly related. The information content of the SSR data was high. The data from just one SSR locus allows the accessions to be uniquely identified.

314. Bhartiya, Anuradha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Mani, S.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Johri, Tanu; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pande, Kamal K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Application of isozyme markers for DUS testing for rice (Oryza sativa L.) varieties. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.150-154 KEYWORDS: ISOENZYMES. GENETIC MARKERS. RICE. ORYZA SATIVA. STABILITY.

Plant morphological characters have been the universally undisputed descriptor for genotype characterization. But these descriptors, besides being limited in number, make the process time consuming and also less reliable, owing to their interaction with the environment in which the variety is grown. In this regard the potential of biochemical descriptor like seed esterase, peroxidases, malate dehydrogenases and alcohol dehydrogenases, merits investigation. Isozyme has been proven to be more powerful as genetic marker for studies of plant population than morphological characters. More information can be obtained from isozyme marker than morphological markers since more loci are detected and isozymes are codominant markers. Genetic inheritance of isozyme is also easier to determine and allelic frequency can be calculated directly. Isozymes have also been found to be independent of environmental influences.

315. Yadav, Narendra Singh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Kamendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pushpendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, B.V.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pandey, Kamal; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Gupta, M.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Correlation and path coefficient study in elite breeding lines of soybean [Glycine max (L.) Merrill.]. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.155-160 KEYWORDS: GLYCINE MAX. BREEDING METHODS. STATISTICAL METHODS. GENETIC CORRELATION. SOYBEANS. YIELD COMPONENTS.

An experiment was conducted during kharif 2004 with 48 genotypes of soybean for twelve quantitative characters to study correlations and path coefficient analysis of yield and its component characters. Correlation studies showed that grain yield had significant positive correlation with number of primary branches per plant, number of pods per plant, dry matter weight per plant, plant height, harvest index and seed yield efficiency at both phenotypic and genotypic levels. Path coefficient analyses indicated that dry matter weight per plant, harvest index, number of pods per plant, plant height and basal pod height have positive direct effect in influencing seed yield. The dry matter weight per plant affected seed yield both directly and indirectly. Based on correlation and path coefficient analysis dry matter weight per plant, number of pods per plant and plant height were found to be important yield attributing characters in soybean.

316. Singh, Akhilesh Kumar; Narendra Dev University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (India). Department of Genetics and Plant Breeding. Ram Bhajan; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Verma, O.P.; Narendra Dev University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (India). Department of Genetics and Plant Breeding. Kamlesh Kumar; Narendra Dev University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (India). Department of Genetics and Plant Breeding. Genetic divergence analysis in

yellow sarson (Brassica rapa var. yellow sarson). Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.161-165 KEYWORDS: BRASSICA CAMPESTRIS. GENETIC VARIATION. SEED PRODUCTION. YIELD COMPONENTS.

Eighty genotypes of yellow sarson were studied in two environments to understand the genetic diversity and the influence of genotype-environment interactions. High magnitude of genetic divergence was observed between cluster IV and cluster X in E1 and between cluster IV and XI in E2 suggesting wide diversity between them. Length of main raceme, numbers of siliquae per plant, oil content and seed yield per plant together have emerged as major contributor towards genetic divergence (73 %) in both the environments. Based on genetic divergence in both the environments NDYS–9601 and MYSL-201 may be hybridized with the parents belonging to cluster IV especially NDYS- 118 and NDYS-132 to generate desired variability.

317. Maurya, Maya; Janta Vedic College, Baraut, Baghpat (India). Mohan, J.; Janta Vedic College, Baraut, Baghpat (India). Kushwaha, M.L.; G.B. Pant University of Agriculture and Technology, Bharsar,Pauri Garhwal (India). V.C.S.G. College of Horticulture. Studies on heterobeltiosis and combining ability in bittergourd (Momordica charantia L.). Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.177-179 KEYWORDS: MOMORDICA CHARANTIA. HETEROSIS. COMBINING ABILITY. HYBRIDIZATION.

A study on heterosis and combining ability was carried out involving 15 hybrids from 6 diverse genotypes of bittergourd (Momordica charantia L.). Evaluation was done during kharif season 2003 and summer season 2004 at Janta Vedic College, Baraut, Baghpat. Out of 15 crosses 9 crosses showed consistently high significant heterobeltiosis over the season for fruit yield per plant. The outstanding hybrid in order of superiority were BIG-1 x Kalyanpur Sona, BIG-4 x BIG-56, BIG-11 x Kalyanpur Sona and BIG-11 x BIG-56. Based on general combining ability over the seasons, the best general combiners for fruit yield per plant were Kalyanpur Sona, BIG-4 and BIG-11. Based on specific combining ability effects, the promising crosses were BIG-4 x BIG-56, BIG-1 x Kalyanpur Sona, BIG-4 x Kalyanpur Sona and BIG-4 x BIG-11.

318. Thapliyal, Alok; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Singh, J.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Stability analysis for growth, yield and quality characters of tomato (Solanum lycopersicum L). Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.180-183 KEYWORDS: LYCOPERSICON ESCULENTUM. GENOTYPE ENVIRONMENT INTERACTION. QUALITATIVE ANALYSIS. TOMATOES. STABILITY.

The existence of genotypes x environment interactions was frequently used by plant breeders for measuring stability of selected genotypes performance. The magnitude of the statistical variance make possible to select entries with high potential yield, and other character of stability, including in tomato as well. The experimental material consisted of thirty three genotypes. All these thirty three genotypes were evaluated over three environments i.e., summer and winter of 2006 and winter of 2007. Highly significant differences were observed among genotypes for all thirteen characters under observation viz., plant height (cm), number of primary branches per plant, days to 50% flowering, number of flower clusters per plant, days to 50% fruit set, days to first harvest, days to last harvest, average fruit weight (g), number of locules per fruit, fruit weight per plant (g), number of fruits per plant, TSS (%) and yield (q/ha). The differences among the environment were also highly significant for all characters except plant height where it was significant only. While this component was non-significant for number of locules per fruit. The analysis of variance revealed the presence of genotype-environment interaction for plant height, days to 50% flowering, number of flower clusters per plant, days to 50% fruit set, days to first harvest, days to last harvest, average fruit weight, fruit weight per plant, number of fruits per plant and yield (q/ha).

319. Dutta, M.; G.B. Pant University of Agriculture & Technology, Hill Campus Ranichauri (India). College of Forestry and Hill Agriculture. Yadav, V.K.; G.B. Pant University of

Agriculture & Technology, Hill Campus Ranichauri (India). College of Forestry and Hill Agriculture. Bandyopadhyay, B.B.; G.B. Pant University of Agriculture & Technology, Hill Campus Ranichauri (India). College of Forestry and Hill Agriculture. Tej Pratap; G.B. Pant University of Agriculture & Technology, Hill Campus Ranichauri (India). College of Forestry and Hill Agriculture. Prasad, Rajendra; G.B. Pant University of Agriculture & Technology, Hill Campus Ranichauri (India). College of Forestry and Hill Agriculture. Genetic variability and path analysis in buckwheat. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.23-28 KEYWORDS: GENETIC VARIATION. STATISTICAL METHODS. BUCKWHEAT. HERITABILITY.

Buckwheat is important indigenous crop of the Himalayan region because it can withstand cold temperature and acidic soil conditions. The present study was undertaken to assess the genetic variation, heritability, correlation, and direct and indirect effects of quantitative characters on seed yield in a set of diverse buckwheat genotypes during Kharif 2000 and 2001. Based on two years pooled data high PCV and GCV were observed for number of secondary branches, number of leaves and seed yield per plant and high heritability coupled with high genetic advance were observed for number of secondary branches, seed yield, number of leaves, number of primary branches and basal girth. Correlation as well as direct positive effect on seed yield, number of leaves, weight of 100 seeds, number of racemes, basal girth and days to maturity were the important yield contributing traits and hence could be relied upon as selection parameters for yield improvement in buckwheat.

320. Sanjeev Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Molecular Biology and Genetic Engineering. Khanna, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. A study of diversity in germplasm collection of hexaploid wheat by RAPD analysis. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.29-35 KEYWORDS: GENETIC DISTANCE. GERMPLASM. WHEATS. RAPD. HEXAPLOIDY. PCR.

Polymerase chain reaction (PCR) based randomly amplified polymorphic DNA (RAPD) markers were used to study the genetic relationship and genetic diversity among 15 Indian wheat accessions. Screening was done with 6 random primers. All of the 32 amplified RAPD bands were polymorphic. The similarity coefficient between hexaploids ranged from 0.00 to 0.80. Primers UBC 552, UBC 18 and UBC 535 showed maximum number of banding pattern and were able to distinguish eight varieties. Primer UBC 572, UBC 18, UBC 337, and UBC 535 were found to give a distinguishable number of unique RAPD markers. Dendrogram showed that variety HD 2687 was very diverse.

321. Pandey, Suneeta; G.B. Pant University of Agriculture and Technology,Pantnagar (India). Department of Genetics and Plant Breeding. Pushpendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, B.V.; G.B. Pant University of Agriculture and Technology,Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Kamendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Gupta, M.K.; G.B. Pant University of Agriculture and Technology,Pantnagar (India). Department of Genetics and Plant Breeding. Effect of hydration treatment on germination and yield components in F3 generation of black and yellow seeded soybean (Glycine max (L.) Merrill.). Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.36-41 KEYWORDS: HYDRATION. GERMINATION. SEEDS. YIELD COMPONENTS. SOYBEANS. GLYCINE MAX.

Fifty-nine F3 individual plants derived from the cross of Birsa Soy-1/JS-71-05 were evaluated for amount of water absorption and hard seededness through hydration treatment. Highest amount of water absorption (67.0 mg/20 seeds) was recorded for GTP-27 (genotype-27) whereas lowest amount of water absorption was reported for GTP-61A (9.70 mg). In general, those genotypes, which were recorded for high amount of water absorption, exhibited high germination percentage (74.5- 94.0 %). Water absorption showed highly significant positive correlation with germination percentage.

The primary yield components viz., number of pods per plant, dry matter weight per plant, 100-seed weight and harvest index were positively associated with each other. Highest estimate for broad sense heritability was observed for 100-seed weight (0.857), followed by germination percentage (0.840), water absorption (0.822) and dry matter weight per plant (0.812), respectively. High value of expected genetic advance was observed for germination percentage (46.30), followed by water absorption (23.04), pods per plant (22.27), dry matter weight per plant (15.19), respectively.

322. Verma, S.K.; National Bureau of Plant Genetic Resources, Bhowali (India). Regional Station. Negi, K.S.; National Bureau of Plant Genetic Resources, Bhowali (India). Regional Station. Muneem, K.C.; National Bureau of Plant Genetic Resources, Bhowali (India). Regional Station. Arya, R.R.; National Bureau of Plant Genetic Resources, Bhowali (India). Regional Station. Preliminary evaluation of chilli germplasm. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.81-85 KEYWORDS: CHILLIES. GERMPLASM. GENETIC VARIATION. CAPSICUM ANNUUM. QUALITATIVE ANALYSIS. QUANTITATIVE ANALYSIS.

Two hundred three genotypes of chilli (Capsicum annuum L.) were evaluated at National Bureau of Plant Genetic Resources, Regional Station Bhowali-263 132, Nainital, Uttarakhand during 2003. A wide range of variability in plant height 37-93 cm, plant canopy 560-3140 cm2, days to 50% flowering 137-163, days to 50% fruiting 144-168, fruit length 2.76-12.06 cm, fruit width 0.51-2.77 cm, number of fruit / plant 5.2-76.2, number of seed / fruit 25-130, fresh fruit weight 1.5 - 7.5 g and fruit yield per plant 33.8 – 291.0 g were recorded. Promising accessions IC356001, IC360849, IC360860 for early fruiting, IC355950, IC356514, IC355978, IC356512, IC356515, IC355954 for higher number of fruits, IC298637, IC308778, IC356510, IC310893, IC336770, IC318033 for long fruit size and IC315909, IC338782, IC355954, IC333267, IC338786, IC341431 for taller plants could be directly utilized in a hybridization programme for selecting desirable segregants / cross combinations.

323. Deepti Prabha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Seed Science and Technology. Khanna, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Negi, Yogesh K.; SBS PG Institute of Biomedical Sciences and Research, Balawala, Dehradun (India). Department of Microbiology. Assessment of seed protein variability in two cultivated species of Barnyard millet through SDS-PAGE. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.96-100 KEYWORDS: GENETIC DISTANCE. ECHINOCHLOA FRUMENTACEA. ELECTROPHORESIS. MICROBIOLOGY. SEEDS. STORAGE PROTEINS.

324. Ratna Preeti Kaur; G.B. Pant University of Agriculture and Technology, Pantnagar (India). College of Agriculture. Department of Genetics and Plant Breeding. Saini, D.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). College of Agriculture. Department of Genetics and Plant Breeding. Jaiswal, J.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India).College of Agriculture. Department of Genetics and Plant Breeding. Genetic variability studies in wheat under timely and late sown irrigated conditions. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.101-105 KEYWORDS: GENETIC VARIATION. WHEATS. SOWING DATE. IRRIGATED FARMING.

325. Massey, Preeti; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, B.V.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Kamendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pushpendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Gupta, M.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Transgressive

segregation for yield and yield contributing traits in F2 generations in soybean [Glycine max (L.) Merrill]. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.106-109 KEYWORDS: SEGREGATION. YIELD COMPONENTS. HERITABILITY. SOYBEANS. GLYCINE MAX.

F60 Plant Physiology And Biochemistry

326. Vikas, V.K.; Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology. Arora, A.; Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology. Singh, V.P.; Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology. Inositol prevents senescence of gladiolus flowers. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 303-309 KEYWORDS: SENESCENCE. GLADIOLUS. INOSITOL. ANTIOXIDANTS.

An experiment was conducted to study the effect of inositol on the vase life of cut flowers of gladiolus variety Snow Princess. Vase life of gladiolus was increased when treated with inositol (75 mM). Fresh weight, membrane stability index, total soluble protein content and activities of antioxidant enzymes, superoxide dismutase, catalase, glutathione reductase and ascorbate peroxidase were also increased by the treatment in comparison to control. On the other hand, level of lipid peroxidation in terms of thiobarbituric acid reactive substances (TBARS) and the activities of lipoxygenase enzyme were reduced by inositol treatment. This suggests that inositol mediates the scavenging of free radicals, hence decrease their interaction with proteins and lipid, delaying the process of lipid peroxidation and consequently senescence.

327. Sarika; Gobind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Biological Sciences. Pandey, N.; Kumaun University, Nainital (India). Dept. of Botany. Rao, P.B.; Gobind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Biological Sciences. Allelopathic effects of weed species extracts on some physiological parameters of wheat varieties. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 310-318 KEYWORDS: ALLELOPATHY. PLANT COMPETITION. WHEATS. SEED SIZE. ADAPTATION.

Effect of aqueous extracts of Ageratum conyzoides L., Chenopodium album L., Cynodon dactylon (L.) Pers., Melilotus alba L., Parthenium hysterophorus L., Phalaris minor L. and Solanum nigrum L. were examined on seedling dry weight, chlorophyll (a, b and total), carotenoid and proline content; net photosynthetic rate, net transpiration rate and stomatal resistance in PBW-154, PBW-343, PBW-373, PBW-443, PBW-502, RR-21, UP-262, UP-ll09, UP-2382 and UP-2425 varieties of wheat (Triticum aestivum L.). The extracts of all weeds except C. dactylon and P. minor significantly decreased the seedling dry weight in all the varieties. The per cent reduction in chl-a was 100% of the varieties with A. conyzoides and S. nigrum; 90% with both C. dactylon and P. hysterophorus; 80% with M. alba; 70% with P. minor and 30% with C. album. But the percent reduction in chl-b was 80; 60; 50 and 20 per cent of the varieties with A. conyzoides, M. alba and S. nigrum; both P. hysterophorus and P. minor, C. dactylon and C. album, respectively. The proline content in different varieties was significantly increased with all weed extracts, except PBW-154 with C. dactylon; RR-21 with both C. album and C. dactylon and PBW -343, PBW -443 and UP-2382 with C. dactylon. The net photosynthetic rate (P) (flmoV m2/s); net transpiration rate (E) (mM/m2/s) and stomatal resistance (.R) (m2s/mol) decreased in different varieties with all weed extracts as compared to control. Results revealed that PBW-154, PBW-373, PBW-443 and UP-ll09 were resistant and others were susceptible. The inhibitory effects of weed extracts on different varieties followed the order: P. hysterophorus M. alba A. conyzoides S. nigrum C. album P. minor and C. dactylon.

328. Seema; Kurukshetra University, Kurukshetra (India). Dept. of Botany. Mukherjee, D.; Kurukshetra University, Kurukshetra (India). Dept. of Botany). Senescence regulation in leaf discs of Raphanus sativus L. by plant growth regulators in dark. Indian

Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 319-326 KEYWORDS: KINETIN. PURINES. MORPHACTINS. RAPHANUS SATIVUS. SENESCENCE. ENZYMES.

From mature and fresh leaves of Raphanus sativus L. cv. Chetki long, discs were punched out and treated with two different concentrations of kinetin (KN, 0.375 and 3.75 J.lM) and a morphactin (MOR, CME 74050, 3.64 and 36.4 J.lM) in order to make a comparative assessment of plant growth regulators (PGR's) with regard to senescence regulation. A gradual breakdown of chlorophylls, carotenoids, proteins and an increment in protease and peroxidase activity were noticed. Total sugars also registered an increasing trend. Applications of both PGR's could delay senescence by minimizing degradation of chloroplast pigments and bringing down protease and peroxidase acdvity as well as sugar accumulation. Protein breakdown was reduced markedly by only KN.

329. Sairam, R.K.; Indian Agricultural Research Institute, New Delhi (India) Div. of Plant Physiology. Dharmar, K.; University of California, Riverside (United States of America). Dept. of Botany and Plant Sciences. Chinnusamy, V.; University of California, Riverside (United States of America). Dept. of Botany and Plant Sciences. Ethylenesynthesis, aerenchyma formation and expression of xyloglucan endotransglycosylase in roots of Vigna sps. under waterlogging condition. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 327-337 KEYWORDS: GENE EXPRESSION. MUNG BEANS. ETHYLENE. WETLANDS. WATERLOGGING.

The objective of this study was to examine the role of ethylene, aerenchyma formation and expression of xyloglucan endotransglycosylase (XET) in the waterlogging tolerance of contrasting mung bean (Vigna radiata) genotypes viz., T 44 (tolerant) and Pusa Baisakhi (susceptible), and a highly tolerant wild Vigna species Vigna luteola under pot-culture condition. Waterlogging resulted in decrease in relative water content (RWC) and chlorophyll (Chi) content in leaves, and membrane stability index (MSI) in root and leaf tissues. Waterlogging induced decline in RWC, MSI, and Chi was greater in Pus a Baisakhi (PB) than V. luteola and T 44. Ethylene production .in the roots increased in all the genotypes, however, the concentration was higher in V. luteola and T 44 than Pusa Baisakhi. Though the waterlogging induced XET expression in the roots was observed in case of V. luteola and T 44, aerenchyma formation was observed only in the roots of V. luteola. PCR band products were cloned and sequenced, and partial cDNAs of 455 and 456 bp were obtained for V. luteola and T 44, respectively. The partial cDNA sequences of cloned XET genes showed 98 % homology in V. luteola and T 44. T 44 and V. luteola showed 100 and 98 % homology with maize XET (Genbank Acc. No. ZMU15781), while in case of rice (Genebank Ace. No. Os06g0696600) the similarity was in the range of 87 and 86%, respectively. The results suggest that one of the reasons of the waterlogging tolerance of V. luteola is its ability to develop aerenchyma. Further, besides XET some other factor may also be essential for aerenehyma formation in the roots, which might be absent in T 44.

330. Pathak, G.C.; University of Lucknow, Lucknow (India). Dept. of Botany. Pandey, N.; University of Lucknow, Lucknow (India). Dept. of Botany. Improving zinc density and seed yield lof green gram by foliar application of zinc at early reproductive phase. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 338-342 KEYWORDS: DENSITY. FOLIAR APPLICATION. SEEDS. YIELDS. POLLEN. REPRODUCTION. VIGNA RADIATA. ZINC.

The effect of foliar Zn treatments was studied on pollen-stigma interaction, its involvement in fertilization, seed Zn and seed yield. The plants grown with deficient supply of (ZnD) reduced the size of anthers, pollen producing capacity, size and viability of p~llen grains. SEM studies of pollen grains showed the morphological changes in pollen shape and size with changes in the exine ornamentation. Flowers of ZnD plants showed a decrease in the pollen receptive area and a persistent cuticle over the stigmatic surface which affected the germinability of the pollen grains. The foliar applications of Zn to Zn deficient plants partially reversed the above effects. Foliar application of Zn also improved the yield, boldness, vigor and viability of seeds. Seed Zn was also appreciably enhanced in Zn sufficient plants given foliar Zn.

331. Pandey, R.; Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology. Chacko, P.M.; Indian Agricultural Research Institute, New Delhi (India). Div. of Floriculture and Land Scaping. Pal, M.; Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology. Choudhary, M.L.; Indian Agricultural Research Institute, New Delhi (India). Div. of Floriculture and Land Scaping. Singh, R.; Indian Agricultural Research Institute, New Delhi (India). National Phytotron Facility). Influence of growth temperature on keeping quality traits of rose (Rosa hybrida L.) cut flowers grown under continuous CO2 enrichment. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 343-349 KEYWORDS: CUT FLOWERS. GROWTH. TEMPERATURE. QUALITY. ROSACEAE. PLANTS.

An attempt was made to find out if there is any effect of higher than optimum growth temperature along With contmuous CO2 ennchment on the keeping qualIty traIts of Rose (Rosa hybrida L.) cut flowers at harvest. Five rose cultivars, viz. 'First Red', 'Arjun', 'Raktima', 'Raktagandha' and 'Pusa Pitamber' were grown in phytotron and exposed to high (35125°C, Tl) or optimum (28!18°C, TO) temperature with enriched CO2 (1000 J.1Illol moP) until flowering. Cultivar means at Tl showed significant reduction in keeping quality parameters of flowering shoots in terms of number of days required from flower bud appearance to harvest (34%), stalk length (5%), number of petals (16%), flower diameter (24%), and fresh (17%) and dry (14%) weight of flowers compared to plants grown at TO. However, the vase life of cut flower was not affected by the pre-harvest growing conditions but there was significant cultivar difference. Among the cultivars, except Arjun, all other showed significantly higher number of stomata per cut flower at higher temperature. Days to harvest were significantly correlated with stalk length (0.172**), flower diameter (0.588**) and dry matter accumulation (0.52**) in flowers while it was negatively associated with the number of stomata per cut flower (-0.381 *). This study indicates that CO enrichment does not mitigate the effect of high temperature during growth of Rose plants and thus does not improve the keeping quality traits of cut flowers at harvest. Hence, CO2 enrichment in greenhouses during summers will not yield in good quality cut flowers.

