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C20 Extension

412. Babu, A.; Singh, P. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Extension). Problem solving approach of agricultural officers under peoples plan programme. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 744-747 KEYWORDS: ADIVISORY OFFICERS; EXTENSION ACTIVITIES; PARTICIPATION; SOCIAL PARTICIPATION; AGRICULTURAL WORKERS; PUBLIC OPINION.

E50 Rural Sociology and Social Security

413. Singh, N.; Brar, R. (Panjab University, Chandigarh (India). Govt. Home Science College)). Attitude and study habits in adolscents as influenced by television viewing. Annals of Biology (India). (Jan 2001) v. 17(1) p. 123-125 KEYWORDS: HUMAN BEHAVIOUR; BEHAVIOUR; YOUTH; TELEVISION.

A majority of students felt that television watching helped with their studies as it improved their general knowledge and skills. Percentage of adolescents attributed their decreased study involvement to television watching.

414. Rai, T.; Saini, N. (Guru Nanak Girls College, Yamuna Nagar (India). Dept. of Human Development)). Intelligence quotient (IQ) and emotional maturity of college students. Annals of Biology (India). (Dec 2001) v. 17(2) p. 223-226 KEYWORDS: MENTAL ABILITY; MATURITY; PSYCHOLOGICAL FACTORS; HUMAN BEHAVIOUR; STUDENTS; UNIVERSITIES.

The present investigation aims at exploring the pattern of intelligence quotient (lQ) and emotional maturity of a specific target group of college students and to detennine the association between intelligence and emotional maturity. A total of 100 college students comprising 50 males and 50 females studying in valied fields, ranging in age from 18 to 20 years, served as subjects. Standard progressive matrices and emotional maturity scale were used. The data obtained were subjected to computation of mean, standard deviation and chi-square test. The results of the present study revealed that there was a close association between IQ and emotional maturity. Majority of the respondents were above average in their intellectual capacity and were emotionally stable.

E73 Consumer Economics

415. Sarda, C. (Central Institute of Brackishwater Aquaculture, Chennai (India); Prajneshu (Indian Agricultural Statistics Research Institute, New Delhi (India). Modelling and forecasting country's pesticide consumption data using arima time-series approach. Annals of Agricultural

Research (India). (Dec 2002) v. 23(4) p. 719-722 KEYWORDS: CONSUMPTION; PESTICIDES; TIME SERIES ANALYSIS; FORECASTING; MODELS; DATA ANALYSIS.

Pesticide consumption in the country has jumped more than four-folds during the, tlrst twentyfive years of post Green-revolution era. Subsequently, in the ,last decade or so; it has witnessed a steady decline. Therefore, an important question, having far reaching policy implications, is to examine as to how long in future this declining trend is likely to continue. To this end, autoregressive integrated moving average (ARIMA) approach is'adopted. Standard software packages are employed to analyze time-series data. An interesting conclusion emerging out of the analysis is that the declining trend in country's pesticide consumption is likely to be reversed in near future.

E80 Home Economics, Industries and Crafts

416. Kumar, J.; Anand, R.C.; Yadav, K.S.; Mehra, R.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Microbiology)). Effect of temperature and pH on decolourization of dyes. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 241-243 KEYWORDS: DYES; TEMPERATURE; BIODEGRADATION; DECOLOURIZATION; PH; CHEMICAL REACTION; BIOLOGICAL ANALYSIS; CHEMICAL REAGENTS.

The effect of temperature and pH on decolourization of dyes viz., crystal violet, malachite green and brilliant green from isolates obtained from textile effluent was studied. The optimum temperature and pH were 30°C and 7.0, respectively, for all the three dyes tested. However, brilliant green dye was not decolourized at the temperatures and pH tested. The decrease in decolourization of dye was 50-70 percent with the increase in temperature from 30°C to 40°C. Similar trend was observed when pH was increased to 8.0.

F01 Crop Husbandry

417. Bhargava, B.S. (Maharashtra Stae Grape Growers' Association, Pune (India). R & D Research, Training Service and Demonstration Stn.). Leaf analysis for nutrient diagnosis, recommendation and management in fruit crops. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 352-373 KEYWORDS: NUTRITIONAL REQUIREMENTS; NUTRITIONAL DISORDERS; PLANT ANATOMY; FRUIT CROPS; PLANT NUTRITION; LEAF MEAL.

418. Bama, K.S. (Tamil Nadu Agricultural University, Coimbatore (India). Dept. of Soil Science and Agricultural Chemistry); Basker, A. (Pandit Jawaharlal Nehru College of Agriculture, Karaikal (India); Jayakumar, R. (Tamil Nadu Agricultural University, Coimbatore (India). Dept. of Soil Science and Agricultural Chemistry). Degradation and persistence of mepiquatchloride in lateritic soils (Typic hapluhumults). Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 505-507 KEYWORDS: CROP HUSBANDRY; SOIL SCIENCE; MEPIQUAT; AGRICULTURAL CHEMISTRY; DEGRADATION; PESTICIDE PERSISTENCE; FERRALSOLS.

419. Yadava, J.S.; Singh, A.K.; Chauhan, J.S. (National Research Centre on Rapeseed-Mustard, Bharatpur (India)). Stategic issues for doubling the productivity of rapeseed-mustard in next decade in India. Annals of Biology (India). (Jan 2001) v. 17(1) p. 1-20 KEYWORDS: RAPESEED;

MUSTARD; PRODUCTIVITY; YIELDS; OIL CROPS; PRODUCTION; CROPPING SYSTEMS; TECHNOLOGY; INDIA.

India grows a wide range of oilseed crops. Nearly 64 percent of the total edible oils produced in the country is derived from groundnut and rapeseed-mustard. Rapeseed-mustard with 25.6 percent of the total 26.81 million hectares of area under nine oilseeds, 27.8 percent of the total annual oilseeds production and 32.3 percent of the total annual edible oil production, is the second major group of oleiferous crops next to groundnut. At the' global level, India ranks second next. only to China and accounts for 27.5 and 20 percent of the total hectarage and production share. of rapeseed-mustard, respectively. Unlike other oil seeds (groundnut, soybean and sunflower), the rapeseed-mustard of commerce is not necessarily the product of a single species. Under the names rapeseed and mustard, seven important annual oil seeds belonging to the Brassicaceae (Cmciferae) are grown in India. They are Indian mustard [Brassica juncea (L.) Czern & Coss.], commonly called rai (raya or laha), the three ecotypes of Indian rape, B. campestris L. (Syn. B. rapa) ssp. ole!fera viz., toria, brown sarson (lotni and tora types) and yellow sarson, Swede rape or Argentina mustard or gobhi sarson (B. napus L.), Ethiopian mustard or karan rai (B. carinata Braun.) and taramira or tara (Eruca sativa Mill.). In trade, toria, brown sarson, yellow sarson, gobhi sarson and taramira are known as rapeseed, and raya and karan rai as mustard. On the Indian subcontinent B. juncea is the dominalit species grown, although some areas are also sown with B. call1pestris types (tori a and sarson). Besides, taramira, believed to be a native of southern Europe and north Africa is grown in the drier parts of north-west India comprising the states of Punjab, Haryana, Uttar Pradesh and Rajasthan. Of late, two other exotics, namely, gobhi sarson and karan rai are becoming popular with the farmers in the states of Himachal Pradesh, Punjab, Haryana, Rajasthan and Uttar Pradesh where winter spell is longer. While gobhi sarson cultivation is confined only to irrigated areas; karan rai is better adapted to rainfed conditions. The rapeseedmustard group of crops is largely grown under the hardy conditions of rainfed agriculture with low input management during rabi season, but has a good inherent potential to convert natural resources into usable biological energy.

420. Singh, A.; Singh, S. (National Research Centre for Citrus, Nagpur (India)). Effect of lanking of branches on the quality of Nagpur mandarin fruits. Annals of Biology (India). (Jan 2001) v. 17(1) p. 71-74 KEYWORDS: CITRUS RECTICULATA; QUALITY; FRUITS; BRANCHES; SIZE; COLOUR.

During the years of heavy bearing of Nagpur mandarin, the branches lanle Effect of this lanking of branches was studied on size, weight and quality of fruits in comparison to. nonnal straight branches of the same plants. The fully coloured fruits in lanking branches were smaU and had low TSS : acid ratio in comparison to yellow and green ftuits. This situation was reverse in ftuits from straight branches. It was observed that lanking of branches reduced fruit size, weight and fruit quality. It is suggested that to improve the ftuit quality, only optimum ftuit load should be allowed on the plant by avoiding the reduction of lanking of branches.

421. Sandhu, G.S. (Chaudhary Charan Singh Hisar Agricultural University, Sirsa (India). Cotton Research Centre)). Adoption of package of practices of wheat in Sirsa district. Annals of

Biology (India). (Jan 2001) v. 17(1) p. 115-118 KEYWORDS: TECHNOLOGY; WHEATS; INNOVATION; VARIETIES; FARMERS; HARYANA; PRODUCTION; APPROPRIATE TECHNOLOGY.

Studies on adoption of package of practices in wheat of Sirsa district were conducted during 1999-2000 rabi crops season. Observations of 250 fanners from 25 villages of five circles were recorded with respect to 13 practices of wheat production technology. It was observed that all the fanners grew improved varieties and there was a total good response by the old varieties like C-306. Good response of the fanners was also observed for seed rate, irrigation, use of urea, DAP and weedicide. The majority of the fanners used no zinc. Similar trend was also observed for seed treatment. None of the fanners had adopted foliar spray of urea/zinc/DAP. The use of Azotobacter is popularized llow-a-days but it appears that fanners are not aware of the said practice at all.

422. Gayen, P.; Singharoy, A.K. (Uttar Banga Krishi Viswavidyalaya, Cooch Behar (India). Faculty of Agriculture)). Estimation of leaf area in tosa jute (Corchorus oletorius L.) by linear measurements. Annals of Biology (India). (Dec 2001) v. 17(2) p. 179-182 KEYWORDS: CORCHORUS OLETORIUS; LEAF AREA; MEASUREMENT; AGRONOMIC CHARACTERS; WEST BENGAL.

Six cultivars of tosa jute (Corchorus olelorius L.) were grown during pre-kharif 2000, following normal agronomic practices at the University Research Farm, Pundibari, Cooch Behar which is one of the terai districts of West Bengal. Thirty random matured leaves from each cultivar were collected at 95 days crop age. Con-elation coefficients of leaf area with lenboth, breadth. multiple of length and breadth and dry weight of leaves were highly significant and positive in each cultivar and over cultivars. Breadth of leaf or multiple of length and breadth can be successfully utilized to estimate the leaf area in situ in tosa jute inespective of cultivars. The equations may be Y=18.02Xt 42.23 or Y=0.69X1+2.77. where 'Y' is estimated leaf area and 'XI' and 'X2' :ue the breadth and multiple of length and breadth of leaf.

423. Gupta, T.C.; Mali, A.L.; Nanwal, R.K.; Sharma, R.K. (Rajasthan College of Agriculture, Udaipur (India). Dept. of Agronomy)). Performance of dual purpose elite sorghum genotypes at varying plant densities with respect to physiological parameters, biological yield, nitrogen uptake and protein content . Annals of Biology (India). (Dec 2001) v. 17(2) p. 195-198 KEYWORDS: PLANT POPULATION; SORGHUM BICOLOR; PROTEIN CONTENT; NUTRIENT UPTAKE; NITROGEN; YIELDS; GROWTH.

An experiment was conducted at Udaipur to assess the relative performance of promising dual purpose sorghum genotypes at different plant densities. The result of experiment revealed that genotype Spy 946 registered significantly higher values of crop growth rate, relative growth rate and total mtrogen uptake over Spy 938 and the check Spy 462. Protein content in grain was also significantly higher in promising genotype Spy 946 over Spy 938, whereas it was at par with Spy 462. These genotypes were unable to cause any significant difference in protein content in fodder. There was significant reduction in above mentioned parameters as plant population increased fwm lowest (1.5 x 105 plants ha-1) to highest (2.4 x IOs ha-J) except biological yield significantly which was highest at 2.1 x 105 plants ha-1 and

total nitrogen uptake which was not reduced significantly upto plant density of 2.1 x IOs plants ha-l. Thereafter there was significaut reduction.

424. Rai, L.; Hasija, R.C.; Kaushik, L.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Mathematics and Statistics)). Perspective and retrospective of cotton crop in Haryana. Annals of Biology (India). (Dec 2001) v. 17(2) p. 213-218 KEYWORDS: COTTON; ECONOMIC GROWTH RATE; YIELD; PRODUCTION; HARYANA; PRODUCTIVITY; ECONOMICS.

Cotton is one of the most important commercial crops grown in Halyana state and contlibutes a major share in state economy. In this study, an attempt has been made to examine the rate of growth as well as forecasting of area, production and productivity of American and desi cotton and factors influencing variability of yield in different distlicts of the state. For forecasting linear, quadratic, exponential power and logarithmic curves have been fitted and projections have been made on the basis of the best fitted regression model.

425. Tyagi, P.K.; Pannu, R.K.; Sharma, K.D.; Chaudhary, B.D.; Singh, D.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy)). Effect of sowing time on performance of wheat genotypes. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 119-122 KEYWORDS: SOWING DATES; GENOTYPES; WHEAT; TRITICUM AESTIVUM; GRAINS; YIELDS.

Twenty-five wheat (Triticum aestivum L.) genotypes were evaluated for their yield performance under two sowing dates viz., 20 November (normal) and 21 December (late) during rabi (winter) season of 2000-01 at Agronomy Research Farm ofCCS Haryana Agricultural University, Hisar (29°10' N latitude, 75°46' E longitude and 215 M altitude). The results revealed that number of grains spike'l, grain and biological yield were reduced significantly under late sown condition. The 3 I-day delay in sowing beyond 20 November reduced the grain yield from 5587 to 4410 kg ha.-1 i. e. 21.1 percent. Genotypes PBW 484 (6716 kg ha-l), WR 251 (6617 kg ha-l), UP 2425 (6457 kg ha-l), HUW 234 (6358 kg ha-l) and PBW 435 (6235 kg ha-1) were highest grain yielder under normal sown condition. Whereas PBW 483 (5284 kg ha"), HD 2428 (4926 kg ha-1l), NIAW 612 (4915 kg ha-1l), NIAW 34 (4864 kg ha-1) and PBW 435 (4815 kg ha-l) were highest grain yielder under late sown condition. The stress tolerance index was highest in genotypes PBW 435 (0.96) followed by UP 2425 (0.95) and HUW 234 (0.94). The significant positive correlation of biological yield with grain yield under both the environments indicated that total plant biomass yield played an important role for higher grain yield in wheat.

426. Ralli, S.; Dhingra, K.K. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy)). Response of soybean to different planting methods . Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 151-155 KEYWORDS: CULTIVATION; GLYCINE MAX; SOWING; METHODS; YIELDS; PLANTING; SOYABEANS.

A field experiment was conducted during the kharif season of 2000 on loamy sand soil to assess the effect of different planting methods i. e. sowing on flat, ridge, furrow, bed and sowing of water soaked seeds. Among methods of sowing, ridge and bed methods recorded significantly higher temperatures over furrow and flat sowing methods, whereas furrow method recorded significantly lower temperature than all other sowing methods. Sowing on

ridges, beds or in furrows did not influence yield performance of soybean as compared to flat method of sowing. Similarly, soaking of seeds in water before sowing failed to improve emergence, growth and yield of soybean.

427. Pathak, K.; Barman, U.; Kalita, M.K.; Saha, N.N. (Assam Agricultural University, Cachar (India). Krishi Vigyan Kendra)). Assessment of management practices on production of rapeseed under rainfed condition in farmer's field of Assam. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 157-159 KEYWORDS: CROP MANAGEMENT; BRASSICA CAMPESTRIS; CULTURAL METHODS; RAPESEED; RAINFED FARMING; PRODUCTION; FIELD EXPERIMENTATION; ASSAM.

On-farm trials were conducted from 1996-97 to 1998-99 to study the influence of difierent management practices on the productivity of rapeseed (Brasica campestris var. toria). The productivity of toria could be increased by 85.3,52.9 and 21.8 percent over farmer's practices adopting integrated approach of recommended NPK +borax 10 kg/ha+need-based plant protection measures, application of only recorrunended NPK and half of the recommended NPK, respectively. Highest net retum (Rs./ha) was recorded with the integrated approach of management practices.

428. Yadav, L.M. (Rajendra Agricultural University, Saharsa (India). Regional Research Stn.). To select high yielding variety of omum (Trachyspermum ommi Linn.). Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 175-177 KEYWORDS: SELECTION; HIGH YIELDING VARIETIES; OMUM; TRACHYSPERMUM OMMIL LINN.

Out of eight varieties under study, the variety RA-I showed superiority in plant height, number of branches per plant, number of umbles per plant, number of seeds per umble and seed yield. The pooled mean seed yield of 10.27 qlha was recorded with var. RA-I which was 1.25 q/ha higher than check var. RA-9 and 2.27 qlha than var. RA-6 which was lowest yielder among all varieties under study.

429. Singh, I. (Indian Agricultural Research Institute, New Delhi (India). Div. of Plant Physiology and Biochemistry); Shono, M.; Fukamachi, H.; Suzuki, K (Japan International Research Centre for Agricultural Sciences, Okinawa (Japan). Okinawa Subtropical Stn.). Effect of heat stress on gas exchange characteristics in tomato. Indian Journal of Plant Physiology (India). (July-Sept 2005) v. 10(3) p. 283-286 KEYWORDS: HEAT STRESS; PHOTOSYNTHESIS; STOMATAL CONDUCTANCE; TRANSPIRATION.

The effect of high temperature on CO2 fixation was studied in four tomato genotypes, viz. Ailsa craig, Suncherry extra, DCA 204A and CLN 2026E. High temperature adversely affected the CO2 gas exchange characteristics at the onset of flowering in all the four genotypes but magnitude of response differed. Photosynthetic rate was reduced significantly by heat-stress in genotypes DC 204A and Suncherry extra at early flowering stage (75 DAS) but it did not change in Ailsa craig and CLN 2026E. Significant reduction in photosynthetic rate due to heat-stress was observed during late flowering and ripening stage. The magnitude of reduction, however, was higher in genotypes Suncherry extra and DC 204A.. Transpiration rate increased significantly in all the four genotypes at early flowering stage during heat-stress. However, we

observed significant decrease in transpiration rate at later growth stages in Suncherry extra and DC 204A and this could be the possible reason for lesser adaptability of these genotypes at high temperature. The stomatal conductance followed same pattern, as of transpiration at flowering stage; however, stomatal conductance was not affected by heat-stress at ripening stage. The internal CO2 concentration increased in all the four genotypes at flowering stage, however, no significant change in internal CO2 concentration was noticed during ripening stage at high temperature.

430. Nayak, B.C.; Dalei, B.B.; Choudhury, B.K. (Orissa University of Agriculture and Technology, Bhubaneswar (India). Dept. of Agronomy). Response of hybrid rice (Oryza sativa) to date of planting, spacing and seedling rate during wet season. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 172-174 KEYWORDS: ORYZA SATIVA; PLANTING DATE; SEEDLINGS; HYBRIDS; SAPCING; WET SEASON; YIELD COMPONENTS; YIELDS; HARVEST INDEX.

A field experiment was conducted at Bhubaneshwar during wet season of 1999 and 2000, to find out the response of hybrid rice 'Pro Agro 6201' to 3 dates of planting (16, 31 July and 16 August), 3 spacings (20 cm x 15 cm, 20 cm x 10 cm and 15 cmx 15 cm) and 2 seedling rates (1 and 2 seedlings/hill). Planting the crop on 16 July recorded the highest grain yield, which declined by 5.5 and 24.3 percent due to 15 and 30 days delay in planting respectively. Yield did not vary significantly due to spacing during the first year. During the second year, planting the crop with a closer spacing of 20 cm x 10 cm yielded significantly more than that with wider spacing of 20 cm x 15 cm. Planting 2 seedlings/hill was beneficial with yield advantage or 8.2 percent over 1 seedling/hill.

431. Jat, R.S.; Nepalia, V.; Jat, R.L. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Agronomy). Effect of weed control and sowing methods on production potential of wheat (Triticum aestivum) . Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 192-195 KEYWORDS: TRITICUM AESTIVUM; WEED CONTROL; YIELD COMPONENTS; CONTROL METHODS; YIELDS; HERBICIDES; SOWING; PRODUCTION POSSIBILITIES.

A field experiment was conducted during winter seasons of 1999-2000 and 2000-2001 to find out effect of weed control and sowing methods on production potential of'Lok l' wheat (Triticum aestivum L. emend. Fiori & Paol.). Twentyfour treatment combinations consisted of 8 weed-control treatments and 3 methods of sowing. On pooled basis, the monocot and dicot weeds constituted 23.4 and 76.6 percent weed population respectively. Tank mix application of metsulfuron methyl and isoproturon (4+750 g/ha) recorded the lowest weed dry matter which was at par with other tank mix applications but statistically superior to individual applications. Among individual applications, isoproturon was found statistically superior in reducing weed dry matter. The weed-control treatments recorded significantly higher yield attributes, yield, net returns and benefit: cost ratio compared to weedy check. Application of metsulfuron methyl + isoproturon (4 + 750 g/ha) recorded maximum values of all these parameters which were at par with other tank mix applications but found statistically superior to individual applications. Among individual applications, isoproturon recorded maximum value but found statistically equivalent to other individually applied herbicides. The maximum values of yield attributes, yield, net return and benefit: cost ratio were recorded in cross

sowing (22.5 cm x 22.5 cm) compared to normal (22.5 cm) and close (18 cm) line sowing. Cross-sowing methods also recorded lowest weed dry matter.

432. Gozubenli, H.; Sener, O.; Konuskan, O.; Kilinc, M. (Mustafa Kemal University Agricultral Faculty, Hatay (Turkey). Field Crops Dept.)_. Effect of hybrid and plant density on grain yield and yield components of maize (Zea mays). Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 203-205 KEYWORDS: ZEA MAYS; MAIZE; HYBRIDS; PLANT POPULATION; YIELD COMPONENTS; YIELDS.

A study was carried out to find out optimum plant densities for maize (Zea mays L.), hybrids mostly cultivated as a second crop in Hatay, Turkey, during 2000 and 2001. Five maize hybrids ['Cargill 6127', 'Oekalb 626,' 'Oracma' ('Novartis'), 'Pioneer 3394' and Ttm 815] were examined at 6 plant densities [50,000, 60,000, 70,000, 80,000, 90,000 and 100,000 plants/ha]. The effects of hybrids and plant densities on yield and yield components were statistically significant, however, hybrid x plant density interaction effects were not significant. The highest grain yield was obtained from 'Oracma' and 'P 3394' hybrids (9,591 kg/ha and 9,170 kg/ha respectively). GraIn yield increased with increasing plant densities up to 90,000 plants/ha (9,406 kg/ha) but slightly decreased at 100,000 plants/ha.

433. Raskar, B.S. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Water Management Project). Effect of planting technique and fertigation on growth, yield and quality of banana (Musa sp.). Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 235-237 KEYWORDS: PLANTING; BANANAS; MUSA; FERTIGATION; YIELDS; YIELD COMPONENTS; WATER USE; EFFICIENCY; ECONOMICS; QUALITY.

An experiment was conducted during 1997-98 and 1999-2000 to assess the effect of planting technique and fertigation through drip on the growth, yield and quality of banana (MU5 sp.). Twelve treatments comprising fertilizer sources [water-soluble and straight (N through drip)], 3 fertilizer levels [50, 75 and 100 percent of recommended fertilizer (444:178:888 kg N : P2O5 : k2O/ha)J and 2 planting systems [normal planting (1.5 m x 1.5 m) and triimgulafpaired planting (0.90-2.10 m x 1.5 m) along with surfaca method of irrigation using straight fertilizer as usual were tried in factorial randomized block design with 3 replications. Banana yield was significantly higher under normal planting than paired planting, resulting 11.38 percent higher fruit yield. The yield of banana was increased significantly where water-soluble fertilizer used in fertigation compared to straight fertilizer. The yield, pulp: peel ratio and total soluble solids (TSS) were increased significantly by application of 100 percent recommended dose of fertilizer. Application of 50 percent recommended fertilizer dose thought drip, resulted in 50 peercent of fertilizer saving than surface irrigation. Water-use efficiency under drip at 100 percent fertilizer level was more than double compared to surface method of irrigation (2.18 kg/ha-cm). The returns and benefit: cost ration were significantly higher in normal planting in straight fertilizer with N through drip and application of 100 percent recommended dose of fertilizer than those observed under the treatments of paired planting straight fertilizer and lower fertilizer levels.

434. Guha Sarkar, C.K.; Srivastava, P.S.L.; Deshmukh, P.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics). Effect of terminal high temperature stress

tolerance in bread wheat (Triticum aestivum L. Em. Thell.) : Estimation of character association and contribution of yield attributes to grain yield. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 75-78 KEYWORDS: HEAT STRESS; HEAT TOLERANCE; WHEATS; TRITICUM AESTIVUM; STATISTICAL ANALYSIS; GENOTYPES; GENETIC CORRELATION; AGRONOMIC CHARACTERS; YIELDS; YIELD COMPONENTS.

The present study on correlation and path coefficient for fifteen morphophysiological traits itl fifteen diverse wheatcultivars under three different temperature regimes showed high positive correlation of harvest index, biomass and 100 grain weight with grain yield for all environments. Ear length was also positively associated with grain yield for late planting. Path analysis confirmed the results of correlation and revealed the importance of the three traits on seed yield, suggesting their direct use for genetic improvement of wheat suited for any environment. Along with these, ear length proves to be of an important trait for consideration in breeding for terminal high ternperatures stress tolerance.

435. Kumar, K.S. (Kerala Agricultural University, Trivandrum (India). Dept. of Horticulture). Character association in banana CV. Nendran (Musa aab group). Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 105-108 KEYWORDS: BANANAS; YIELDS; GENETIC VARIATION; MUSA; YIELD COMPONENTS; GENOTYPES; GENETIC CORRELATION; STATISTICAL METHODS; PHENOTYPES.

Estimates of phenotypic correlation revealed that bunch yield in Nendran banana is strongly associatyd with length ofbunc~, number of hands, numper of fingers, length, girth and weight of fingers, leaf area (Juration (LAD), height of plant and. girth of pseudostem at bunch emergence. Path coefficients showed that weight offinger, number of hands. and length of bunch along with height of plant are the major characters that contributed to final bunch yield. Though indirect, girth oft inger, leaf area, LAD and grith ofpsendostem at bunchernergence also had signIficant effect on final bunch yield.

436. Arora, S.K.; Singh, J.; Batra, B.R.; Mehra, R.; Singh, J. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Vegetable Crops). Effect of plant density and irrigation levels on shoot-root growth and fruit yield in chilli (Caposicum annuum L.) CV. HC-44. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 136-140 KEYWORDS: PLANT POPULATION; CAPSICUM ANNUM; GROWTH; YIELDS; CHILE; IRRIGATION.

Field experiments comprising of six plant densities and four irrigation levels were conducted to study their effect on shoot-root growth and fruit yield in chilli cv. HC-44 during 1?94 and]995. Among various levels of plant densities tested Ds (24 plants/ plot) produced maximum dry weight ofleaves, root length and root biomass whereas D4 (60 plants/plot) produced maximum fruit yield (q/ha). Among the irrigation levels tested]3 (ID/CPE ratio of 1.0) gave maximum dry weight ofleaves and fruit yield (q/ha) while 12 (ID/CPE ratio of 0.75) gave maximum root length and root biomass. The interaction effect of plant density and irrigation levels showed that D4IJ (60 plants/pot with irrigation level having lD/CPE ratio of 0.75) resulted in maximum yield of red ripe fruits while least was recorded in Dsl3 (24 plants/plant with ID/CPE ratio of 1.0).

437. Pal, M.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Effect of plant density on seed yield and harvest index of sunflower (Helianthus annuus L.) in tarai belt of Uttranchal. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 155-158 KEYWORDS: PLANT POPULATION; HARVEST INDEX; HELIANTHUS ANNUS; SEED; YIELDS; GROWTH; YIELD COMPONENTS; UTTAR PRADESH.

438. Mishra, S.K.; Gupta, B.; Shrivastava, G.K.; Lakhera, M.L.; Rathore, A.L.; Choubey, N.K. (Indira Gandhi Agricultural University, Raipur (India). Dept. of Agronomy). Correlation and path coefficient analysis in chickpea (Cicer arietinum L.). Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 168-170 KEYWORDS: CHICKPEAS; GROWTH; STATISTICAL METHODS; YIELDS; YIELD COMPONENTS; CICER ARIETINUM.

439. Singh, K.P. (Indian Institute of Horticultural Research, Bangalore (India). Response of gerbera to planting densities under naturally ventilated greenhouse. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 177-179 KEYWORDS: GERBERA; PLANT POPULATION; GREEN HOUSES; CUT FLOWERS; GROWTH.

440. Rani, R.B.; Ramaswamy, N. (Agriculture College and Research Institute, Madurai (India). Dept. of Horticulture). Path analysis of yield attributes in open pollinated clones of Cassava esculenta Crantz). Annals of Agricultural Research (India). (Sep 2002) v. 23(2) p. 578-580 KEYWORDS: CASSAVA; MANIHOT ESCULENTA; YIELD COMPONENTS; STATISTICAL METHODS.

Path coefficient analysis of yield attributes in twenty one open pollinated clones of cassava was undertaken and conclusion drawn. Tuber girth exerted maximum direct effect on tuber yield per plant. Height at first branch, tuber length, plant height and harvest index'were found to contribute positive and direct effect to yield per plant.

441. Shekhawat, P.S.; Gautam, R.C. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Effect of row spacings and weed control methods on growth attributes and grain yield of maize under tilled and untilled conditions. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 626-629 KEYWORDS: SPACING; WEED CONTROL; GROWTH; TILLAGE; MAIZE; ZEA MAYS; YIELDS; YIELD COMPONENTS.

Afield experiment was conducted at Crop Research Centre, Pantnagar during 1999 and 2000 to study the effect of row spacing and weed control methods of growth attributes and grain yield of maize under tilled and untilled conditions. Tilled conditions caused slight to moderate increase in growth attributes and grain yield per plant over the untilled plots. Similarly, row spacings had non-significant effect on growth attributes and grain yield per plant over the untilled plots, but the difference was non-significant except grain yield per plant during 2000 only. All the weed control treatments caused significant increase in growth attributes and grain yield of maize over the weedy check during both years. Maximum number of green leaves, plant height plant dry matter accumulation, effective root length, root dry weight and grain yield per plant were recorded under weed free plots.

442. Singh, F.; Sinsinwar, B.S.; Premi, O.P.; Kumar, M. (National Research Centre on Rapeseed-Mustard, Bharatpur (India). Effect of low monetary agro techniques on sustained productivity

of mustard (Brassica juncea). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 638-641 KEYWORDS: LOW INPUT AGRICULTURE; MUSTARD; SOWING; THINNING; BRASSICA JUNCEA; YIELDS; YIELD COMPONENTS; GYPSUM; LIPID CONTENT; SUSTAINABILITY; APPROPRIATE TECHNOLOGY.

A field experiment was conducted during rabi seasons of 1996-97 and 1997-98 to study the effect of thinning, detopping, sowing direction, use of gypsum removal of 4th row and 4th plant (for fodder) and limited use of water. The recommended practices + thinning at 15 and 25 DAS + detopping at bud initiation stage produced seed yield at par with recommended practices + thinning at 15 and 25 DAS and recommended practices + thinning at 15 and 25 DAS + N-S sowing, but recorded 12.6 percent higher seed yield over local practices. The oil content did not show any significant variation among different agro techniques.

443. Singh, A.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Engineering); Singh, V. (Raja Balwant Singh College, Bichpuri (India). Dept. of Horticulture). Influence of set size and time of planting on growth, yield and grade of kharif onion bulbs. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 654-658 KEYWORDS: PLANTING; ALLIUM CEPA; YIELDS; GROWTH; YIELD COMPONENTS; PLANTING DATE; ONIONS; SEED SIZE.

A field trial was conducted during kharif season of \998-99 and 1999-2000 to study the combind effect of size of onion mother sets and time of planting on the growth, yield and marketable grade bulbs of onion cv. 'N-35'. Larger set size higher with early time of planting (2\ August) produced significantly higher plant height long leaf, thicker plant neck bulb maturity, fresh weight, diameter, gross yield, marketable yield, recovery percentage of' A' grade bulbs and' B' grade of bulbs during both the years.

444. Kumar, A.; Mishra, B.N.; Mishra, P.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Influence of age of seedling and plant density on yield and nutrient uptake by rice hybrids. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 680-684 KEYWORDS: HYBRIDS; SEEDLINGS; NUTRIENT UPTAKE; RICE; PLANT POPULATION; YIELDS.

The yield performance of 20 days old seedling was significant and it recorded 4.3 and 11.6 per cent more grain yield over 25 and 30 days old seedling. Planting 25 plants/m2 proved superior,33 and 50 plants/m2. In case of hybrids, a non-scented hybrid, Pusa RH.6 gave 13 per cent more grain yield to that of a scented hybrid Pusa RH.I 0 with adxance in the age of seedling the total N, P and K uptake remarkably decreased. The N and P uptake were significantly higher at a density of 25 plants/m2 whereas K uptake at 50 plants/m2. Rice hybrids significant varied in nutrients uptake.Pusa RH.6 recorded 13.6: 14.2 and 16.1 per cent higher N, P andK uptake respectively to that of Pusa RH.IO.

445. Singh, K.P. (Indian Institute of Horticultural Research, Bangalore (India). Effect of planting methods and earthing up on gladiolus. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 723-725 KEYWORDS: PLANTING; GLADIOLUS; CUT FLOWERS; HILLING; YIELD COMPONENTS.

446. Rana, G.S.; Sharma, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Horticulture). Effect of different intensities of shade houses on the

performance of strawberry (Fragaria xananassa Duch) cultivars. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 730-731 KEYWORDS: STRAWBERRY; SHADING; GROWTH; PRODUCTION; PHYSICAL CONTROL; FRAGARIA; VARIETIES; YIELDS.

447. Narwal, S.S.; Sardana, V. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Effect of harvest stages on the seed quality of different sorghum (Sorghum bicolor (L.) Moench) varieties. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 737-739 KEYWORDS: SORGHUM; SORGHUM BICOLOR; SEED QUALITY; HARVESTING FREQUENCY; VARIETIES; SEED TESTING.

448. Sharma, M.K.; Joolka, N.K. (Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni (India). Dept. of Pomology). Effect of bioregulators and rootstocks on growth, photosynthetic efficiency and water relations of Nonpareil almond. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 740-743 KEYWORDS: ALMONDS; ROOTSTOCKS; PHOTOSYNTHESIS; PLANT WATER RELATIONS; PLANT GROWTH SUBSTANCES.

F02 Plant Propagation

449. Jain, A.; Babber, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Botany)). Micropropagation of CMS line of sunflower (Helianthus annuus L.). Annals of Biology (India). (Dec 2001) v. 17(2) p. 141-145 KEYWORDS: MICROPROPAGATION; HELIANTHUS ANNUUS; CALLUS; INVITRO; REGENERATION; INVITRO REGENERATION.

Callus induction and plant regeneration from shoot apex, cotyledon, petiole, leaf, hypocotyl, coty-ledonary node and nodal explants of CMS-7-1A and CMS-7-1B lines of Helianlhus annuus L. were tried on Murashige and Skooge's (MS) medium supplemented with several concentrations of the auxins (NAA) and cytokinin (BAP). Responses varied according to the hormonal concentrations and explant type. Rooting of shoots. was achieved on honnone free MS medium.

450. Girhotra, R.P. (Punjab Agricultural University, Ludhiana (India). Dept. of Plant Breeding); Brar, K.S. (Punjab Agricultural University, Bathinda (India). Regional Research Stn.); Sandhu, B.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Plant Breeding). Micropropagation of male sterile lines in cotton. Annals of Biology (India). (Dec 2001) v. 17(2) p. 147-151 KEYWORDS: MICROPROPAGATION; GOSSYPIUM HIRSUTUM; GOSSYPIUM ARBOREUM; HARDENING; INVITRO; AUXINS.

Shoot tips from 8-10 days old seedlings and axillary buds from 35-40 and 55-60 days field grown plants of Gossypium hirsutum CMS LH 900 and (G. arboretum GMS DS 5 were aseptically cultured on different media, 1/2, MS+sucrose (I percent) proved to be the best medium for explant establish ment as well as shoot proliferation in vilro, whereas root induction was best on y, MS+IBA (2 mg/-I) + sucrose (I percent). Seedlings survival in creased significantly when rooted plantlets were hardened in , MS+sucrose (I percent)+mannitol (3 percent) for 5-6 days and then transferred to the soil. Addition of phytohormones and high concentration of sucrose if more than 1.5 percent proved hannful for micropropagation. Explant taken from younger plants gave hetter response than older plants. Subsequent suh-

culturing lowered the mean rate of axillary bud proliferation. Further screening of genotypes and retlnement of micropropagation techniques are required to increase the rate of in vitro multiplication upto the level where it can be used for commercial purposes.

451. Jain, A.; Punia, M.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding)). Callus induction and plant regeneration studies in sunflower (Helianthus annus L.) using different explants and genotypes. Annals of Biology (India). (Dec 2001) v. 17(2) p. 171-175 KEYWORDS: GENOTYPES; CALLUS; INDUCED MUTATION; REGENERATION; HELIANTHUS ANNUUS; EXPLANTS; INVITRO CULTURE.

The present study consisted of four sunflower genotypes viz., CMS7-IA, RHA-271, CMS7-JA x RHA-27 I (Hyblid), CMS-234A and their four explants viz., hypocotyl, cotyledon, apical meristem and leaf were tested for callus development and plant regeneration. Callusogenesis and plant organogenesis varied depending upon genotype, explant and medium used. APSH-ll hybrid (CMS7-IA x RHA-271) showed highest callus induction on MSD4 medium (MS+0.5 mg/1 BAP+0.05 mg! I NAA) and plant regeneration on R medium (MS+ 1.0 mg/1 BAP+O.I mg/1 G~ +500 mg/1 C. A) from explants hypocotyl and apical melistem, respectively.

452. Yadav, R.K.; Kumar, A. (Central Soil Salinity Research Institute, Karnal (India); Lal, D. (Central Institute for Research onBuffaloes, Hisar (India). Effect of cutting management and nitrogen levels on biomass production and proximate quality of barley (Hordeum vulgare) in saline soil. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 199-202 KEYWORDS: HORDEUM VULGARE; BIOMASS; BARLEY; CUTTING; FERTILIZER APPLICATION; NITROGEN; PRODUCTION; PROXIMATE COMPOSITION; YIELDS.

A field experiment was conducted during the winter (tabl) seasons of 1997-1998 to 1999-2000 on an alluvial loamy sand saline soil at Hisar, to find out the effect of cutting management and nitrogen levels on biomass preduction and proximate quality of barley (Hordeum vulgare L.). Dry forage yield of barley was 6.3 percent higher when harvested once at 50 percent heading compared with 2 cuttings at 60 days of growth and 50 percent heading. The total biomass was 3.8 percent higher when harvested for grain purpose compared to the treatment in which the crop was first harvested for forage at 60 days and subsequently left for grain purpose. However, no significant differences were observed in the yield equivalents of barley grown for grain purpose or green forage and grain. Application of N significantly increased the yield from 22.5 q/ha with 60 kg N/ha to 29.3 q/ha with 80 kg N/ha. The protein and mineral matter contents were higher in grains (9.2 and 4.7 percent) and fodder (5.3 and 10.3 percent) harvested at the ear\'1 stages than 9.0 and 4.6 percent in grain; and 4.9 and 9.8 percent in fodder at the late stage. However, the fibre and lignin contents were more in fodder harvested at later stages. With increasing levels of N application, the mineral matter remained unaffected, while the crude protein and lignin contents increased and fibre decreased in both fodder as well as grain.

453. Mishra, S.K. (National Bureau of Plant Genetic Resources, New Delhi (India); Singh, V. (Directorate of Marketing and Inspection, Faridabad (India); Pareek, S.K. (National Bureau of Plant Genetic Resources, New Delhi (India). Standardization of propagation techniques in

Asparagus. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 608-610 KEYWORDS: PLANT PROPAGATION; ASPARAGUS; SEEDS; GERMIANTION.

An experiment was conducted to work-out the propagation techniques in Asparagus racemosus (Shataver). The seeds collected from the forest of Madhya pradesh and were categorized in two groups, one group from the freshly harvested seeds and other group from the one year old seeds\fhe fresh seeds were again categorized into three groups, first group was without water soaking, fresh seed only (Control), second group was fresh seeds with water soaking and the third group was fresh seeds treated with cow's urine. The one year old seeds were also categorized into three groups. In the first group on year old seed was taken without water soaking (control), in the second group, one year old seeds was treated with water soaking and the third group one year old seed was treated with cow's urine. It was observed that the fresh seeds gave early germination as well as better germination percentage than the one year old seeds. Seeds treatment with cow's urine have shown early germination as well as better gemination percentage compared to rest of the treatments.

F03 Seed Production and Processing

454. Mittal, R.K. (Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dept. of Plant Breeding and Genetics); Meharchandani, N.; Singh, M. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Genetics); Gautam, A.S. (Himchal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dept. of Plant Breeding and Genetics). Induced morphological variations in green gram [Vigna radiata (L.) Wilczek]. Annals of Biology (India). (Dec 2001) v. 17(2) p. 159-163 KEYWORDS: GAMA IRRADIATION; HYBRIDIZATION; GENETIC VARIABILITY; VARIANTS; VIGNA RADIATA; INDUCED MUTATION.