332. Zacharias, M.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Singh, S.D.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Kumar, S.N.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Harit, R.C. Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Aggarwal, P.K.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Impact of elevated temperature at different phenological stages on the growth and yield of wheat and rice. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 350-358 KEYWORDS: PHENOLOGY. TEMPERATURE. GROWTH. YIELDS. WHEATS. RICE.

In this study we have evaluated the response of two cultivars of wheat (PBW-343 and Kundan) and rice (PS-2 and P-44) to high temperature stress. The stress was given either throughout crop growth period or at one of the three growth phases viz., seedling to panicle initiation, panicle initiation to flowering and flowering to maturity. Results indicated that the warmer temperature hasten crop development, shortens the growth period and thus finally lowers the grain yield in both crops. The impact of high temperature on crop growth and yield is largely determined by the duration and coincidence of it with sensitive crop growth phase. Period from panicle initiation to flowering stage was found to be more sensitive to high temperature stress in both wheat and rice. Exposure to high temperature from seedling stage to panicle initiation stage affected yield predominantly due to associated tiller mortality and reduced number of spikes. Coincidence of high temperature stress with panicle initiation to flowering phase of crop affect grain yield by reducing dry matter accumulation, productive tillers, number of spikes, grain weight and increased floret sterility. When the crop is exposed to heat stress from flowering to maturity, then the reduction in yield is predominantly caused by floret sterility leading to reduced number of grains per spike and also due to reduced

grain weight. Among the varieties, Kundan of wheat and PS-2 of rice were found to be more tolerant to heat stress.

333. Mishra, Y.; Tropical Forest Research Institute, Jabalpur (India). Usmani, M.G.; Tropical Forest Research Institute, Jabalpur (India). Mandal, A.K.; Tropical Forest Research Institute, Jabalpur (India). Micropropagation and field evaluation of Tinospora cordifolia : an important medicinal climber. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 359-363 KEYWORDS: CALLUS. SHOOT PRUNING. DRUG PLANTS.

A protocol was developed for clonal propagation of Tinospora cordifoiia through in vitro culture of mature nodal explants. The shoot cultures were established from nodal explants treated. with mercuric chloride (HgCI2) on MS (Murashige and Skoog) medium supplemented with different concentrations of 6-benzyladenine (BA). Among various doses of HgCl2 and BA tested, the nodal segments treated with 0.2% HgCl2for 7 minutes and implanted on MS medium with 5 JIM BA resulted in 100% sprouting and 66% aseptic cultures. Healthy shoots with 4 fold multiplication rate were obtained on MS medium supplemented with 5 JIM BA + 150 JIM glutamine. In vitro regenerated shoots inoculated on 1/2 MS medium enriched with 0.5 JIM indole-3-butyric acid (IBA) resulted in 100% rooting. Rooted plants were successfully hardened and transferred to the field with 100% survival which showed vigorous growth after 6 months. The developed protocol can be used for en masse propagation and conservation of T. cordifolia.

334. Banerjee, S.N.; Institute of Agricultural Science, Kolkata (India). Dept. of Plant Physiology. Chakrabarti, K.; Institute of Agricultural Science, Kolkata (India). Dept. of Biochemistry. Pal, S.K.; Bengal College of Engineering and Technology, Durgapur (India). Dept. of Biotechnology. Changes in antioxidant defense components associated with senescence of detaced rice leaves. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 364-371 KEYWORDS: RICE. ANTIOXIDANTS. SENESCENCE.

Different components of the antioxidant defense system were studied during the course of dark-induced senescence of detached primary leaves of rice (Oryza sativa L. cv. IR36) seedlings. The activities of ascorbate peroxidase, peroxidase (o-dianisidine) and superoxide dismutase were increased in senescing leaves as compared to control leaves (freshly excised), while catalase activity showed drastic loss during senescence. Among the non-enzymic antioxidants, glutathione content was elevated and ascorbate content was decreased in senescing leaves. In contrast to other antioxidants, peroxidase activity showed striking elevation even at the advance stages of senescence. Isozyme analysis of peroxidase on native PAGE also revealed higher synthesis of the enzyme from senescing leaves. Determination of peroxidase activity with function-specific substrates such as syringaldazine (for linification) and NADH (for H202 generation) also revealed large increases at the final stages of senescence. The activity of IAA oxidase remained unchanged at this time period. Probable role of antioxidants along with peroxidase(s) during senescence had been discussed.

335. Singh, M.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Gupta, R.K.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Chauhan, J.S.; Directorate of Rapeseed Mustard Research, Bharatpur (India). Biochemical basis of high temperature tolerance during germination in Indian mustard (Brassica juncea L.). Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 372-377 KEYWORDS:TEMPERATURE. AMYLASES. BRASSICA JUNCEA. TOLERANCE. GERMINATION. HEAT TOLERANCE.COLD TOLERANCE.

The present investigation was carried out under laboratory conditions with 10 genotypes of Indian mustard (Brassica juncea) to study the high temperature induced changes during germination in carbohydrates, activities of peroxidase, superoxide dismutase (SOD), amylase and nitrate reductase enzymes. The temperature regime significantly affected all the characters studied. The genotypes x temperature interaction effects were significant only for germination and peroxidase activity. Increased temperature promoted the SOD and peroxidase but decreased nitrate reductase and

amylase activities. Decline in the carbohydrates utilization in seeds limited by reduced amylase activity might have led to reduced germination. Germination exhibited positive and significant relationship with the activities of amylase (r=0.392**), nitrate reductase (r0.265*) and peroxidase (r=0.506**) under high temperature regime. The regression analysis revealed that under high temperature regime, peroxidase and amylase enzyme activities were important contributors to germination accounting for 24.4% and 14.5%, respectively, of the total variability in seed germination.

336. Chawla, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Goyal, S.C.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Datta, K.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Angrish, R.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Protein profile changes under salt-boron toxicity and its regulation by hydrogen peroxide and glutathione in pibeonpea (Cajanus cajan L.). Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 378-383 KEYWORDS: HYDROGEN PEROXIDE. CAJANUS CAJAN.

Two genotypes of pigeon pea (Cajanus cajan L. Millsp.), salt tolerant Manak, (H77-216) and salt sensitive ICPL 88039 were subjected to treatment solutions with distilled water (C), HzOz (100 JIM; H), Glutathione, GSH (500 pM; G), HzOz (100 pM) + GSH (500 pM) superimposed with SoBo (DW), SoBlo (0 mM NaCI + 10 mM B as NazB407.10HzO, S100 + Bo (100 mM NaCI + 0 mM B) and SI00B10 (100 mM NaCI + 10 mM B) at the seedling stage in a BOD incubator at 27:t l°C in dark for 96 h. Proteins from coleoptiles and radicles were resolved by SDS-PAGE. In tolerant cultivar Manak two proteins of molecular weight 67.6 and 81.1 kDa disappeared in SoBlo C, however 67.6 kDa reappeared with SoBlo Hand SoBlo H+G treatments. Similarly two bands of 51.2 and 87.0 kDa disappeared due to S100 treatment but only 51.2 kDa reappeared with SI00BoH and SI00Bo H+G treatments. Likewise in radicle of Manak a 66.6 kDa protein disappeared with SoBlo C but same protein reappeared with HzOz , Glutathione, HzOz + GSH treatments. Even S100BI0 C treatment repressed 79.8 kDa protein in ICPL 88039 but got recovered with HzOz, Glutathione and HzOz + GSH treatments. These observations accord credence to step-up regulation of protein synthetic machinery in pigeonpea by HzOz and glutathione under salt-B toxicity conditions.

337. Gopalakrishnan, N.; Central Institute of Cotton Research, Coimbatore (India). Prakash, A.H.; Central Institute of Cotton Research, Coimbatore (India). Balachandran, Y.L. Differential metabolic and RAPD expression during early fibre development in normal and its lintless mutant of cotton (Gossypium hirsutum L.). Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 384-388 KEYWORDS: COTTON. GOSSYPIUM HIRSUTUM. MUTANTS. POLYMORPHISM.

A comparative analysis of a cotton cv. MCV 5 and its fibreless mutant was made to have a better understanding of the biochemical and thereby the molecular processes associated in fiber initiation process. Biochemical analysis of the lintless mutant ovules revealed that there was a marked reduction in the synthesis of reducing sugars, total free amino acids and total soluble protein content, while there was no effect on the proline and phenol content of ovules from 0 to 5 DPA. Genomic DNA extracted from 5 day old ovules was utilized for the RAPD analysis using 20 synthetic primers. Two primers were found non-polymorphic with extra bands. The primer sequence - 3' GAGAGGCTCC 5' showed 66 % polymorphism with two extra bands at 2040 (+-10) bp and 630 (+-10) bp, and the primer sequence 3' TCCGTGCTGA 5' showed 85% polymorphism with one extra band at 1160 (+-:10) bp in MCV 5, which might be involved in the fiber initiation processes.

338. Singh, D.; Narender Deva University of Agriculture and Technology, Faizabad (India). Dept. of Crop Physiology. Ram, P.C.; Narender Deva University of Agriculture and Technology, Faizabad (India). Dept. of Crop Physiology. Dar, S.R.; Central Soil Salinity Research Institute, Karnal (India). Sharma, P.C.; Central Soil Salinity Research

Institute, Karnal (India). Alleviating adverse effect of soil salinity in wheat (Triticum aestivum L.) through application of zinc fertilizer. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 389-395 KEYWORDS: SOIL SALINITY. TRITICUM AESTIVUM. ZINC. FERTILIZERS. GERMINATION.

An experiment was conducted to study the alleviating adverse effect of soil salinity on three wheat varieties through application of zinc fertilizer. Wheat varieties KRL 19, NW 1012 (salt-tolerant) and HD 2285 (salt-susceptible) were grown in pots under non-saline (0, 20 kg Zn) and saline (8.0 dSm-1, 20 kg Zn +8.0 dSm-1) conditions during the rabi seasons. Study revealed that soil salinity adversely affected germination, plant height, number of tiller, number of leaves and leaf area per plant in all the three varieties at the tillering stage. Yield parameters viz., number of ear per plant, number of grain per ear, test weight, economic and biological yields declined significantly. Maximum reduction in these parameters was recorded in the susceptible variety (HD 2285) and minimum reduction in the tolerant varieties (KRL 19 and NW 1012). Zn application 20 kg ha-1 partially alleviated the adverse effects of salinity on economic yield with higher response (22.3% increment) in the susceptible variety HD 2285 compared to no application.

339. Sabale, A.; Shivaji University, Kohlapur (India). Dept. of Botany. Kale, P.B.; Shivaji University, Kohlapur (India). Dept. of Botany. Response of coriander (Coriandrum sativum L.) to waterlogging. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p. 396-400 KEYWORDS: CORIANDRUM SATIVUM. WATERLOGGING. SUGAR. OXIDATION.

Under waterlogging condition, behaviour of Coriandrum sativum L. var. IDdoori revealed a significant increase in total soluble sugars and anthocyanins in the leaves which was 100% for four days and 200% for eight days waterlogging. Accumulation of ascorbic acid at eight days waterlogging condition was noticeable. A marked enhancement in reducing sugars and free amino acids (75%) was also evident in the waterlogged plants. On the contrary total chlorophylls, carotenoids and flavonoids declined by about 50% but relative water content, leaf water potential and chlorophyll stability index followed a negligible reduction during stress. Lipid peroxidation (MDA content), superoxide dismutase activity and proline accumulation enhanced with a parallel decline in proline oxidase activity. After relieving the stress, relative water content and leaf water potential remained unchanged but proline and ascorbic acid content decreased. Similarly, proline oxidase, superoxide dismutase activities also recovered and MDA content declined. Total chlorophylls enhanced by 27-35%. These results indicated that the variety is sensitive and susceptible to waterlogging. Ascorbic acid and anthocyanins might function as antioxidant to face oxidative stress while total sugars, proline and free amino acids, as osmoprotectants. Four days waterlogging did not cause much damage to the crop but at eight days waterlogging stress physiological alterations were seen.

340. Saravanan, R.; Directorate of Medicinal and Aromatic Plants Research, Anand (India). Mandal, K.; Directorate of Medicinal and Aromatic Plants Research, Anand (India). Gautam, S.; Indian Agricultural Research Institute, New Delhi (India). Unit of Simulation and Informatics. Samanta, J.N.; Directorate of Medicinal and Aromatic Plants Research, Anand (India). Kumar, V.S.; Indian Institute of Information Technology and Management, Thiruvananthapuram (India). School of Ecological Informatics. Changes in photosysnthesis related parameters in isabgol (Plantago ovata) under downy mildew infection. Indian Journal of Plant Physiology (India). (Oct-Dec 2010) v.15(4) p.401-405 KEYWORDS: PHOTOSYNTHESIS. PLANTAGO OVATA.

Sequential changes in leaf chlorophyll content and associated gas exchange parameters in isabgol (Plantago ovata) were recorded over a period of nine days starting from initial sporulation to severe chlorosis in a highly downy mildew susceptible cultivar (Niharika). The Downy mildew caused significant reduction in chlorophyll content. The loss of chlorophyll was more severe in case of chlorophyll 'a' compared to chlorophyll 'b'. Net photosynthetic rate and stomatal conductance in the diseased leaves also reduced

compared to healthy ones. However, internal CO2 concentration (Ci) increased in diseased leaves. Difference between healthy and infected leaves in terms of stomatal conductance and Ci became significant at ninth day of study. In the complex situation of variable disease severity and leaf physiological stage, we found net photosynthetic rate was highly correlated (r=-0.8) with the disease severity.

341. Kukreja, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Nandwal, A.S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Kumar, N.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Singh, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Sharma, S.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Sciences. Sharma, S.K.; Central Soil Salinity Research Institute, Karnal (India). Devi, S.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Kumar, A.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Ethylene evoluation and modification of antioxidant defense mechanism as indices of salinity stress tolerance in Ciceer arietinum L. nodules. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.203-212 KEYWORDS: CICER ARIETINUM. PROLINE. ETHYLENE. ANTIOXIDANTS. SALINITY. MEMBRANES. PLANT GROWTH SUBSTANCES. SALT TOLERANCE.

Salinity induced changes in the ethylene evolution, antioxidant activity, and membrane integrity in relation to water and mineral status in indeterminate type of chickpea (Cicer arietinum L.) nodules in cv. CSG-8962, (National check for salinity tolerance) were studied under natural conditions of screen house. At flowering stage (80-90 DAS) plants were exposed to single saline irrigation (CI--dominated) of levels 2.5, 5.0, and 10.0 dSm-1 and sampled after 3 d. The control plants were irrigated with canal water. The other set of treated plants were revived after desalinization and the plants were sampled after further 3 d. Water potential ('Pw) of leaf and osmotic potential ('Ps) of leaf and nodules significantly decreased from -0.77 to -0.93 MPa and from -0.86 to -1.35 MPa and from -0.94 to -1.75 MPa, respectively upon salinization. Relative water content (RWC%) of leaf and nodules also reduced from 82.55% to 75.60% and 95.75% to 85.35%, respectively. The decline in ('I's) of nodules was due to accumulation of proline and total soluble sugars. In comparison to control, the increase in ethylene (CzHJ production was 33% to 82% higher and correspondingly increases in 1-aminocyclopropane-1-carboxylic acid (ACC) content (50-162%) and ACC oxidase activity (46-167%) was also noticed. Similarly, 1.42 to 3.08 fold and 1.08 to 1.61 fold increase in HzOz and thiobarbituric acid reactive substances (TBRAS) contents was also observed, respectively. N content of nodules declined after saline irrigation. The induction in specific activity of antioxidant enzymes was confirmed by the increase in specific activity of superoxide dismutase (11-133%), catalase (9-109%), peroxidase (50-227%), ascorbate peroxidase (17-87%), glutathione reductase (69-288%) and glutathione transferase (8-66%). The induced antioxidant enzymes activity was not sufficient to scavenge the oxidative damage of nodules as it is clear from the accumulation of H202 in nodules. Ascorbic acid (AA) content also declined from 13.24 to 54.50%, whereas Na+lK+ ratio and CI- content were significanty increased. All the metabolic changes were also correlated to the osmotic status of the nodules. Upon revival, a partial recovery in all above metabolic processes. a.nd water relation paramete{s were noticed. It is concluded that under the cumulative effect of salinity and reduced water statusi ethylene, lipid peroxidation and H20Z are playing a key role in the functioning of chickpea nodules.

342. Lakshmamma, P.; Directorate of Oilseeds Research, Hyderabad (India). Prayaga, L.; Directorate of Oilseeds Research, Hyderabad (India). Lakshminarayana, M.; Directorate of Oilseeds Research, Hyderabad (India). Alivelu, K.; Directorate of Oilseeds Research, Hyderabad (India). Source manipulation induced variation in dry matter

partitioning to reproductive sink in castor. Indian Journal of Plant Physiology (India). (Jul - Sept 2010) v. 15(3) p. 213-218 KEYWORDS: SPIKELETS. GENES. DEFOLIATION. SPIKES. BEAVERS.

An experiment on effect of defoliation at different spike initiation stages on biomass partitioning was conducted for two consecutive years during 2005-07 using DCS-9 variety. Treatments consisted offour defoliation levels (25%, 50%, 75% and 100%) at primary, secondary and tertiary spike initiation stages on entire plant along with control, with 3 replications in RBD. With increase in percent defoliation at any stage there was reduction in stem, leaf, capsule dry weight which resulted in significant reduction in total dry matter. There was compensation in growth only up to 25% defoliation at any stage. Only primary seed yield was affected with defoliation at primary spike initiation stage, but with secondary stage defoliation, yield of all order branches was affected. Secondary, tertiary and quarternary seed yield was affected with defoliation at tertiary stage. Yield of one order decreased with 25% defoliation at that order and 50% defoliation at next lower or higher order spikes.

343. Pooja; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Sharma, K.D.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany and Plant Physiology. Salicylic acid induced amelioration in growth, biochemical metabolites and yield of mungbean (Vigna radiata L.) under salinity stress. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.219-225 KEYWORDS: SALICYLIC ACIDS. YIELDS. VIGNA RADIATA. PROLINE.

The study was conducted in green house to determine whether exogenous application of salicylic acid (SA) through foliar spray could modulate the plant growth, biochemical attributes, mineral nutrition, and yield in mungbean (Vigna radiata L.) under two levels of salinity. The chloride dominated (CI:S04 ratio 7:3) salinity was maintained in earthen pots at 4 and 6 dS m-1levels after seed germination. At flower initiation, two concentration of salicylic acid viz 0.25 and 0.50 mM were applied as foliar spray on both control and salinity treated plants and observations were recorded at 2 and 6 days after spray of salicylic acid. Increasing salt stress reduced the dry matter accumulation in leaves, stem and roots along with leaf area. The salicylic acid application at 0.5 mM improved the growth parameters and the response was more at 6 days stage. Biochemical metabolites i.e. total soluble protein declined under salinity stress, however, tree proline, total soluble carbohydrates, and free amino acids content showed sharp rise under salinity stress. Foliar SA application increased all the above biochemical metabolites under salinity. The leaf ionic composition of Na+, CI- and SO4- increased but that of K+ declined under salinity stress. Salicylic acid reversed the accumulation trend of ions under salt stressed condition. Significant reduction in seed yield and its attributes were recorded under both levels of salinity. Salicylic acid application protected against salinity induced decline in yield components. The recovery was more pronounced at 6 dS m-1 salinity as compared to 4 dS m-l salinity level particularly w!th 0.5 mM salicylic acid.

344. Warrier, K.C.S.; Indian Council of Forestry Research and Education, Coimbatore (India). Institute of Forest Genetics and Tree Breeding. Vankataramanan, K.S.; Indian Council of Forestry Research and Education, Coimbatore (India). Institute of Forest Genetics and Tree Breeding. Gas exchange characteristics in Eucalyptus clones. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.226-233 KEYWORDS: EUCALYPTUS. PHOTOSYNTHESIS. RESPIRATION. EFFICIENCY. WATER USE.

The largest operational clonal forestry programmes are with several species in the genus Eucalyptus and a number of clones are being deployed to increase the productivity of this species in India. There exists tremendous variation with reference to yield and tree form in clones of eucalypts. Studies on photosynthesis and related physiological parameters of various clones shall provide valuable information for establishing plantations at different geographic locations. Considerable variations were observed when 59 clones of Eucalyptus camaldulensis Dehnh. were subjected to physiological

studies at the Institute of Forest Genetics and Tree Breeding (IFGTB), Coimbatore. Five clones exhibited superior growth coupled with favourable physiological characteristics including high photosynthesis, carboxylation efficiency and water use efficiency.

345. Biradar, K.S.; University of Agricultural Sciences, Dharwad (India). National Seed Project. Nadaf, H.L.; University of Agricultural Sciences, Dharwad (India). National Seed Project. Kenganal, M.; University of Agricultural Sciences, Dharwad (India). National Seed Project. Discrimination of transgenic cotton seed using visible and near infrared diffuse reflectance specvtroscopy (NIRS). Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.234-241 KEYWORDS: TRANSGENICS. MUTANTS. MODELS. STATISTICAL METHODS.

Visible/near-infrared (Vis/NIR) diffuse reflectance spectroscopy combined with chemometrics techniques, was used to distinguish transgenic cotton seed from non-transgenics. Two hundred fifty cotton seeds of RCH-2 genotype containing Cry lAc gene conferring resistance to lepidopteron pests and the same number of their parent non-transgenic seeds were scanned in the Vis/NIR wavelength spectrum of 400-2500 nm. Modified partial least square (mPLS), partial least square (PLS) and principal component regression (PCR) models were applied for calibration and classification of samples into two groups. The results showed that differences exist between transgenic and non-transgenic cotton seeds and excellent classification can be obtained after optimizing spectral pretreatment. The spectral difference between the two groups are observed at a wavelength range of 1100-1900 nm, which is related to first and second overtone of C-H stretching vibrations and sixth overtone of C=C stretching vibrations. Standard normal variate (SNV) and detrend scatter correction with second derivative data pretreatment using mPLS model could achieve 100% accurate classification for both transgenic and non-transgenic samples. Reliable equations were developed with r=0.96 and r=0.92 for calibration and validation set respectively with low standard error of performance (SEP) (0.13) using mPLS model.

346. Amudhan, M.S.; Central Plantation Crops Research Institute, Vittal (India). Div. of Physiology and Biochemistry. Changes in polyphenol and arecoline contents in Areca catechu genotypes during maturity. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.242-245 KEYWORDS: GENOTYPES. ARECA CATECHU. DRUG PLANTS. STIMULANT CROPS. MATURITY. ARECOLINE. POLYPHENOLS.