Gamma irradiation followed by hybridization was used to create genetic variability in two varieties of green gram [ViKna radiala (L.) WIlczek]. Eighteen different types of morphological variants (late, very late, early, tall. dwarf, trailing type plant. tobacco type plant, vigorous growth, multifoliate, broad leaved, bold seeded. black seeded. less seeds in a pod, less number of pods, sterile, empty pod, curved pod and constricted pod) were observed in M2, FJ and M,FJ of two varieties (ML-9 and K-851) of green gram [V. radiala (L.) Wilczek]. Maximum types of morphological variants were observed in the irradiated population of both the varieties in M2 generation. Similar trend of morphological valiants was observed in M3, F2 and Mlr Morphological variants such as early matulmg, dwalf and bold seeded could be of great importance directly or indirectly in mungbean improvement.

455. Mittal, R.K.; Sethi, G.S. (Himachal Pradesh Krishi Vishvavidyalaya, Palampur (India). Dept. of Plant Breeding and Genetics)). Association of grain yield with some morpho-physiological traits in triticale x bread wheat derivatives under contrasting soil phosphorus levels. Annals of Biology (India) . (Dec 2001) v. 17(2) p. 165-170 KEYWORDS: GENETIC CORRELATION; TRITICUM AESTIVUM; STRESS; PHOSPHORUS; TRITICOSECALE; AGRONOMIC CHARACTERS; YIELDS.

Conelation coefficient analysis conducted on 26 niticale x wheat deIivatives alongwith two tIiticales and two bread wheat cultivars in phosphoms-Iich (+P) and phosphorus-deficient (-P) environments revealed significant conelation of grain yield with spikes/plant, spike lenbrth and grains/spike in the +p environment and with harvest index in the –P environment. Days to

heading showed significantly negative conelations with IOOO-grain weight and spikelets/spike in both the environments. Days to matUlity was significantly correlated with spike length in the +p environment. Conelations of plant height with spike length and days to matUlity with days to heading were significant in the -P environment. Path-coefficient analysis revealed that spikes/plant and grains/spike in the +p envi-ronment and harvest index in the -P environment had high direct effect on grain yield.

456. Singh, J.V.; Chander, S.; Punia, A.; Jatasra, D.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Forage Res. Section). Studies on variability, heritability and genetic advance in clusterbean (cyamopsis tetragonoloba (L.) Taub.). Annals of Biology (India). (Dec 2001) v. 17(2) p. 177-178 KEYWORDS: GENETIC VARIABILITY; HERITABILITY; GENETIC GAIN; CYAMOPSIS TETRAGONOLOBA.

F04 Fertilizing

457. Arora, S. (Punjab Agricultural University, Ludhiana (India). Dept. of Soils); Singh, M. (Rajasthan Agricultural University, Bikaner (India). Dept. of Soil Science and Agricultural Chemistry). Effect of zinc and nitrogen fertilization on economical yield of barley (Hordeum vulgare L.). Annals of Biology (India). (Jan 2001) v. 17(1) p. 53-55 KEYWORDS: FERTILIZATION; ZINC; NITROGEN; ECONOMICS; YIELDS; HORDEUM VULGARE; BARLEY.

In a field experiment conducted on loamy sand soil to study the effect of zinc and nitrogen fe11ilization on economical yield of barley, the increasing levels of Zn increased the net returns and maximum net return of Rs. 22241.50 ha-1 was recorded with the application of 7.5 kg Zn ha-1, while application of 90 kg N ha-1 registered maximwn retwn of Rs. 22218.00 ha-1 in barley. Combined application of 7.5 kg 2n and 90 kg N ha-1 recorded the maximll1tl retwn of Rs.23869.50 ha-1.

458. Dhankhar, J.S.; Kuhad, M.S.; Singh, N.; Sharma, J.C.; Bhandari, D.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science)). Response of balanced fertilizer use in different crops. Annals of Biology (India). (Jan 2001) v. 17(1) p. 57-60 KEYWORDS: FERTILIZATION; CROPS; FERTILIZER APPLICATION; FIELD CROPS; YIELDS; CHEMICAL FERTILIZERS; FIELD EXPERIMENTATION.

Some trials on different crops were conducted at cultivator's field during 1995-96 on loamy sand soils with a view to demonstrate the fariners, the supremacy of balanced use of chemical fertilizers over tile conventional farmer's practice in crop production. The experimental results revealed that balanced use of chemical fertilizers in bajra resulted in more than 50 percent higher grain yield over the conventional farmer's practice. In mustard, the corresponding increase was 66 percent, in pigeonpea the response of balanced use of chemic;al fertilizer was 150 percent. In all the trials conducted at cultivator's fields, the balanced use of chemical fertilizers emerged undoubtedly superior to the conventional farmer's practice.

459. Dadhich, L.K.; Gupta, A.K. (S.K.N. College of Agriculture, Jobner (India). Dept. of Agronomy)). Effect of phosphate solubilizing bacteria and phosphorus on the growth pattern of clusterbean [Cyamopsis tetragonoloba (L.) Taub.]. Annals of Biology (India). (Jan 2001) v.

17(1) p. 107-110 KEYWORDS: PHOSPHATE; FERTILIZATION; SOLUBILIZATION; BACTERIA; CYAMOPSIS TETRAGONOLOBA; PHOSPHORUS; GROWTH; YIELDS.

A field experiment was conducted at S. K.. N. College of Agriculture, Jobner (Rajasthan), India to find out the effects of seed inoculation with phosphate solubilizing bacteria (PSB) and P fertilization on the growth and yield of clusterbean and also to assess P economy accruing from the use of PSB. Results revealed that applied P upto 30 kg ha-1 increased growth parameters and seed yield of the order of 50 percent over control. Use of PSB led to marked increase in growth, yield attributes and finally the yield of clusterbean. Data further showed that inoculation of seed with PSB was as good as application of P at 10 kg ha-1. Both the treatments were highly cost effective.

460. Kumar, A.; Khangarot, S.S.; Chandra, S.; Jat, R.L. (S.K.N. College of Agriculture, Jobner (India). Dept. of Agronomy)). Effect of nitrogen and IBA on yield attributes and yield behaviour of barley. Annals of Biology (India). (Dec 2001) v. 17(2) p. 153-155 KEYWORDS: NITROGEN; IBA; YIELD COMPONENTS; YIELDS;BARLEY.

A field experiment was conducted during rabi 1995-96 at J obner. The treatments comprised five levels of nitrogen (0, 30, 60, 90 and 120 kg/ha) and four levels of IBA (0, 15, 30 and 45 ppmt ha). Successive increase in nitrogen level upto 120 kg N/ha significantly increased the yield of barley. Maximum grain yield (45.90 qlha) was recorded under 120 kg N/ha. Application of IDA 45 ppmlha recorded maximum grain yield (43.97 q/ha).

461. Sinha, B.K.; Hemantaranjan, A. (Banaras Hindu University, Institute of Agricultural Sciences, Varanasi (India). Dept. of Plant Physiology); Chhabra, M.L. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding). Yield and yield components of pea (Pisum sativum L.) as affected by zinc nutrition. Annals of Biology (India). (Dec 2001) v. 17(2) p. 157-158 KEYWORDS: PISUM SATIVUM; YIELD COMPONENTS; YIELDS; ZINC; PEA.

An experiment was carried out to study the yield and yield components of pea (Pisum sativum L.) as affected by zinc nutrition. Three concentrations of zinc were applied in the form of zinc sulphate (ZnS04.7HP) 1.5, 3.0 and 4.5 mg kg-1 of soil. The yield components i. e. the total number of flowers, total pod setting, pod setting percentage, length of pod (cm), number of seeds per pod, weight of seeds per plant (g) and test weight of 10O seeds (g) all showed significant increase by the application of Zn 4.5 mg kg-1 of soil, whereas Zn 1.5 and 3.0 mg kg-1 of soil could also induce better but non-significant growth. Hower drop (percent) decreased sig-nificantly with zinc 4.5 mg kg-1 soil.

462. Singh, V.P.; Dahiya, D.J.; Kumar, V.; Singh, J.P.; Ahlawat, V.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science)). Response of pearl millet to nitrogen application in relation to preceeding crops. Annals of Biology (India). (Dec 2001) v. 17(2) p. 183-187 KEYWORDS: NITROGEN FERTILIZERS; SEQUENTIAL CROPPING; CROPS; PEARL MILLET; EFFICIENCY.

A field experiment was conducted continuously for two years (1990 and 1991) with five nitrogen levels (0, 40, 80, 120 and 160 kg N ha-I) applied to pearl millet grown after three rabi crops viz_, wheat, raya and gram- Yield (grain and straw) of pearl millet increased significantly

with increased nitrogen levels upto 160 kg ha-1 after wheatJraya and upto 120 kg ha-1 after gram crop. The grain and straw yields of pearl lJ1il1et were significantly more after gram than wheat/raya crop at aU N levels. The uptake of nitrogen in grain and straw of pearl millet after different crops was found in order : Gramrayawheat. The uptake of nitrogen in grain increased significantly upto 120 kg N ha-1 after gram and upto 160 kg ha-1 after wheatJraya crops; however, N uptake in straw increased with increasing N levels upto 160 kg N ha-1 after all the crops. The apparent N recovery in pearl millet ranged from 39.54 to 49.90, 38.34 to 45.0 and 38.64 to 44.87 percent after wheat, raya and gram crops, respectively.

463. Kumawat, P.D.; Khangarot, S.S. (S.K.N. College of Agriculture, Jobner (India)). Response of sulphur, phosphorus and rhizobium inoculation on growth and yield of clusterbean (Cyamopsis tetragonoloba (L.) Taub.). Annals of Biology (India). (Dec 2001) v. 17(2) p. 189-191 KEYWORDS: SULPHUR; PHOSPHORUS; RHIZOBIUM; INOCULATION; CYAMOPSIS TETRAGONOLOBA; YIELDS; GROWTH.

A field experiment was conducted during kharif 1996 at Agronomy Fann, S. K. N. College of Agliculture, Jobner on loamy sand soil to study the response of sulphur, phosphorus and Rhizobium inoculation on growth and yield of clusterbean. Application of 80 kg S ha'] significantly increased seed yield by 31.8 and 10.7 percent over control and 40 kg S ha-l, respectively. Application of 60 kg PP5 ha-1 also significantly increased seed yield by 27.3 and 11.9 percent over control and 30 kg PPs ha-l, respectively Rhizobium inoculation significantly increased the seed yield than control plot.

464. Kumawat, P.D.; Khangarot, S.S. (S.K.N. College of Agricultrue, Jobner (India)). Response of sulphur and phosphorus with and without rhizobium inoculation on quality of clusterbean (Cyamopsis tetragonoloba (L.) Taub.). Annals of Biology (India). (Dec 2001) v. 17(2) p. 193-194 KEYWORDS: SULPHUR; PHOSPHORUS; RHIZOBIUM; INOCULATION; CYAMOPSIS TETRAGONOLOBA; QUALITY.

A field experiment was conducted during Kharif 1996 at Agronomy Farm, S.K.N. College of Agriculture, Jobner on loamy sand soil to study the response of sulphur and phosphorus with and without Rhizobium inoculation on growth, yield and quality of clusterbean. Application of 80 kg ha-1 significantly increased the content of protein and gum in seed by 16.2 and 8.2 percent over control .and by 7.6 and 3.1 percent over 40 kg S ha-1, respectively. Application of 60 kg P205 ha-r also significantly increased the content of protein and gum in seed by 12.5 and 4.5 percent over control and by 6.2 and 2.7 percent over 30 kg P20S ha-1, respectively. Rhizobium inoculation significantly increased the protein and gum content in seed than control plot.

465. Kumar, R.; Singh, V.P.; Singh, R.C.; Singh, S.N. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy)). Monetary analysis of N and P fertilization to mungbean during summer season. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 123-127 KEYWORDS: FERTILIZATION; MUNGBEANS; ECONOMICS; NITROGEN; VIGNA RADIATA; YIELDS; PHOSPHORUS; GENOTYPES.

Study carried out on Nand P fertilization to mungbean revealed that genotype MH 85-111 produced 64.5 percent more yield and fetched 63.9 percent higher net return/ha over T44

Grain yield of mungbean was significantly increased with increasing levels ofN upto 20 kg/ha and further elevation had no effect on yield, whereas mungbean crop responded upto 40 kg p2O5 q/ha in respect of yield and net return/ha. The maximum net return of Rs. 14150 and 11406 was obtained with MH 85-111 and T44' respectively, when fertilized with 20 kg N and 40 kg p2O5/ha.

466. Dhaka, A.K.; Kumar, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy)). Response of fertility levels and organic sources on late planted raya. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 129-133 KEYWORDS: BRASSICA JUNECIA; ORGANIC MATTER; SOIL FERTILITY; YIELDS; YIELD COMPONENTS; NITROGEN; PLANTING DATE; FARMYARD MANURE.

A field experiment was conducted during winter season (rabi) 1997 and 1998 on sandy loam soils of CCS Haryana Agricultural University, Hisar. The seed yield and yield attributes increased significantly with the increase in nitrogen level upto 80 kg ha-1. More)Ver, integration of 30 kg PPs ha-J alongwith 80 kg N ha-J produced significantly higher yield and yield attributes. Application of vermicompost or FYM 5 t ha-J produced statistically similar yields but vermicompost produced better yields as compared to FYM. Vermicompost lOt ha-J proved statistically significant with the increase in nitrogen application, integration of phosphorus and with the amount of organic matter.

467. Singh, S.; Kumar, Y.; Gill, O.P. (Agricultural Research Station, Jaipur (India). Div. of Agronomy)). Growth characteristics of summer groundnut (Arachis hypogaea L.) as influenced by sulphur levels, irrigation schedules and organic manures. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 135-139 KEYWORDS: ARACHIS HYPOGAEA; SULPHUR; GROUNDNUTS; AGRONOMIC CHARACTERS; IRRIGATION SCHEDULING; ORGANIC FERTILIZERS.

A field experiment was conducted during summer seasons of 1994 and 1995 at R. C. A., Udaipur on sandy loam soil to study the response of summer peanut (Arachis hypogaea L.) to varying irrigation schedules, organic manures (FYM and CBS) and sulphur nutrition. The irrigation schedule 13 (0.7/0.7/ 0.7) and 12 (0.4/0.7/0.7) based on IW/CPE ratio being at par significantly enhanced growth characteristics of summer peanut over irrigation schedule II (0.4/0.7/0.7) during both the years. FYM and CBS were found to be significantly at par in increasing growth parameters over no manure. S at 60 kg ha.1 significantly enhanced growth characters of summer peanut while compared to 30 kg S ha" and no sulphur, respectively, during both the years.

468. Chejara, V.K.; Gupta, A.K.; Gupta, D.K. (SKN College of Agriculture, Jobner (India). Dept. of Agronomy)). Effect of phosphorus and sulphur on yield, quality, nutrient concentration and their uptake by pearl millet (Pennisetum glaucum (L.) R. Br. Emend Stuntz). Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 141-145 KEYWORDS: PENNISETUM GLAUCUM; SULPHUR; PEARL MILLET.NUTRIENT UPTAKE; YIELDS; PHOSPHORUS; QUALITY; YIELD COMPONENTS.

A field experiment was conducted to evaluate the effect of phosphorus and sulphur levels on yield, nutrient (N, P and S) content and uptake by pearl millet. Results revealed that increasing levels of phosphorus upto 30 kg PP5 ha-I significantly increased the grain and straw yield, protein content, N content and uptake of N and S, whereas P content and uptake

increased upto 45 kg P P 5 ha-1. Similarly, application of 40 kg S ha-' increased the grain and straw yields, protein content, N, P and S concentration but, uptake of N, P and S increased significantly upto 60 kg S ha-1.

469. Vikrant, V.R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India); Sharma, A. (Chaudhary Charan Singh University, Meerut (India). Dept. of Plant Pathology); Singh, B.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Herbage yield of Japanese mint as affected by nitrogen and harvesting time. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 147-150 KEYWORDS: FERTILIZER APPLICATION; MENTHA ARVENSIS; NITROGEN; YIELDS; HERBAGE CROPS; HARVESTING DATE.

Application of graded doses of nitrogen enhanced the plant height (cm) number of branches/plant in I and II cutting of Japanese mint. Plant height and number of branches increased upto 140 days after planting in 1 cutting while in 11 cutting, plant height increased upto 130 days after planting and number of branches/plant decreased gradually with delay in harvesting time. Herbage yield increased significantly in I and 11 cutting as well as the total herbage yield with increasing levels of nitrogen, while herbage yield increased in I cutting with delayed harvesting but in 11 cutting and total herbage yield it gradually decreased with delayed harvesting. Interactive effect between levels of nitrogen and harvesting times was observed on dry matter accumulation at I and 11 cutting as well as on number of branches/plant in I cutting.

470. Jha, A.C.; Rai, B.; Jha, M.M.; Kumar, B. (Rajendra Agricultural University, Pusa (India). Dept. of Plant Pathology)). Effect of inorganic nutrients on brown spot of rice. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 187-189 KEYWORDS: NUTRIENTS; DISEASE SURVELLANCE; INORGANIC FERTILIZERS; SPOTS; RICE; NPK FERTILIZERS; ZINC SULPHATES.

Nutrients can affect the relationship between crop and pathogen in different ways. Manipulation of crop nutrition, therefore, gives the farmer a valuable tool for managing crop health. Balanced application of N, P and K alongwith zinc sulphate at the rate of 25 kg per hectare showed minimum disease severity and it increased when the balance of nutrients was disturbed. Maximum disease severity of 61.6 percent was recorded where nutrition was not applied at all.

471. Thakur, K.S.; Kumar, A.; Manuja, S. (Chaudhary Sarwan Kumr Himachal Pradesh Krishi Vishwavidyalaya, Kangra (India). Oilseeds Res. Stn.). Effect of nitrogen fertiolization on productivity and nitrogen balance in soil in gobhi sarson (Brassica napur)-based crop sequences. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 160-163 KEYWORDS: FERTILIZER APPLICATION; SEQUENTIAL CROPPING; PRODUCTIVITY; PHASEOLUS MUNGO; ZEA MAYS; NITROGEN FERTILIZERS; BRASSICA NAPUS; SOIL FERTILITY; GLYCINE MAX; SESBANIA BISPINOSA.

An experiment was conducted during 1997-98 to 1999-2000 at the Oilseeds Research Station, Kangra, consisting of 4 rainy-season crops, viz. maize (Zea mays L.), dhaincha (Sesbania acu/eata Pers.), soybean [G/ycine max (L.) Merr.] and blackgram (Phaseo/us mungo L.), followed by gobhi sdrson (Brassica napus ssp. o/eifera var annua) at 5 levels of N (0, 40, 80, 120 and 160 kg N/ha). Dhaincha-gobhi sarson sequence showed the maximum N balance in

soil at all levels of N application. This was followed by soybean-gobhi sarson, blackgram-gobhi sarson and maize-gobhi sarson where positive N balance was observed at 40-160 kg N/ha. The balance sheet of N showed that there was gain of N in soybean-gobhi sarson and blackgram-gobhi sarson sequences, whereas it was negative in Clhaincha-gobhi sarson and maize-gobhi sarson sequences. The gain of N in balance sheet was higher at lower levels of N application. The maximum grain yield of gobhi sarson was obtained in dhaincha-gobhi sarson sequence. The yield in dhaincha-gobhi sarson at 40 kg N/ha, blackgram-gobhi sarson at 80 kg N/ha and maize-gobhi sarson at 120 kg N/ha also remained at par with one another.

472. Suja, G. (Kerala Agricultural University, Thiruvananthapuram (India). Div. of Crop Production); Nair, V.M. (Kerala Agricultural University, Thiruvananthapuram (India). College of Agriculture); Sreekumar, J. (Central Tuber Crops Research Institute, Thiruvananthapuram (India). All India Coordinated Research Project on Tuber Crops). Influence of organic manures, nitrogen and potassium on nutrient uptake and nutrient use efficiency of white yam (Dioscorea rotundata) intercropped coconut (Cocos nucifera) garden. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 168-171 KEYWORDS: FERTILIZER APPLICATION; NITROGEN; INTERCROPPING; COCOS NUCIFERA; NURTIENTS; ORGANIC FERTILIZERS; POTASSIUM; DIOSCOREA ROTUNDATA; NUTRIENT UPTAKE; EFFICIENCY.

The influence of 3 organic manures (farmyard manure, coir pith compost and in-situ green manuring using sunhemp) and 3 levels each of Nand K (40, 80, 120 kg/ha) on nutrient uptake and nutrient-use efficiency of white yam (Dioscorea rotundata) intercropped in coconut (Cocos nucifera L.) garden was studied during 1998-2000) at Vellayani, Thiruvananthapuram. Application of coir pith compost resulted in significantly higher uptake of Nand K. Higher rates of Nand K favoured uptake of N, P and K by the crop. An intercrop of white yam in coconut garden fertilized with coir pith compost 5 tonnes/ha and N, P and K 80,60 and 80 kglha respectively, yielding 24.61 tonnes/ha of fresh tuber equivalent and 7.36 tonnes/ha of dry matter removed 89.59, 10.10 and 92.99 kglha of N, due to qreen-manuring. Enhanced supply of N or K reduced the efficiency of the respective nutrients, whereas addition of one nutrient at higher rates promoted the efficiency of the other nutrient.

473. Singh, T.; Rai, R.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Growth parameters, nutrient luptake and soil fertility under wheat (Triticum aestivum) as influenced by levels of phosphorus and phosphate solubilizing micro-organisms. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 182-185 KEYWORDS: TRITICUM AESTIVUM; PHOSPHORUS; WHEATS; NITROGEN; NUTRIENT UPTAKE; GROWTH; AGRONOMIC CHARACTERS; SOIL FERTILITY; PHOSPHATES.

A field experiment was conducted during the winter season of 1998-99 and 1999-2000, to study the effect of phosphorus levels and phosphate-solubilizing micro-organisms on growth parameters,. nutnent uptake and sod fertility under wheat (Triticum aestivum L. emend. Fiori & Paol) crop. The treatments consisted of 4 levels of phosphorus (0, 30, 60 and 90 kg Pp/ha) and of phosphate-solubilizing micro-organisms (no inoculation, Pseudomonas striata, Aspergillus awamori and Pseudomonas striata + Aspergillus awamofl). The growth parameters like dry matter production, root dry weight yield and nitrogen and phosphorus uptake were significantly improved with application of 60 kg P205/ha. similarly, all these parameters were

significantly increased owing to combined inoculation with Pseudomonas striata + AspergIllus awamorl over indivIdual and no inoculatfon. Nitrogen and phosphorus uptake of wheal crop Increased significantly only up to 60 kg P2O5/ha. Though increasing levels of phosphorus (up to 90 kg/ha) left the soil rich significantly in respect of post-harvest status of phosphorus. However, successive higher levels of phosphorus declined the available soil nitrogen status, though significant depletion was observed only up to 60 kg P2O5,/ha. Inoculation with phosphate-solubilizing micro-organisms also reduced the post-harvest status of available soil nitrogen and phosphorus pool. Highest deciine was observed due to combined inoculation with Pseudomonas striata + Aspergillus awamori.

474. Nasreen, S.; Farid, A.T.M. (Bangladesh Agricultural Research Institute, Gazipur (Bangladesh). Div. of Soil Science). Influence of different nutrients on growth and yield of garden pea (Pisum sativum). Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 206-209 KEYWORDS: PISUM SATIVUM; NUTRIENTS; YIELDS; YIELD COMPONENTS; PEAS; FERTILIZER APPLICATION; GROWTH.

A field experiment was carried out in Grey Terrace soil (Albaquept) at the Gazipur, Bangladesh, during the winter (rabl) seasons of 2000-2001 and 2001-2002, to find out the proper combination of fertilizer nutrients that promotes better yield of 'BARI Motorsuti l' garden pea (Pisum sativum L.). Yield and yield components of garden pea varied significantry due to variation otnutrient~. Significantly highest yield and yield attributes were recorded under treatmenfN30PSo~K40 S2~Mol BI (kg/ha), followed by N30PsoK4oS20 Mo, BI Znl, N30 Pso K40S2O MOl and N30 P50K40S20 treatments. Germination (percent), seedling length, dry weight of seedling and vigour index were also more when the crop was raised from these 4 treatments over the control. Treatments N30 P 50 K40 S20 Mol, N30 P 50 K40 S20 Mo1B1 and N30 P50 K40 S20 M01 B1 Zn1 (kglha) were not economical because of their higher cost investment. However, application of N30 Pso K40 S20 kglha would be economically profitable for enhancing growth parameters and yield of garden pea.

475. Panwar, A.S.; Singh, N.P. (ICAR Research Complex for North Eastern Hill Region, Umiam (India). Div. of Agronomy). Effect of conjunctive use of phosphorus and bio-organics on growth and yield of groundnut (Arachis hypogaea) . Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 214-216 KEYWORDS: GROUNDNUTS; ARACHIS HYPOGAEA; PHOSPHORUS; BIOFERTILIZERS; YIELD COMPONENTS; YIELDS; GROWTH; RHIZOBIUM; MEGHALAYA.

A field experiment was conducted during the rainy season of 2000 and 2001, to study the effect of conjunctive use of phosphorus and bio-organics on groundnut (Arachis hypogaea L.). Application of 60 kg pp/ha markedly influenced the growth and yield attributes resulting in significant increase of pod yield by 14.01 percent over the control. Seed inoculation with Rhizobium or phosphorus-solubilizing micro-organism (PSM) marginally improved yield, but their combined use increased pod yield significantly. Both the organics, i.e. FYM and need-cake, significantly increased the pod and haulm yields, but when half quantity of these organics were integrated with Rhizobium and PSM, the highest pod yield of 31.80 q/ha with FYM 5 tonnes/ha + Rhizobium + PSM was obtained. Neem-cake 1.5 tonnes/ha in the presence of same biofertilizers was next to it.

476. Rana, K.S.; Rana, D.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Response of mustard (Brassica juncea) to nitrogen and sulphur under dryland conditions. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 217-219 KEYWORDS: MUSTARD; BRASSICA JUNCEA; FERTILIZER APPLICATION; NITROGEN; SULPHUR; YIELDS; DRY FARMING; GROWTH; YIELD COMPONENTS; HARVEST INDEX.

A field experiment was conducted during winter seasons of 2000-2001 and 2001-2002 to study the response of Indian mustard [Brassica juncea (L.) Czernj & Cosson] cv. 'Pusa Barani'to nitrogen and sulphur levels. Application of 60 kg N/ha and 40 kg S/ha significantly increased the seed yield with concomitant increase in yield attributes. The per cent increase in seed yield at 60 kg N/ha over 40, 20 and the control was 12.6, 23.8 and 79.8 and at 40 kg S/ha over 20 and control was 12.7 and 32.5 respectively. Each higher level of nitrogen and sulphur appreciably improved the growth and yield attributes (branches/plant, siliquae/plant, seed yield/plant, t,OOO-seed weight and harvest index. The seed yield response to tested levels of Nand S was found quadratic. Based on response equation optimum dose of Nand S for Indian mustard cv. 'Pusa Barani' was found to be 70.8 and 51 kg/ha, respectively. The uptake of Nand S increased sign. icantly up to 80 and 40 kg N/ha, respectively, while sulphur application resulted. in marked increase in Nand S uptake only up to 40 kg S/ha. Maximum net returns/ha was recorded with 80 kg N (Rs 10,538/ha) and 60 kg S/ha (Rs 9,176/ha).

477. Badiyala, D.; Kumar, S. (Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvividyalaya, Palampur (India). Dept. of Agronomy). Effect of organic and inorganic fertilizers on growth and yield of linseed (Linum usitatissimum) under mid-hill conditions of Himachal Pradesh. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 220-223 KEYWORDS: FERTILIZER APPLICATION; INORGANIC FERTILIZERS; HIGHLANDS; LINSEED; LINUM USITATISSIMUM; YIELD COMPONENTS; YIELDS; ORGANIC FERTILIZERS; FARMYARD MANURE; HIMACHAL PRADESH.

The effect of farmyard manure (FYM) and chemical fertilizers on growth and yield of linseed (Linum usitatissimum L.) under mid-hill conditions of Himachal Pradesh was studied during the winter (rabl) seasons of 1995-96, 1996-97 and 1997-98. Better growth, yield attributes as well as yield were recorded with application of FYM 5 tonnes/ha over no FYM. Recommended doses of chemical fertilizers (NsoP 4oK2o) produced taller plants with more number of primary branches, capsules/plant, seeds/capsule and 1 ,ODD-seed weight compared to 50 percent and 75 percent of the recommended dose of NPK. Highest gross and net returns (Rs/ha) were also obtained with application of the recommended dose of fertilizer, N50P40K20.

478. Patel, B.S.; Amin, A.U.; Patel, K.P.; Patel, M.M. (Gujarat Agricultural University, Jagudan (India). Main Spices Research Station). Inflience of organic manures alone or in combination with inorganic fertilizer on productivity of winter drilled fennel (Foeniculum vulgare). Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 232-234 KEYWORDS: FENNEL; FOENICULUM VULGARE; ORGANIC FERTILIZERS; INORGANIC FERTILIZERS; FARMYARD MANURE; PRODUCTIVITY; YIELD COMPONENTS; YIELDS.

Effect of organic manures [castor cake, mustard cake and farmyard manure (FYM)] alone or in combination with inorganic fertilizers was studied during 1997-98 to 1999-2000 on yield,

quality and economics of winter fennel (Foeniculum vulgare Mill.) at Main Spices Research Station, Jagudan. Maximum seed yield and its attributes were obtained when recommended fertilizer dose applied through inorganic fertilizer. Different organic manures (castor cake, mustard cake and FYM) were equally effective and gave significantly lower seed yield than that with inorganic fertilizer. Application of different organic manures alone or mix with inorganic fertilizers significantly improved the oil content of fennel (1.56 to 1.64 percent). The highest net profit (Rs/ha 70,139) and benefit: cost ratio (4.13) were obtained when recommended dose of fertilizer applied in the form of chemical fertilizers. However, on the basis of premium price of organic product, recommended fertilizer dose applied through FYM alone recorded the maximum net realization 90,393 (Rs/ha) and benefit: cost ratio (1 : 5.14).

479. Singh, V.; Singh, K.; Singh, R.V.; Singh, S. (R.B.S. College, Bichpuri (India). Dept. of Agricultural Chemistry and Soil Science). Nutrient uptake and yield of wheat as influenced by iron and FYM application in an alluvial soil. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 4-7 KEYWORDS: ALLUVIAL SOILS; NUTRIENT UPTAKE; NUTRIENTS; FERTILIZER APPLICAITON; IRON; FARMYARD MANURE; WHEATS; YIELDS.

In a field experiment on light textured soil, the effect of iron and FYM applied alone and in combination was studied on wheat. Application of iron alone upto 10 mg kg-I soil increased significantly the grain and straw yield and also the uptake of nutrients by the soil crop. Likewise, application of FYM also significantly enhanced the yield and uptake ofN, P, K and Fe by the crop. Iron and FYM showed a synergistic interaction effect on the uptake of N. P. K and Fe and ultimately on the grain and straw production of wheat. Maximum grain and straw yield were obtained in the treatment where Fe was applied 10 mg kg. soil with 40 t ha-1 organic matter.

480. Joshi, Y.P.; Kumar, S.; Singh, V.; Pandey, P.C.; Pandey, C.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Effect of nitrogen and seed rate on herbage quality of teosinte (Euchlaena maxicana Schrad.). Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 8-11 KEYWORDS: FERTILIZER APPLICATION; NITROGEN; ZEA MEXICANA; NUTRITIONAL STATUS; DRY MATTER CONTENT; QUALITY; YIELDS; FORAGE; HERBAGE; SEED PRODUCTION.

Increase in nitrogen from 0 to 120 kg per ha increased dry matter yield, ash and ADF content of teosinte. however, crude protein and dry matter digestibility increased with increase in mtrogen upto 160 kg per ha. NDF and hemi-cellulose content increased upto 80 kg nitrogen per ha. Increase in seed rate from 30 to 50 kg per ha increased dry matter yield, crude protein and digestible dry matter content. But there was no significant difference between seed rates on dry matter, ADF, NDF, hemi..cellulose and cell content of teosinte.

481. Kumar, D. (Indian Grassland and Fodder Research Institute, Jhansi (India); Singh, S.; Sharma, S.N.; Shivay, Y.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effect of levels, sources and time of nitrogen applicaiton on N uptake and quality of mustard (Brassica juncea (L.) Czern and Coss.). Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 12-16 KEYWORDS: FERTILIZER APPLICATION; BRASSICA JUNCEA; QUALITY; YIELDS; NUTRIENT UPTAKE; NITROGEN; MUSTARD; VARIETIES.

Field experiments were conducted to study the effect of levels, sources and time of N application on N uptake and quality of mustard varieties. The experiments were laid out in a randomized block desjgn with three replications. Significantly higher N uptake and cake yield was recorded in variety Pusa Bold as compared to BIO-902. N uptake, oil yield and cake yield increased significantly with each successive level ofN. Blending of urea with 10 percent DCD-N proved beneficial over untreated urea or treated with higher amounts of DCD (15 percent DCD-N) as regards to N uptake and quality. Time ofN application did not affect above parameters significantly.

482. Medhi, D.N.; Sarma, A.C.; Medhi, B.D. (Assam Agricultural University, Jorhat (India). Dept. of Agronomy). Effect of integrated nutrient management on rice-linseed cropping sequence in high rainfall areas of Assam. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 17-21 KEYWORDS: NUTRITIONAL REQUIREMENTS; SEQUENTIAL CROPPING; ORGANIC FERTILIZERS; RICE; LINSEED; RESIDUAL EFFECTS; RAINFED EFFECTS; YIELDS; FERTILIZERS; YIELD COMPONENTS.

Field experiments were conducted to evaluate the effect of integrated nutrient management on rice-linseed cropping sequence. Ten treatment combinations involving no fertilizer NP~ 100 per cent NPK alone and 75 per cent and 50 per cent NPK in combination with four organic sources viz., FYM, pressmud; biogas sluny and Sesbania . rostrata were tested in a randomized block design replicated thrice. T'he soil had pH 4.5, organic carbon 0.70 percent, CEC 7.10 cmol ,(p"1/kg and available N, PPs and KP were 290.75, 19.50 and 86.10 kg/ha respectively. Growth characters and yield attributes of both the crop were increased due to different.treatments. During both the years the yield of rice and linseed and ~otal rice equivalent yield of the system as a whole were increased significantly due to direct and residual effect of treatments than that of control. Organic manures when combined with chemical fertilizers gave better result iri tenns of yield indicating a net saving of 25 to 50 per cent chemical fertilizer application.

483. Singh, A.K. (R.B.S. College, Bichpuri (India). Dept. of Agronomy). Yield maximization by fertilizer farm yard manure and plant population in pearlmillet - wheat cropping system. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 22-25 KEYWORDS: FERTILIZER APPLICAITON; CROPPING SYSTEMS; PLANT POPULATION; WHEATS; PEARLMILLET; YIELDS; YIELD COMPONENTS; FARMYARD MANURE.

A field experiment was conducted during 1993-94 and 1994-95 at R.B.S. College, Agricultural Research Farm, Bichpuri (Agra). Results revealed that application of NPK nutrient level 100-50-50 kg ha-I (125 percent of recommended level) to pearlmillet and 90-45-30 kg NPK ha-1 (75 percent of recommended level) to wheat alongwith FYM 10 t ha-I to both) crops in pearlmillet – wheat cropping system, coupled with optimum plant population appeared quite effective for maximization of crop yields.

484. Chander, S.; Pandey, J. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Influence of nitrogen and herbicides on competition for potassium between scented rice (Oryza sativa) and weeds under different rice cultures. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 26-32 KEYWORDS: ORYZA SATIVA; VARIETIES; RICE;

NITROGEN; HERBICIDES; WEEDS; POTASSIUM; DIRECT SOWING; WEED CONTROL; TRANSPLANTATION.

A field experiment was undertaken on scented rice variety Pusa Basmati 1 in Kharif of 1993 and 1994, using different nitrogen levels, weed control treatments and rice cultures at Indian Agriculture Research Institute. Competition for potassium by weeds was 4 to 8 times intense under direct seeded puddled rice culture than transplanted rice culture. K depletion at 120 kg N/ha level was significantly higher than at 60 N/ha. In hand weeding, K depletion was maximum (1.2,5.9 and 7.2 kg/ha, at maximum tillering, flowering and maturity, respectively) followed by anilofos .5 kg/ha. Unchecked weed growth (weedy check) depleted K to the extent of 11.3,37.0 and 63.1 k/ha respectively at maximum tillering, flowering and maturity. Relative potassium uptake by weeds increased with advance in crop growth stages whereas reverse was uptake by crop. In transplanted rice culture, K uptake by crop was significantly higher than in direct seeded rice culture. Nitrogen at 120 kg/ha effected marked increased in K uptake than to 60 kg N/ha. In hand weeding, in both the years, deletion was significantly lower than herbicides. effect of herbicides was conspicuous In transplanted rice culture. Their application brought down the competition markedly in direct seeded rice culture as compared to weedy check. Relative K uptake by rice was higher under transplanted rice culture than' unaer direct seeded rice. In hand weeding relative K uptake was highest followed by anilofos and it was lowest in weedy check.

485. Singh, D.K.; Singh, Y.; Quadeer, A. (Horticultural Research Centre, Patherchatta (India). Response of nitrogen on the productivity of cabbage cultivars. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 33-37 KEYWORDS: CABBAGES; VARIETIES; NITROGEN; FERTILIZAR APPLICATION; YIELDS; YIELD COMPONENTS.

Under agroclimatic conditions of Tarai Region ofU.P., Cabbage cultivar-vishesh (FI hybrid), Chaubatia early and Umber (FI hybrid) found superior than Anuglory,(FI hybrid) for most of the attributes. Head yield increased with increasing the nitrogen doses as compared to control: Nitrogen 150 kg/ha' followed by Nitrogen 100 kg and N 50 kglha produced significantly higher yield over No (control). Vishesh produced 273.3', 227.2 and 213.4 percent higher yield in N 150; N 100 and N '50 kg/ha over control (No), respectively. Chaubatia early gave 242.2 percent higher yield in N 100 kg/ha over control (No) treatment.

486. Vanaja, M.; Raju, A.S. (Acharya N.G. Ranga Agricultural University, Hyderabad (India). Dept. of Soil Science and Agricultural Chemistry). Integrated nutrient management performance in rice crop. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 51-56 KEYWORDS: FERTILIZER APPLICATION; NUTRITIONAL REQUIREMENTS; ORGANIC FERTILIZERS; FARMYARD MANURE; NUTRIENT UPTAKE; BIOFERTILIZERS; RICE; YIELDS; DRYMATTER CONTENT.

Field experiment was conducted for one year during 1996-97. in sandy loam soil having pH of8.4 at Student's Farm College of Agriulutre, Hyderabad. Organic manures (FYM, poultry manure) and biofertilizers (BOA, Azospirillum) alone and in combinatIon with inorganic fertilizer nitrogen were .studied on rice crop. Among the different combinations, tfie treatmenfwith poultry manure 2 t ha-I + 75 percent RDFN showed the highesf dry matter yield at flowering, grain and straw yields at maturity with values of 95.1, 55.0 and 73.9 q ha-I which

were increased by.92.9, 112.6 and 96.0 per cent, respectively over control. The highest total uptake ofN by rice crop at maturity was also recorded in the same treatment followeCl by FYM lOt ha-I + 75 percent RDFN appfied with the values of 148.24 ana 141.16 kg/ha-l, respectively. The total uptake ofP and K at maturity was also recorded in poultry manure applied at 2t ha-I along with 75 percent of RDFN. App1ication' of entire nitrogen through urea resulted in 85.2 percent, 99.2 and 85.9 per cent of dry matter yield at flowering grain and straw yields aematurity, respectively over control. The relationship between totaf dry matter production at maturity and total uptake of nutients (N, P and K) was highly significant.

487. Prakash, Y.S.; Bhadoria, P.B.S. (Indian Institute of Technology, Kharagpur (India). Agricultural and Food Engineering Dept.). Influence of organic manures on crop tolerance to pathogenes and pests in two varieties of rice. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 79-85 KEYWORDS: ORGANIC FERTILIZERS; RICE; PATHOGENS; FARMYARD MANURE; CROP TOLERANCE; VARIETIES; PESTS.

Field experiment was conducted to study the effect of vermicompost, farmyard manure and water hyacinth compost in comparsion to chemically fertilized and unfertilized plots on crop-plants tolernace to pests and diseases in HYV Swarna and local variety Mugasial. Pest control measures were not adopted during the course of experiment. Significant variation in grain yield between the varieties, among the nutrient sources and their interactions was observed. Grain yield recorded in HYV Swarna was higher to local Mugasial irrespective of the treatments and hence Swarna was considered to be more tolerant than Mugasial. Among the nutrient sources, treatment wih vermicomposd imparted maximum tolerance 0 crop-plants as grain yield recorded with it was higher to all other nutrient sources irrespective of varieties. The results suggest that nutritional quality and favourable balance of nutrient offered by different sources along with genetic response of varieties were responsible for differences among the nutrient sources and varieties in respect of crop-plants tolerance to pathogens and pests.

488. Bansal, O.P. (Dayal Singh College, Aligarh (India). Chemistry Dept.). Effect of carbamate pesticides on the growth and content of trace elements in wheat plants. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 109-115 KEYWORDS: CARBAMATES; PESTICIDES; NUTRIENT UPTAKE; TRACE ELEMENTS; GROWTH; WHEATS; SOIL TYPES; CHEMICOPHYSICAL PROPERTIES.

The effect of different doses of three carbamate pesticides (I, II, III) on uptake of mieronutrients Zn. Mn, Cu. Fe and B by wheat plants grown on three types (alluvial, aridisol, aerie halaquept) soils of Aligarh district werestudied. The uptake of metals by wheat plants was found to be increased with lower doses of pesticides. With lower doses of pes tie ides there was a decrease in pH, increase in oxidation reduction potential and increase in microbial population. The effect of pesticides on availability of micronutrients was in the order pesticide IIIIII. The concentration of micronutrients in grain and straw of wheat was found in the same order as present in native soil.