The consequence on different maturity stages and genotypes on polyphenol, condensed tannins and arecoline content of areca nut were investigated. The content of polyphenol, condensed tannins and arecoline showed significant differences among months and decrease in content of polyphenol was found during fruit attaining maturity or ripe stage in arecanut genotypes. The arecanut genotypes showed a marked increase in condensed tannins (CT) content beginning from the 3 month (very tender stage) while a marked decrease 20% to 40% in CT was observed in semi ripe and .fully ripen stages. The ratio of CT to total polyphenol (TP) was found to be 40-50% for entire growth period which gives an indication of the relative proportions of CT. Ripe arecanut showed high arecoline content than unripe arecanut. Moderate arecoline content was recorded in at semiripe stage (6 month) in arecanut. With respect to arecanut maturity stages, tender nut stage (6-7 month) may be ideal stage for arecanut chewing purpose which also showed lower arecoline content and this stage may also be ideal for optimum extraction of polyphenol and CT for pharmacological uses.

347. Rajput, V.D.; Indian Institute of Pulses Research, Kanpur (India). Singh, N.P.; Indian Institute of Pulses Research, Kanpur (India). Studies on in vitro regeneration and direct organogenesis in pea (Pisum sativum L.). Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.246-249 KEYWORDS: IN VITRO. REGENERATION. PISUM SATIVUM.

A regeneration protocol has been optimized in Pea (Pisum sativum L.) genotypes HUDP-15 and IPF -99-25 with explants viz. embryonic axes as such, and also as sliced and decapitated and cotyledonary node. Direct shoot regeneration was achieved on

medium containing MS salts + Bs vitamins and various concentrations of BAP, NAA and IBA. The best direct regeneration efficiency (10.37::1:3.18 shoots/ explant) and frequency (84.66::1:0.84%) was achieved from embryonic axes slices on MS salts + Bs vitamins + 3.0 mg/I BAP + 2.0 mg/I IBA + 40 gm/I sucrose. The regenerated shoots were excised and transferred to rooting medium, containing NAA and IAA at various concentrations. The highest rooting was observed on the medium supplemented with Y2 MS salts + Bs vitamins + 2.0 mg/I lAA + 30 gm/I sucrose, rooted plants were acclimatized and transferred to field with good survival rate.

348. Singh, V.K.; Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology. Dwivedi, P.; Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology. Efficienct in vitro shoot multiplication of Gymnema sylvestre R. Br. - An antidiabetic medicinal plant. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.240-254 KEYWORDS: IN VITRO. ACIDS. TISSUE ANALYSIS.

An efficient in vitro shoot multiplication protocol was developed for Gymnema sylvestre R.Br. which is a potent anti-diabetic plant. Nodal explants were inoculated in half strength MS media containing different auxins (IAA and IBA) and cytokinins (BAP and Kinetin) at various concentrations for rapid multiple shoot induction. Multiple shooting (3.25:1:0.62) was obtained in presence of BAP and Kn at 3.0 mg/I each. Best response in terms of shoot length was recorded (1.97:1:0.06 cm) in the media supplemented with Kn and IAA at 1.5 mg/I each. Microshoots obtained in vitro were inoculated in Yi MS media which produced maximum of 5 roots at 1.0 mg/1 IBA.

349. Singh, D.; Central Soil Salinity Research Institute, Karnal (India). Sharma, P.C.; Central Soil Salinity Research Institute, Karnal (India). Effect of NaCI stress on photosynthesis characteristics and antioxidant enzymes in rice cultivars. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.255-258 KEYWORDS: ANTIOXIDANTS. PHOTOSYNTHESIS. ENZYMES. RICE.

The effect of NaCI stress 90 physiological and biochemical characteristics of salinity tolerant CSR 27 and sensitive Pusa Basmati 1 rice cultivar was studied in comparison with CSRI0. Thirty-five days old seedling was transplanted in earthen pots with three ievel of salinity stress (0, 6.0 and 12.0 dSm-1) treatment. Observation were recorded for the rate of photosyntnesis (P N) chlorophyll content, relative water content (RWC) and antioxidant enzymes viz. Superoxide dismutase (SOD) and Catalase (CAT) were determiiied at 35 and 65 days after traqsplanting. Rate of photosynthesis and chlorophyll content Ireased marginally by NaCI stress in CSR 27 and CSR 10 but Basmati 1 showed greater reduction. CSR 10 and CSR 27 maintained higher RWC under NaCI stress compared to sensitive Pusa Basmati- 1. SOD activity was highly induced umfer NaCI stress in CSRI0 but CAT activity decreased. In CSR 27, induction of SOD and CAT activities was higher than that of Pusa Basmati-1. The results indicate that maintenance of higher RWC and induction SOD activity under NaCI stress in CSR 27 contributed to its salt tolerant characteristics.

350. Brar, J.S.; Punjab Agricultural University, Bathinda (India). Regional Research Stn. Effect of paclobutrazol and ethephon on leaf nutrient uptake in 'Allahabad safeda' guava (Psidium guajava L.) plants. Indian Journal of Plant Physiology (India). (Jul - Sept 2010) v. 15(3) p. 259-261 KEYWORDS: PACLOBUTRAZOL. ETHEPHON. NUTRIENT UPTAKE. PSIDIUM GUAJAVA. LEAVES.

The guava plants-treated with paclobutrazol (PBZ) and ethephon assimilated significantly higher N, P, Zn and Fe content in leaves. However, the leaf K concentration was reduced with PBZ treatments and improved with ethephon treatments. The concentration of all nutrients in the leaves of treated plants was recorded highest after fruit harvest in the month of October except P and Fe, which was recorded maximum in the month of August and September, respectively under ethephon treatments. The nutrient assimilation was significantly affected in all treated plants but PBZ particularly 1000ppm application markedly increased the overall nutrient assimilation.

351. Malik, S.K.; National Bureau of Plant Genetic Resources, New Delhi (India). Tissue Culture and Crypopreservation Unit. Kalia, R.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Centre for Plant Biotechnology. Chaudhury, R.; National Bureau of Plant Genetic Resources, New Delhi (India). Tissue Culture and Crypopreservation Unit. In vitro regeneration of Garcinia indica using leaf lexplants. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.262-266 KEYWORDS: IN VITRO. REGENERATION. MICROPROPAGATION. GARCINIA. PLANT EXTRACTS.

Regeneration of plantlets via adventitious bud differentiation on leaf explants of Garcinia indica (Thouars) Choisy, a medicinally important apomictic tropical tree species was done. Leaves were cultured on Murashige and Skoog's medium supplemented with cytokinins (6-Benzylaminopurine, BAP, kinetin and Thidiazuron, TDZ) alone and in combination with auxin (a-Napthaleneacetic acid, NAA) for direct shoot proliferation. Maximum number of shoots were formed in 63.89% explants on MS medium supplemented with 1.0 M TDZ after 2-4 weeks of culture. Elongation of the induced shoots was achieved on MS basal medium containing 0.2% activated charcoal. Maximum rooting (83.33%) was observed in shoots cultured on half-strength MS medium supplemented with 10 M mA. The plantlets were successfully transferred to soil after hardening.

352. Singh, S.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Singh, A.L.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Kalpana, S.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Misra, S.; Indian Agricultural Research Institute, New Delhi (India). Div. of Environmental Sciences. Genetic diversity for growth, yield and quality traits in groundnut (Arachis hypogaea L.). Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.267-271 KEYWORDS: GROWTH. YIELDS. QUALITY. ARACHIS HYPOGAEA.

Thirty two groundnut genotypes of both spreading and bunch types were evaluated for their yield, yield attributes, seed protein and oil content to analyse the degree of genetic variability in quantitative and qualitative traits and to use as pedigree for further development of varieties with greater yield potential and seed quality. The genotypes showed the extent of variation from 550-1125 g m2 in biomass, 142-277 g m2 in pod weight, 91-216 g m2 in seed yield, 4-23 pods/plant, 1-3 seeds per pod, 245-594 g m2 in 1000 seed weight, 53-87% in shelling percent, 11-27% in harvest index, 20.8-28.9% in protein and 39.6-49.1% in oil contents of seeds. This degree of variation in seed yield and quality traits offer an opportunity to further evolve the promising groundnut varieties to boost both the seed and oil production in the country.

353. Singh, R.; National Research Centre for Agroforestry, Jhansi (India). Alam, B.; National Research Centre for Agroforestry, Jhansi (India). Changes in the crop phenology of green gram (Vigna radiata L.) and soybean (Glycine max L. Merril.) under varying regimes of shade in a semi-arid agroclimatic location. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.272-277 KEYWORDS: GERMINATION. VIGNA RADIATA. GLYCINE MAX. PHENOLOGY. MICROCLIMATE.

The experiments were conducted during 2007 and 2008 under simulated shade net house conditions by growing crops namely green gram (Vigna radiata L.) and soybean (Glycine max L. Merril.) with three different regimes of shade (33, 50 and 75%) or without shade as control (open sunlight) to test the influence of shade on the phenology of crops beginning with the germination. Although seed germination was successful (93% to 100%) in all the three regimes of shade and open field, germination was faster in shade than open field in both the crops. However, there was differential response with the requirement of days to achieve maximum germination between the crops where green gram showed faster rate of germination than soybean. Time taken for leaf maturity or full expansion varied with the crops and the intensity of shade. Expansion rates of leaf length (LER) and lamina width were higher in shade than in open field. These were faster in green gram than soybean. However, degree of difference in

LER between shade and open grown plants was less in soybean than in green gram. In green gram, flowering initiation was observed within 31-38 DAS (days after sowing) either in open field or 33% shade and within 34-40 DAS in 50% or 75% shade. In soybean, flowering initiation was observed within 33-41 DAS in all the three regimes of shade and it took relatively more time to flower initiation in open condition i.e. 37-44 DAS. A trend similar to flowering initiation was also observed in pod formation in green gram and soybean. The observed consistent trend for all the parameters of crop phenology indicate a relatively better shade adaptability in terms of its resilience to shade induced changes in crop phenology in soybean than green gram in a semi-arid region.

354. Rai, R.K.; Indian Institute of Sugarcane Research, Lucknow (India). Div. of Plant Physiology and Biochemistry. Singh, P.; Indian Institute of Sugarcane Research, Lucknow (India). Div. of Plant Physiology and Biochemistry. Chandra, A.; Indian Institute of Sugarcane Research, Lucknow (India). Div. of Plant Physiology and Biochemistry. Yadav, R.L.; Indian Institute of Sugarcane Research, Lucknow (India). Div. of Plant Physiology and Biochemistry. Salinity induced changes in phosphorus fractions of sugarcane laminae adversely affect sucrose contents. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.278-282 KEYWORDS: PHOSPHORUS. SUCROSE. SUGARCANE. SODIUM.

Growth, development and sucrose accumulation are regulated by phosphorus accumulation during growth cycle. In the present experiment, the effects of sodium salts on sugarcane growth were evaluated. The pool size of different phosphorus (P) fractions in leaf laminae of sugarcane varieties under test varied significantly as compared to control. The inorganic-P pool size was higher in CoLk 8102 as compared to Co 1148. On the contrary, organic-P fractions were lower in CoLk 8102 than Co 1148. The inorganic-P fractions were higher in CoLk 8102 as compared with Co1148 while organic P fractions were lower in CoLk 8102 as compared with Co 1148 in all treatments under evaluation. Higher concentration of sodium salts induced significant reduction in, total tissue phosphorus concentration during growth cycle as compared to control in both varieties and showed strong negative correlation with leaf area, cane dry weight and sucrose contents.

355. Dhakshanamoorthy, D.; Annamalai University, Annamalainagar (India). Dept. of Botany. Selvaraj, R.; Annamalai University, Annamalainagar (India). Dept. of Botany. Use of RAPD marker for identification of DNA polymorphism in gamma rays treated Jatropha curcas L. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.283-287 KEYWORDS: GAMMA RADIATION. JATROPHA CURCAS.IDENTIFICATION.

The aim of this study is to examine the discriminatory power of random amplified polymorphic DNA (RAPD) marker in Jatropha curcas, and to determine the effect of various dose exposures (0, 5, 10, 15, 20 and 25 Kr) of gamma rays on J. curcas, at molecular level. All the ten random primers used produced reproducible polymorphic bands. PCR products of mutant genome revealed a total of 40 bands, out of which 27 were polymorphic. Polymorphism information content (PIC) values were ranged from O.OO to 0.40 and the highest PIC value of 0.40 was observed in primer OPU-13 followed by primers OPAL-ll and OPT-18 (0.30) while no PIC value were reported in primers OPH-18 and OPM-13. Jaccard's coefficient of similarity varied from 0.476 to 0.723, indicative of high level of genetic variation among the mutants studied. UPGMA cluster analysis indicated three distinct clusters, one comprising control while the second included four mutants viz., 10, 15, 25 and 20 Kr. The mutant 5 Kr remained distinct and formed third cluster indicating its higher genetic diversity from the rest of the mutants and control. The primer OPU-13 produced maximum number of bands (8) showed highest discriminatory power and PIC (0.40) by showing maximum number of polymorphic bands (5) when compared to other primers used. The study reveals that RAPD molecular markers can be used to assess polymorphism among the mutants and can be a useful tool to supplement the distinctness, uniformity and stability analysis for plant varietal identification and protection.

356. Kariali, E.; Sambalpur University, Sambalpur (India). School of Life Science. Patel, S.; Sambalpur University, Sambalpur (India). School of Life Science. Panigrahi, R.; Sambalpur University, Sambalpur (India). School of Life Science. Mohapatra, P.K.; Sambalpur University, Sambalpur (India). School of Life Science. Change of adaptive plasticity of Oryza rufipogon Griff. in response to variation of growth habitats. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.288-292 KEYWORDSECOTYPES.ORYZA RUFIPOGON. GROWTH.

We assessed the margin of plasticity in assimilate partitioning between plant organs in three ecotypes of Oryza rufipogon Griff. living in dryland, lowland and deep water habitats and in each ecotype grown in three simulated habitats resembling the natural habitats. Growth duration, biomass and grain yield and assimilate concentration of reproductive organs were low in the dryland ecotype, but high in the other two ecotypes, although the proportion of biomass partitioned to panicle declined. Simulated habitats were beneficial for shoot dry matter production of dryland ecotype but not always for the other two; shoot biomass did not improve, when deep water ecotype was placed in simulated conditions. The pattern of distribution of assimilates or dry matter between the organs of the ecotypes did not differ between the natural and simulated conditions. Thus, difference in morphological attributes of the ecotypes was mostly determined by variation of environmental conditions irrespective of any variation accrued in the genotype owing to adaptation in the habitat. The adaptivf plasticity of Oryza rufipogon resulting in morphological divergence of the species across the gradation of habitats may be a trait useful for rice agronomy.

357. Kumar, A.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy. Singh, D.P.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy. Singh, P.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy. Chaudhary, B.D.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy. Thakral, S.K.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy. Sharma, K.D.; Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy. Difference in plant growth, dry matter partitioning, yield and water use efficiency of mungbean x black gram hybrids under rainfed conditions. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.293-296 KEYWORDS: DRY MATTER CONTENT. GROWTH. YIELDS. VIGNA RADIATA. VIGNA MUNGO.

Six hybrids, three each with foliage morphology similar to mungbean and black gram were evaluated for plant growth and grain yield. Mungbean type produced higher yield than black gram type hybrids. Hybrids Tl-18 and T2-36 showed rapid root growth and greater allocation of dry matter to grains. Biomass was positively related to total moisture use and seed yield to daily crop transpiration. Combined contribution of number of seeds pod-l, seed size and pods plant-l (R2=O.998) or the number of grains pod-l and seed size (R2=O.997) towards grain yield indicated our primary concern to focus attention to improve the seed size of these legumes under rainfed conditions.

358. Yadav, M.; Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology. Dwivedi, P.; Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology. Singh, P.; Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology. Singh, V.K.; Banaras Hindu University, Varanasi (India). Dept. of Plant Physiology. In vitro culture protocol of Tylophora asthmatica, an anti-asthmatic medicinal herb. Indian Journal of Plant Physiology (India). (Jul-Sep 2010) v.15(3) p.297-301 KEYWORDS: IN VITRO. DRUG PLANTS. CULTURE MEDIA. TISSUE ANALYSIS.

Tylophora asthamatica, a perennial climbing plant and member of Asclepiadaceae, has tremendous medicinal value in Ayurvedic system of medicine. It is generally used for anti-asthamatic and anti-allergic treatment. Besides being effective in the treatment of bronchial asthma, bronchitis, hay fever, rheumatism and dermatitis, its major constituent alkaloid tylophorine also has anti-inflammatory action. Over-

exploitation of Tylophora for its above mentioned medicinal properties has prompted to undertake its conservation strategies through plant tissue culture technique. For regenerating shoots of Tylophora asthamatica nodal segments were inoculated on to MS half strength and MS full strength media containing different concentrations and combinations of auxins (IAA and IBA) and cytokinins (Kinetin and BAP). The MS half strength medium fortified with BAP (L5 mg/I), BAP + IBA (1.0 mg/I each), Kn + IBA (0.2 mg/I each) and Kn + IBA (0.5 mg/I each) favoured best response in terms of multiple shooting, leaf number, leaf length and rooting, respectively, whereas snoot elongation was best in case of full strength of MS medium fortified with BAP + kinetin (0.5 mg/I each) after 45 days of inoculation of explants. The plantlets thus developed were hardened and acclimatized in mixture of garden soil and sand (1:1).

359. Chaudhary, Priyanka; Indian Agricultural Research Institute, New Delhi (India). Pandey, Alok K.; Indian Agricultural Research Institute, New Delhi (India). Singh, Shashi B.; Indian Agricultural Research Institute, New Delhi (India). Prasanna, Radha; Indian Agricultural Research Institute, New Delhi (India). Chaudhry, Smita; Kurukshetra University, Kurukshetra (India). Institute of Environmental Studies. Nain, Lata; Indian Agricultural Research Institute, New Delhi (India). Evaluating the phenotypic and functional diversity of Polycyclic Aromatic Hydrocarbon utilizing bacteria isolated from Petroleum refinery soil. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.129-133 KEYWORDS:PETROLEUM. PURIFICATION. AROMATIC COMPOUNDS. BACTERIA. SOIL.

Polycyclic aromatic hydrocarbon utilizing soil bacteria were isolated from different sites in petroleum refinery premises at Mathura, India. A total of twenty six bacterial type strains with different colony morphologies and phenotypic traits were isolated. These bacteria could utilize, as sole carbon source, an equimolar mixture of four polycyclic aromatic hydrocarbons namely anthracene, fluorene, phenanthrene and pyrene at 50 ppm concentration. The profile of each bacterial isolate was matched with the phenotypes of the standard bacterial genera listed in Bergey's manual of Determinative Bacteriology. The isolates were identified as members of diverse genera namely - Bacillus, Acinetobacter, Stenotrophomonas, Pseudomonas, Alcaligenes, Lysinibacillus, Brevibacterium and Serratia. This study emphasized the need to develop enrichment strategies using these isolates for bioremediation of PAH contaminated soils.

360. Singh, S.K.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Singh, B.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Srivastava, J.S.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Use of Rhizobium, mycorrhizal fungi and organic amendments on growth of Pisum sativum. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.134-7 KEYWORDS: GLOMUS MOSSEAE. PISUM SATIVUM. RHIZOBIUM.

It was observed that some of the soil types were more suitable for mycorrhizal colonization as well as nodulation. A correlation was found between nutritional status of the soil and mycorrhizal colonization. Effect of Glomus mosseae, G. fasciculatum and Rhizobium leguminosarum P-6-96 was also seen on pea var. Rachna. Highest nodulation was recorded with G. mosseae + G. fasciculatum + P-6-96 treatment. When two species of Glomus were compared, it was found that G. mosseae was better. It was noticed that mycorrhizal colonization enhanced (27.8–28.2%) after treatment with Rhizobium. A tendency of enhancement in mycorrhizal colonization (33.0%) was noticed with the soil amended with the neem leaves along with mycorrhiza.

361. Rana, Anuj; Indian Agricultural Research Institute, New Delhi (India). Division of Microbiology. Saharan, Baljeet; Kurukshetra University, Kurukshetra (India). Division of Microbiology. Kabi, Soumya Ranjan; Indian Agricultural Research Institute, New Delhi (India). Division of Microbiology. Prasanna, Radha; Indian Agricultural Research Institute, New Delhi (India). Division of Microbiology. Nain, Lata; Indian Agricultural Research Institute, New Delhi (India). Division of Microbiology. Providencia, a PGPR with

biocontrol potential elicits defense enzymes in wheat. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.138-41 KEYWORDS: CATECHOL OXIDASE. PHENYLALANINE AMMONIA LYASE. TRITICUM AESTIVUM.

Plant growth-promoting rhizobacteria (PGPRs) were tested for their efficacy to elicit plant defense enzymes in wheat (Titicum aestivum) at ear stage under field conditions. A significant enhancement was observed in the defense enzyme activities in the homogenates prepared from wheat leaves. Providencia sp. (AW5) alone and with combination of Bacillus sp. (AW1) and Brevundimonas sp. (AW7) showed 42.5 - 56.9% increase in Peroxidase (PO) and Polyphenol oxidase (PPO) activities simultaneously, and a two fold increase in Phenylalanine ammonia-lyase (PAL) activity as compared with the non-inoculated control plants. These results revealed that Providencia sp (AW5) alone as well as in combination with AW1 and AW7 was found the potential to increase defense enzymes in wheat plant under field conditions.

362. Dubey, Nidhi; Indian Pharmacopoeia Commission, Ghaziabad (India). Gupta, R.L.; Indian Agricultural Research Institute, New Delhi (India). Raghav, C.S.; National Bureau of Plant Genetic Resources, New Delhi (India). Study of yield, physico-chemical properties, chemical composition and antifungal activity of essential oils of North Indian Vetiver roots. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.150-4 KEYWORDS: ESSENTIAL OILS. YIELD COMPONENTS. YIELDS. CHEMICOPHYSICAL PROPERTIES. RHIZOCTONIA SOLANI. VETIVERIA ZIZANIOIDES.

The highest oil yield was obtained from lachha followed by nakhuni and munjhar (local names), irrespective of distillation methods. Similarly, in case of effectiveness of distillation methods, the highest oil yield was obtained from solvent extraction method followed by steam distillation and deg bhapka method. The oil yield ranged from 0.076% to 0.45%. Physico-chemical properties, were obtained from three commercial grades of vetiver roots quantitative comparison among the concentrations of vetivone, a key component known for its pesticidal value, was found higher in lachha by 11.73% and 30.35% as compared to nakhuni and munjhar, respectively. Bicyclovetivenol, the another important component known for its pesticidal value was found in higher concentration in lachha. The results indicated that irrespective of different grades of root materials as source of vetiver oil, the oils obtained from steam distillation method showed highest antifungal activity followed by solvent extraction method in all cases of graded root materials. It is observed that irrespective of extraction/distillation methods, the oil obtained from lachha showed highest antifungal activity against Rhizoctonia solani followed by oil obtained from nakhuni.