489. Sharma, S.C.; Vyas, A.K. (Central Sheep and Wool Research Institute, Avikanagar (India). Influence of phosphorus nutrition and FYM on quality parameters of soybean and succeeding

wheat. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 141-145 KEYWORDS: FERTILIZER APPLICATION; PHOSPHORUS; FARMYARD MANURE; PROTEIN CONTENT; LIPID CONTENT; QUALITY; YIELDS; SOYABEAN; WHEATS.

An experiment was conducted during 1997~98 and 1998-99 to evaluate the performance of quality parameters of soybean and succeeding wheat under different levels and sources of P with and without FYM applied to soybean. Protein and oil content, oil and seed yield of soybean significantly increased with increasing levels ofP up to 60 kg/ha. Residual effect of 90 kg P P slha gave the maximum grain yield of succeeding wheat that was significantly superior to 30 kg P2°slha. Among P sources. PARP and PARP + PSB gave at pafOil and Seed yields of soybean to that of SSP and significantly" superior to URP, however, graiil yield of succeeding wheat was significantly higher with P ARTP and P ARP°'F PSB in comparison to SSP and URP. Oil content of soybean and protein content of wheat remained unaffected due to P sources. Application of FYM 10 t/ha considerably increased oil and protein content, oil and seed yield of soybean as well as protein content and grain yield of succeeding wheat.

490. Rajput, T.B.S.; Patel, N. (Indian Agricultural Research Institute, New Delhi (India). Water Technology Centre). Yield response of okra (Abelmoschus esculentus L.) to different levels of fertigation. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 164-165 KEYWORDS: FERTILIZER APPLICATION; OKRAS; ABELMOSCHUS ESCULENTUS; FERTIGATION; YIELDS.

491. Negi, M.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Field Station); Singh, O.P.; Malik, H.P.S. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Nitrogen and phosphorus uptake by sorghum (Sorghum bicolor) hybrids as influenced by different levels of nitrogen and phosphorus fertilization. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 180-183 KEYWORDS: FERTILIZER APPLICATION; NITROGEN; NUTRIENT UPTAKE; SORGHUM BICOLOR; PHOSPHORUS; HYBRIDS; SORGHUM.

492. Prakash, Y.S.; Bhadoria, P.B.S.; Rakshit, A. (Indian Institute of Technology, Kharagpur (India). Agriculture and Food Engineering Dept.). Relative efficacy of organic manures in improving resistance and pest tolerance of okra (CV. Parbhani Kranti). Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 525-531 KEYWORDS: FERTILIZER APPLICATION; ORGANIC FERTILIZERS; OKARAS; PEST RESISTANCE; FERRASOLS; FERTILIZER COMBINATIONS.

Field experiments were carried out to evaluate relative efficacy of organic manures in improving pest tolerance of okra crop in lateritic soil. Three commercial manures viz., processed city waste (PCW), vermin compost (VC) and oil cake pellets (OCP) were assessed in relation to farmyard (FYM) alone and in combination with microbial culture MC). These organic manures were also used in combination with chemical fertilizers f) to assess the usefulness of such treatments against application of only CF. The influence of organic manures on resistance of okra to pests was assessed and it was observed that under no pest control treatment, per cent affected with borer in case of okra was 41 percent,21 percent 71 percent 44 percent, 26 percent 59 percent and 17 percent, (average of two years) with different nutrient sources PCW,VC, OCP, FYM+MC, FYM, CF and UC respectively. With regard to influence of organic manures on tolerance of crop to attack by pests, the treatment with FYM

imparted maximum tolerance as edible fruit yield recorded was highest compared to the treatment under conditioJ1;where no pest control measures were adopted. The extent of tolerance with FYM treatment against the treatments PCW, VC, OCP, FYM+MC, CF and UC was 26 percent 36 percent 78 percent 12 percent,71 percent and 145 percent respectivelv (average of two years).

493. Singh, S.; Choudhary, S.S. (Rajasthan College of Agriculture, Udaipur (India). Dept. of Agricultural Chemistry and Soil Science). Effect of different levels of phosphorus, zinc and soil types on yield, content and uptake (P & Zn) in wheat (Triticum durum). Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 535-540 KEYWORDS: FERTILIZATION; YIELDS; SOIL TYPES; WHEATS; PHOSPHORUS; TRITICUM AESTIVUM; ZINC; NUTRIENT UPTAKE; FERTILIZER APPLICATION; NUTRIENT AVAILABILITY; TRITICUM DURUM.

The effect of phosphorus and zinc fertilization and soil types on yield, content and uptake of phosphorus and zinc in wheat (Triticum durum) variety Raj. - 1555 was studied in a pot experiment in randomized design taking clay loam and sandy clay soils. Grain and straw yield of wheat increased with increasing levels of phosphorus and zinc was applied upto 10 kg ha-I. Highest grain and straw yield were recorded in Sz (clay loam) soil. Content and uptake of phosphorus by wheat grain and straw and zinc uptake by grain increased and zinc content in wheat grain and straw decreased with I increasing levels of phosphorus, whereas Zn uptake by wheat straw increased when phosphorus was applied upto 10 kg ha-I. Maximum content and uptake of zinc by I wheat grain and straw were observed in 2nl5 treatment. Phosphorus content and uptake by wheat straw declined with increasing levels of zinc, whereas phosphorus uptake by wheat grain increased when zinc was applied upto 10 kg ha-I. However, highest phosphorus and zinc content and uptake by wheat (grain and straw) were recorded in S2 (clay loam) soil.

494. Venkatesh, M.S.; Majumdar, B.; Kumar, K.; Patiram (ICAR Research Complex for North Eastern Hill Region, Umiam (India). Div. of Soil Science). Response of ginger (Zingiber officinale R.) to phosphorus source, FYM and mother rhizome removal in acid alfisol of Meghalaya. Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 548-553 KEYWORDS: FERTILIZER APPLICATION; PHOSPHORUS; ROCK PHOSPHATES; FARMYARD MANURE; RIZOMES; ZINGIBER OFFICINALE; MEGHALAYA; NUTRIENT UPTAKE; ACID SOILS; SOIL CHEMICOPHYSICAL PROPERTIES.

Field experiment were conducted at ICAR Research Complex farm Umiam, Meghalaya Iduring kharif 1999 and 2000 to study the response of ginger to phosphorus sources (rock phosphate and SSP), FYM and mother rhizome removal. Application of rock phosphate (RP) 100 kg pp/ha in conjunction with FYM 10 t/ha resulted in maximum growth, rhizome yield and nutrient uptake by rhizome. Effect of mother rhizome removal on growth and rhizome yield was not significant but it provided an extra income to the farmer during the off season. Available phosphorus content in post harvest soil was maximum in RP + FYM treatment whereas the other soil properties viz., pH, organic carbon and exchangeable cations were at par due to RP and SSP application. Rock phosphate proved to be a better source of P than SSP.

495. Dubey, A.K. (ICAR Research Complex for North Eastern Hill Region, Umiam (India). Div. of Horticulture). Effect of plant growth regulators on fruit drop, yield and quality of Khasi mandarin (Citrus reticulata Blanco) fruits. Annals of Agricultural Research (India). (Sep 2002) v. 23(2) p. 574-577 KEYWORDS: FOLIAR APPLICATION; FRUIT DROP; PLANT GROWTH SUBSTANCES; MANDARINS; CITRUS RETICULATA; YIELDS; ARUNACHAL PRADESH.

A study was conducted with'tI1ree-plant growth regulators viz, 2, 4, 5-D, 2, 4, 5-T and GA3 in various concentration as folier spray in Madarin orange at ICAR Research Complex for NEH Region, Arunchal Pradesh,centre, Basar during year 1999-2000. Results showed that application of plant growth regulators significantly reduced fruit drop and enhanced yield. The application of27 mgl,l 2, 4-D was found most effective in controlling of fruit drop upto 60 percent and increased yield by 79.16 percent as compared to untreated-trees. However, application of 27mgl of 2, 4, 5- T gave the highest fruit weight (181-60gm) and juice content in fruit (90.1Oml/fruit).

496. Aishwath, O.P. (National Research Centre for Medicinal and Aromatic Plants, Anand (India); Dravid, M.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Soil Science and Agricultural Chemistry). Performance of pigeonpea (Cajanus cajan L.) with residual fertility in wheat - pigeonpea cropping sequence under integrated nutrient management. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 611-617 KEYWORDS: FERTILIZER APPLICATION; FERTILIZER COMBINATIONS; SEQUENTIAL CROPPING; RESIDUAL EFFECTS; BIOFERTILIZERS; FARMYARD MANURES; CAJANUS CAJAN; WHEATS; NUTRITIONAL REQUIREMENTS; NUTRIENT UPDATE.

A field experiment was conducted on Typic Ustitluvents (saline phase) soil with various combinations of N, P, FYM and bio-fertilizers. These treatments were directly applied to wheat crop and residual effect of these treatments was studied on pigeonpea crop. The yield of pigeon pea and the uptake of N, P and K increased significantly with residual N levels alone or in combination with P or FYM. The yield and uptake of nutrients were highest when P and FYM were applied together with N levels. The influence of FYM alone or in combination with N levels was more pronounced as compared to the P alone or its combination with N levels. The yield and uptake of N, P and K were higher with both the inoculants as compared to no inoculation and Azotobacter proved to be better than the Azospirillum. The magnitude effect of FYM was more pronounced than P with respect to K uptake and it was reverse with. P uptake.

497. Kalaiyarasan, C.; Vaiyapuri, V.; Sekharan, S.R.M.V. (Annamalai University, Annamalainagar (India). Faculty of Agriculture). Effect of sulphur sources and levels on the growth and yield of groundnut in red lateritic soil. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 618-621 KEYWORDS: FERTILIZER APPLICATION; SUPERPHOSPHATE; SULPHUR; GYPSUM; GROUNDNUTS; YIELD COMPONENTS; FERRASOLS; GROWTH; YIELDS.

Field experiments were conducted in red lateritic soil to assess the effect of different sources of sulphur viz., gypsum, single superphosphate (SSP) and iron pyrite applied at three levels of S (15, 30 and 45 kg ha-1) on the growth and yield of groundnut. The results revealed that growth and yield of groundnut were significantly increased with S levels and maximum was noticed at 45 kg ha-1. Among the S sources, application of 'gypsum at 45 kg S ha-1

significantly increased the plant height (61.5 cm), LaL'(3.96), DMP (5.92 t ha-1), number of pods plant" (26), 100 kernel weight (50.4), pod yield (2.38 t ha-1) and kernel yield (1.86 t ha"). This was closely followed by SSP at 30 kg S ha-1.

498. Shukla, R.K.; Kumar, A.; Mahapatra, B.S.; Singh, R.P.; Kandpal, B. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Response of promising varieties of rapeseed (Brassica napus) to nitrogen and sulphur fertilization in tarai region of Uttranchal. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 630-633 KEYWORDS: FERTILIZER APPLICATION; BRASSICA NAPUS; SULPHUR; RAPESEED; VARIETIES; NITROGEN; UTTAR PRADESH; YIELDS.

A field experiment was conducted during 1998-99 and 1999-2000 at the Crop Research Centre of 9.8. Pant University of Agriculture and Technology, Pantnagar to study the effect of sulphur and nitrogen fertilization in different cultivars of rape (Brassica napl/S L), Among the culivars; 'GSL l' gave maximum seed yield and it was at parwith 'Hyola 40 I' and significantly higher than 'TERI (R-05)'. Sulphur application at the rate of 40 kglha failed to give significant effect. However 120 kg N/ha gave significantly higher seed yield over 60 kg N/ha. Similar trends were observed in case of seed yield at different branches and contribution of branches in seed yield.

499. Kumar, S.; Choudhary, G.R.; Chaudhari, A.C. (S.K.N. College of Agriculture, Jobner (India). Dept. of Agronomy). Effect of nitrogen and bio-fertilizers on yield and quality of coriander (Coriandrum sativum L.). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 634-637 KEYWORDS: FERTILIZER APPLICATION; YIELDS; CORIANDER; CORIANDRUM SATIVUM; HARVEST INDEX; NITROGEN; BIOFERTILIZERS; QUALITY.

Application of 60 kg N/ha significantly increased seed and stover yield as well as the total N-uptake over control and 30 kg N/ha. The harvest index remained superior only upto 30 kg N/ha over control. Nitrogen, protein and essential oil content in seed were significantly higher at 60 kg N/ha compared to control. Combined inoculation of Azospirillum significantly enhanced seed and stover yield, harvest index as well as the total N-uptake by crop over no-inoculation.

500. Kamla, K.; Paliyal, S.S. (Himachal Pradesh Krishi Vishwa Vidyalaya, Dhaulakuaon (India). Regional Res. Stn.). Influence of phosphorus management and organic manuring on uptake and yield of chickpea (Cicer arietinum). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 642-645 KEYWORDS: FERTILIZER APPLICATION; ORGANIC MANURES; PHOSPHRUS; FARMYARD MANURE; NUTRITIONAL REQUIREMENTS; CICER ARIETINUM; NUTRIENT UPTAKE; YIELDS; CRUDE PROTEIN; PROTEIN CONTENT.

A field experiment was conducted for two years on sandy loam soils at HPKVV, Regional Research Station, Ohaulakuan to study the effect of integrated phosphorus management involving organic manures (FYM and Vermicompost) on yield and crude protein content of chickpea. Grain yield of chickpea and P-uptake by chickpea was maximum at 50 kg pp/ha applied alongwith FYM or Vermicompost. FYM and Vermicompost were equally effective in increasing grain yield and crude protein contents of chickpea. The increase in crude protein contents of chickpea was 5.52, 14.62 and 20.35 percent with P dose from 25, 50 and 75kglha,

respectively over control. With organic manures i.e. FYM or Vermicompost optimum dose of P for chickpea is 50 kglha.

501. Asrey, R.; Singh, R.; Kumar, S. (Central Institute of Post Harvest Engineering and Technology, Abohar (India). Influence of organic manures and flower preservation on post harveswt vase life of gradilous cut flower. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 659-663 KEYWORDS: GLADIOLUS; FERTILIZER APPLICATION; ORGANIC MANURE; CUT FLOWERS; COTTONSEED MEAL; KEEPING QUALITY; PLANT WAQTER RELATION; POST HARVEST PHYSIOLOGY; SPIKES.

Field and laboratory studies were conqucted at Central lnstitute of Post Harvest Engineering & Technology, Abhor to record the effect of organic manure vermin-compost, farm yard manure and cotton cake),. silver nitrate and hydroxyquinolints on, vase life of gladiolus cut flower. Soil application of cotton cake .1.25. kg/m2 followed by spike treatment given the highest cut flower vaselife. Hydroxyquinoline-8 and silver nitrate vase solution at higher concentration (150 and 90 ppm) enhanced flower vase life (13.41 and 12.46 days), whereas control it was 8.56 datas. Cotton cake proved best in respect of cuttlower vase life followed by vermin-compost and FYM.

502. Saikia, U.S.; Chopra, U.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Physics); Singh, A.K. (Indian Agricultural Research Institute, New Delhi (India). Water Technology Centre); Goswami, B. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Physics). Simulation of biomass and seed yield of Indian mustard (Brassica juncea) under different levels of nitrogen. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 685-691 KEYWORDS: SIMULATION MODELS; FERTILIZER APPLICATION; NITROGEN; BIOMASS; SIMULATION; BIOMASS; MUSTARD; BRASSICA JUNCEA; SEEDS; YIELDS.

The response of mustard variety Pusa Jaikisan to different levels of applied fertilizer nitrogen was studied using Campbell-Diaz model To take care of the dificit and excess conqitions of fertilizer application, three types of crop response factors were used based on drymatter production, availability of nitrogen in its nitrate form and simple dose of fertilizer application. The response factor was included in the main model as a multiplicative factor, Results revealed that inclusion of response factors has improved the performance of estimation of dry matter and seed yield under different levels of nitrogen fertilizer application. The response factor based on the dry matter production was found to be most suitable.

503. Agrawal, S.B.; Tomar, S.S.; Bhadauria, A.K.S.; Kewat, M.L. (Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). Dept. of Agronomy). Response of fodder oat (Avena sativa L.) to methods of Azotobacter inoculation under various levels of nitrogen. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 692-696 KEYWORDS: AZOTOBACTER; AVENA SATIVA; INOCULATION; OATS; NITROGEN; YIELD COMPONENTS; YIELDS; FORAGE; DRYMATTER CONTENT.

A field investigation was carried out during 1993-94 and 1994-95 to study'the response of fodder oat (Avena Sativa L.) to 3 methods of inoculation (without inoculation, seed inoculation and soil inoculation)and 4 levels of nitrogen (O, 40, 60 and 80 kg N ha"). Inoculation with Azotobacter either of the methods sjgnificantly increased the plant, height, number of leaves/

plant, tillers/plant, green fodder, dry matter and crude protein yields. The crop responded significantly upto 80 kg N a-1 for green fodder, dry matter and crude protein yields. Interaction between inoculation methods and N levels was found significant. Inoculation of seed with Azotobacter receiving moderate levels of nitrogen (60 kg N h-I) gives similarly yields to that recorded under higher dose of 80 kg ha-1 alone.

504. Majumdar, B.; Venkatesh, M.S.; Kumar, K.; Patiram (ICAR Research Complex for North Eastern Hill Region, Umiam (India). Div. of Soil Science). Efficiency of rock phosphate, superphosphate and their mixture with farm yard manure on soybean in an acid alfisol of Meghalaya. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 697-703 KEYWORDS: FERTILIZER APPLICATION; FERTILIZER COMBINATIONS; ROCK PHOSPHATES; SUPERPHOSPHATES; NUTRIENT UPTAKE; FARMYARD MANURE; YIELDS; SOYBEANS; LUVISOLS; MEGHALAYA.

Field experiments were conducted for two years on a phosphorus deficient Ultic Hapludalft6 study the effectiveness of different levels of SSP (superphosphate) and RP (rock phosphate) and their mixtures along with FYM on soybean. SSP 60 kg PP5 ha-' alone or in combination with 5t ha-' FYM was superior to rock phosphate .30 or 60 kg PZ05 ha-I alone or with FYM; but was at par with 60 kg'PP5 ha'i as SSP + RP (I: 1) alone or in combination with FYM with regard to grain and straw yield and P uptake. The performance of SSP 30 kg PP5 ha-I alone or with FYM was almost equivalent to RP 30 or 60 kg PP5 ha-I and SSP + RP (1: I) 30 kg PP5 ha-I alone or in conjunction with FYM. The maximum Protein and oil content were recorded with SSP (60 kgPP5 ha-') in combination with FYM and removal of N and K was also maximum. Available Nand P increased from 8.6 to 57.3 and from 2.4 to 18.9 kg ha-1 respectively over the initial values after two subsequent soybean crops and build up was more with 60 kg PP5 hit-' as SSP with FYM. Maximum phosphorus j.lse efficiency Of 17.2 per cent was with SSP 30 kg PP5 ha" + FYM. Per cent yield response was maximuIp (80 percent) with 60 kg PP5 ha-I as SSP + FYM. Significant positive correlations between organic carbon and available N, nodule weight/plant with available N and available N with total N and P were also observed of the post harvest soil after two years.

505. Shivay, Y.S. (Zhejiang Agricultural University, Hangzhou (China). Dept. of Agronomy). Effect of K nutrition and genotypes on yield attributes, yields and nutrients accumulation of barley (Hordeum vulgare L.) under low lavailable soil potassium condition. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 704-709 KEYWORDS: FERTILIZATION; GENOTYPES; HORDEUM VULGARE; POTASSIUM; BARLEY; NUTRIENTS; YIELDS; YIELD COMPONENTS; NUTRIENT UPTAKE; NUTRIENT AVAILABILITY.

A field experiment was carried out at the experimental farm of Zhejiang Agricultural University, Hangzhou, P. R. China, during rabi season of 1998-99, to study the effect of K nutrition. and genotypes on yield attributes, yields and nutrients accumulation in barely under low available soil potassium condition. There were significant effect of potassium nutrition on yield attributes, yields and nutrient accumulation of barley genotypes with Successive increase in potassium levels. The maximum grain yield (6.32 Mg/ha) was recorded with highest level of potassium nutrition (225 kg Kp/ha) and it was7.7, 19.9 and 35.9 percent higher over 150, 75 kg K20/ha and control, respectively. Among the tested genotypes, 96-6 genotype recorded the

maximum values of yield attributes, yields and nutrient accumulation in grain as well asjn straw. Indicating the efficient utilizer of nutrients especially K utilization under low available soil potassium condition to exploit the maximum yield potential for further barley improvement programme.

506. Singh, S.P. (Sambhu Dayal College, Mathura (India). Dept. of Agricultural Chemistry and Soil Science); Singh, B. (Raja Balwant Singh College, Bichpuri (India). Dept. of Agricultural Chemistry and Soil Science). Effect of phosphorus application on the germination, growth and yield of french bean (Phaseolus vulgare L.) irrigated with sodic water. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 710-713 KEYWORDS: FERTILIZER APPLICATION; PHASEOLUS VULGARE; IRRIGATION; YIELD COMPONENTS; SALINE WATER; GERMINATION; GROWTH; YIELDS.