363. Verma, Satish K.; Indira Gandhi Krishi Vishwavidyalaya, Raipur (India). College of Agriculture. Department of Horticulture. Asati, B.S.; Indira Gandhi Krishi Vishwavidyalaya, Raipur (India). College of Agriculture. Department of Horticulture. Tamrakar, S.K.; Indira Gandhi Krishi Vishwavidyalaya, Raipur (India). College of Agriculture. Department of Horticulture. Nanda, H.C.; Indira Gandhi Krishi Vishwavidyalaya, Raipur (India). College of Agriculture. Department of Horticulture. Gupta, C.R.; Indira Gandhi Krishi Vishwavidyalaya, Raipur (India). College of Agriculture. Department of Horticulture. Effect of organic components on growth, yield and economic returns in potato. Potato Journal (India). (Jan 2011) v.38(1) p.51-55 KEYWORDS: ORGANIC COMPOUNDS. GROWTH. YIELDS. ECONOMICS. POTATOES.

An experiment was conducted on potato variety Kufri Jawahar to assess the effect of organic components on growth, yield and economic return in potato. The results revealed that combination of crop residues + azotobacter + phosphobacteria + biodynamic approach + microbial culture was the best among all the treatments for most of the growth and yield parameters under study and gave highest net return and B:C ratio. Thus, it can be concluded that the biofertlizers(azotobacter, phosphobacteria, microbial culture and biodynamic approach) are an advantageous source for sustainable organic agriculture, specially for heavy feeder crops like potato.

364. Devrajan, K.; Prabhu, S.; Seenivasan, N.; Sudha, A.; Ramakrishnan, S.; Anita, B. Occurrence of native microbial antagonists against potato cyst nematodes in the Nilgiri Hills of Tamil Nadu. Potato Journal (India). (Jan 2011) v.38(1) p.67-72 KEYWORDS: ANTIMETABOLITES. NEMATODA. POTATOES. TAMIL NADU.

Three hundred and twenty eight fungus, 178 bacteria and 15 actinomycetes were isolated from the potato rhizosphere soil samples and cysts collected from 67 villages of Nilgiris District. The fungal isolates included 36 Trichoderma, 15 Paecilomyces, 8 Vericillium, 21 Fusarium, 16 Aspergillus and 71 unidentified fungal species, bacterial isolates included 45 Bacillus and 7 Pseudomonas species and actinomycetes included 15 Streptomyces species. The fungal isolates were screened for their antagonistic potential against the potato cyst nematodes (PCN), Globodera rostochiensis and G. pallida based on positive reaction for chitinase activity, antibiotic production, inhibition of egg-hatching and egg parasitization. Positive reactions for chitinase activity, antibiotic production, egg-hatching inhibition and egg parasitization were observed in Fusarium isolate KEUF 255, Paecilomyces isolates NDPL 145, NDPL 264, MOPL 122, THPC 166 and DKPC 132 and Trichoderma isolates NDTH 343, NDTV 364, MOTV 164, EPTV 172, IRTX 176, TKTX 165, BGTV 175 and PNTV 168. They also exhibited the antagonistic potential against Phytophthora infestans in dual plate technique. The bacterial isolates were screened for their antagonistic potential against PCN based on positive reaction for chitinase activity, antibiotic production, acid production, HCN production, egg-hatching inhibition and egg parasitization. Bacillus isolates KEBX296, EPBX147, BGBX135 and KOBX134 expressed positive reactions. Investigation suggests that the virulence of naturally occurring microbial antagonists could be exploited as potential candidates for the management of potato cyst nematodes in the Nilgiri hills of Tamil Nadu.

365. Sachan, J.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Basudeo; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, S.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pant, D.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Dhirendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. PRQ 2005-1 (INGR No. 06013) as a source of low erucic acid with yellow seed in Indian mustard [Brassica juncea (L.) Czern & Coss]. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.82-84 KEYWORDS: BRASSICA JUNCEA. ERUCIC ACID. HIGH YIELDING VARIETIES. PLANT OILS.

366. Tripathi, Neeta; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Verma, R.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Influence of late planting on physiological parameters in wheat (Triticum aestivum L.) varieties. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.6-8 KEYWORDS: PLANTING DATE. PLANT PHYSIOLOGY. PHYSIOLOGICAL FUNCTIONS. WHEATS. YIELD COMPONENTS.

367. Kewat, R.N.; N.D. University of Agriculture and Technology, Kumarganj, Faizabad (India). Department of Biochemistry. Singh, R.P.; N.D. University of Agriculture and Technology, Kumarganj, Faizabad (India). Department of Biochemistry. Abidi, A.B.; N.D. University of Agriculture and Technology, Kumarganj, Faizabad (India). Department of Biochemistry. Screening of pointed gourd (Trichosanthes dioica Roxb.) varieties and strains for sweet making. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.14-16 KEYWORDS: TRICHOSANTHES. HIGH YIELDING VARIETIES. ORGANOLEPTIC ANALYSIS. CRUDE FIBRE. VEGETABLES. BIOCHEMISTRY.

The present investigation was undertaken with a view to screen the pointed gourd fruits for the preparation of sweets on the basis of physical and biochemical observations.Sixteen varieties/ strains of pointed gourd viz., FP-4 FP-118, FP-152, FP-

206, FP-207, FP-216, FP-229, FP-260, FP-270, FP-304, FP-305, FP-306, FP-307, FP-308, FP-313 and, FP-316 were used as experimental material and analyzed for physical and biochemical characters namely shape, weight, seed, thickness, fruit length, diameter, fruiting behaviour, weight of flesh, TSS, total sugar, crude fibre and organoleptic evaluation. The sweets prepared from various pointed gourd strain/varieties were judged by a panel of professors and students for organoleptic evaluation. Best performance of parwal sweets were noticed in strains FP-4, FP-152, FP-260, FP-304, FP-305 and FP-316 and rated superior in organoleptic taste and recommended for making of sweets.

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368. Mallick, S.A.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Gupta, Moni; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Mondal, S.K.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Sinha, B.K.; Sher-e-Kashmir University of Agricultural Sciences and Technology,Jammu (India). Characterization of wheat (Triticum aestivum) genotypes on the basis of metabolic changes associated with water stress. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.767–71 KEYWORDS: PROTEIN METABOLISM. AMINO ACIDS. SUPEROXIDE DISMUTASE. REDUCING SUGARS. RELATIVE HUMIDITY. MOISTURE CONTENT. PEROXIDASES. TRITICUM AESTIVUM.

Drought stress responses in cross bred wheat genotypes, viz RSP 561, RSP 566, RSP 529, RSP 564, RSP 511 and RSP 560 was studied by measuring the changes in osmolytes and cell protecting biochemicals, viz proline, reducing sugar, free amino acid, total polyphenol, antioxidant, superoxide dismutase (SOD), catalase and peroxidase (POD) along with relative water content (RWC) from the leaves samples after induction of water stress at flowering stages. National wheat cultivars, PBW 175 recognized as drought resistant and PBW 343 susceptible, were taken as references. It was recorded that all the parameters under water stress except relative water content increased significantly in all the wheat genotypes. The inter-genotypic variation of proline, reducing sugar, free amino acid, total polyphenol, antioxidant, SOD, catalase and peroxidase levels in controls ranged from 1.09– 2.70 mmole/g, 0.48–0.96%, 0.68–1.13%, 11.51–24.40 mg/ g, 5.43–36.51%, 27.35– 72.95 mM H2O2/min/100 mg, 151.85–172.10 unit/min/100 mg and 130.71–158.92 unit/ min/100 mg and the raised levels ranged from 6.07–14.96 mmole/g, 1.93– 3.92%, 2.02–4.41%, 15.33– 28.38 mg/g, 10.76–44.51%, 32.59–98.66 mM H2 O2/min/100 mg, 170.64– 210.72 unit/min/100 mg, 168.8–186.78 unit/min/100 mg respectively, whereas the RWC decreased from 58.33–80.68% to 47.06–61.71%. The wheat genotypes RSP 564 and RSP 529 carried significantly high values of proline, free amino acid, reducing sugar, total polyphenols, antioxidant content and detoxicating enzymes SOD, catalase and POD activities both in control and water stress conditions along with maximum leaf water retention and hence can be considered highly tolerant to water stress, followed by national cultivar PBW 175 with the values in the third position in order. PBW 343 though possessed high values in total polyphenol, antioxidant and detoxicating enzymes but showed very low values in osmolytes and RWC and can be assessed low tolerant to water stress. RSP 566 which showed lowest values in most of these parameters can be elucidated as drought stress susceptible genotype.

369. Mamta; Guru Jambeshwar University of Science and Technology, Hisar (India). Dept. of Food Technology.Sharma, A.; Guru Jambeshwar University of Science and Technology, Hisar (India). Dept. of Food Technology. An in vitro study on the antifungal activities of crude juices of Allium sativum and Zingiber officinale. Annals of Biology (India). (Dec 2010) v.26(2) p.177-178 KEYWORDS: GARLIC. ALLIUM SATIVUM. IN VITRO. ZINGIBER OFFICINALE. FUNGICIDES.

Crude juices of Allium satiHlm (bulbs) and Zingiber officinale (rhizomes) were screened (in vitro) independently for their antifungal activities against Alternaria solani. Broth dilution method was used for this in vitro study. Results obtained indicated that

crude juices of both the referenc~ spice samples inhibited the growth of A. solani and it was also found that crude juice of A. satiHlm bulbs was more inhibitory than Z. officinale rhizomes.

370. Panwar, Rashmi; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Singh, C.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Effect of preharvest foliar spray of micronutrients on chemical properties of mango fruit cv. Langra. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.56-61 KEYWORDS: PREHARVEST TREATMENT. FOLIAR APPLICATION. TRACE ELEMENTS. CHEMICOPHYSICAL PROPERTIES. MANGOES.

The present investigation was carried out to study the effect of preharvest foliar spray of micronutrients on chemical attributes on mango cv. Langra. It was found that combined application of boron, zinc, iron and copper increased the total soluble solids, total sugar, â-carotene and vitamin A content while decreased the total titrable acidity of fruits.

F62 Plant Physiology – Growth and Development

371. Kumar, D.; Central Potato Research Institute Campus, Meerut (India). Singh, B.P.; Central Potato Research Institute Campus, Meerut (India). Rawal, Sanjay; Central Potato Research Institute Campus, Meerut (India). Minhas, J.S.; Central Potato Research Institute, Shimla (India). Pandey, S.K.; Central Potato Research Institute, Shimla (India). Rehabilitation of frosted potato crop through plant growth regulators. Potato Journal (India). (Jan 2011) v.38(1) p.18-25 KEYWORDS: FROST. POTATOES. PLANT GROWTH SUBSTANCES.

Frost incidence in Indo-Gangetic plains is often, unpredictable and causes moderate to heavy yield losses in potato. However, there is no technology in place for rehabilitation of the frosted crop. An attempt was, therefore, made to mitigate the freezing damage in a sixty days crop having 60–70% foliar destruction and to capitalize on subsequent favourable weather. GA3 was chosen to promote the re-growth of leaf and stem and cycocel to check the excess growth of foliage for diversion of photosynthates into the tubers. After one week, foliar spray of gibberellic acid (50, 100, 150 and 200 ppm, GA3) alone or in combination with 125 ppm cycocel (3 weeks after frost) were evaluated in RBD with four replications. Observations on morpho-physiological parameters indicated that 100 ppm dose of GA3 increased leaf area to a maximum (2368 cm2) in comparison to other treatments including control (1455 cm2) and maintained the density of photosynthetic pigments (chlorophyll a/b ratio:1.67) at par with control. Similarly, the dry weights were significantly higher in stem (6.8 g plant^{-1}), leaf (11.1 g) and entire plant (38.6 g) with 100 ppm dose of GA3 as against unsprayed control (23.4 g plant^{-1}). Tuber length was also increased progressively with the increase in GA3 concentrations but was reduced when GA3 was combined with cycocel. Regarding yields, the spray of 100 ppm GA3 and 125 ppm cycocel produced maximum tuber yields (9.16 kg plot^{-1}, plot:3.0 m2), followed by GA3 alone (8.04 kg plot^{-1}), which were significantly higher than unsprayed control (6.89 kg plot^{-1}). The finding needs to be exploited in framing strategies for rehabilitating the frost annihilated potato crop so as to restore productivity and farm profits.

372. Pandey, Sunita T.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Bisht, L.D.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Gaur, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biochemistry. Rajesh Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Horticulture. Singh, Sarnam; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Chilana, Kishor; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Impact of various nutritional packages on seed and oil yield of

European dill (Anethum graveolens) in subtropical belt of Uttarakhand. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.41-43 KEYWORDS: SEED PRODUCTION. ANETHUM GRAVEOLENS. DILL. DRUG PLANTS. SUBTROPICAL ZONES. COMPOSTING. ORGANIC AGRICULTURE. FARMYARD MANURE. PLANT OILS.

Investigation was carried out to standardize the nutritional package for getting maximum seed/oil yield of European dill in split plot design with three planting distances (30, 45 and 60 cm) as main plot treatments and eight treatments of different organic and inorganic sources of nutrients and their combinations as sub plot treatments with four replications. Plant height, number of branches/plant, number of umbels/plant, seed and oil yield were not influenced significantly by planting distance alone, however, fresh and dry weight of plants increased significantly with increase in planting distance. Applied nutrients significantly influenced the seed and oil yield. Maximum seed/oil yield was found in N75P40K30 treatment at 45 cm row spacing while minimum was recorded under control treatment.

H10 Pests of Plants

373. Jaiswal, R.K.; Indian Agricultural Research Institute, New Delhi (India). Division of Nematology. Singh, K.P.; Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences. Srivastava, A.N.; Indian Agricultural Research Institute, New Delhi (India). Division of Nematology. Pathogenic effect of Meloidogyne graminicola on growth of rice seedlings and susceptibility of cultivars. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.174-7 KEYWORDS: MELOIDOGYNE GRAMINICOLA. PATHOGENICITY. TESTING.

Pathogenicity test conducted on rice cv. Malvia 36 showed conclusive evidence of the damaging potential of M. graminicola on rice seedlings in terms of plant growth characters. Eventhough maximum reduction in all the plant growth parameters was recorded at 5000 J2, the significant reduction in shoot & root length and fresh shoot & root weight was observed at 1000 J2 / kg of soil and was considered as damaging threshold level of M. graminicola. The nematode significantly reduced the growth of rice seedlings: shoot length by 31.2, 44.0 and 63.5%; root length by 39.2, 40.8 and 43.4%; fresh weight of shoot by 42.0, 53.6 and 69.5%; fresh weight of root by 40.2, 42.7 and 49.1%, respectively at 1000, 2000 and 5000 J2 / kg of soil. The root galls also increased significantly with the increasing levels of nematode inocula with maximum at 2J2/g being at 2000 J2 / kg of soil. Wilting of rice seedlings was also observed at 5000 J2 / kg of soil. Twenty one varieties/ genotypes of rice were screened against M. graminicola and almost all the genotypes showed susceptibility. However, number of root galls varied with genotypes. Maximum numbers of root galls (41.8) were recorded in rice cv. Ratna whereas minimum root galls (2.0) were registered in rice cv. BL-111-3. In general, all the varieties showed yellowing and stunting; however, some varieties viz., BL- 149, PBS- 23, HUR- 3021, and LM- 1 recorded wilting of seedlings.

374. Das, Deban; Assam Agricultural University, Jorhat (India). Bajaj, Harish K.; Chaudhary Charan Singh Agricultural University, Hisar (India). Embryonic development of Ditylenchus myceliophagus Goodey, 1958. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.183-187. KEYWORDS: DITYLENCHUS. MBRYONIC DEVELOPMENT. HATCHING.

Embryonic development of Ditylenchus myceliophagus was completed in 75 hrs and 279 hrs at 25o C and 13o C, respectively under laboratory condition. A considerable variation in timing of cleavages was recorded at two temperatures, while eggs of D. myceliophagus failed to develop at 5o and 35^{o}C. Hatching was assisted by the movement of juvenile inside the egg shell, stylet thrusting as well as the pressure exerted by the lip region on egg shell. Sexes can be differentiated after second moult with the position of germinal nucleus in the genital primordium. Eggs, continuously exposed to light during embryogenesis failed to hatch.

375. Hasan, Wajid; A.M.U., Aligarh (India). Faculty of Agril. Sciences. Department of Plant Protection. entowajidmail.com. Singh, C.P.; G.B. Pant University of Agriculture & Technology, Pantnagar (India), Department of Entomology. Field assessment of Mustard aphid, Lipaphis erysimi (Kalt.) on cultivars of Indian mustard (Brassica juncea L.). Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.51-54 KEYWORDS: BRASSICA JUNCEA. LIPAPHIS ERYSIMI. POPULATION DYNAMICS. VARIETIES.

The incidence of Lipaphis erysimi appeared on mustard commenced from 2nd S.W. and gradually reached its peak 207.22, 262.89 aphid /10 cm central twig in 5th standard week, thereafter population started to decline significantly and reached its lowest 2.56, 0.44 in 6th S.W. during 2007–2008 and 2008–2009 crop seasons, respectively. The highest population of L. erysimi was observed in 4th and 5th S.W. from PRKS-14 (126.11 aphid) and PR-2006-14 (207.22 aphid), respectively during 2007–2008 with lowest zero from PBC-2005-3. Whereas during 2008–2009 crop season, it was highest as on Ashirvad (174.00 aphid), Ashirvad (360.56 aphid) and lowest as on PRKS-28 (1.11 aphid), PRKS-28 (4.11aphid) in 4th and 5th S.W., respectively. After 5th S.W. the population of L. erysimi gradually declined due to increase in temperature.

376. Chandel, B.S.; D.B.S. College, Kanpur (India). P.G. Department of Zoology (Entomology). rbschandelsmailboxediffmail. com. Vajpai, Shail; D.B.S. College, Kanpur (India). P.G. Department of Zoology (Entomology). Rajani; D.B.S. College, Kanpur (India). P.G. Department of Zoology (Entomology). Chauhan, A.K.S.; Narain College, Sikohabad (India). P.G. Department of Zoology. Insecticidal efficacy of indigenous Zingiberaceous phytochemicals against Mustard sawfly, Athalia proxima Klug.. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.55-58 KEYWORDS: BRASSICA CAMPESTRIS. ATHALIA. BOTANICAL INSECTICIDES. BOTANICAL PESTICIDES. ALPINIA GALANGA. CURCUMA LONGA.

Results revealed that the plant extract of Alpinia galanga caused maximum mortality (80.8%) larval mortality of Athalia proxima followed by 67.9% in C. longa, 66.3% in A. melegueta and 62.1% in Z. officinale and compared to 6.6% in control. The plant extract of Alpinia galangal differed significantly from remaining plant extracts except C. longa. The concentration of 2.0% was superior to 1.0 and 0.5%. It was also observed that the difference in the percentage kill of larvae between concentrations 1.0% and 2.0% was greater than the difference in mortality between 0.5% and 1.0% in all the three periods. It was also seen that 2.0% induced 83.5% larval mortality with in 6 hrs of exposure but in another 18 hrs larval mortality increased only by 7.58%.

377. Maurice, Navodita; Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad (India). Department of Biological Sciences. Department of Plant Protection. robin.navoditamail.com. Kumar, Ashwani; Sam Higginbottom Institute of Agriculture, Technology and Sciences. Allahabad (India). Department of Biological Sciences. Department of Plant Protection. Effect of quantity and consumption of food on body weight and development of two species of Ladybird beetles. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.59-62 KEYWORDS: COCCINELLA. COCCINELLA SEPTEMPUNCTATA. FOODS. COLEOPTERA.

The food quantity provided and the food consumed affected the overall weight gained by the insect body. The efficiency to consume food increased from the early instar to the final instar and decreased few days before the last instar entered pupation. The food conversion efficiency was least in the first instar but highest in the fourth instar. The developmental duration shortens when the prey was present in abundance and the larva proceeded towards pupation early. Two species of ladybirds viz., Coccinella septempunctata and C. transversalis occured in the agricultural fields and share almost same prey habitat. The fourth instar of both the species was found to be highly voracious before pupation. The instars of C. sepetempunctata were found to be heavier in body weight and consumed more food as compared to the instars of C. transversalis.

378. Chakraborty, Kaushik; Alipurduar College, Alipurduar, Jalpaiguri (India). Department of Zoology. Extent of suppression of yellow stem borer, Scirpophaga

incertulas, Walker population by insecticides in field of scented local Paddy. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.63-66 KEYWORDS: ORYZA SATIVA. SCIRPOPHAGA INCERTULAS. CROP YIELD. LOSSES. INSECTICIDES.

All the treatments were significantly effective in checking stem borer infestation causing to decrease in both dead heart (DH%) and white head (WH%) number. Numerically least damage was noted for imidacloprid 17.8 SL (100 ml/ha), followed by carbofuran 3G (30 kg/ha), fipronil 0.3G (750 ml/ ha), monocrotophos 36 WSC (1125 ml/ha), propenphos 50 EC (500 ml/ha), bifenthrin 10 EC (500 ml/ ha) and chlopyriphos 20EC (1875 ml/ha) in ascending order. The control plot has registered 6.1% DH and 4.3% WH, respectively. In consideration of yield increase over control, maximum yield was registered for imidacloprid 17.8 SL, respectively followed by, carbofuran 3G, fipronil 0.3G and monocrotophos 36 WSC in descending order.

379. Sheeba, S.; T.N.A.U., Coimbatore (India). Department of Entomology. sjrento79ahoo. co.in. Roseleen, J.; T.N.A.U., Coimbatore (India). Department of Entomology. Ramaraju, K.; T.N.A.U., Coimbatore (India). Department of Entomology. Effect of Okra entries on biology of two spotted spider mite Tetranychus urticae (Koch.). Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.67-70 KEYWORDS: ABELMOSCHUS ESCULENTUS. BIOLOGY. TETRANYCHUS URTICAE.

Morphological trait namely trichomes (length & numbers) exhibited negative effect on the mite population and development. Laboratory experiments on antibiosis of various resistant categories of okra revealed that fecundity of Tetranychus urticae females was significantly less on the resistant wild type Kasturi bhendi (41.5 eggs/female) compared to the susceptible check Mahyco 10 (77.1 eggs/female). The developmental period of larva, protonymph and deutonymph was shorter on the susceptible Mahyco 10 (10 days), while it was the longest (19.8 days) on the resistant entry, Kasturi bhendi among the accessions tested. Adult longevity and sex ratio analysed on the selected test entries depicted that irrespective of the levels of resistance, the females lived longer than the males. The higher fecundity (77.1eggs/female), lesser incubation period (3.4 days), higher egg hatchability (86.5%) and lower mortality of developmental stages in susceptible entry and the reduced rate of reproduction on resistant entries explained the cumulative effect of antibiosis.

380. Halder, Jaydeep; Sri Venkateswara Agril. College, Tirupati (India). Department of Entomology. jaydeep_iariediffmail.com. Srinivasan, S.; Sri Venkateswara Agril. College, Tirupati (India). Department of Entomology. Varietal screening and role of morphological factors on distribution and abundance of spotted pod borer, Maruca vitrata (Geyer) on Cowpea. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.71-74 KEYWORDS: MARUCA VITRATA. FRUIT. DAMAGE. TRICHOMES. BIOPHYSICS. VARIETY TRIALS. BODY CONFORMATION. COWPEAS. VIGNA UNGUICULATA.

Eight plant parameters, viz., pod wall thickness, number of pods / cluster, angle between the pods, trichomes on leaves and stems, trichome length, pod length and pod width were studied in relation to the expression of varietal reaction towards, Maruca vitrata in eleven varieties of cowpea. It was observed that highly susceptible cv. GC-9708 had least number of trichomes on stems (5.1) and leaves (4.8) as compared to highly tolerant cv. HC-270 which had 7.5 and 9.4 trichomes/mm2, respectively. Pod wall thickness, angle between the pods and pod width showed a negative correlation with pod damage. Highly susceptible cv. GC-9708 possessed lowest pod wall thickness (0.77 mm), least pod width (6.35 mm) and minimum pod angle (40^{o}) as compared to most tolerant cv. HC-270 (0,89 mm, 7.80 mm & 85^{o}, respectively). Similarly, highest pod length (15.55 cm) and maximum number of pods / cluster (2.8) were recorded from GC-9708 as compared to others. Free choice arena test also confirmed that highest larval orientation was observed in GC-9708 (susceptible) both in pods (18%) and flowers (13%) than the tolerant cv. (HC-270).

381. Singh, Ram S.; B.N.P.G. College, Rath, Hamirpur (India). Department of Entomology. Nath, Paras; B.H.U., Varanasi (India). Institute of Agricultural Science.

Department of Ent. and Agril. Zoology. Effect of biorational approaches on Pigeon pea pod and grain damage by pod bug (Clavigralla gibbosa Spinola). Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.75-79 KEYWORDS: CAJANUS CAJAN. FRUIT. HETEROPTERA. INSECTA. DAMAGE.

The intercropping had significant difference in reduction of pod damage, grain damage (in number & by weight basis) as compare to pigeon pea monocrop. The two sprays of biopesticides were found most effective in reducing crop losses incurred by pod bug. The intercrops pigeon pea+rice, pigeonpea+sorghum and two sprays of NSKE 5% were found most effective combination for the management of pod, grain and grain weight loss by Clavigralla. gibbosa. The plots devoid of biopesticidal treatment had 15.8 to 16.8%, 6.3 to 7.3% and 3.4 to 4.8% pod damage, grain damage and grain weight loss, respectively.

382. Ahmad, Hafeez; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Faculty of Agriculture. Division of Entomology. Kumar, Mahesh; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Faculty of Agriculture. Division of Entomology. Sharma, Devinder; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Faculty of Agriculture. Division of Entomology. Jamwal, V.V.S.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Faculty of Agriculture. Division of Entomology. Khan, Rabia B.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Faculty of Agriculture. Division of Entomology. Gupta, Saurav; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Faculty of Agriculture. Division of Entomology. Bionomics of Diamondback moth, Plutella xylostella (L.) on cabbage. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.80-83 KEYWORDS: BRASSICA OLERACEA. PLUTELLA XYLOSTELLA. BIOLOGY. ECOLOGY.

The biological studies on Plutella xylostell revealed that after mating period of 69.9±2.58 min. and laid eggs 3.1±0.16 days after mating. Single female laid on an average of 45.11±2.31 eggs during an oviposition period of 4.8±0.24 days. The post oviposition period was recorded 5.5±0.34 days. The pre-pupal and pupal period lasted for 1.20±0.13 and 4.6±0.37 days, respectively. The larvae passed through four instars and total larval developmental period from egg to adult emergence varied from 21.5±1.10 days. Longevity of adult male was 7.0±0.25, while for female it was 11.8±0.44 days.

383. Vishwakarma, Ramanuj; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (India). Department of Agril. Entomology. Chand, Pool; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (India). Department of Agril. Entomology. Ghatak, Sibani S.; Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (India). Department of Agril. Entomology. Potential plant extracts and entomopathogenic Fungi against Red pumpkin beetle, Raphidopalpa foveicollis (Lucas). Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.84-87 KEYWORDS: PUMPKINS. LAGENARIA SICERARIA. COLEOPTERA. ENTOMOGENOUS FUNGI. PLANT PRODUCTS.

Field trials were conducted to assess the bio-efficacy of two indigenous plant products, viz. seed extracts of Strychnos nuxvomica and Pachyrrhizus erosus, using petroleum either as solvent and two entomopathogenic fungi, viz. Beauveria bassiana and Metarhizium anisopliae, in controlling red pumpkin beetle, Raphidopalpa foveicollis on cv. Narendra Rashmi bottle gourd. Both the botanicals were used 2.0, 3.0 and 4.0 ml/lit. of water while the entomopathogenic fungi, were used 2.0 g, 2.5 g and 3.0 g/lit. of water, keeping an untreated control. Significantly maximum reduction in damage (70.2%) was achieved in treatment with B. bassiana, when used 3.0 g/lit of water along with crop yield of 315.36 q/ha, as compared to untreated control, followed by S. nuxvomica (65.4% at 4.0 ml/lit), M. anisopliae (64.7% at 3.0 g/lit.) and P. erosus (60.9% at 4.0 ml/ lit.), vis-a-vis crop yield of 298.18, 286.48, and 278.81 q/ha, respectively. B. bassiana 3.0 g/lit. of water recorded the highest economic return with a B:C ratio of 21.54:1 as compared to untreated control.

384. Saranya, S.; Kerala Agricultural University, Vellanikkara, Thrissur (India). Department of Agrl. Entomology. saransellamuthumail.com. Ushakumari, R.; Kerala Agricultural University, Vellanikkara, Thrissur (India). Department of Agrl. Entomology. Evaluation of pure cultures and formulations of Entomopathogenic fungi against Cowpea aphid, Aphis craccivora (Koch). Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.88-92 KEYWORDS: COWPEAS. CICER ARIETINUM. ENTOMOGENOUS FUNGI. APHIS CRACCIVORA.

Studies were conducted to evaluate the efficiency of pure cultures and commercial formulations of Beauveria bassiana, Metarhizium anisopliae, Pochonia (Verticillium) lecanii, Hirsutella thompsonii and Cladosporium oxysporum against cowpea aphid. Spray application of pure culture of B. bassiana and P. lecanii 108 spores ml 1 and Fusarium pallidoroseum 7x106 spores ml 1 gave cent per cent mortality at 14 days after treatment and were found to be highly efficient in controlling the aphid population. Among the four commercial formulations tested, biocatch (P. lecanii) and Biopower (B. bassiana) 0.2% recorded more than 90% mortality and was found to be on par with malathion 0.05%. The highest yield was obtained in plants treated with F. pallidoroseum 7x106 spores ml 1 (47.8%) which recorded the maximum number and weight of pods followed by P. lecanii and B. bassiana 108 spores ml 1 gave 47.1 and 45.1% respectively.

385. Singh, Amar; N.D. University of Agriculture and Technology, Faizabad (India). Department of Entomology. singhamarentmail.com. Lal, M.N.; N.D. University of Agriculture and Technology, Faizabad (India). Department of Entomology. mnlalediffmail.com. Eco-friendly approaches for management of Mustard Aphid, Lipaphis erysimi (Kalt.). Annals of Plant Protection Sciences (India). (Mar 2011) v. 19(1) p. 93-96 KEYWORDS: BRASSICA JUNCEA. LIPAPHIS ERYSIMI. PEST CONTROL. BIOLOGICAL CONTROL.

Different methods such as mechanical, biological and botanical were adopted singly as well as in combination to manage mustard aphid. The mustard aphid was regularly monitored during crop season to give treatments for management of mustard aphid on need basis. The application of treatments was done on the basis of ETL i.e. 25 aphids 10 cm 1 central twig plant 1. All the treatments were effective in controlling mustard aphid. The chemical control with oxydemeton methyl 25 EC 0.05% was found as the most effective resulting in significantly higher yield as compare to other treatments. The treatments comprising mechanical+botanical+biological control were found to be the best alternative to chemical control for management of mustard aphid.

386. Fakhri, M. Sadre Alam; Aligarh Muslim University, Aligarh (India). Department of Zoology. fakhrimsaahoo.co.in. Ansari, M. Shafiq; Aligarh Muslim University, Aligarh (India). Department of Zoology. Jamal Khowaja; Aligarh Muslim University, Aligarh (India). Department of Plant Protection. Ali, Haidar; Aligarh Muslim University, Aligarh (India). Department of Plant Protection. Comparative efficacy of neemjeevan and monocrotophos against life stages of Dysdercus koenigii Fabr. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.97-100 KEYWORDS: DYSDERCUS KOENIGII. DEVELOPMENTAL STAGES. NEEM EXTRACTS. MONOCROTOPHOS.

Efforts were taken to compare the toxicity of neemjeevan and monocrotophos on the biology of Dysdercus koenigii. Three different concentrations i.e. 0.01, 0.02 and 0.04% of neemjeevan (0.30EC) and 0.001, 0.002 and 0.004% of monocrotophos (Hilcron, 36 SL), were topically applied on the thorasic terga of 4th nymphal instar by the help of micro-applicator and the observations were made up to longevity of mated and unmated adults. Mortality was dose dependent in both cases; however monocrotophos showed higher mortality than neemjeevan. Higher concentration of monocrotophos showed highest mortality i.e. 48.33 where in case of neemjeevan it was 41.66.

387. Meena, Radhe Shyam; M.P.U.A.T., Udaipur (India). Rajasthan College of Agriculture. Department of Agril. Zoology and Entomology. radheentomail.com. Gupta, H.C.L.; M.P.U.A.T., Udaipur (India). Rajasthan College of Agriculture. Department of Agril. Zoology and Entomology. Sharma, R.P.; M.P.U.A.T., Udaipur (India). Rajasthan College of Agriculture. Department of Agril. Zoology and Entomology. Evaluation of insecticides against Coriander aphid and estimation of residues. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.101-105 KEYWORDS: CORIANDRUM SATIVUM. HYADAPHIS. INSECTICIDES. RESIDUES.

LC50 values of imidacloprid, profenofos, ethion, thiomethoxam, dimethoate, malathion and endosulfan were found to be 0.01646, 1.17892, 1.16890, 1.01642, 1.26798, 1.13530 and 1.04456%, respectively. Results revealed the highest toxicity of imidacloprid while dimethoate showed the low toxicity. Microbioassay residue film method using one day old male, Drosophila melonogaster was used for detection of micro quantities of residue of imidacloprid in coriander leaves and seeds. It was possible to detect as low as 0.005 µg of imidacloprid present in the sample by this technique. More than 85% recovery of these insecticides was obtained from fortified samples of leaves and seeds of coriander. Spray application of imidacloprid 160 ml a.i./ha resulted in the deposits 4.2778 ppm on leaves and 2.8655 ppm on seed, which dissipated almost 100% in 15 days from leaves and 13 days from seeds. The half life values could be estimated as 2.37 days on leaves and 2.19 days on seed. The waiting period after last spray was worked out to be 4.97 days for leaves and 3.32 for seeds.

388. Sharma, R.N.; R.A.U., Sriganganagar (India). Agricultural Research Station. Department of Plant Pathology. sharmarn123mail.com. Maharshi, R.P.; R.A.U., Jobner (India). S.K.N. College of Agriculture. Gaur, R.B.; R.A.U., Sriganganagar (India). Agricultural Research Station. Department of Plant Pathology. Ram, Jeewa; R.A.U., Sriganganagar (India). Krishi Vigyan Kendra. Management of post-harvest diseases of Kinnow fruits through plant growth regulator and food preservative. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.122-125 KEYWORDS: CITRUS FRUITS. FOODS. PRESERVATION. PRESERVATIVES. PLANT GROWTH SUBSTANCES. POSTHARVEST DECAY.

Studies were conducted to evaluate the efficacy of plant growth regulator {naphthalene acetic acid (NAA)} and food preservative {potassium metabisulfite (KMS)} against post-harvest diseases. Dipping treatment of KMS solution (600 ppm) proved significantly superior to NAA (100 ppm) in respect of retarding the incidence of post-harvest diseases except sour rot. The reduction of 43.5, 53.6 and 40.7% incidence was recorded in core rot, stem-end rot and sour rot disease, respectively in pre-inoculation treatment of KMS (600 ppm) while 28.4, 44.2 and 31.5% reduction in incidence of these diseases was noted in post-inoculation treatment of the same chemical in comparison to control. The disease incidence was found to increase with increasing period of incubation. At 6th and 8th day of inoculation, the incidence was significantly higher to the incidence occurred at 3rd and 4th day of inoculation, respectively in both pre- as well as post-inoculation treatments.

389. Fazal, Munawar; Sachchidanand Sinha College, Aurangabad (India). Department of Botany. Bhat, Mohd Yaqub; University of Kashmir, Srinagar (India). Department of Botany. Ashaq, Mohd; Government Degree College, Akhnoor (India). Department of Botany. Combined application of Paecilomyces lilacinus and Carbosulfan for management of Meloidogyne incognita and Rotylenchulus reniformis. Annals of Plant Protection Sciences (India).. (Mar 2011) v.19(1) p.168-73 KEYWORDS: MELOIDOGYNE INCOGNITA. ROTYLENCHULUS RENIFORMIS. PAECILOMYCES.

The results revealed that the fungus or chemical at optimum dose alone reduced the nematode population of both the species, singly or concomitantly and increased the plant growth. However, integration of these components in various treatments was better in reducing the population of both the nematode species and increased plant growth than when used alone. The best combination of these components with regard to reduction in gall number and population of either of the nematode species and increase

in plant growth of infected plants (singly or concomitantly) was 2.0 g P. lilacinus combined with 1.0g a.i carbosulfan.

390. Seenivasan, N.; Tamil Nadu Agricultural University, Coimbatore (India). Murugan, V. Thirumal; Adiparasakthi Agricultural College, Kalavai (India). Optimization of delivery methods for Pseudomonas fluorescens in management of Rice root nematode, Hirschmanniella gracilis. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.188-92 KEYWORDS: PSEUDOMONAS FLUORESCENS. HIRSCHMANNIELLA. RICE. ROOTS.

In a field trial with rice, the plant growth promoting rhizobacterium, Pseudomonas fluorescens, was evaluated as seed treatment, seedling root dip and soil application individually and in different combinations for management of Hirschmanniella gracilis. All bacterial application methods reduced populations of H. gracilis in soil and roots. A combination of seed treatment, seedling root dip, and soil application of the bacterium was the most effective treatment and gave similar control as carbofuran 3G. There was significant increase in phenol, peroxidase and chitinase accumulation in plants treated with P. fluorescens. The bacterium also increased the plant growth parameters and grain yield. The highest grain yield resulted from the seed + seedling dipping + soil application and seed + seedling dip treatments.

391. Maurya, Ravi Prakash; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Khan, M.A.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Development of cartap hydrochloride tolerant strain of egg parasitoid, Trichogramma chilonis Ishii through artificial selection. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.44-52 KEYWORDS: TRICHOGRAMMA CHILONIS. BIOLOGICAL CONTROL. CARTAP. INSECTICIDES. PARASITOIDS. SELECTION. PEST INSECTS. NATURAL ENEMIES.

Development of cartap hydrochloride tolerant strain of Trichogramma chilonis was conducted in Biocontrol Laboratory, G. B. Pant University of Agriculture and Technology, Pantnagar. For the cartap hydrochloride tolerance, superior native strain of T. chilonis was subjected to selection pressure. Laboratory selection was started from the 1/10th of field recommended dose and ended with 1/4th of field dose of cartap hydrochloride. T. chilonis took eight generations to develop tolerance against 1/10th of field dose, thirteen generations against 1/8th, twenty-one generations against 1/6th of field dose and twenty-four generations against 1/4th of field recommended dose. Parasitoid population took 66 generations to develop tolerance against 1/4th of field recommended dose of cartap hydrochloride with 80.34 per cent parasitisation and 79.66 per cent emergence from the eggs of Corcyra cephalonica. At each 5th generation strain was tested for consistency and at F65 per cent parasitization and per cent emergence by tolerant strain were increased up to 82.34 per cent and 81.34 per cent, respectively, whereas 16.33 per cent and 19.67 per cent parasitization and adult emergence were given by susceptible strain at 1/4th of the field dose of cartap hydrochloride. Only 65.67 per cent parasitization and 52.00 per cent emergence were recorded by tolerant strain as compare with 15.33 per cent parasitization and 19.00 per cent emergence by susceptible strain at 5th generation at 1/10th of field recommended dose of cartap hydrochloride.

392. Tiwari, Ruchira; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Sehgal, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Field efficacy of some insecticides and Bt against Helicoverpa armigera on chickpea. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.53-58 KEYWORDS: FIELD EXPERIMENTATION. INSECTICIDES. BOTANICAL INSECTICIDES. BIOLOGICAL CONTROL. BACILLUS THURINGIENSIS. CHICKPEAS. CICER ARIETINUM. PEST INSECTS.

The field efficacy of insecticides (endosulfan, monocrotophos, cypermethrin, deltamethrin and fenvalerate) individually and in combination with Bacillus thuringiensis var kurstaki (Bt) Berliner was evaluated on Helicoverpa armigera (Hubner) in chickpea under field conditions during 1998-99 and 1999-2000 rabi crop seasons. The chickpea

crop was sprayed twice in both the years with the respective insecticides when pest population exceeded the economic threshold level. Among the tested chemicals, cypermethrin + Bt var kurstaki, cypermethrin, deltamethrin + Bt var kurstaki and Bt var kurstaki were found significantly superior over rest of the treatments and two years data clearly showed that insecticides in combination with Bt var kurstaki were found highly effective in increase in grain yield and in reducing larval population and pod borer damage.

393. Arora, Manisha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Chemistry. Mall, Pramod; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Kanaujia, Sudha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Chemistry. Fumigant action of different volatile chemicals used as grain protectants against pulse beetle (Callosobruchus chinensis L.) in increasing storability of pigeon pea. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.59-61 KEYWORDS: PIGEON PEAS. CAJANUS CAJAN. STORED PRODUCTS PEST CONTROL. PEST INSECTS. FUMIGATION. VOLATILE COMPOUNDS. GRAIN LEGUMES. CALLOSOBRUCHUS CHINENSIS.

Studies were carried out to evaluate the efficacy of six volatile fumigants viz., Benzene, chloroform, ethanol, methanol, acetic acid, acetone 10, 5, 1 and 0.1 ml of each chemical per 100 gram grain. Cotton was soaked with chemicals separately and used as protectants in pigeon pea against pulse beetle (Callosobruchus chinensis L.). Mortality in the adult insects was recorded after 24 hrs. Out of all the chemicals, acetic acid was found to be most effective in all the concentrations followed by benzene, chloroform and acetone. Acetic acid being a part of vinegar and ethyl alcohol used in medicines are not highly toxic, hence could be effectively used to control the insect pests of storage grain.

394. Purwar, J.P.; G.B. Pant University of Agriculture and Technology, Majhera (India). Agriculture Research Station. Agrawal, Anjuli; G.B. Pant University of Agriculture and Technology, Majhera (India). Agriculture Research Station. Vishwanath; G.B. Pant University of Agriculture and Technology, Majhera (India). Agriculture Research Station. Evaluation of host preference of Spodoptera litura (Fabricius) among pulses grown in Uttarakhand hills . Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.100-102 KEYWORDS: HOST PLANTS. GRAIN LEGUMES. SPODOPTERA LITURA. PEST INSECTS. HIGHLANDS.

Of the six pulses like soybean, pigeonpea, blackgram, horsegram, rajmah, cowpea, rice bean grown in Uttarakhand hills, blackgram (Vigna mungo) was found to be the best preferred host of tobacco caterpillar, Spodoptera litura (Fab.), followed by cowpea (Vigna sinensis) on the basis of preference index and consumed leaf area. Horsegram (Macrotyloma uniflorum) was more preferred by S. litura than soybean (Glycine max), rajmah (Phaseolus vulgaris) and rice bean (Vigna umbelata). Least food consumption was recorded in soybean and pigeon pea when castor and soybean were standard hosts plants, respectively.

395. Hitendra Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Singh, Gajendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Biology of litchi bug, Tessaratoma javanica Thunberg (Hemiptera: Pentatomidae) on litchi. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.17-20 KEYWORDS: PEST INSECTS. BIOLOGY. LITCHI. TESSARATOMA. PENTATOMIDAE.

A detailed study on biology of the litchi bug, Tessaratoma javanica Thunberg was undertaken. Insect laid globular and off pink eggs, mostly in bunch of fourteen on lower surface of leaves. The insect passed through five instars, which were sub rectangular and dark brick red except first instar, which was nearly subrectangular. Newly emerged adult was dirty white and soft bodied insect but colour changed to yellow red after few days. The average duration of male and female adults was 43.2±7.7 and 47.2±9.5 days, respectively. Both adults and nymph fed mostly on tender plant parts such as growing

buds, leaf petioles, fruit stalks and tender branches of litchi tree. Excessive feeding caused drying of growing buds, tender shoots and ultimately fruit drop.

396. Ahmad, Tariq; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Mumtaz, Rashid; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Suneel Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Maurya, R.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Khan, M.A.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Ecological studies on Choreodocus illustris Walker (Orthoptera: Acrididae) with special reference to suspected gregariousness in hoppers. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.21-23 KEYWORDS: ECOLOGY. ACRIDIDAE. PEST INSECTS. SUGARCANE. LIFE CYCLE.

397. Thakur, Seema Singh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Karnatak, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Karnataka, D.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Effect of a carbamate insecticide, Carbosulfan on the foraging behaviour of Apis mellifera L. foragers. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.24-26 KEYWORDS: CARBAMATES. INSECTICIDES. CARBOSULFAN. FORAGING. APIS MELLIFERA. HONEY BEES.

Investigations were done to observe the effect of a carbamate insecticide, carbosulfan on the foraging activity of Apis mellifera L. The experiment consisted of two sets. In the first set the bees were allowed to come in direct contact of insecticide treated surface while in the second set a wire net was kept over the treated surface so that only odour repelled the bees. Carbosulfan was found to repel the bees only through it s contact action while its odour was found ineffective to repel the bees at all concentrations. When comparison was made between contact and odour action with control, for all the 3 concentrations, in combination then also the results were found to be significant. There was found significant difference in the number of bees visiting the petriplates (contact, odour and control) during different time intervals. When interaction was observed between concentrations and the effects (control, odour and contact), it was significant.

398. Karnatak, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Karnataka, D.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Thakur, Seema Singh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Shukla, Awdhesh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Impact of commonly used pesticides on the population of beneficial soil inhabitants (enchytraeids) and yield in the rice ecosystem. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.27-29 KEYWORDS: PESTICIDES. PEST INSECTS. ENCHYTRAEIDAE. ECOSYSTEMS. RICE.