A pot experiment was conducted for two year with fjve level RSC Viz., control 2.5,5.0,7.5 and 10 .0 m mol L-1, rich irrigation water and four levels of phosphorus Viz, control, 45,60 and 75 Kg ha-1on sandy loam sqil. The germination percentage plant height. humber of pods plant^{-1} number of grains, pod-1,grain and straw yieids of French bean decreased signficantly with the use of sodic irrigation water, while significant enhancement in germination, growth and yield were noted with phosphorus application up to 75 kgha-I. It was concluded that phosphorus fertilization would be beneticial if the RSC rich irrigation waters up to 10.0 m mol L-I are used.

507. Shukla, D.K.; Shukla, A.; Mahapatra, B.S.; Singh, R.P. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Agronomy). Evaluation of quality characters of yellow sarson cultivars under different rate of N fertilization in tarai region. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 726-727 KEYWORDS: FERTILIZER APPLICATION; BRASSICA CAMPESTRIS; YIELDS; NUTRITION UPTAKE; YIELD COMPONENTS; AGRONOMIC CHARACTERS; NITROGEN; VARIETIES; QUALITY.

508. Chauhan, S.K.; Maheshwari, S.K.; Tiwari, G. (All India Coordinated Research Project on Medicinal and Aromatic Plants, Indore (India). Effect of sources and levels of nitrogen on morphological attributes and drymatter production of kalmegh (Andrographis paniculata (Burm. F.) Wall. Ex Nees) under rainfed conditions of Malwa plateau. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 728-729 KEYWORDS: ACANTHACEA; NITROGEN; DRYMATTER CONTENT; ORGANIC MANURES; PLANT ANATOMY; PRODUCTION; RAINFED FARMING; MADHYA PRADESH; FERTILIZER APPLICATION.

509. Sutaliya, R.; Gupta, A.K.; Ram, V. (S.K.N. College of Agriculture, Jobner (India). Dept. of Agronomy). Response of barley to varying levels of phosphorus and sulphur. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 732-733 KEYWORDS: FERTILIZER APPLICATION; FERTILIZER COMBINATIONS; PHOSPHORUS; SULPHUR; BARLEY; YIELDS; YIELD COMPONENTS.

510. Singh, S. (Punjab Agricultural University, Ludhiana (India). Dept. of Agronomy); Jat, N.L. (S.K.N. College of Agriculture, Jobner (India). Dept. of Agronomy). Effect of phosphorus and

zinc fertilization on growth and yield of coriander (Coriandrum sativum L.). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 734-736 KEYWORDS: FERTILIZER APPLCIATION; PHOSPHORUS; ZINC; GROWTH; YIELDS; CORIANDER; CORIANDRUM SATIVUM; YIELD COMPONENTS; FERTILIZER COMBINATIONS.

F06 Irrigation

511. Kibe, A.M.; Singh, S. (Indian Agricultural Research Institute, New Delhi (India). Water Technology Centre). Influence of irrigation, nitrogen and zinc on productivity and water use by late-sown wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 186-191 KEYWORDS: TRITICUM AESTIVUM; IRRIGATION SCHEDULING; NITROGEN; ZINC; SOWING DATE; WATER USE; YIELD COMPONENTS; EFFICIENCY; HARVEST INDEX.

A field experiment was conducted on deep sandy soil (Typic Ustochrept) at the Water Technology Centre, Indian Agricultural Research Institute, New Delhi, during winter seasons of 1999-2000 and 2000-2001 with latesown 'HD 2285' wheat (Triticum aestivum L. emend. Fiori & PaoL.). The treatments comprising 4 irrigation levels [10 no post-sowing irrigation; 11 1 irrigation at crown-root intiation (CRI) stage; 12, 2 irrigations, each at CRI and flowering stages; 13,4 irrigation each given at CRI, jointing, flowering and dough stages] in main plots and combinations of 3 N levels (0, 50 and 100 kg N/ha) and 2 zinc levels (0 and 5 kg Zn/ha) in subplots were laid out in split-design, replicated 3 times, to find out the influence of irrigation, nitrogen, zinc and their interactions on yield and moisture use by the crop. Progressive increase in irrigations from 0 to 4 and N levels from 0 to 100 kg/ha, increased wheat yield attributes and grain yield significantly over the control tredlments (/0 and NO- The average seasonal consumptive water use (CU) by wheat increased with every additional irrigation level to a maximum of 328.4 mm and 301.7 mm in the first and second season respectively. On an average (2 seasons), water-use efficiency (WUE) was the highest (1.38 kg grain/m3) with 12, However, the straw yield (6,808.5 kg/ha) and grain yield (3,962.5 kglha) were highest with 13. The average moisture use rate increased with increase in irrigation to a maximum of 2.63 mrn/day. Maximum moisture extraction of 59.4 to 65.8 percent was from the 0-30 cm and the minimum (7.10 to 5.32 percent) from the 90-120 cm soil depth. The WUE increased markedly with the increase in N level.

512. Raskar, B.S.; Bhoi, P.G. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Water Management Project). Response of summer groundnut (Arachis hypogaea) to irrigation regimes and mulching. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 210-213 KEYWORDS: GROUNDNUTS; MULCHING; ARACHIS HYPOGAEA; IRRIGATION SCHEDULING; YIELD COMPONENTS; YIELDS; ECONOMICS.

A field experiment was conducted during summer seasons of 1999-2001 at Rahuri, Maharashtra, to find out appropriate irrigation schedule for summer groundnut (Arachis hypogaea L.) and to evaluate the effect of mulch on crop performance in broad bed-furrow method. Twenty-four treatment combinations, comprising 4 irrigation regimes based on cumulative pan evaporation (CPE), viz. 75,100,125 and 150 mm CPE, and 6 mulching treatment, viz. sugarcane trash 5 tonnes/ha and plastic film mulch (7 micron) with and without kaoline 8 percent and the control. Among all the irrigation regimes, irrigation

scheduled at 75 mm CPE to summer groundnut recorded significantly higher yield parameters, dry pod yield (34.08 q/ha) and net returns (Rs 32,012/ha) in broad bed furrow (60-30 cm x 6.67 cm) than 100, 125 and 150 mm CPE. Mulching of plastic film with kaoline spray (8 percent) was found effective and registered highest pod yield (34.70 q/ha) over rest of treatments. The net returns obtained owing to mulching with plastic film and sugarcane trash with and without kaoline spray were almost identical. The benefit: cost ratio indicated that the use of sugarcane trash 5 tonnes/h~ was found economically feasible agronomic practice for summer groundnut. The total consumptive use of water (738 mm) was higher with minimum water-use efficiency (4.61 kglha-mm) when irrigation was scheduled at 75 mm CPE. The water-use efficiency was higher-with use-of, plastic film mulch with kaoline (6.69 kglha-mm) and was lowest with the control (3.49 kg/ha-mm). On an average, the evapotranspiration losses were reduced to the extent of 25.77, 14.63 and 4.56 peercent due to application of plastic film, sugarcane trash and kaoline spray, respectively.

513. Raskar, B.S. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Water Management Project). Increasing yield potential of potato (Solanum tuberosum) by using irrigation methods and fertilizer levels. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 229-231 KEYWORDS: IRRIGATION METHODS; POTATOES; SOLANUM TUBEROSUM; FERTILIZERS; YIELDS; ECONOMICS.

The experiment was conducted during 1998-99 and 1999-2000 to study the yield potential of potato (Solanum tuberosum L.) by adopting different irrigation methods and fertilizer levels. Eighteen treatments comprising 3 irrigation methods, viz. sprinkler, drip and furrow, and 6 fertilizer levels, viz. 80: 40 :40, 120 : 60 : 60, 160 : 80 : 80, 80 :40 : 80, 120 : 60 : 120 : and 160 : 80 : 160 (N : P Ps:O kg/ha), were undertaken in split-plot design with 6 replications. The crop was planted in November during both the years on ridges, spaced at 60 cm keeping 20 cm space between plants. The pooled results indicated that sprinkler and drip irrigation systems resulted in significantly higher potato tuber yield to extent of 43.5 and 21.2 perent, respectively, compared with the furrow-irrigation method. The fertilizer dose of 120 : 60 : 120 N : P2O5:K2O kg/ha resulted in significant higher yield than rest of fertilizers levels and found optimum for potato. Sprinkler irrigation gave the maximum returns (Rs 42,B50/ha) and benefit: cost ratio with 120 : 60 : 120 N : P2O5 : K2O kg/ha and benefit: cost ratio and hence found less economical for potato.

514. Jadhav, A.G.; Karanjikar, P.N. (Mahatma Phule Krishi Vidyapeeth, Niphad (India). Agricultural Res. Stn.). Performance of new wheat genotypes under restricted irrigation. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 162-163 KEYWORDS: IRRIGATION SCHEDULING; YIELDS; YIELD COMPONENTS; GENOTYPES; WHEATS.

F07 Soil Cultivation

515. Kukal, S.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Soils). Interactive effect of intensity and depth of puddling and water stress on the performance of rice in a sandy loam soil. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 131-135

KEYWORDS: PUDDLING; DEPTH; DROUGHT STRESS; SOIL CHEMICOPHYSICAL PROPERTIES; RICE; SOIL WATER MOVEMENT.

Puddling reduces percolation losses of water in rice fields, the extent of reduction being a function of intensity and depth of puddling. A three year field study was undertaken on a sandy soil to analyse the interactive effect of puddling intensity, depth and water stress on grain yield of rice crop. The treatments comprised of three puddling intensities viz., unpuddled (Po)' two wet cultivations followed by one planking (medium) and four wet cultivations followed by one planking (high) each at shallow (5-6 cm) and normal (I O-J 2 cm) depths. Average percolation rate decreased to the extent of 54-58 per cent with medium puddling but it did not increase any further significantly with high puddling. Puddling depth had no effect on percolatIon:.rate of soils. Water stress at reproductive stage significantly decreased grain yield of rice during all the three years of study. Puddling intensity and water stress interacted significantly to affect the rice grain yield. The reduction in grain yield due to water stress was more in Po compared to that in medium and high puddling. Interaction of puddling depth and water stress was non-significant.

F08 Cropping Patterns and Systems

516. Acharya, C.L. (Indian Institute of Soil Science, Bhopal (India). Integrated input management for sustainable crop production in rainfed agro-ecosystems. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 398-413 KEYWORDS: INTEGRATION; SUSTAINABILITY; AGROECOSYSTEMS; RAINFED FARMING; SOIL FERTILITY.

517. Saikia, J.; Baruah, H.K.; Phookan, D.B. (Assam Agricultural University, Jorhat (India). Dept. of Horticulture)). Off season production of cucumber inside lowcost polyhouse. Annals of Biology (India). (Jan 2001) v. 17(1) p. 61-64 KEYWORDS: CROPPING SYSTEMS; PRODUCTION; OFF SEASON CULTIVATION; CUCUMIS SATIVUS; PROTECTED CULTIVATION; GREEN HOUSES.

An experiment was laid out inside LDPE fihu covered bamboo structured low cost polyhouse (gableeven type) in which four varieties of cucumber viz., Poinsette, Pusa Smyog, AAUC-l and AAUC2 were grown during winter season as off season crop. The temperature differences in the polyhouse with ambient temperature were calculated. The variety AAUC-2 recorded highest mean values for characters such as number of fruits per plant, fruit length, average fruit weight and yield per plant. Highest benefit : cost ratio was observed in AAUC-2 (3.48:1) followed by AAUC-l (3.18:1). Inspite of low cost structure, the inside temperatures in the polyhouse were fOl.Uld considerably higher during October to February compared to ambient temperatures for which summer season vegetable like cucumber could be grown profitably inside polyhouse as off season crop during winter months.

518. Kharub, A.S.; Chauhan, D.S.; Sharma, R.K.; Chhokar, R.S.; Tripathi, S.C. (Directorate of Wheat Research, Karnal (India). Diversification of rice (Oryza sativa)-wheat (Triticum aestivum) system for improving soil fertility and productivity. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 149-152 KEYWORDS: CROPPING SYSTEMS; ORYZA SATIVA; DIVERSIFICATION; SEQUENTIAL CROPPING; TRITICUM AESTIVUM; SOIL FERTILITY; PRODUCTIVITY; YIELDS; GREEN MANURING; FERTILIZER APPLICATION.

A field experiment was conducted during 1996-97 to 1999-2000 at Karnal, to evaluate the effect of 6 rice (Oryza sativa L.)-based crop sequences on soil fertility and productivity. Maximum wheat-equivalent yield was recorded by inclusion of potato (Solanum tuberosum L.) (197.1-200.3 q/ha), followed by vegetable pea (Pisum sativum L.) (173.5-173.8 q/ha) between rice and wheat (Triticum aestivum L. emend. Fiori & Paol.) crops. These systems resulted in additional wheat-equivalent yield of 48-71 qlha over the rice-wheat system. Continuous incorporation of Sesbania aculeata as green-manure increased organic carbon by 8.7 percent, available N by 12.1 percent, Olsen's P by 10.1 percent and available K by 5.0 percent in soil compared to rice-wheat sequence. Growing of vegetable pea and potato between rice and wheat also increased organic carbon by 8.9 and 17.1 percent, available N by 6.3 and 8.3 percent and available P by 6.3 and 19.0 percent, respectively, compared to rice-wheat system. Green-manuring with Sesbania aculeata added 97-109 kg Nlha and enhanced the wheat-equivalent yield in the rice-wheat system. Electrical conductivity and pH of soil decreased due to the inclusion of vegetable rice, potato and green manure.

519. Rathore, S.S.; Gautam, R.C. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Response of direct-seeded and transplanted pearlmillet (Pennisetum glaucum) to nitrogen, phosphorus and biofertilizers in intercropping system. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 153-155 KEYWORDS: INTERCROPPING; DIRECT SOWING; TRANSPLANTING; BIOFERTILIZERS; RAINFED FARMING; PENNISETUM GLAUCUM; PEARLMILLET; VIGNA UNGUICULATA; FERTILIZER APPLICATION; YIELDS.

A field experiment was conducted during the rainy (kharif) seasons of 1999 and 2000, at New Delhi, to study nutrient management in pearlmillet [Pennisetum glaucum (l.) R. Sr. emend. Stuntz.]. Hybrid 'Pusa 23' in sole and intercropping system with cow'pea [Vigna unguiculata (L.) Walp.] Variety 'Pusa Komal' under direct-seeded and transplanted conditions. The crops were grown with varying tevels of I, PPs along with biofertilizers (Azospirillum culture + VAM). The treatments comprised 4 main plot treatments with 2 methods of planting pearlmillet with and without intercrop and 7 levels of fertilizers. The transplanting of pearl millet was on a par with direct seeding. Although the transplanted crop had lower 'grain weight/ear and shorter ear length, it had mora ears/m2 and greater 1,000-grain weight than direct-seeded crop which led to similar yield under both the conditions. The grain yield of pearlmillet with application of 40 kg N + 30 kg P2O/ha along with biofertilizers was at par with recommended dose of 60 kg N + 45 kg P p/ha indicating saving of 20 kg Nand 15 kg P p/ha through biofertilizers. There was no effect of co~pea intercropped with pearlmillet in both the years.

520. Jat, H.S.; Ahlawat, I.P.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Response of pigeonpea (Cajanus cajan) + groundnut (Arachis hypogaea) intercropping system to planting pattern and phosphorus management. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 156-159 KEYWORDS: INTERCROPPING; CAJANUS CAJAN; GROWTH; PLANTING; ARACHIS HYPOGAEA; YIELDS; YIELD COMPONENTS; PHOSPHORUS; PRODUCTIVITY; PROTEIN CONTENT.

A field experiment was conducted at New Delhi during the rainy season of 2000 and 2001, to study the effect of planting pattern and P-fertilizer management in pigeonpea [Cajanus

cajan (L.) Millsp.] + groundnut (Arachis hypogaea L.) intercropping system. Planting patterns failed to affect the growth and yield attributes, protein content and yield of pigeon pea. Gtoundnut in all the intercropping treatments being at par recorded significantly lower yieald attributes (except 1,OOO seed weight) ana yield compared with sole groundnut. Pigeonpea + groundnut intercropping in various planting patterns being at par recorded significantly higher pigeonpea-equivalent yield (PEY) and P uptake than sole pigeonpea. Both pigeonpea and groundnut in sole and intercropping systems responded favourably upto 40 kg P2O5/ha only for growth and yield attributes (except 1,000 seed weight and harvest index), protein content, yield, PEY and P uptake over no phosphorus.

521. Sarkar, R.K.; Malik, G.C.; Goswami, S. (Calcutta University, Kolkata (India). Dept. of Agronomy). Productivity potential and economic feasibility of sesame (Sesamum indicum)-based intercropping system with different planting patterns on rainfed upland. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 164-167 KEYWORDS: INTERCROPPING; SESAMUM INDICUM; PRODUCTIVITY; HIGHLANDS; ECONOMICS; YIELDS; PLANTING; YIELD COMPONENTS; RAINFED FARMING; PRODUCTION POSSIBILITIES.

A field experiment was conducted during the rainy season of 2000 and 2001 to determine productivity and economic feasibility of sesame (Sesamum indicum L.)-based intercropping system on Gangetic alluvial rainfed upland. All the intercropping systems registered significant and appreciable increase in total productivity in terms of sesame-equivalent yield over sole sesame. Among different intercropping patterns of sesame with pulse and oilseed crops, paired row planted sesame (30/60 cm) +1 row groundnut (Arachis hypogaea L.) resulted in maximum sesame-equivalent yield (1,654 kg/haJ, net return (As 9,414 kglha), land-equivalent ratio (1.59), monetary advantage (Rs 8,751 kg/haJ, and indicated a modest aggressivity index (:to.29) owing to minimum competition between crops. This system, thus, proved most efficient and sustainable on rainfed upland ecosystem.

522. Vani, K.P. (Acharya N.G. Ranga Agricultural University, Hyderabad (India); Bheemaiah, G. (Acharya N.G. Ranga Agricultural University, Hyderabad (India). Dept. of Forestry). Effect of alley cropping of castor (Ricinus communis) and integrated management practices on productivity status of soil under SAT regions. Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 224-228 KEYWORDS: ALLEY CROPPING; SEMI ARID ZONES; SOIL FERTILITY; RICINUS COMMUNIS; GREEN MANURE; SOIL CHEMICOPHYSICAL PROPERTIES; DALBERGIA; LEUCAENA ALBRIZIA.

A study was conducted during. 1996 and 1997 to find out the changes in productivity status of soil due to alley cropping of castor (Ricinus communis L.) and integrated nutrient managemant practices at Hyderabad. Physical properties of 'soil like field capacity (18.1 and 19.9 percent) and infiltration rate (7 and 7.2 cm/hr) improved, while the bulk density (1.49 and 1.29 mglm3) decreased due to alley cropping in both the years over sole cropping of castor. Application of green leaf manures of trees also increased the field capacity and infiltration rate and reduced the soil ' compaction when compared with- no green leaf manuring. Leucaeria green leaf manuring produced pronounced' effect of increasing field capacity (18.9 and 21.2 percent) and infiltration rate of the soil (7.5 and 8.6 cm/hr) but reduced the bulk density (1.48 and 1.24 mglm3) specially under alley cropping with Dalbergia.

Field analysis of soil samples seasonally for chemical properties indicated that available N, organic carbon, total nitrogen and C : N ratio were found optimum under alley cropping with green leaf manuring 90 days after sowing (DAS) with gradual increase from 30 DAS. Incubation studies at differenfperiods also showed that the soil fertility started building up from initial stages of incubation both under alley cropping and green leaf manuring. However, the soil productivity in terms of available nitrogen, organic carbon total nitrogen and C: N ratio was found better at 75 days after incubation (DAI) in alley cropping and green leaf manuring as well.

523. Padhi, A.K. (Orissa University of Agriculture and Technology, Kalimela (India). Regional Research Station). Studies on productivity, economics and energetics of maize (Zea mays L.) - legume intercropping. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 38-45 KEYWORDS: INTERCROPPING; URD; LEGUMES; ZEA MAYS; YIELDS; ECONOMICS; LAND USE; PRODUCTIITY; MAIZE.

Studies on maize-legume based intercropping systems demonstrated that maize + blackgram at I : 1 row ratio was found to be more productive, economically and energetically viable system with the highest maize-equivalent yield, net return, return rupee invested, land equivalent ratio, area time equivalent ratio, relative value total, relative net return, monetary advantage index, energy output and energy use efficienty for main and total produce. This system enhanced the total maize equivalent yield by 49.9 percent over that of normally sown sole maize (2512.3 kglha) and by 109.8 percent over that of sole blackgram (1786.2 kglha). The net return realised from this system was increased" by Rs6093 and Rs4840/haand energy output by 8.14x 1000 and 85.53 x 1000 MJ/ha over normally sown sole maize and sole blackgram, respectively. Maize + soybean at 1: 1 and 2:2 row ratio closely followed this system on the above aspects. Maize + groundnut, however, at I: 1,2: I and 2:2 row ratio although found uneconomical compared to sole maize but accrued more profit compared to sole blackgram.