A study was conducted during Kharif season to observe the effect of some common pesticides and their combinations in rice ecosystem on the enchytraeid population and consequently on yield of rice crop. Samples from soil were collected before and after 24 hours of the pesticide application during transplanting, 30 days after transplanting (DAT), panicle initiation stage and harvesting stage of the crop. The maximum population of enchytraeid (2666.67 per m2) was observed at the time of transplanting in control plots. The minimum population (133.33 per m2) was recorded in the plots where phorate, butachlor and quinalphos were applied in combination after 24 hours of pesticide application at 30 DAT. Maximum number of tillers (15.66), maximum ear length (24.66 cm), maximum 1000 grain weight (31.20g) and Maximum yield (4926.33 kg/ha) were obtained in the plots where combination of phorate, butachlor and quinalphos were applied. Minimum number of tillers (13.66), minimum ear length (22.03

cm), minimum 1000 grain weight (28.09g) and minimum yield (4390.33 kg/ha) were recorded from control plots. Among all pesticides, caldan (cartap hydrochloride) was found to be economically sound and safest ecologically. Application of caldan in rice crop do not disturb the ecosystem as enchytraeid population was found adequately high in caldan treated plots than with other pesticides treated plots and moreover, yield was also high (4852.00 kg/ha). Application of pesticides imposed serious hazards on enchytraeid population. Combine application of more than one pesticide in the field was found to be lethal in comparison to the application of single pesticide. The pesticides used in combinations significantly increase the yield of rice crop.

399. Thakur, Seema Singh; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Kanaujia, Sudha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Karnatak, D.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Influence of day hours, temperature and relative humidity on bee visitation in calendula, Calendula officinalis L. and justicia, Justicia gendarussa L.. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.30-32 KEYWORDS: PHOTOPERIODICITY. TEMPERATURE. RELATIVE HUMIDITY. APIDAE. CALENDULA. JUSTICIA. HONEY BEES.

Studies were undertaken to observe the influence of day hours, temperature and relative humidity on bee visitation in calendula, Calendula offlcinalis L. and justicia, Justicia gendarussa L. The number of Apis species was counted for 3 minutes on randomly selected flowers/panicles from 09:00 to 17:00h at hourly interval. Temperature and relative humidity were simultaneously noted down on 2002 Apis dorsata and Apis mellifera were found to be visiting calendula flowers plant. During the period of observation the air temperature varied from 19°C to 28°C and relative humidity 65 to 85 per cent. In justicia the major Apis foragers included Apis dorsata, Apis mellifera and Apis cerana indica. During the period of observation, the air temperature varied from 28°C to 36°C and relative humidity from 57 per cent to 72 per cent. A. florea did not visit the flowers throughout the day.

400. Gupta, Ajay Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Singh, C.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Singh, U.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Evaluation of pathogenicity of different isolates of Beauveria bassiana (Balsamo) Vuillemin on different larval stages of Bihar hairy caterpillar, Spilarctia obliqua (Walker). Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.22-28 KEYWORDS: PATHOGENICITY. ISOLATION. BEAUVERIA BASSIANA. LARVAE. SPILOSOMA OBLIQUA. ENTOMOGENOUS FUNGI.

Evaluation of the pathogenicity of eight isolates of entomopathogenic fungi, Beauveria bassiana (Balsamo) Vuillemin to Spilarctia obliqua (Walker) were determined by topical application of 2-3,5-6 and 10-11 days old larvae in the laboratory with six conidial concentrations ranging from 103 to 108 conidia ml^{-1}. The median lethal concentrations LC50 recorded with Pantnagar isolate, MTCC-4121, Multiplex isolate, MTCC 4492 and MTCC-4503 isolate against 2-3 days old larvae were 2.49 × 104, 5.24 × 105, 1.11 × 105, 7.56 × 104; and 9.88 × 104; against 5-6 days old larva were 1.59 × 105, 2.34 × 105, 1.83 × 105, 2.85 × 105 and 3.73 × 106 and against 10-11 days old larvae 2.05 × 106, 4.31 × 106, 1.74 × 107,1.95 × 106 and 3.07 × 107, respectively. Highest LT50 (142 h) was found against 10-11 days old larva inoculated with MTCC 4503 and lowest LT50 (51.2h) was found against 2-3 days old larvae treated with Pantnagar isolate. The results of the bioefficacy indicated that susceptibility decreased with increase in age of the larvae in terms of both LC50 and LT50. Among eight isolates only five were found to be pathogenic while remaining three isolates viz., IARI-Delhi, NCIPM-Delhi and MTCC 4122 isolates were found to be nonpathogenic to all the age groups of S. obliqua larvae. The order of pathogenicity against the test insect was found as Pantnagar isolate MTCC 4121 Multiplex isolate MTCC 4492 MTCC 4503.

401. Tiwari, Ruchira; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Karnatak, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Kale, S.P.; Bhabha Atomic Research Centre, Trombay, Mumbai (India). Nuclear Agriculture and Biotechnology Division. Pesticide residue analysis of fresh and stored honey of Tarai region of Uttarakhand (India) using multi-residue analysis method. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p. 29-32 KEYWORDS: GAS CHROMATOGRAPHY. SYNTHETIC PYRETHRINS. STORED PRODUCTS. PESTICIDES. RESIDUES. HONEY. FRESH PRODUCTS.

Honey samples from the Tarai region of Uttarakhand (Pant nagar and adjoining areas of District Udham Singh Nagar) were analyzed for pesticide residues of organachlorine, organophosphate and synthetic pyrethroid groups in 2006. Residue levels of 20 pesticides in fresh and stored honey samples were analyzed following multi-residue analysis methods by gas liquid chromatography (GLC). The results revealed that none of the fresh and stored honey samples were contaminated with pesticide residues and therefore the honey of nearby areas of Pantnagar is safe from consumer's point of view.

402. Arvind Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Sharma, Kuldeep; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Sunil Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Khan, M.A.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Seasonal abundance of Helicoverpa armigera Hübner and Scirpophaga incertulus Walker in Tarai of Uttarakhand. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.139-142 KEYWORDS: STEM EATING INSECTS. PEST CONTROL. HELICOVERPA ARMIGERA. SCIRPOPHAGA INCERTULAS. PHEROMONE TRAPS.

Experiments on seasonal abundance of Scirpophaga incertulas Walker and Helicoverpa armigera Hübner based on pheromone trap catch were conducted during 2005-07. The number of H. armigera moths catch was higher during 2005-06 than 2006-07 and on the basis of data of both the years; the most favorable was period was from 23rd to 26th standard week. During the year 2006-07 number of Scirpophaga incertulas moth catches was higher than 2005-06 and the most favorable period was observed from 36th to 42nd standard week.

403. Tiwari, Ruchira; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Sehgal, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Bioactivity of different formulations of Bacillus thuringiensis (Berliner) and their combinations with endosulfan against pod borer Helicoverpa armigera (Hubner). Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.12-19 KEYWORDS: FORMULATIONS. BACILLUS THURINGIENSIS. ENDOSULFAN. HELICOVERPA ARMIGERA. PEST INSECTS. PEST CONTROL.

Bioassay studies carried out in the laboratory to determine the effect of sublethal doses of four commercial formulations of Bacillus thuringiensis (Berliner) (Bt) i.e., Bt var kurstaki viz Dipel 8L (Bt1), Dipel 2x (Bt3), Bioasp, Biolep, and two different Bt strains, Bt var aizawai (Centari) (Bt2), and Bt var thuringiensis (Biotox) alone and in combination with endosulfan for their bioactivity against 0-24 hr old neonate larvae and 7 days old larvae of H. armigera. Growth and development of neonate larvae was drastically suppressed in all Bt treatments alone and in combination with endosulfan as 100 per cent mortality was observed after 1 to 3 days of feeding on treated diets. Similarly, higher doses of Bt and half dose of Bt+half dose of endosulfan were found highly effective against 7 days old larvae with 10.7 per cent pupation but all the pupae were deformed and did not produce any adult moth. Relative toxicity of all Bt treatments using artificial diet technique of bioassay showed that Bt var. kurstaki (Bt1)

was the most effective with the lowest value of LD50 (0.0013) followed by Bioasp, Biolep, Biotox and Bt2 with LD5 0 values of 0.0015 and 0.0015, 0.0018, 0.0028, respectively, for 7 days old larvae for the feeding period of 72 hours. Bt1 was found 27.7 times more toxic than endosulfan and the order of relative toxicity was found to be Bt1 Bioasp Biolep Biotox Bt2 to H. armigera larvae. All the concentrations of Bt have adverse effect on growth and development of the test insect. Increased larval mortality, larval period, growth inhibition, decreased pupation, darkening of larval skin and failure in adult emergence were recorded with the increased dose of Bt under laboratory conditions.

404. Sharma, Kuldeep; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Khan, M.A.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Suneel Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Studies on biological parameters of Chrysoperla carnea Stephens (Neuroptera:Chrysopidae) at different temperature regimes. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.20-22 KEYWORDS: BIOLOGY. CHRYSOPERLA CARNEA. TEMPERATURE. NATURAL ENEMIES. PEST INSECTS.

H20 Plant Diseases

405. Jain, Rajni; University of Rajasthan, Jaipur (India). Department of Botany. jain.rajni7mail.com. Agrawal, Kailash; University of Rajasthan, Jaipur (India). Department of Botany. agkailashindiamail.com. Bio-efficacy of plant extracts against Pseudomonas syringae pv. syringae causing leaf spot of Cluster bean. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.106-112 KEYWORDS: CYAMOPSIS PSORALIOIDES. SPOTS. PSEUDOMONAS SYRINGAE. PLANT EXTRACTS. EFFICIENCY.

Aqueous extracts of fresh leaves and fruits of some plants were evaluated in vitro for their antibacterial activity against Pseudomonas syringae pv. syringae that causes bacterial leaf spot in cluster bean using filter paper disc assay and seed treatment method. Leaf extracts of purple fleabane (Vernonia cinerea) and winter cherry (Withania somnifera), extracts of fresh fruits of emblic (Emblica officinalis), lime (Citrus aurantifolia), winter cherry (W. somnifera) and dried fruits of soap pod (Acacia rugata), emblic (E. officinalis), soap nut (Sapindus emarginatus) and belleric myrobalan (Terminalia bellirica) were found significantly effective to control the pathogen individually. All the plant extracts as seed treatment also controlled the pathogen and improved seed germination significantly over the check.

406. Jadon, Kuldeep S.; Directorate of Groundnut Research, Junagadh (India). kuldeep.rcamail.com. Tiwari, P.K.; G.A.U., Raipur (India). College of Agriculture. Department of Plant Pathology . Pathogen physiology and management of Brinjal collar rot caused by Sclerotium rolfsii. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.113-117 KEYWORDS: AUBERGINES. CORTICIUM ROLFSII. SOLANUM MELONGENA. BOTANICAL PESTICIDES. PATHOGENS.

Potato sucrose agar and potato dextrose agar (90 mm) were found to be best for mycelial growth of the pathogen, whereas good sclerotia production was obtained in Kings B(180) and soybean leaf medium (120). The optimum mycelial growth was recorded at the temperature of 30^{o}C (89.33 mm) and pH 5.0 (84 mm) whereas, sclerotia production at 25^{o}C (181.66) and pH 7.0 (107). Trichoderma viride was found most effective in inhibiting both mycelial growth (81.2%) and sclerotia production (14.15) of Sclerotium rolfsii. Among the medicinal plants leaf extracts Acorus calamus showed the best inhibitory effect (25 mm & 2 sclerotia). Under mist chamber condition, the soil and seedling dip treatments with T. viride and summer ploughing found most effective to reduce the per cent disease incidence of collar of brinjal.

407. Pandey, S.B.; C.S.A. University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Biswas, S.K.; C.S.A. University of Agriculture &

Technology, Kanpur (India). Department of Plant Pathology. samirkrbiswasediffmail. com. Rajik Mohd.; C.S.A. University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Kamalwanshi, R.S.; C.S.A. University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Evaluation on potentiality of bio-agents against Drechslera oryzae causing brown leaf spot of Paddy. Annals of Plant Protection Sciences (India). (Mar 2011) v. 9(1) p.118-121 KEYWORDS: ORYZA SATIVA. COCHLIOBOLUS MIYABEANUS. BIOLOGICAL CONTROL. SPOTS.

The potentiality of bio-agents viz. Trichoderma harzianum (Delhi), T. hazianum (Kanpur), T. viride (Delhi), T. viride (Kanpur). G. virens (K), T. hamatium (K) against Drechslera oryzae inhibited the growth of Drechslera oryzae. Maximum reduction (98.8%) was recorded in T. harzianum (Delhi) isolate followed by T. harzianum (Kanpur) (94.6%). Treatment of rice seeds with spore suspension of T. harzianum (Delhi) proved significantly superior in enhancing the maximum shoot length and root length at 30 days of seedlings. The foliar spray with crude extract of bio-agents were competence enough to reduce the number of lesion from 13.49 to 3.15. Disease severity was varied significantly from 14.1–58.1% in different treatments.

408. Kumar, Upesh; Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Singh, Jitendra; Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Naresh, Prem; Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Singh, Ramesh; Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (India). Department of Plant Pathology. Management of Stemphylium blight of Garlic through chemicals. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.126-128 KEYWORDS: ALLIUM SATIVUM. FUNGICIDES. PLEOSPORA HERBARUM.

Out of ten fungicides tested, bavistin, benomyl, mancozeb, vitavax, companion, topsin-M and captan proved to be the most effective to inhibit the growth of fungus in vitro. In field spraying of mancozeb (0.25%) on garlic crop at 15 days interval gave lowest disease intensity 9.8% with highest yield (36.3 kg/plot) over control. The satisfactory results was also observed in case of clove treatment along with two foliar sprays of mancozeb (0.25%).

409. Singh, Vimla; Directorate of Maize Research, New Delhi (India). Shukla, Kalawati; Deen Dayal Upadhyay Gorakhpur University, Gorakhpur (India). Influence of inoculation time on severity of virus disease caused by Papaya ringspot virus. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.142-6 KEYWORDS: CARICA PAPAYA. INOCULATION. TIME. PAPAYAS. RINGWORM. VIROSES. YIELDS.

Inoculations were done in pre-kharif season (March to April) and kharif season (July to August), to study the disease severity and yield of host. The symptoms were very severe in seedlings inoculated in kharif. The foliage, stems, roots and fruits showed typical ringspot symptoms and distortion, which further increased in winters. The overall yield of the plants was only 63.9%, however, seedlings inoculated in pre-kharif season showed mild mottling and the plants were normal. Also, only slight reduction in yield of the plant was recorded. The symptoms were masked at high temperatures resulting in a mild incidence of the disease. But, at low temperatures severe expression of symptoms was noted, and also a heavy yield loss. The disease severity in the seedlings inoculated in kharif season was high due to increased population of aphids.

410. Singh, Satyandra; Indian Institute of Vegetable Research, Varanasi (India). Bhagawati, B.; Assam Agricultural University, Jorhat (India). Goswami, B.K.; Amity University, Noida (India). Bio-management of root-knot disease of chick pea caused by Meloidogyne incognita. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.159-63 KEYWORDS: ASPERGILLUS NIGER. CHICKPEAS. MELOIDOGYNE INCOGNITA. PAECILOMYCES.

The fields were naturally infested with Meloidoyne incognita at 2–3 J2/g soil. Talc preparations of fungal bioagents i.e. Aspergillus niger 1% W.P. (3×107 cfu/g) and

Paecilomyces lilacinus 1% W.P. (2×106 cfu/g) at 5 kg/ha each were applied by enriching FYM at 5 tons/ha alone and in combinations with neem oilseed cake at 1.5 ha. Combined application of both the bioagents at half dose along with neem oilseed cake was found to be most effective in increasing the yield of chick pea and suppressed nematode multiplication as compared to farmer's practices and also found to be better than carbofuran. Two fold increase in the yield of chick pea was recorded in reduced dose treatment with a significant reduction up to 71 and 83% in number of galls and number of egg masses, respectively. The number of M. incognita in 10 roots of chick pea was reduced up to 61%. Thus, application of FYM enriched with fungal bioagents, A. niger and P. lilacinus along with neem cake may be an ideal approach for management of root-knot disease of chick pea under field condition.

411. Sahoo, S.K.; Punjab Agricultural University, Ludhiana (India). Mandal, Kousik; Punjab Agricultural University, Ludhiana (India). Kumar, Rajinder,; Punjab Agricultural University, Ludhiana (India). Singh, Balwinder; Punjab Agricultural University, Ludhiana (India). Battu, R.S.; Punjab Agricultural University, Ludhiana (India). Persistence of Chlorpyrifos and Lindane under moisture conditions. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.199-202 KEYWORDS: INSECTICIDES. RESIDUES. CHLORPYRIFOS. LINDANE. MOISTURE CONTENT.

The estimation of chlorpyrifos and lindane residues were done by a multiresidue analytical methodology employing GC-FTD and GC-ECD systems with capillary columns and confirmed by GC-MS. The limits of quantification (LOQ) for both the compounds were found to be 0.01 µg g 1. The mean initial residues of chlorpyrifos were 8.99, 9.19 and 8.99 µg kg 1, respectively at dry, irrigated and flooded soil. Whereas the corresponding values for lindane were 9.52, 9.22 and 9.29 mg kg 1, respectively. The results revealed that chlorpyrifos persisted for longer period under dry conditions whereas lindane was found to persist more under irrigated conditions.

412. Singh, Aarti; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Pandey, M.P.; G.B.Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Evaluation of NILs and pyramiding bacterial leaf blight and blast resistance genes into an elite cultivar of indica rice (Oryza sativa L.) through marker assisted selection. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.65-69 KEYWORDS: BACTERIOSES. BLIGHT. LEAVES. XANTHOMONAS ORYZAE. PYRICULARIA ORYZAE. RICE. SELECTION. DISEASE RESISTANCE.

NILs were screened for bacterial leaf blight (BB) (Xanthomonas oryzae pv oryzae) and blast (BL) (Pyricularia oryzae) diseases of rice. The results revealed NILs, IRBB-52 and C101A51 to be good donors in the gene pyramiding programme. The banding pattern of parental lines and BC1F2 progenies of cross IRBB52/C101 A51//Pant Sugandh Dhan-17 after PCR amplification with STS primers revealed the homozygosity of Xa 4, Xa 21 and Pi-2 by marker alleles in seven, six and eight progenies. Two progenies viz., PSD 17 BC1F 2-672 and PSD 17 BC1F 2-701 revealed two gene pyramids Xa4 + Pi-2 and Xa21 + Pi-2, respectively. The results of BC1F2 plants explicitly show the wider and higher level of resistance exhibited by Xa 21 gene.

413. Ray, Anjana; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Kumar, P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Effect of culture filterate of Rhizoctonia solani Kuhn on germinated seedlings of soybean. Pantnagar Journal of Research (India). (Jul-Dec 2007) v.5(2) p.103-104 KEYWORDS: RHIZOCTONIA SOLANI. PHYTOTOXINS. FUNGAL DISEASES. SOYBEANS. SEEDLINGS. GLYCINE MAX. GERMINATION.

414. Akhtar, Jameel; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Bioefficacy of fungicides and sensitivity of the isolates of Phomopsis vexans. Pantnagar Journal of Research (India). (Jan-Jun 2007)

v.5(1) p.62-65 KEYWORDS: BIOLOGICAL CONTROL. FUNGICIDES. ISOLATION. PHOMOPSIS. DIAPORTHE. FUNGAL DISEASES. AUBERGINES.

0835. Vishwanath; G.B. Pant University of Agriculture and Technology, Majhera (India). Agriculture Research Station. Vineeta; G.B. Pant University of Agriculture and Technology, Majhera (India). Agriculture Research Station. Systemic resistance induction against alternaria leaf blight through avirulent strain of Alternaria brassicae in mustard. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.66-69 KEYWORDS: FUNGAL DISEASES. INDUCED RESISTANCE. DISEASE RESISTANCE. ALTERNARIA BRASSICAE. MUSTARD. LEAVES. INOCULATION. RAPESEED. MUSTARD.

Alternaria leaf blight caused by Alternaria brassicae (Berk.) Sacc., is one of the most important diseases of the rapeseed-mustard crop. The present study deals with induced resistance in mustard using avirulent isolate of A. Brassicae against the two other virulent isolates of the same pathogen. The full leaf was pre inoculated with Alternaria alternata and challenge inoculated with Alternaria brassicae isolates A (aba) or Alternaria brassicae isolate C (abc). The Alternaria brassicae isolate A (aba) Challenged Inoculation (CI) showed maximum disease severity followed by Challenged Inoculation (CI) with Alternaria brassicae isolate C (abc) in comparison with Alternaria alternata-Water (Aa-W) check treatment which did not produce any spots on the leaf. The disease severity due to Alternaria alternata - Alternaria brassicae isolate A (Aa-aba) and Alternaria alternata - Alternaria brassicae isolate C (Aa-abc) treatments were comparable to Alternaria brassicae isolate A-Water (aba -W) and or Alternaria brassicae isolate C-Water (abc -W) treatments respectively. Similar results in terms of induced inoculation with Alternaria alternata (Aa) or Alternaria brassicae isolate D (abd) and challenged inoculation (CI) with or Alternaria brassicae isolate A(aba) and or Alternaria brassicae isolate C (abc) were recorded on the detached leaf. But the degree of increase in disease severity in the case of Alternaria alternata - Alternaria brassicae isolate A (Aa-aba) and Alternaria alternata - Alternaria brassicae isolate C (Aa-abc) was slightly more than on the attached leaf surface.

415. Ray, Anjana; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Pradeep Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Influence of media, pH and temperature on growth and sclerotial production of Rhizoctonia solani kühn causing aerial blight of soybean. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.50-53 KEYWORDS: SOYBEANS. FUNGAL MORPHOLOGY. GLYCINE MAX. RHIZOCTONIA SOLANI. PH. TEMPERATURE. AERIAL PARTS. BLIGHT. GROWING MEDIA.

Five different media tested, among them, Czapek s Dox Agar supported best mycelial growth (75.13 mm) and sclerotia production of the fungus followed by Potato Dextrose Agar, Asthana and Hawker s medium, Richard s medium and Corn meal agar media. The colony diameter and sclerotia production of R. solani was maximum at 30^0C on Czapek's Dox agar medium followed by 35, 25, 20 and 15^0C. Maximum mycelial dry weight (379.67 mg) of the test fungus was recorded at pH 7.0 while minimum dry weight (115.21 mg) at pH 3.0.

416. Bhatt, Rashmi; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Awasthi, R.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Tewari, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Management of downy mildew and white rust diseases of mustard. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.54-59 KEYWORDS: PERONOSPORA PARASITICA. BIOLOGICAL CONTROL AGENTS. FUNGICIDES. FUNGAL DISEASES. ALBUGO CANDIDA. MILDEWS. MUSTARD. RUSTS.

Downy mildew and white rust cause both qualitative and quantitative losses to Brassica crops. Three chemical fungicides viz., metalaxyl 35 SD, carbendazim 50WP and metalaxyl 8% + mancozeb 64% (ridomil MZ 72WP) , powder and oil based commercial

formulations of two biocontrol agents (Pseudomonas fluorescens and Trichoderma harzianum) and one plant extract (garlic bulb) were evaluated alone and in combinations against these diseases. Seed treatment with metalaxyl in combination with three successive sprays of metalaxyl+mancozeb (ridomil MZ 72WP) was highly effective in reducing the diseases from cotyledon stage to maturity of the plants and increasing the grain yield. Garlic bulb extract as seed treatment with successive foliar spray was also equally effective which can be used as an ecofriendly alternative for disease management.

417. Saxena, Priti; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Singh, Kamendra; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Bhatt, Usha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Khanna, V.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Genetics and Plant Breeding. Identification of ISSR marker for the resistance to Yellow Mosaic Virus in Soybean [Glycine max. (L).Merrill]. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.166-170 KEYWORDS: GENETIC MARKERS. DISEASE RESISTANCE. VIROSES. GLYCINE MAX. SOYBEANS. GENOTYPES. PLANT VIRUSES.

The investigation involving identification of inter simple sequence repeats (ISSR) marker(s) for yellow mosaic virus (YMV) resistance in soybean (Glycine max) was carried out with the cross JS-335 x UPSM-534, parents, their F1s and F2 generations. The ISSR analysis revealed that primer 50 SS was useful to find out the gene(s) resistant to YMV in soybean. The resistant parent UPSM-534 and 75 F2 plants showed the presence of a band at 1000 bp position, whereas susceptible parent JS-335, F1s and 27 F2s have no band at 1000 bp position. This finding may further help in increasing the selection efficiency of the breeding program.

418. Srivastava, Rashmi; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biological Sciences. Sharma, S.K.; K.R. College, Mathura (India). Department of Botany. Singh, J.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Vegetable Research Centre. Sharma, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Biological Sciences. Evaluation of tomato (Solanum lycopersicum L.) germplasms against Fusarium oxysporum f. sp. lycopersici, causing wilt. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.192-195 KEYWORDS: TOMATOES. LYCOPERSICON ESCULENTUM. GERMPLASM. FUSARIUM OXYSPORUM. WILTS. FUNGAL DISEASES. Fusarium oxysporum (Sacc.)

Snyder & Hans f. sp. lycopersici, appears to be a most widespread soil inhabiting fungus which causes wilt disease in tomato and inflicts tremendous yield loss to the crop in different growing regions. The incidence of fusarial wilt can be overcome either by application of fungicide or use of resistant cultivars. Use of resistant cultivars is one of the most cost effective and environmental friendly approaches in disease management. In this study, twenty-five germplasms of tomato were evaluated against pathogenic and the most virulent isolate of F. oxysporum f. sp. lycopersici. Among all, germplasm CL-11-31-0-38-4-0 was found to be most resistant while as Pant Tomato –3 showed most susceptible reaction.

419. Singh, S.R.; Sher-e-Kashmir University of Agricultural Sciences and Technology, Wadura, Sopore (India). Regional Research Station. Singh, H.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Chaubey, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Effect of AM Fungi and Azotobacter chroococcum on rhizospheric micro-organisms, nutrient uptake, fertility status and yield of wheat. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.58-65 KEYWORDS: VESICULAR ARBUSCULAR MYCORRHIZAE. AZOTOBACTER. RHIZOSPHERE. MICROORGANISMS. NUTRIENT UPTAKE. SOIL FERTILITY. WHEATS. TRITICUM AESTIVUM.

Three strains of arbuscular mycorrhizae and two strains of Azotobacter chroococcum, isolated from Tarai agro-climatic region were used to inoculate wheat seed singly with AM fungi or Azotobacter chroococcum and in combination to study their effect on rhizosphere microorganisms, nutrient uptake, fertility status of soil and yield of wheat (Triticum aestvum L) under pot condition. Increases in root colonization, populations of AM fungi, bacteria including Azotobacter and actinomycetes were observed in the rhizosphere of wheat inoculated with AM fungi and Azotobacter individually as compared to uninoculated plants but dual inoculation resulted significantly greater population of all microorganisms, except AM spores and actinomycetes at 131 and 80 DAS, respectively as compared to their individual inoculation. However, fungal population was significantly reduced at 80 and 131 days after sowing (DAS). The effect of M1, M2 and M3 strains of AM and A1 and A2 strains of Azotobacter individually significantly increased 1000-grain weight, uptake of N, P and K by shoot, straw, grain and total biomass, and yield of wheat over the control, while P uptake by shoot at 80 DAS, available P and straw yield increased significantly by dual inoculation with AM and Azotobacter. Except M3xA1 interaction, all the interactions significantly increased the available P in the soil over their individual inoculation, the maximum (73.08% more than control) being with M3 xA2 interaction. In general M3 and M2 strains of AM fungi and both strains of Azotobacter were at par to each other but M3 and A2 strains resulted maximum in all the parameters studied.

420. Akhtar, Jameel; Birsa Agricultural University, Ranchi (India). Department of Plant Pathology. Singh, M.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Chaube, H.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Effect of nutrition on formation of acervuli, setae and sporulation of the isolates of Colletotrichum capsici. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.110-113 KEYWORDS: SPORULATION. COLLETOTRICHUM CAPSICI. FUNGAL DISEASES. ISOLATION. FUNGAL SPORES. CHILLIES. CAPSICUM.

421. Shailbala; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Pundhir, V.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Plant Pathology. Fungicide spray schedule for economical management of potato late blight. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.114-117 KEYWORDS: FUNGICIDES. SPRAYING. POTATOES. BLIGHT. DISEASE CONTROL. PHYTOPHTHORA INFESTANS.

H50 Miscellaneous Plant Disorders

422. Naik, S.K.; ICAR Research Complex for Eastern Region, Ranchi (India). Devadas, R.; National Research Centre for Orchids, Pakyong (India). Ushabharathi, T.; National Research Centre for Orchids, Pakyong (India). Barman, D.; National Research Centre for Orchids, Pakyong (India). Medhi, R.P.; National Research Centre for Orchids, Pakyong (India). Changes in nutrient content and iron deficiency in growing media of Cymbidium hybrid; Pine Clash Moon Venus. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.764–6 KEYWORDS: CYMBIDIUM. IRON. DEFICIENCY DISEASES. NUTRIENT AVAILABILITY.

The experiment was undertaken during 2008 and 2009 to study the distribution of major (N, P and K), secondary (Ca, Mg and S) and micronutrient (Fe, Mn, Zn and Cu) on the growing media and to overcome the iron deficiency problem in Cymbidium; Pine Clash Moon Venus. Among all the nutrients, potassium and iron content were very low in the growing media. Most of the tissue culture Cymbidium hybrid shows iron deficiency after six month of growth in plastic poly bag under greenhouse condition. Foliar application of 50 ppm iron in the form of iron sulphate at 15 days interval for two consecutive months controls the iron deficiency in one year old Cymbidium; Pine Clash Moon Venus. However, foliar application of 100 ppm iron is suitable to overcome Fe deficiency in two year old Cymbidium; Pine Clash Moon Venus.

H60 Weeds and Weed Control

423. Kumar, Vinod; Singh, R.V.; Singh. H.S. Management of Meloidogyne incognita Race-1 and Rotylenchulus reniformis by seed treatment with biological agents, organic cakes and pesticides on cowpea. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.164-7 KEYWORDS: MANAGEMENT. MELOIDOGYNE INCOGNITA. ROTYLENCHULUS RENIFORMIS. VIGNA UNGUICULATA.

The seeds of susceptible cowpea cv. Pusa Komal were treated with Pseudomonas fluorescens 10 g/kg, Trichoderma viride 4g/kg, neem seed and jatropha seed kernel poweder each 10% (w/w), cartap hydrochloride 50 (SP) 1.5% (w/w) and carbosulfan 25 (DS) 3% (w/w). Soil application with carbofuran (3G) 2kg a.i/ha. was also included as treated check. Root-knot nematode 2J2 /g of soil and two young females alongwith equal number of males/g soil of reniform nematode were inoculated after 10 days of germination. The observations indicated that the growth parameters of cowpea plants were better and population level of both the nematodes were declined in all the treatments used when compared to inoculated control.

424. Kaur, Harpreet; Punjabi University, Patiala (India). Department of Zoology. Kaur, Harjinder; Punjabi University, Patiala(India). Department of Zoology. Rishi, Praveen; Punjabi University, Patiala (India). Department of Zoology. Therapeutic and preventive nematicidal activity of aqueous neem leaf extract on Meloidogyne incognita and growth of tomato. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p.178-82 KEYWORDS: AZADIRACHTA INDICA. NEEM EXTRACTS. LEAVES. MELOIDOGYNE INCOGNITA. LYCOPERSICON ESCULENTUM.

Results indicated that 100% concentration of aqueous neem leaf extract gave 100% J2 Meloidogyne incognita mortality after 48hrs of exposure. After treatment with 75% at 12 hrs and 24 hrs, 50% at 12 hrs and 24 hrs, 25% at 72 hrs less than 50% immobile J2 were revived when immersed in distilled water in comparison to 100% revivability in controls. Percentage of viable J2 was decreased with increase in exposure time from 12 hrs to 72 hrs in each concentration. Application of 100% concentration of aqueous neem leaf extract in potted tomato plants prior to the inoculation of J2 (plant + neem + nematode) resulted in significant (0.05) reduction in total number of females/root system, number of galls/root, number of females/gall and number of nematodes (males+J2)/250g soil as compared to control-2 (plant+nematode). Preventive treatment gave significant enhancement in various growth parameters such as total fresh weight of root and shoot (20.46±5.71 and 43.88±12.72) in tomato as compared to therapeutic group (18.76±4.9 and 38.14±11.05). The fruit yield was also significantly better in preventive than in therapeutic group.

425. Singh, V. Pratap; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, G.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Pandey, P.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, R.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Dhyani, V.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, S.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Sharma, G.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Kumar, A.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, M.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Efficacy of different herbicides alone and with follow up application of 2,4-D with regard to weeds and yield of zero tillage direct seeded rice. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.1-11 KEYWORDS: HERBICIDES. WEED CONTROL. ZERO TILLAGE. DIRECT SOWING. 2,4-D. RICE.

Fimbristylis miliacea was most dominant weed in zero tilled condition with average contribution 55.3 per cent at 60 days stage. Higher dry weight was observed during the second year of experiment. Anilofos 0.4 kg ha–1 as early post emergence application followed by 2, 4-D at 0.5 kg ha–1 reduced density and total dry weight of weeds at 60 days stage resulting in highest weed control efficiency (91.5 and 55.1 per cent respectively during 2001 and 2002) among herbicidal treatments. Weeds caused complete destruction of rice crop in weedy check plots. Owing to better control of weeds pendimethalin at 1.0 kg ha–1 followed by 2, 4-D at 0.5 kg ha–1 and anilofos 0.4 kg ha–1 as early post emergence application followed by 2,4-D at 0.5 kg ha–1 recorded significantly higher number of panicles m-2 and thus grain yield.

426. Jitendra Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, Dheer; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Weed management in direct seeded unpuddled rice (Oryza sativa L.) under different sowing dates. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.17-21 KEYWORDS: WEED CONTROL. DIRECT SOWING. PUDDLING. RICE. ORYZA SATIVA. SOWING DATE.

Highest grain yield (2488.9 kg ha-1 during 2006 and 2703.3 kg ha-1 during 2007) was recorded from 20 June sown rice crop which was significantly higher over rest two dates of sowing (05 June and 05 July). Pendimethalin 1.0 kg ha-1 + anilophos 0.4 kg ha-1 (pre-emergence) produced significantly higher grain yield (3096.7 kg ha-1 during 2006 and 3289 kg ha-1 during 2007) over rest of the treatments. Due to less number and dry matter of weeds resulting in better crop growth, reflecting in higher number of panicles per metre row length, grains per panicle and 1000-grain weight. The grain yield was highest in mechanical two weedings at 20 and 40 DAS (3323 kg ha-1 during 2006 and 3437 kg ha-1 during 2007) being significantly superior over rest of the treatments. Reduction in grain yield of rice due to uncontrolled weeds in weedy plots was recorded 70.4 per cent during 2006 and 67.4 per cent during 2007. Echinochloa colonum among grasses and Commelina benghalensis, Caesulia axillaris among non-grasses and Cyperus rotundus among sedges were the predominant weed species in the experimental plot.

427. Puniya, Ramphool; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Pandey, P.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Bisht, P.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Evaluation of new herbicides in transplanted rice (Oryza sativa L.). Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.115-119 KEYWORDS: TRANSPLANTATION. RICE. ORYZA SATIVA. WEED CONTROL. HERBICIDES.

428. Tiwari, Dinesh; T.D. P.G. College, Jaunpur (India). Department of Agronomy. Singh, S.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Singh, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Puniya, Ramphool; T.D. P.G. College, Jaunpur (India). Department of Agronomy. Effect of market available herbicides on growth and yield of wheat (Triticum aestivum l. Emond. Fiori and paol) and associated weeds. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.220-222 KEYWORDS: HERBICIDES. WHEATS. WEED CONTROL. TRITICUM AESTIVUM.

429. Gupta, Akansha; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Saxena, S.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Agronomy. Weed management in soybean (Glycine max. L Merrill) in Tarai region of Uttarakhand to sustain productivity. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.1-5 KEYWORDS: WEED CONTROL. SOYBEANS. GLYCINE MAX. SUSTAINABILITY. ECONOMICS.

The experiment was conducted during Kharif seasons (July to November) of 2003 and 2004 to study weed management in soybean (Glycine max. L. Merrill) in Tarai

region of Uttarakhand to sustain productivity. Result indicated that in-situ mulching recorded maximum weed reduction, weed control efficiency, plant growth, yield attributes, seed yield, gross return and incremental benefit: cost ratio and it was higher than treatments like two hand weeding (HW) at 30 and 45 DAS and two hoeing at 20 and 40 DAS. The grain yield was 278.6, 14.69, and 10.85 per cent higher in in-situ mulching than in weedy (check), two-hand weeding, and two hoeing, respectively. Benefit:cost ratio was 24, 19.23 and 248.33 per cent higher in in- situ mulching than in two HW, two hoeings and weedy (check). Integration of herbicides with one HW like Pendimethalin 1.0 kg ai/ha PE) + one HW at 30DAS and Clomazone .0 kg ai/ha (PE) + one HW at 30 DAS produced significantly higher seed yield than pre-emergence and post emergence herbicides. Significantly highest protein and oil content yield was recorded in Quizalofop ethyl 50 g ai/ha (POE) and Pendimethalin 1.0 kg ai/ha (PE), which was 4.8 and 3.2 per cent higher than weedy (check), respectively.

430. Sundharaiya, K.; Tamil Nadu Agricultural University, Coimbatore (India). Jansirani, P.; Tamil Nadu Agricultural University, Coimbatore(India). Sivakumar, M.; Tamil Nadu Agricultural University, Coimbatore(India). Biochemical response of Tomato genotypes to Meloidogyne incognita infection. Annals of Plant Protection Sciences (India). (Mar 2011) v.19(1) p. 193-8 KEYWORDS: BIOCHEMISTRY. MELOIDOGYNE INCOGNITA. LYCOPERSICON ESCULENTUM.

A field trial was conducted in tomato with nine genotypes including two newly synthesized F1 hybrids viz., CLN 2123 A X HN2 and HN2 X CLN 2123A and their parents CLN 2123A and HN2 along with resistant and susceptible check varieties/hybrids to study the biochemical response to root knot nematode infection at three different geographical locations viz., Rayakottai of Dharmapuri District, Oddanchatram of Dindigul District and Attur of Salem District of Tamil Nadu. The results revealed that the cross HN2 X CLN 2123A, nematode resistant check Hisar Lalit and the parent HN2 registered higher root phenol content and root ascorbic acid content, these genotypes also registered higher peroxidise activity, polyphenol oxidase activity, IAA oxidase activity and acid phosphatise activity. Similarly, the same genotypes also registered lower per se values for root-knot index in all the three locations of the study. Susceptible genotypes viz., (CO 3 & LCR 2) showed the lowest root phenol content, root ascorbic acid content, peroxidise activity, polyphenol oxidase activity, IAA oxidase activity, acid phosphatise activity and higher per se for root knot index in all the three locations of the study.

431. Vikas Kumar; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Mall, Promod; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Exploration of pollen substitute for Apis mellifera L.. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.120-123 KEYWORDS: APICULTURE. APIDAE. POLLEN. BEE FEEDING.

432. Bhatnagar, Shiwani; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Karnatak, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Entomology. Evaluation of toxicity of monocrotophos, alphamethrin and endosulfan to Apis mellifera L. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.135-138 KEYWORDS: APICULTURE. INSECTICIDES. HONEY BEES. ENDOSULFAN. MONOCROTOPHOS. TOXICITY. APIS MELLIFERA.

Studies were carried out to evaluate the toxicity of monocrotophos, alphamethrin and endosulfan against Italian honeybee A. mellifera at 10 min exposure period .The LC50 values obtained were 35.33 ppm, 62.15 ppm and 363.16 ppm, respectively. Based on relative toxicity tests, endosulfan was found to be least toxic among synthetic insecticides to honeybees as compared to monocrotophos and alphamethrin.

N01 Agricultural Engineering

433. Goyal, S.K.; S.V.B. Patel University of Agriculture and Technology, Meerut (India). Department of Agricultural Engineering and Food Technology. Work performance of tractor-implement system and fuel economy in different soil conditions. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.125-128 KEYWORDS: TRACTORS. CULTIVATORS. DISC HARROWS. FIELD CAPACITY. EQUIPMENT. FUELS.

The experiments were conducted to evaluate tractor-implement system performance with disc harrow and cultivator in sandy loam soil. Three soil cover conditions viz. unploughed soil, stubble soil and tilled irrigated soil surfaces were taken to determine the better performance of tractor-implement system and fuel economy. Three tractors were used of 41, 26 and 22.5 kW, at three speed control setting of the tractors, viz. 1/3rd(5000 rpm), 2/3rd (1300 rpm) and full lever (1900 rpm) positions. The disc and cultivator combination were found most economical to be operated at 2/3rd speed control position. Maximum fuel consumption of 4.1 l/h in tilled irrigated soil with cultivator and 3.6 l/h with disc harrow at 2/3rd throttle position was observed because of increased depth of operation. Almost in all soil cover conditions, cultivator gave maximum field capacity. Fuel consumption for disc harrow was lesser than cultivator due to lesser depth of cut.

N20 Agricultural Machinery and Equipment

434. Saxena, A.C.; Central Institute of Agricultural Engineering, Bhopal (India).. Characterize material and bulk hardening for rotavator blade to resist abrasive wear. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.88-95 KEYWORDS: HARDENING. ENGINEERING. HEAT TREATMENT. FARM EQUIPMENT.

operation, the blades of rotavator are subjected to fatigue and abrasive wear. As a result theses blades require frequent replacement, which add to equipment running cost as well as down time. The purpose of this study is to undertake metallurgical up-gradation on rotavator blades to enhance its service life. Four grades of spring steels (two Boron based and two Boron free) were selected for the study. The quenching and tempering on all grades and additional austempering on two grades of Boron steels were imparted. All six treatments were compared for abrasive wear with two popular brands of rotavator blades.The wear analysis of six treatments was carried our in three stages, firstly in laboratory scale by using DUCOM make dry sand abrasion test ring(ASTM G 65), secondly in a specially deigned rotary soil bin and finally in the field trial. The study revealed an identical wear ranking order of treatments in all three stages. The 50B50 (Boron steel) quenched and tempered steel ranked top as far as mass wear is concerned. But the higher cost of boron steels in Indian market put this to second place and the SAE-6150 has been found to be the best suitable steel considering benefit cost ratio.

435. Pateriya, R.N.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Farm Machinery and Power Engineering. Singh, Shailesh; IPST, MGCGVV, Chitrakoot, Satna (India). Ergonomic evaluation of the tractors seat. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.200-207 KEYWORDS: ERGONOMICS. TRACTORS. FARM EQUIPMENT.

Most of the tractors industries are producing tractors in the range of 35-85hp, the human factors and aesthetic appeal have become essential sales factors. Human factors in the system development discipline influence man-machine system. The primary human factors include various controls of the tractor, dimensions of the equipment, type and arrangement of the internal components to accommodate the person who has to maintain the equipment. The operator seat is one of the important part for the man-machine system and comfort of tractor operator. Therefore, knowing the importance of the tractor seat a study was conducted on tractors seat, with particular reference to seating dimensions to add the comfort of the operator. The surface of the loaded cushion measured with the loading device in accordance with IS: 11806-1986. Dimensions for seat pan and backrest were measured and analyzed, according to BIS recommendations. The results indicated that the best accessibility index was 0.199 out of the other tractors

that were found 0.251 & 0.038 and the relative position of the controls seat pan width were found satisfactorily with the high percentile tractor operators. The study also highlighted that present tractor seats need minor modifications/improvement in seating dimensions as per BIS recommendations.

436. Saxena, Avinash Chandra; Central Institute of Agricultural Engineering, Bhopal (India). Development of shot peening package for duck foot cultivator sweep. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.208-215 KEYWORDS: FARM EQUIPMENT. CULTIVATORS. PLOUGHING.

The duck foot cultivator sweeps during ploughing are subjected to abrasive wear which results into blunt edge. Around 4–6 edge sharpening using conventional heat treatment are required during its entire service life of 200 h. Shot peening is a widely used to induce residual stresses on surface of the critical component to resisting abrasive wear. This study aimed to develop a shot peening package on widely used EN 45 grade spring steel after considering four level of peening intensities on as received (virgin) and bulk hardened steel. Shot peening produced appreciable gain in service life of sweep blade. A peening intensity of 0.17 mm A produced 91% and 53% gain in service life of quenched and tempering and as received samples at 75 N loading respectively. The quenched & tempered samples produced a gain at all loadings. The best laboratory performed samples produced similar wear order in ploughing 125.3 acres (109.45 h) at farmer s field. Accordingly, a shot peening package has been developed for sweep blade.

P31 Soil Surveys and Mapping

437. Mehta, Harsh; Central Soil and Water Conservation Research and Training Institute, Dehradun (India). Tyagi, P.C.; Central Soil and Water Conservation Research and Training Institute, Dehradun (India). Dadhwal, K.S.; Central Soil and Water Conservation Research and Training Institute, Dehradun (India). High-yielding provenances of bhimal (Grewia optiva) for fodder and fuelwood production in north-western Himalayas. Indian Journal of Agricultural Sciences (India). (Aug 2011) v. 81(8) p. 717–22 KEYWORDS: FEED CROPS. GENETIC VARIATION. GREWIA. FUELWOOD.