524. Singh, R.; Kumar, A.; Chillar, R.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Direct and residual effects of fertility levels on the productivity of maize (Zea mays) based cropping systems . Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 46-50 KEYWORDS: CROPPING SYTEMS; MAIZE; INTER CROPPING; ZEA MAYS; RESIDUAL EFFECTS; FERTILITY; PRODUCTIVITY.

To evaluate the performance of various maize based cropping systems under different fertility levels a field experiment was conducted during 1998-2000 at New Delhi. Results indicated that maize + cowpea intercropping and 150 kg N + 60 kg P205 + 60kg K20lha had maximum maize green cob equivalents. Residual effect of intercropping . systems on the succeeding potato and cauliflower was also higher when grown after maize + cowpea in sequence. The fertility level of 100 kg N + 40 kg P 2°5 + 40 kg K2O' + lOt FYMlha was superior In respect of its residual effect on succeeding potato and cauliflower and also had more residual contents ofN, P and K in soil.

525. Sharma, R. (Project Dirctorate for Cropping Systems Research, Modipuram (India). Effect of mungbean intercropping on the productivity of sunflower and its resource use. Annals of

Agricultural Research (India). (Mar 2002) v. 23(1) p. 166-167 KEYWORDS: INTERCROPPING; MUNGBEANS; HELIANTHUS ANNUS; LEAF AREA INDEX; YIELDS; PRODUCTIVITY.

536. Singh, S.N.; Kumar, A. (Indian Agricultural Research Institute, New Delhi (India). Div . of Agronomy). Production potential and economics of winter maize based intercropping systems. Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 532-534 KEYWORDS: CROPPING SYSTEMS; PRODUCTION POSSIBILITIES; YIELDS; MAIZE; INTERCROPPING; ECONOMICS.

In a field experiment in Indian Agricultural Research Institute, New Delhi, nine winter maize based cropping systems were tried in randomized block design and replicated nice. Maximum and minimum maize cobs equivalents of inter crops were recorded by radish (157.2 q/ha) and faba bean (25.3 q/ha), respectively. Maize + radish was the best I1tercropping system in terms of total maize equivalents, net return and net return /rupee, invested. Intercropping with carrot, turnip and potato reduced the maize cobs yield to the extent of 34.9, 31.4. and 27.8 per cent compared to maize (sole), respectively.

537. Dhurandher, R.L.; Khanna, P.; Pandey, N.; Tripathi, R.S. (Indira Gandhi Agricultural University, Raipur (India). Dept. of Agronomy). Economics and productivity of early duration rice (Oryza sativa L.) based cropping system under assured irrigation in alfisol. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 669-673 KEYWORDS: CROPPING SYSTEMS; PRECOCITY; RICE; ORYZA SATIVA; ECONOMICS; PRODUCTIVITY; IRRIGATION.

A field experiment was conducted from 1995-96 to 1996-97 at IGAU, Raipur to find out the most suitable/profitable early duration rice based cropping sequence on alfisol under assured water supply. Among different sequences, rice-cabbage-onion-jowar (t) recorded the highest rice equivalent yield (283.40 q ha.J ,production efficiency (82.04 kg ha.J day'J), land use efficiency (94.66 percent), net return (Rs. 58,040 ha") and B:C ratio (0.94). This sequence was followed by rice-tomato-moong-jowar (t), rice-palak bottleguard, rice-coriander (leaves) - wheat-moong, rice-methi (Ieaves)-chickpea-jowar (f) and rice-mustard-amaranthus (leafy vegetable).

F30 Plant Genetics and Breeding

538. Chander, S.; Dhari, R.; Kumar, R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding)). Variation in selected recombinant inbred lines of two crosses in chickpea (Cicer arietinum L.). Annals of Biology (India). (Jan 2001) v. 17(1) p. 29-34 KEYWORDS: CICER ARIETINUM; GENETIC VARIABILITY; CHICKPEAS; HERITABILITY; GENETIC GAIN; GENOTYPES; ENVIRONMENT.

Various parameters of variability were studied in 33 chickpea genotypes (RILs) grown in five enviromnents. The enviromnents were created by dates of sowing, locations and with manipulation of feltilizer dose, irrigation and spacing. The analysis of variance showed substantial variability for different characters. The present investigation revealed that number of secondary branches per plant and number of seeds per pod were stable traits and, therefore, very useful in breeding programme.

539. Yadav, R.; National Research Centre on Rapeseed-Mustard, Bharatpur (India); Mor, B.R.; Yadav, I.S. (Chaudhary charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding). Induced genetic variability for alternaria blight resistance and the basis of resistance in Indian mustard. Annals of Biology (India). (Jan 2001) v. 17(1) p. 35-42 KEYWORDS: ALTERNARIA; BLIGHT; BRASSICA JUNCEA; BREEDING METHODS; GENETIC VARIABILITY; INDUCED MUTATION; ENDEMIC; INDIA.

Alternaria blight, an endemic disease of north and north-eastern part of India, takes heavy toll of Indian mustard each year. In the absence of useful donors for resistance to Alternaria" blight ill the available germplasm, mutation breeding is one of the feasible techniques for breeding Alternaria blight resistant varieties. The seeds of the four commercial varieties of Indian mustard, namely, RH 30, RH 819, Varona and Kranti were exposed to physical mutagen (gamma rays) and chemical mutagen (EMS) individually as well as to their combined doses. M2 generation 'was evaluated for Alternaria blight resistance under artificially created epiphytic conditions. The combined dose of physical 'and chemical mutagen was more effective in generating the resistant type of mutants. The morphological and biochemical analysis of the resistant mutants alongwith theiI sllsceptible counterpart revealed the significance of days to maturity, plant height, phenol, sugar and glucosinolate in Alternaria blight resistance.

540. Kumar, B.; Thakur, R.; Mishra, S.B.; Singh, D.N. (Rajendra Agricultural University, Pusa (India). Dept. of Plant Breeding)). Variability studies in sugarcane population of rice (Oryza sativa L.). Annals of Biology (India). (Jan 2001) v. 17(1) p. 43-45 KEYWORDS: SEGREGATION; POPULATION; ORYZA SATIVA; GENETIC VARIABILITY; HERITABILITY; GENETIC GAIN.

The population of 42 progenies derived from seven crosses was studied in segregating generation for 10 quantitative characters. The phenotypic coefficient of variation was comparatively higher than the corresponding genotypic coefficient of variation for all the characters studied. Heritability was highe for days to 50 percent flowering, plant height and lOOO-grain weight. Characters like plant height, L/B ratio and lOOO-grain weight showed moderate genetic advance.

541. Singh, A.; Singh, S. (National Research Centre for Citrus, Nagpur (India)). Clonal selection in Nagpur mandarin. Annals of Biology (India). (Jan 2001) v. 17(1) p. 65-69 KEYWORDS: CLONES; PLANT INTRODUCTION; BUDDING; MUATION; MATURATION; PRECOCITY; CITRUS RECTICULATA; MAHARASHTRA.

Bud mutations occur fairly often in citrus and many have been described over a long period. Nagpur mandarin (Citrus retiroulata Blanco) is the main citrus cultivar grown in Central India. In a survey of 229 orchards (139984 plants) to select desirable clones having good fruit quality and early/late maturity, 36. plants were identified as having early (early February) or late. (April end) maturity, less seeded fruits (5 seeds/fruit), high fruit yield, deep orange colour of fruits and high Brix ratio. One early maturing (15-20 days) N2 and two less seeded N4 and N, (5 seeds/fruit) were selected for their consistent perfonnance for three years. N4 is having 3.57 seeds/fruit, while N, is having 3.27 seeds/fruit in comparison to nonnal 10-12 seeds/fruit. The fruits of these selections are round and neckless with good quality characters.

542. Munjal, R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding); Bansal, K.C. (Indian Agricultural Research Institute, New Delhi (India). National Research Centre on Plant Biotechnology); Madan, S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Breeding). Impact of biotechnology on food security. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 113-118 KEYWORDS: BIOTECHNOLOGY; FOOD SECURITY; GENETIC ENGINEERING; SUSTAINABILITY; GENETICALLY MODIFIED ORGANISMS; FOODS; QUALITY.

Biotechnology today is a fast growing frontier area of research with immense technology benefits to society in diverse ways such as food security, environmental protection, nutritional supplement, medicine, health care products and other industrial applications. Benefits for food security include improvement in fruit and vegetable shelf-life and organoleptic quality, improved nutritional quality and quantity of meat, milk and livestock. Other potential benefits are the use of genetically modified livestock to grow organs for transplant into humans, use of genetically modified organism in drug manufacture, in recycling oftoxic industrial wastes. Despite the potential benefits of genetic engineering of food, the technology is surrounded by controversy. Critics of genetically modified technology include consumers and health groups, grain importers, organic farmers, environmentalists, concerned scientists, politicians and trade practioners. This criticism is due to some fears which include alteration in nutritional quality offoods, potential toxicity, possible antibiotic resistance from genetically modified crops, potential allergenicity and carcinogenicity from consuming genetically modified foods. In addition, some more general concerns include environmental pollution, unintentional gene transfer to wild plants, possible creation of new viruses and toxins, limited access of seeds due to patenting of genetically modified food. Besides its potential to assist farmers in reducing on-farm inputs and produce value added commodities, it may lead to greater farmers dependence on the providers of new technology. Biotechnology research can be made compatible with sustainable agriculture, if it maintains economic and social viability while preserving the high productivity and quality of the food.

543. Swami, M.L.; Bhatnagar, S.K. (Agricultural Research Station, Jodhpur (India). Project Coordinating Unit (AICMIP)). Genotype x environment interaction of grain yield and other characters of promising pearl millet hybrids and varieties. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 191-193 KEYWORDS: NUTRIENT; DISEASE SURVELLANCE; SPOTS; RICE; NPK FERTILIZERS; INORGANIC FERTILIZERS; ZINC SULPHATES.

Stability parameters were estimated in 12 promising cultivars (eight hybrids and four varieties) of pearl millet [Pennisetum glaucum (L.) R. Br.] under 12 locations of Rajasthan, Gujarat, Haryana and Madbya Pradesh in coordinated trial (RHVT) conducted during 1995-97. Variance due to genotype, environments, genotype x environment interaction and its linear and non-linear components were found significant for days to 50 percent flowering, days to maturity, plant height, grain yield and fodder yield indicating presence of enormous variability in the genotype, differences among the environments and possibility of prediction of performance in different environments, respectively. Pooled deviations (non-linear component) significant against pooled error for all the characters revealed that large portion of G x E interaction was accounted for by non-linear function. Hybrid HHB-67 and variety ICTP 8203 had regression coefficient less than unity <1) and non-significant deviation from

regression for grain field suggested better performance in poor environment. Whereas hybrid GHB-15 had high mean unit egression coefficient and least and non-significant deviation from regression for grain yield. This iybrid was found suitable in different agro-climatic conditions of Rajasthan, Gujarat, Haryana and Madhya Pradesh states. Varieties, namely, Raj 171, ICMV 221 and lCMV 155 exhibited high mean, unit egression and non-significant deviation from regression indicated their suitability in varied agro-climatic conditions. Evidently they were more adaptive than hybrids.

544. Meena, B.S. (Agricultural Research Station, Sriganganagar (India); Sastrym, E.V.D. (SKN College of Agriculture, Jobner (India). Dept. of Plant Breeding and Genetics). Combining ability in bread wheat (Triticum aestivum L.) . Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 205-208 KEYWORDS: COMBINING ABILITY; TRITICUM AESTIVUM; STATISTICAL ANALYSIS; WHEAT; SELECTION; YIELDS.

A set of four parents, namely, Job-666, Job-984, Raj-3777 and Raj-1482 was crossed in all possible combinations excluding reciprocals. The results indicated significant diftcrenees between progenies for all the traits, namely, plant height, spike length, peduncle length, tillers per plant, yield per plant and harvest index. Appropriate Statistieal analysis was applied to determine the combining ability variance and effects. Combining ability analysis indicated significant, both gca and sea variances for spike length, peduncle length and tillers per plant. The gea : sea ratio showed that additive eftects were preponderant tor plant height, spike length and peduncle length.

545. Mohanty, B.K. (Orissa University of Agriculture and Technology, Bhawanipatna (India). Regional Research Station). Studies on variability, heritability, interrelationship and path analysis in tomato. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 65-69 KEYWORDS: TOMATOES; STATISTICAL ANALYSIS; LYCOPERSICON ESCULENTUM; HERITABILITY; GENETIC VARIABILITY; GENOTYPES; GENETIC GAIN; GENETIC CORRELATION; YIELD COMPONENTS.

Evaluation of 18 genotypes of tomato revealed high heritability with moderate to high GCV and genetic gain for average fruit weight (93.0, 34.94, 68.59 percent, respectively), number of branches (92.3, 32.52, 64.40 percent, respectively) and fruits/plant (87.4,27.87, 53.690/0, respectively), plant height (87.1,22.35,43.57 percent respectively) and days to first harvest (91.4,] 5.29,28.53 percent, respectively) which could be improved by simple selection. Yield exhibited significantly positive phenotypic and genotypic 'association with days.to first harvest, number of branches and fruits/plant. Path analysis confirmed that number of fruits/plant and average fruit weight exerted high positive direct effect on yield and high negative indirect effect through each other on yield. Direct and indirect effects of number of branches/plant and days to first harvest contributed substantially towards yield. Number of branches and fruits/plant and days to first harvest should be emphasized simultaneously for amenability in yield of tomato.

546. Mahla, H.R. (Rajasthan Agricultural University, Bikaner (India). Plant Biotechnology Centre); Ramakrishna, K. (S.K.N. College of Agriculture, Jobner (India). Dept. of Plant Breeding and Genetics). An Assessment of induced genetic variation in fennel (Foeniculum vulgare

Mill.). Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 86-91 KEYWORDS: INDUCED MUTATION; GENES; MUTAGENS; GENETIC VARIATION; FENNEL; FOENICULUM VULGARE; MUTAGENCITY.

In the present study 270 M2 progenies of fennel variety RF-IOI were evaluated for various quantitative traits. Analysis of variance revealed that inter family variance was significant for all the characters studied whereas the intra family variance was non-significant for all the characters except plant height. The range in the treated population was invariably wider than control for all the characters and the means of each treatment were slightly higher than control mean in respect of various characters studied. Coefficient of variation among the treatment groups in respect of various characters were closely comparable.

547. Venugopal, M.; Ansari, N.A.; Rao, N.V. (College of Agriculture, Hyderabad (India). Dept. of Genetics and Plant Breeding). Combining ability studies in maize (Zea mays L.). Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 92-95 KEYWORDS: COMBINING ABILITY; MAIZE; ZEA MAYS; YIELD COMPONENTS.

Combining ability analysis was carried out using 45 single crosses derived from a lOx 1 0 diallel mating for grain yield. days to silking, days to tasselling, plant height, ear height, ear length, ear girth, IOO-seed weight, number of seed per row, number of seed rows per ear and protein content. Analysis revealed that non-additive'gene effects were more important for all the characters. From the results inbred lines, AML -148 and AML - 164 for grain yield, and AML - 135, AML -114 and AML - 141 for protein content, were adjudged as good general combiners. Based on sca effects and perse performance the hybrids. AML - 105 x AML - 135 and AML - 146 x AML - 148 for grain yield, AML - 114 x AML -148 and AML - 135 x AML - 148 for protein content were found as potential combinations.

548. Kumar, P.; Gupta, S.C. (Maharana Pratap University of Agriculture and Technology, Udaipur (India). Dept. of Plant Breeding and Genetics). Inheritance of some quantitative traits in maize. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 96-100 KEYWORDS: GENETIC VARIATION; HERITABILITY; GENETIC INHERITANCE; COUPLING; MAIZE; ZEA MAYS.

The estimates of genetic analysis revealed that both additive (D) and dominance (HI) gene action, with preponderance of dominance component, were responsible for expression of various traits. The distribution of genes with positive and negative effects were asymmetrical and only one gene or gene group operated in the expression of individual trait. The heritability (ns) was higher (50 percent) for anthesis-silking interval, while other traits had low to moderate estimates. To utilize additive (D) and dominance (H) genetic variance simultaniously, biparental mating or reciprocal recurrent selection methodology may b~ adopted in maize improvement programme.

549. Lal, S.K.; Raina, R. (Banaras Hindu University, Varanasi (India). Institute of Agricultural Sciences, Dept. of Genetics and Plant Breeding). Inter-relationships between yield and its component traits in long duration hybrids in pigeonpea. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 101-104 KEYWORDS: PIGEONPEA; CAJANUS CAJAN; GENETIC CORRELATION; HYBRIDS; YIELDS; YIELD COMPONENTS; STATISTICAL METHODS.

Eighteen experimental long duration pigeonpea hybrids were studied for ascertaining inter-relationships between yield and its components. Number of primary and secondary branches, Harvest index, dry matter at maturity and pods per plant exhibited five correlations with yield. The main contribution of direct effects towards yield observed for Harvest index, dry matter at maturity, number of primary branches pods per plan negative direct effects were observed for traits like secondary branches, seed weight, seed per pods and plant height. The results indicate a need for proper lce between biomass and harvest index by way of reduction in-plant height and ber of secondary branches.

550. Singh, R.V.; Dwivedi, J.L.; Singh, R.K. (Narendra Deva University of Agriculture and Technology, Faizabad (India). Crop Research Stn.). Heterosis studies in rice hybrids involving WA sources of CMS lines. Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 541-547 KEYWORDS: HETEROSIS; HYBRIDS; GENOTYEPS; RICE; YIELDS; YIELD COMPONENTS; VARIETIES.

Hybrids, utilizing two wild abortive cytoplasmic (W A) male sterile lines (PMS. A and IR 58025 A) and 18 genotypes were crossed in line x tester design and evaluated for heterosis suited to irrigated ecosystem. About 38-50 percent of all the hybrids manifested significant and positive heterobeltiosis and standard heterosis for grain yield planrl in the range of 21.40 to 151-66 and 17.71 to 79-76 percent, respectively. Heterosis for grain yield was mostly due to simultaneous heterosis for EBT planrl, IOOO-grain weight, fertile grains panicle-I, snikelet density offertile grains, biological yield and harvest index. The top heterotic combinations exhibiting 60 percent standard heterosis over check variety Sarjoo-52 for yield were IR 58025 AINDR 6054, PMS,AINDR 2022. However, these hybrids should be screened for their stability in yield.

551. Singh, D.; Yadavendra, J.P. (Gujarat Agricultural University, Anand (India). Forage Research Project). Gene actions for ginning outturn and staple length in cotton. Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 558-562 KEYWORDS: GENES; GENE INTERACTION; COTTON GINNING; COTTON.

Information on genetic effects is derived from data on 2 yield components in a set of 6 generations (PI, P2, F I, F2 BC I and BC2) derived from 4 crosses. Additive, dominance, additive x additive additive x dominance gene effects governing staple length except in cross II. For genning outturn, additive, dominance and epistatic gene effects were responsible for its inheritance. Also, in various crosses for ginning outturn, dominance, additive x additive and dominance x dominance were of duplicate type. Overdominance was found to be present for staple length only.

552. Prabhakar (National Research Centre on Sorghum, Solapur (India). Centre on Rabi Sorghum). Stability analysis for flowering, maturity and grain yield in rabi sorghum. Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 563-566 KEYWORDS: SORGHUM; GENOTYPES; GENOTYPE ENVIRONMENT INTERACTION; GENETIC VARIABILITY; STABILITY; YIELDS; STATISTICAL METHODS.

Genotype x environment interaction in 20 genotypes of rabi sorghum were studied over three environments for flowering, maturity and grain yield. Significant differences were

observed among environments and genotypes. The G x E interactions for the characters were significant and the significant mean squares due to environment (liner) indicated the existence of real varietal differences in characters for regression over environmental mean. The genotypes namely Spy -1537, RSLG-262 and Sel-3 were found stable for earliness and they can be directly used for breeding earliness. For improvement of grain yield, the genotypes NIC-21275, SPV-1375, SPV-1538 and SPV-1155 were the most stable under rainfed situation. These genotypes can be directly used in various breeding programmes for enchancing rabi sorghum productivity.

553. Umakanth, A.V. (National Research Centre for Sorghum, Hyderabad (India); Kumar, M.V.N. (Directorate of Oilseeds Research, Hyderabad (India). Evaluation of high oil hybrids of maize. Annals of Agricultural Research (India). (Sep 2002) v. 23(2) p. 570-573 KEYWORDS: MAIZE; HYBRIDS; HIGH YIELDING VARIETIES; HETEROSIS; PROTEINT CONTENT; LIPID CONTENT; YIELDS; IDENTIFICATION.