Provenance evaluation of bhimal (Grewia optia J R Drumm. ex Burret) was initiated in 1995 with respect to growth and productivity parameters for assessing genetic variations and identifying the most productive provenances which could be recommended in prevailing agroforestry systems. The materials comprised seven provenances of G. optiva collected from different locations of the northern states of Uttarakhand and Himachal Pradesh and planted in complete randomized block design with three replications. The data were recorded for growth and productivity parameters for 10 years. Significant variations were recorded for growth and productivity parameters. The highest fresh fodder productivity recorded in I C Malas 3.57 tonnes/ha, statistically at par with I C Bhaintan 3.49±0.04 tonnes/ha) was 1.21 times more than the least productive provenance I C Nauni. However, in respect of dry weight of debarked fuelwood and dry weight of bark fibre, I C Bhaintan produced 0.71 and 0.37 tonnes/ha biomass, which was 1.80 and 2.0 times higher than the least productive provenance (I C Tachla). The ranking of provenances based on the cumulative score of growth and productivity parameters indicated that I C Malas was the most productive provenance, followed by I C Bhaintan. These elite provenances (I C Bhaintan, I C Malas and I C Chamba) were multiplied in 2006 in a polyhouse and planted under different agroforestry systems on the farmers fields at different elevations in the lower and middle Himalayas of Uttarakhand, as part of multi-location testing.

438. Paul, Amrit Kumar; Indian Agricultural Statistics Research Institute, New Delhi (India). Alam, Wasi; Indian Agricultural Statistics Research Institute, New Delhi (India). Singh, Pal; Indian Agricultural Statistics Research Institute, New Delhi (India). Average linkage method for clustering rice (Oryza sativa) producing states of India. Indian Journal of Agricultural Sciences (India). (Aug 2011) v. 81(8) p. 690–4 KEYWORDS: RICE. ORYZA SATIVA. INDIA. METHODS.

This study can provide an opportunity to discover more precisely the clusters of least rice-producing states as well as clusters of moderate rice-producing states, whose production level marginally fall below the national average. This can assist in exploring the reasons of small production in a particular cluster of geographical locations. Cluster of the geographical locations of high productivity can further be studied for improving the low rice producing states. Application of average linkage clustering method is more effective statistical technique in identification of homogeneous group of geographical locations producing the similar rice production level.

P33 Soil Chemistry and Physics

439. Agarwal, Mina; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Mishra, Vineeta; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Studies on effect of moisture and thermal regimes on mineralization of organic carbon in Mollisol. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.88-91 KEYWORDS: SOIL CHEMICOPHYSICAL PROPERTIES. SOIL WATER. TEMPERATURE. ORGANIC FERTILIZERS. CARBON. MINERALIZATION. FIELD CAPACITY.

A laboratory experiment was conducted to study the effect of moisture and thermal regimes on mineralization of organic carbon with eight treatments viz. control, starter nitrogen, wheat straw, FYM, wheat straw +N, FYM+N, rice straw and rice straw +N, three replications of each treatment. Rice straw, wheat straw and FYM are applied at the rate of 5t/ha, 5t/ha, and 15t/ha respectively with or without starter dose of nitrogen (for straw 20 kg N/ha and for FYM 90 kg N/ha). These treatments were incubated at two moisture levels under two temperatures for 90 days. The mineralization of carbon was measured quantitatively following alkali trap method. Carbon mineralization at 20^0C temperature was greater than at 5^0C temperature for all the days of incubation. Carbon mineralization was more at field capacity moisture condition as compared to saturated soil moisture condition in all the treatments under both these temperatures. The amount of carbon mineralized from the soil was maximum with the rice straw. Thus, increase in temperature and field capacity moisture condition accelerated the process of mineralization.

P35 Soil Fertility

440. Katkar, R.N.; Sonune B.A.; Kadu P.R. Long-term effect of fertilization on soil chemical and biological characteristics and productivity under sorghum (Sorghum bicolor)–wheat (Triticum aestivum) system in Vertisol. Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.734–9 KEYWORDS: OXIDOREDUCTASES. SOIL FERTILITY. BIOMASS. SORGHUM BICOLOR. TRITICUM AESTIVUM.

An experiment was undertaken during 2007–08 to study the effect of long-term fertilization and manuring on soil chemical and biological properties in Vertisol. The dynamics of soil characteristics was studied in the on-going longterm fertilizer experiment initiated in rainy (kharif) season 1988 at Akola, Maharashtra comprised 12 treatments including NPK levels with and without FYM, sulphur and zinc replicated four times in randomised block design. The manure and mineral fertilizers were given to sorghum [Sorghum bicolor (L.) Moench] crop every year and only mineral fertilizers were applied to succeeding wheat (Triticum aestivum L. emend Fiori & Paol). Soil samples from all the treatments were collected from 0–20 cm depth. The chemical & biological soil characteristics were studied. Significantly highest increase in soil organic carbon and total nitrogen were recorded with 100% NPK + FYM 0 tonnes/ha. The availability of N, P, K, S, soil microbial biomass carbon and nitrogen, dehydrogenase assay and productivity of sorghum and wheat were significantly increased with the integrated application of organic manure (FYM 10 tonnes/ha) and mineral fertilizer (100% NPK) over control and other fertilizer treatments after 20 years of experimentation. Highly significant positive correlation of total productivity was observed

with available K, N, and P, whereas moderately positive significant correlation was observed with organic carbon, total nitrogen and biological parameters.

441. Mishra, Peeyush; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, S.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Srivastava, P.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, Sobaran; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Availability of NPKS in some Inceptisols and Mollisols as related with soil characteristics. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.70-75 KEYWORDS: NUTRIENT AVAILABILITY. NPK FERTILIZERS. SULPHUR FERTILIZERS. SOIL CHEMICOPHYSICAL PROPERTIES.

Distribution of available N, P, K and S in soils was studied in relation to soil properties. Results showed that soil pH ranged from 5.61 to 8.28, EC 0.18 to 2.08 dSm^{-1}, CaCO3 0.20 to 0.80%, CEC 8.03 to 21.80 c mol (p+) kg^{-1} and organic carbon 0.39 to1.65 %. Available N, P, K and S contents ranged from 84 to 438, 21 to 113, 102 to 210 and 19 to 113 kg ha^{-1}, respectively. Maximum concentration was recorded in surface soil and in general it decreased with depth. Soil pH showed significant negative correlation with available N and P while it was positively correlated with available K and S. Organic carbon was significantly and positively correlated with available N, P, K and S. Cation exchange capacity showed a significant positive correlation with available N, K and S. Thus, a definite role of soil properties in supplying plant nutrients is indicated.

442. Singh, Room; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Nand Ram; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Mishra, Peeyush; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Economics of fertilizer use under continuous rice-wheat cropping in a Mollisol. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.76-80 KEYWORDS: RICE. WHEATS. CROPPING SYSTEMS. SOIL CHEMICOPHYSICAL PROPERTIES. ECONOMICS. FERTILIZERS.

The present study was undertaken to compute the economics of using fertilizers and manure under continuous rice-wheat cropping for over 3-decades on an Aquic Hapludoll. Various fertilizer and manurial treatments substantially increased the yields of both crops with successive increase in the levels of NPK along with Zn. Application of 100% NPK with FYM produced the highest yields as well as maximum net profit (Rs. 32477/= ha^{-1} yr^{-1}) of nutrient application. Treatments receiving recommended level of optimal NPK with zinc fetched about 97 per cent of the maximum net profit. With the application of only recommended N with Zn and at 50% NPK dose with Zn net profit was only about 77 per cent and 67 per cent, respectively. However, their value cost ratios were higher than all other treatments. These two fertilizer practices seem to be suitable options for low input farming.

443. Mishra, Peeyush; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, S.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Srivastava, P.C.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Singh, Sobaran; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Vertical distribution of DTPA-extractable Zn, Cu, Mn and Fe in some soils of Tarai and Rohilkhand plains in relation to soil properties. Pantnagar Journal of Research (India). (Jan-Jun 2007) v.5(1) p.92-98 KEYWORDS: TRACE ELEMENTS. ZINC. MANGANESE. IRON. NUTRIENT AVAILABILITY. SOIL CHEMICOPHYSICAL PROPERTIES.

Depthwise distribution of available Zn, Cu, Mn and Fe in soils extracted by DTPA was studied in relation to some physical and chemical properties. Results showed that soil pH ranged from 6.42 to 8.02, EC 0.31 to 0.59 dSm^{-1}, CaCO3 0.40 to 0.86%, CEC 8.09 to 18.20 c mol(P+) kg^{-1} and organic carbon 0.26 to 1.32 per cent. The DTPA-

extractable Zn, Cu, Mn and Fe contents ranged from 0.18 to 2.08, 0.57 to 2.48, 1.32 to 45.63 and 3.07 to 21.35 mg kg^{-1}, respectively. Maximum concentration was recorded in surface soil and in general it decreases with depth. Soil pH showed a significant negative correlation while organic carbon, CEC and clay content was significantly and positively correlated with DTPA-Zn. The $CaCo_3$ showed a significant negative correlation whereas clay content showed significant positive correlation with DTPA- Mn and Fe. Thus, soil properties have a major role to play in supplying plant nutrients from soil.

444. Misra, Vineeta; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Agnihotri, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Influence of thermal and moisture regimes on carbon mineralization in Mollisol. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.72-75 KEYWORDS: SOIL WATER. MINERALIZATION. CARBON CYCLE. ORGANIC AGRICULTURE. FARMYARD MANURE. TEMPERATURE.

An incubation experiment was carried out to study carbon mineralization from different sources of organic manures (rice & wheat straw and farm yard manure) at two temperatures and two moisture regimes. The rate of carbon mineralization from each treatment increased with temperature and application of straw. At the end of incubation period carbon mineralization was significantly higher at 35°C(315.3mg C kg^{-1}) as compared to 15°C (289.3 mg C kg^{-1}) due to high level of microbial activity. In all the treatments, the rate of carbon mineralization at field capacity (354.1 mg C kg^{-1}) was more as compared to saturated soil moisture (159.9 mg C kg^{-1}) because of higher microbial activity (aerobic condition). The highest amount of mineralized carbon was found in rice straw treated soil (340.9 mg C kg^{-1}) than other treatments. In general, rate of carbon mineralization in all the treatments was higher up to 30 days of incubation period, thereafter, it slowed down and stabilized by the end of incubation period.

445. Misra, Vineeta; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Agnihotri, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Nitrogen mineralization influenced by thermal and moisture regimes in Mollisol. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.118-121 KEYWORDS: MINERALIZATION. NITROGEN CYCLE. SOIL FERTILITY. SOIL WATER. RICE STRAW. WHEAT STRAW.

446. Gauhar, Swalin; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Raghav, M.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Vegetable Science. Effect of integrated nutrient management on yield and quality of potato (Solanum tuberosum L.). Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.122-124 KEYWORDS: NUTRIENTS. ORGANIC AGRICULTURE. SOIL FERTILITY. POTATOES. SOLANUM TUBEROSUM.

P40 Meteorology and Climatology

447. Krishnamurthy, K.S.; Indian Institute of Spices Research, Calicut (India). Kandiannan, K.; Indian Institute of Spices Research, Calicut (India). Sibin, C.; Indian Institute of Spices Research, Calicut (India). Chempakam, B.; Indian Institute of Spices Research, Calicut (India). Ankegowda, S.J.; Cardamom Research Centre, Appangala (India). Trends in climate and productivity and relationship between climatic variables and productivity in black pepper (Piper nigrum). Indian Journal of Agricultural Sciences (India). (Aug 2011) v.81(8) p.729–33 KEYWORDS: PEPPER. CLIMATIC REQUIREMENTS. RAIN. PIPER NIGRUM. CLIMATIC FACTORS.

Trend analysis of the climatic parameters (past two decades) in major black pepper growing areas of the country showed in general that rainfall is decreasing while temperature is increasing. Black pepper productivity also showed a decreasing trend. Studies on the relationship between climatic parameters and productivity in black pepper showed that December and January rainfall had negative correlation while April and May

rainfall had positive correlation. Minimum temperature had positive correlation in higher elevations while both Tmax and Tmin had negative correlation with productivity in plains. Results on the extent of relationship between climatic parameters and productivity revealed that Tmax and Tmin influenced yield more than rainfall or rainy days. Normalized yield deviations (NYD) were worked out (deviations from the mean for two decades) for different stations based on the climatic data for the past two decades. This was regressed with rainfall, Tmax and Tmin to get regression line which can predict the yield deviations if values for rainfall, Tmax and Tmin are substituted in the equation. However, apart from the weather parameters used for the study, other weather variables such as light and humidity and other factors such as cost of cultivation and price for the produce, diseases and management practices definitely have a role in production and productivity of black pepper.

448. Kushwaha, H.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Chaubey, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Phool Chand; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Soil Science. Manisha Rani; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Shahi, U.P.; SVBPUA&T, Modipuram, Meerut (India). Department of Soil Science. Verification of NCMRWF forecast of four years at Pantnagar on the basis of per cent accuracy, H.K. score and ratio score. Pantnagar Journal of Research (India). (Jan-Jun 2009) v.7(1) p.60-63 KEYWORDS: WEATHER FORECASTING. METEOROLOGY. ECONOMIC SITUATION. PLANT PRODUCTION.

The influence of weather is in fact operative even before the crop is sown, as the moisture availability and the thermal regime of the seed zone determine the date of sowing and the appropriate crop genotype to be sown. In spite of cultivation of high yielding varieties, improved cultural practices and plant protection measures, favorable weather is must for good harvest. In India, the agromet advisory service in terms of adoption of NCMRWF weather forecast based farm operations by the farmers has become very successful in the country in general and G.B Pant University of Agriculture and Technology, Pantnagar in particular and is operative since 1991. The accuracy of weather forecast elements has increased manifold from 30% (1991-92) to 78% (2005-06) and farmers have been benefited by utilizing weather forecast based advisory in this area. In the present investigation, the economic use of location specific agro-meteorological medium range weather forecast (MRWF) of major weather elements viz. rainfall, cloud amount, wind speed & its direction, and maximum & minimum temperatures developed at National Centre for Medium Range Weather Forecast (NCMRWF), Noida on each Tuesday was carried out. The feed back collected indicated that farmers using the advisory based on MRWF on weather sensitive farm operations have been benefited significantly and required Agromet Advisory Service to continue in future for raising their economy. With a critical evaluation it could be concluded that the NCMRWF forecast accuracy for maximum and minimum temperature was found maximum and in all the four seasons it has been more than 80 per cent correct. As far as wind speed and wind direction forecast are concerned, it has been found to be 70 per cent accurate in almost all the four seasons. However, accuracy of cloud cover was maximum in south west monsoon season (66.5 %) followed by hot summer season (57.9 %), post monsoon season (53.6 %) and winter season (44.5 %). The rainfall which is the most important from agriculture point of view, the forecast value were found to be most accurate in post monsoon season (96.2%) followed by winter season (84.5%), hot summer season (82.3%) and lowest in the south west monsoon season (44.7%). The maximum value of ratio score for rainfall for Post monsoon season was 97.33% and that of H.K. Raio value for the same season was highest to be 0.621.

449. Kushwaha, H.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Chaubey, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Phool Chand; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science.

Manisha Rani; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Shahi, U.P; Sardar Ballabh Bhai Patel University of Agriculture and Technology, Modipuram, Meerut (India). Department of Soil Science. Economic impact of agromet advisory services in rice under Tarai conditions. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.53-57 KEYWORDS:ECONOMIC SITUATION. RICE. METEOROLOGICAL OBSERVATIONS. METEOROLOGY. WEATHER. EXTENSION ACTIVITIES.

The aim of agromet advisory service is to utilize the meteorological information on a real time basis for various agricultural operations including irrigation scheduling, disease, and pest management. Provision of weather based agro advisories to farmers in India is complex because of variety of climatic zones. Farming communities in these areas have their special needs in view of the varieties of cropping patterns. Area specific agro-meteorological advisory services (AAS) are, therefore, needed to suit the requirement of each agro-climatic zone. The AAS is a concept in this direction to help agriculturist to carryout farm operations in tune with the rhythm of prevailing and prognosticated weather. It also helps in monitoring the stage and state of crop, the impact of prevailing weather on them and the likely effect of prognosticated weather on their future performance. This paper discuss the economic impact of National Centre for Medium Range Weather Forecasting (NCMRWF), Noida s five days location specific medium range weather forecast (MRWF) applicable for Tarai & Bhabar agro-climatic zone of Uttarakhand, India, during rice seasons of 2004 and 2005. The paper focuses the benefits earned by farmers by better understanding the weather related information and forecast for increasing rice production over those not following the advisory on weather sensitive farm operations in the zone. The AAS farmers harvested an average of 18.0 and 19.2 q $acre^{-1}$ as compared to 17.3 and 18.1 q $acre^{-1}$ yield of rice crop, which was 6.8 and 8.9 per cent more than NON-AAS farmers for both the Kharif seasons of 2004 and 2005, respectively. The AAS farmers were able to reduce 7.6 and 9.0 per cent input cost as compared to NON-AAS farmers for both the year 2004 and 2005, respectively. Ultimately the AAS farmers gained 21.8 and 24.3 per cent more income than NON- AAS farmers for the year 2004-05 and 2005-06, respectively. The benefit-cost (B/C) ratio of AAS and NON AAS farmers were 1.7 & 1.8 and 1.5 & 1.6 for both the kharif seasons of 2004 and 2005, respectively indicating that farmers using the advisory on weather sensitive farm operations have been benefited significantly and required agromet advisory service to continue in future for appraisal of their economic conditions.

450. Kushwaha, H.S.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Chaubey, A.K.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Gangwar, S.P.; G.B. Pant University of Agriculture and Technology, Pantnagar (India). Department of Soil Science. Usability analysis of medium range weather forecast for farming community under agromet advisory service. Pantnagar Journal of Research (India). (Jan-Jun 2008) v.6(1) p.76-80 KEYWORDS: METEOROLOGICAL FACTORS. METEOROLOGY. EXTENSION ACTIVITIES. WEATHER FORECASTING. INFORMATION TECHNOLOGY.

Weather Forecast is referred as the prediction of weather in advance, Weather forecast assumes considerable importance for agricultural activities for the propose of effective planning of modern agricultural practices such as sowing of weather-sensitive high yielding varieties, efficient irrigation and harvest planning, weather forecasts with higher lead time are desirable. The continuous feed back from Pantnagar to NCMRWF has increased the accuracy of all the weather variables to more than 70 per cent indicating more usability of weather forecast for this region which has helped the farmers timely in decision making operations in their field crops for increasing their production.

T01 Pollution

451. Verma, Vijai; Lucknow University, Lucknow (India). Department of Botany. Sharma, Y.K.; Lucknow University, Lucknow (India). Department of Botany. Changes in suspended and respirable suspended particulate matters in relation to locations, years

and seasons. Pantnagar Journal of Research (India). (Jul-Dec 2009) v.7(2) p.187-191 KEYWORDS: AIR POLLUTION. ENVIRONMENTAL PROTECTION. URBAN AREAS. INDUSTRIALIZATION. UTTAR PRADESH.

Suspended particulate matter (SPM) and respirable suspended particulate matter (RSPM) data monitored at 4 residential, 6 commercial and one industrial locations over six years (2002-2007) and two seasons (pre-monsoon & post-monsoon) was statistically analysed. Results revealed significant influence of locations, years and seasons as well as their interactions on the concentration of SPM and RSPM. In general, their level was found maximum at commercial sites. SPM level exceeded prescribed limit of NAAQS at all residential locations and at one of the commercial locations (Charbagh), which is the major traffic junction in Lucknow city. RSPM level exceeded prescribed limits at all locations. Significant differences were found in the concentration of SPM and RSPM in different years. In general, SPM decreased linearly from 2002 to 2007. It is ascribed to adoption of adequate abatement measures. Seasonal effects were significant with less pollutant level during post–monsoon season than pre-monsoon season may be due to wash out effect of rains.

LIST OF CONTRIBUTORS

1. Indian Agricultural Research Institute
   Pusa, New Delhi – 110 012

2. National Research Centre for Sorghum
   Hyderabad-500030,
   Andhra Pradesh

3. National Research Centre on Rapeseed Mustard
   Sewar, Bharatpur-321303,
   Rajasthan

4. Vevekanand Parvatiya Krishi Anusandhan Sansthan
   Almora-263601, Uttarakhand

5. Directorate of Wheat Research
   P.B.No.158, Aggarsain Marg,
   Karnal-132001, Haryana

6. National Research Centre for Soybean
   Khandwa Road, Indore-452017,
   Madhya Pradesh

7. Indian Grassland & Fodder Research Institute
   Jhansi-284 003, Uttar Pradesh

8. Indian Institute of Sugarcane Research
   Lucknow-226 002, Uttar Pradesh

9. Indian Veterinary Research Institute
   Izatnagar-243122, Uttar Pradesh

10. Indian Agricultural Statistics Research Institute
    Library Avenue, Pusa,
    New Delhi-110012

11. National Centre for Agricultural Economics & Policy Research
    Library Avenue, Pusa,
    New Delhi-11012

12. Central Institute for Research on Buffaloes
    Sirsa Road, Hisar-125001, Haryana

13. National Research Centre for Equines
    Hisar-125001, Haryana

14. Central Inland Fisheries Research Institute
    Barrackpore-700120, West Bengal

15. National Institute of Research on Jute & Allied Fibre Technology
    12, Regent Park, Kolkata-700040,
    West Bengal

16. Directorate of Oilseeds Research
    Hyderabad-500 030, Andhra Pradesh

17. Central Potato Research Institute
    Shimla-171 001, Himachal Pradesh

18. Central Tobacco Research Institute
    Bhaskar Nagar, Rajamundry-533105, Andhra Pradesh

19. Central Plantation Crops Research Institute
    Kasargod-671124, Kerala

20. National Bureau of Animal Genetic Resource
    P.B. No.129, Karnal-132 001,
    Haryana

21. Central Research Institute for Jute & Allied Fibres
    Nilganj, Barrackpore-700120, West Bengal

22. Central Research Institute for Dryland Agriculture
    Hyderabad-500 059,
    Andhra Pradesh

23. Central Avian Research Institute
    Izatnagar-243 122, Uttar Pradesh

24. Directorate of Experiment Station
    G.B. Pant Univ. of Agri. & Technology
    Pantnagar – 263 145, Distt. Udham Singh Nagar, Uttarakhand

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28. Central Institute for Research on Goats
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29. Crop Protection Research Centre (CPRC)
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30. Central Soil Salinity Research Institute
    Karnal 132001, Haryana

31. Central Tuber Crops Research Institute
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32. National Bureau of Animal Genetic Resources
    G.T. Road Bye-Pass, P.B.No.129,
    Near Basant Vihar,
    Karnal-132001, Haryana

33. National Bureau of Plant Genetic Resources
    Pusa Campus, New Delhi 110012

34. National Centre for Integrated Pest Management
    LBS Building, Pusa Campus,
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35. National Dairy Research Institute
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36. National Research Centre on Camel
    Post Bag No.07, Jorbeer,
    Bikaner-334001, Rajasthan

37. Directorate of Groundnut Research
    Ivenagar Road P.B.No.5,
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