Heterosis for grain yield, oil, and protein was studied in ten high oil maize hybrids obtained after crossing the oil lines, R 802, R 805 and R 806 introduced from USA with Indian lines viz., CM 119, CM 20 I, CM 20 I, CM 202 and the composite, Hapha. The studies were made over the standard check DHM-I05. For grain yield, the hybrids HOH-8,HOH-2, HOH-5 and HOH-I 0 have shown significantly level heterosis, while the hybrids HOH-3, HOH-6 and HOH-9 were significantly superior to the standard check, DHM-I05 in oil content. Simultaneous increases in yield, oil and starch were observed in HOH-2 and HOH-5, while HOH-8 recorded more protein than DHM-I 05. Hybrids, HOH-2, HOH-5 HOH-8, HOH-9 and HOH-10 can be recommended for further evaluation at several locations as yield, oil, protein and starch are reported to be greatly influenced by both genotype and environment.

554. Venkatesh, S.; Sekhar, J.C.; Singh, N.N.; Singh, S.B.; Gupta, N.P.; Chandel, S.K. (Indian Agricultural Research Institute, New Delhi (India). Directorate of Maize Research, Cummings Lab.). Assessment of elite subtropical maize lines using diverse inbred testers. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 581-588 KEYWORDS: INBRED LINES; COMBINING ABILITY; HYBRIDS; MAIZE; RECURRENT SELECTION; GENETIC DISTANCE; GENETIC VARIATION; SUBTROPICAL ZONES.

Inbred lines of known potential have been widely used as testers of inbred lines for the development of maize signle cross hybrids. Seven promising inbred lines viz. WN I, WN2, WN3, WN4; WN6 and WN7 were derived from an improved population CMIPWN which had undergone S, recurrent selection for three cycles. These lines were crossed to three genetically diverse inbred testers from tropical (CM I 11), subtropical introgressed with some temperate materials (LM6) and purely subtropical backgrounds (CML290). The single cross hybrids deyeloped were tested across two seasons in a randomised complete block design. Pooled analysis of the data indicated the ability of the inbred testers used to differentiate among the lines tested. LM6 was the tester which was most discriminating followed by CML290 and CM II I. The nature of testers to be used for evaluting inbred lines derived from the population CMIPWN have thus been indentified. The promissing hybrids obtained are being tested in the multi-location maize hybrid trials.

555. Swamy, A.A. (Agricultural College, Naira (India). Dept. of Genetics and Plant Breeding); Reddy, G.L.K. (Sri Venkateshwara Agricultural College, Tirupati (India). Dept. of Genetics and Plant Breeding). Genetic divergence and stability analysis in mungbean (Vigna radiata L. Wilczek). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 589-594 KEYWORDS: GENETIC DISTANCE; GENOTYPES; GENETIC STABILITY; MUNGBEANS; VIGNA RADIATA; GENOTYPES ENVIRONMENT INFESTATION; GENETIC VARIABILITY.

Genetic divergence and stability analysis over thr,ee different environnments for twelve. quantitative c,haracters in fifty genotypes of mungbean (Vigna radiata L. Wilczek) were studied. Nine clusters were formed on the basis of D2 estimates. By comparative studies of genetic divergence with stability analysis 10 genotypes (WGG-37, T ARM2, TAP-7, PDM-89-221, LGG-441, LGG-452, LGG-471, LGG-450, LGG-421 ilnd LGG-427) were. selected as they exhibited stability for seed yield and other yield attributing characters and different clustering positions. Or the basis of intra-and inter-cluster distances, crossing among these selected genotypes was suggested to provide enormous genetic variabiliiy [or selection of genetically divergent stable segregants for, future breeding programmes.

556. Khumkar, M.S.; Singh, R.D. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics). Divergence analysis of elite inbred lines of maize (Zea mays L.). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 595-601 KEYWORDS: GENETIC DISTANCE; INBRED LINES; MAIZE; ZEA MAYS; GENOTYPES; BIODIVERSITY; GENETIC RESOURCES.

Thirty elite inbred lines of maize (Zea mays L.) from IARI, New Delhi were studied for their divergence for a set of 18 different characters using D2 technique. Wide diversity was observed among inbreds developed from the same as well as different source populations. The thirty inbred lines could be grouped into six different clusters. The genetic diversity among genotypes did not show and relation to their source population. It was recommended that while choosing .parents for hybridization programme, per se performance of individual constituents of a cluster should be considered in addition to the superior cluster means and inter-cluster distance.

557. Palve, S.M.; Raghavaiah, P. (Indian Agricultural Research Institute, New Delhi (India). Div. of Genetics). Genetic variation and interrelationship of agronomic traits in interspecific derivatives of durum wheat (Triticum durum Desf.). Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 602-607 KEYWORDS: INTERSPECIFIC HYBRIDIZATION; GENETIC VARIATION; AGRONOMIC CHARACTERS; TRITICUM DURUM; HARD WHEAT; HERITABILITY; GENETIC CORRELATION; STATISTICAL METHODS.

Ninety-seven durum derivatives along with thirteen parents representing T. durum. T. aestivuni and T turgidum species were evaluated for grain yield and yield - related traits Considemble variability was found for all character among the genotypes. Mean values of derivatives had higher values compared to the parents for almost all the ,characters. The maximum range was observed for harvest index (3-45 percent), while day to maturity had the least range (117 - 136). The highest coefficient of variation (CV percent) was exhibited by number of productive tillers per plant. GCV sand PCvs were almost of the same, magnitude for sedimentation value, thousand grain weight and days to flowering. Broad sense heritability values were also high for these character indicating a possibility of improving such traits

through selection. Desirable associations were observed among , productive tillers/plant, number of grains/spike, thousand-grain weight, biological yield and harvest index. However, grain yield had a highly significant negative genotypic correlation with protein content (F-0.59) and a weak association with sedimentation values (r=O.03, FO.02, FO.I0). Path analysis of drum derivatives revealed that biological yield/plant and thousand-grain weight are the most important attributes influencing grain yield.

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558. Arya, S.; Bisla, S.S.; Dhillon, R.S.; Dhanda, S.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Forestry)). Effect of physiological maturity indices on seed traits and per cent germination in Azadirchta indica A. Juss. (Neem). Annals of Biology (India). (Jan 2001) v. 17(1) p. 119-122 KEYWORDS: AZADIRCHTA INDICA; SEED SIZE; SEED WEIGHT; MATURITY; GERMINATION; SEEDS; PLUS TREES.

The present study was conducted by collecting seeds or fruits at different physiological maturity stages from a plus tree growing naturally in Hisar. A considerable variation in IOO-seed weight was observed between yellow and green seed lots. However, the variation for seed size was less. Significant variation in per cent germination was also observed in both seed lots of freshly sown I seeds as well as after one and two months of storage in cotton cloth bags at room temperature.

559. Pandey, V.; Agarwal, S. (Jai Narayan Vyas University, Jodhpur (India). Dept. of Botany). Response of cassia angustifolia Vahl to NaCI stress. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 674-679 KEYWORDS: CASSIA ANGUSTIFOLIA; SALINITY; METABULITIES; SODIUM CHLORIDE; GROWTH; SEEDLINGS.

An experiment was conducted to study the seedling growth and growth parameters of Cassia angustifolia vahl (glycophyte) in distilled water and various saline solutions of NaCl (20;50, IOO'andlSD mM);The:freSh and dry weigfit'ofleafand root arid fresh a.nd dry weight of IS DAS (days after sowing) seedling was found to decrease with increase; in salinity levels, Salinity induced changes in the levels of certain leaf and root metabolites (protein, proline, total sugars and total phenols), All concentrations of NaCI had stimulatory effect on protein and sugar content of root and inhibitory effect at 100mM arid ISOI11M on proline and total phenols over control. However, at 20mM and'SOmM proline and 'total phenol contents were increased compared to control. In the leaf SOmM and I OmM NaCI and stimulatory effect on 'protein, 'proline and total sugars but inhibited phenol content when compared to control.

H10 Pests of Plants

560. Sharma, S.K.; Kumar, Y. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Appropriate time and strength for Apis mellifera L. colony division and subsequent build up in Hisar (Haryana). Annals of Biology (India). (Jan 2001) v. 17(1) p. 87-90 KEYWORDS: APIS MELLIFERA; BEE COLONIES; HONEYBEES; DRONES; QUEEN BEES; COLONIZING ABILITY; COUPLATION; HARYANA.

An experiment on appropriate time of colony division and strength of divides in Apis mellifera L. bees was carried out at CCS Halyana Agricultural University, Hisar during autwnn and spring seasons. On the basis of queen mating success and subsequent colony build up, it was concluded that the appropriate time for colony division during spring season is February – March and during autmml season November-December under agro-ecological conditions of Hisar (Haryana).

561. Sharma, S.S.; Kaushik, H.D.; Kalra, V.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Toxicity of Bacillus thuringiensis varieties Kurstaki and Aizawai against some lepidopterous pests. Annals of Biology (India). (Jan 2001) v. 17(1) p. 91-94 KEYWORDS: BACILLUS THURINGIENSIS; VARIETIES; TOXICITY; PESTS; LEPIDOPTERA.

The toxicity of Bacillus thuringiensis vars. kurstaki and aizawai was evaluated against some lepidopterous larvae by leaf/fruit dip method. The substrates (leaves/fruits) were dipped in the respective dilutions (2 g/l of water) of the commercial fonnulations for 5 sec and dried at room temperature. Larvae of the test insect were released on the treated food. Mortality of the test insect was recorded 1, 3, 5 and 7 days after their release. The larvae of Antigastra .catalaunalis were observed to be the most susceptible to both the varieties of B. thuringiensis showing 100 percent mortality one day after release. Per cent mortality of larvae of Euproctis lunata. Cnaphalocrocis medinalis, casewonn (unidentified), Earias vittella, Plutella xylostella, Spodoptera litura an{ Helicoverpa armigera, was recorded after seven days of release which was found to be 60, 75, 80, 98.9, 100 and 75.1 percent, respectively, When these were fed with B. t. var. kurstaki treated food. The corresponding figures with respect to B. t. var. aizawai were 48, 67.9, 72.3, 71.2, 85.4, 93.7 and 72.4 percent, respectively.

562. Mahla, J.C. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Role of gunny bags dipped in different insecticides for checking insect-pests infestation to the stored wheat grains under ambient storage conditions. Annals of Biology (India). (Jan 2001) v. 17(1) p. 95-99 KEYWORDS: INSECTICIDES; INSECTA; PESTS,WHEATS; GRAINS; STORAGE.

Gunny bags (size n) x 45 cm) were dipped in emulsions of 0.1percentchlorpyrifos, dichlorvos and malathion; 0.01 and 0.025 percent cypennethrin and fenvalerate; 0.002 and 0.005 percent deltamethrin prepared on active ingredient 'uasis to prevent storage losses in wheat caused by stored grain insect-pests under natural storage conditions. huested grain on number basis varied from 1.44 to 36.2 percent in 1st year and 3.36 to 46.1 percent in 2nd year (based on 600-700 grains per replication) in different insecticidal treatments against 81 and 65.2 percent, respectively, in the control. Chlorpyrifosand both doses of fenvalerate and cypennethrin and higher dose of deltamethrin were found better in comparison to deltamethrin, dichlorvos and malathion when evaluated by 9 and 12 months after treatment in both the years. The gunny bags treated with different insecticidal treatments proved effective in checking insect-pests infestation for six months. The population of Rhizopertha dominica could not survive under natural storage conditions in all the treatments except control upto six months. 1hereafter, the live population of tlus insect was found more in dichlorvos, malathion, 'fonnothion and lower dose of deltametltrin treated bags. In all the'

treatments, the population build-up of R. dominica was significantly low as 'compared to control.

563. Rana, J.S.; Ombir; Dahiya, K.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Management of termite, Microtermes obesi (Holmgren) in wheat, Triticum aestivum through seed treatment. Annals of Biology (India). (Dec 2001) v. 17(2) p. 207-209 KEYWORDS: ISOPTERA; MICROTERMES; CONTROL METHODS; TRITICUM AESTIVUM; SEED TREATMENT; INSECTICIDES.

A study for two consecutive years revealed that termite, Microtermes obesi was a potential pest of wheat crop, mostly at places where less irrigation was applied. During the first year of studies, it was found that the attack of tennite was delayed to the ealing stage of the crop growth which was between 2.7 damaged tillers/plot to 47 tillers/plot. The plots where seeds were treated with chlorpyliphos and endosulfan 0.9 g a. i./kg seed and 2.4 g a. i./kg seed, respectively, were observed to be the least infested by termites dUling both the years of study.

564. Borah, R.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Effect of sowing dates on incidence of fruit fly (Bactrocera cucurbitae Coq.) and yield of cucumber (Cucumis sativus L.) in the hills zone of Assam. Annals of Biology (India). (Dec 2001) v. 17(2) p. 211-212 KEYWORDS: SOWING DATES; CUCUMBERS; CUCUMIS SATIVUS; CONTROL METHODS; YIELDS; TEPHRITIDAE; BACTEROCERA CUCURBITAE; INFESTATION.

Field investigation canied out at the Regional Agricultural Research Station, Diphu, Assam dming 1996 and 1997 to study the effect of different sowing dates of cucumber on the incidence of fruit fly and yield of the crop revealed that sowing from April 20 to May 20 recorded significantly lower infestation of this pest than the crop sown from June 20 to July 20. The maximum pooled yield (291.0 qlha) was recorded in the April 20 sown crop which differed significantly from the rest of sowing dates except May 20 sowing.

565. Barman, U.; Saha, N.N.; Pathak, K.; Kalita, M.K. (Assam Agricultural University, Silchar (India). Krishi Vigyan Kendra)). Awareness and adoption of IPM practices among sali paddy growers in Assam. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 161-164 KEYWORDS: INTEGRATED PEST MANAGEMENT; RICE; CONTROL METHODS; FARMERS; EXTENSION ACTIVITIES; CULTURAL METHODS; ASSAM.

The study was conducted to determine the awareness and adoption of IPM practices among sali paddy growers of Barak Valley Zone of Assam. The study revealed that majority of the farmers were aware of practices under cultural method of IPM. Practices of mechanical control method other than ers. Almostall the farmers were not aware about different biological control measures of IPM. Under chemical control measures practices viz., ETL based chemicals used, use of proper dose of pesticides, etc. were found to have very low level of awareness among the farmers. Most of the farmers adopted the cultural methods of IPM. The rates of adoption of light trap and rope were found very low.

566. Singh, S.; Yadav, J.P.S.; Tripathi, N.N.; Kumar, R. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Pathology)). Effect of insecticides and

herbicides on root rot of cotton caused by Rhizoctonia solani Kuhn. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 179-181 KEYWORDS: INSECTICIDES; ROOT ROTS; PLANT DISEASES; HERBICIDES; COTTON; RHIZOCTONIA SOLANI.

The effect of four insecticides (Chlorpyriphos, endosulfan, imidac10prid and thiomethoxam) and two herbicides (Pendimethalin and trifluralin) against Rhizoctonia so/ani was studied separately. In pot tests, seed or soil treated with insecticide thiomethoxam gave better control of R. so/ani followed by imidacloprid. Among two herbicides tested as pre-emergence soil application, pendimethalin was found to be more effective as compared to trifluralin in controlling the disease over check.

567. Takar, B.L. (SKN College of Agriculture, Jobner (India). Dept. of Entomology); Deshwal, H.L. (College of Agriculture, Bikaner (India). Dept. of Entomology); Jat, B.L. (SKN College of Agriculture, Jobner (India). Dept. of Entomology). Screening of different varieties/entries of Brassica juncea (L.) Czern and Coss to mustard aphid, Lipaphis erysimi (Kalt.) infestation. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 209-212 KEYWORDS: BRASSICA JUNCEA; VARIETIES; APHIDOIDEA; MUSTARD; INFESTATION; LIPAPHIS ERYSIMI; PEST RESISTANCE.

Twenty varieties/entries were sown in randomized block design (RED) tor the evaluation of resistance against mustrad aphid. Based on aphid population, the varieties/entries T-59 (Varona), B10-902, PCR-7 (Rajat) and DLM-29 were found highly resistant (below 70.45 aphids per plant), varieties/entries Kranti, Pusa Bold, Rohini, VSL-5, B10-772, DLM-58, Brani, RH-8113, Pusa Basant, DLM-80 and DLM-68 were found moderately resistant (between 70.45 to 116.51 aphids per pl ant) and varieties/entries DLM-75, M-21, AG-5, DLRA-343 and P. Lord were found least resistant, having more than 116.51 aphids per plant.

568. Ahmad, H.; Arora, R.K. (Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (India). Div. of Entomology)). Efficacy and economics of some insecticides against gram pod borer, Helicoverpa armigera (Hubner) on chickpea. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 213-216 KEYWORDS: INSECTICIDES; HELICOVERPA ARMIGERA; EFFICIENCY; CHICKPEAS; ECONOMICS.

Five insecticides viz., monocrotophos (36 WSC), endosulfan (35 EC), carbaryl (50 WP), cypermethrin (25 EC) andl1eem oil (0.15 EC) were evaluated for the control of gram pod borer, Helicoverpa armigera (Hubner) on chickpea. All insecticidal treatments were significantly superior over control in reducing the per cent pod infestation and increase in yield. Cypermethrin (0.009, 0.0075 and 0.006 percent) was found to be the most effective followed by monocrotophos (0.08, 0.06 and 0.04 percent) and endosulfan (0.13, 0.1 and 0.07percent. Carbaryl (0.3, 0.2 and 0.1percent) and neem oil (0.30, 0.20 and 0.10 percent) were least effective in controlling the gram pod borer.

569. Sharma, S.S.; Yadav, G.S.; Chhillar, B.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Repellent activity of some plant extracts against Callosobruchus chinensis (L.) in checkpea grains. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 217-218 KEYWORDS: REPELLENTS; CALLOSOBRUCHUS CHINENSIS; GRIAINS; PLANT EXTRACTS; CHICKPEAS; COLEOPTERA; GRAIN LEGUMES.

Repellent activity of some plant extracts viz., Acacia arabica. Dalbergia sissoo. Ricinus communis and Parthenilf"J .hysterophorus was studied against Callosobruchus chinensis on chickpea grains under laboratory conditions. Parthenium extract showed the maximum repellency against this pulse beetle.

570. Sharma, S.S.; Chhillar, B.S.; Dahiya, K.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Entomology)). Incidence of Helicoverpa armigera (Hubner) in wheat in Haryana. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 219-220 KEYWORDS: HELICOVERPA ARMIGERA; HARYANA; INSECTA; WHEATS.

The incidence of Helicoverpa armigera (Hub.) larvae on wheat earheads in Haryana (India) was first time observed during April, 2002. The average population was 2.65 larvae per metre. There was 15.0 percent infestation in wheat earheads/spike and 3.9 percent grain damage in the infested earheads.

571. Yadav, S.K. (SKN College of Agriculture, Jobner (India). Dept. of Entomology); Sharma, A. (Rajasthan Agricultural University, Bikaner (India). Dept. of Entomology); Singh, V. (Rajasthan Agricultural University, Bikaner (India). Relative efficacy of some insecticides.acaricides for the management of mite, Eutetranychus orientalis (Klein) on ber under field conditions. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 221-223 KEYWORDS: INSECTICIDES; EFFICIENCY; ACARINA; ACARICIDES; MITE CONTROL; EUTETRANYCHUS ORIENTALIS; ZIZIPHUS MAURITANA; FIELD EXPERIMENTATION.

Relative efficacy of eight insecticides/acaricides was compared with untreated control against mite, Elltetranychus orientalis (Klein) on ber. Monocrotophos (0.03 percent) was found most effective followed by phosphamidon (0.03 percent) and ethion (0.03 percent), whereas cypermethrin (0.01 percent) was found least etlective. TIle dicofol (0.04 percent), dimethoate (0.03 percent), phosalone (0.05 percent) and endosulfan (0.05 percent) were proved to be moderately effective.

572. Gour, I.S.; Pareek, B.L. (Rajasthan Agricultural University, Jobner (India). Dept. of Entomology)). Biology and predation potential of Coccinella septempunctata Linnaeus on mustard aphid, Lipaphis erysimi (Kalt.) in semi-arid region of Rajasthan. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 225-229 KEYWORDS: BIOLOGY; COCCINELLA SEPTEMPUNCTATA; PREDATION; MUSTARD; COLEOPTERA; LIPAPHIS ERYSIMI; SEMI ARID; RAJASTHAN.

Biology and predation of Coccinella septempunctata Linn. were studied on mustard appleid, Lipaphis elysimi (Kalt.). The predator had four larval instars which lasted for 2, 2, 3 and 4 days and consumed 22.86 to 24.56, 71.13 to 71.67, 178.66 to 185.48 and 333.44 to 338.70 aphids, respectively. An individual in order to complete its larval development on an average consumed 612.91 to 613.56 aphids. The life span of male and female beetle varied from 20 to 25 days (av. 22.83) and 24.0 to 31.5 days (av. 26.63) and devoured aphids ranging fro~ 120.14 to 144.29 (av. 132.32) and 151.18 to 179.33 (av. 165.27) per day, respectively.

573. Brar-Bhullar, M.; Kapur-Ghai, J. (Punjab Agricultural University, Ludhiana (India). Dept. of Entomology)). Seasonal abundance of phytophagous and predatory mites infesting brinjal in

Punjab. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 231-234 KEYWORDS: SEASONAL DEVELOPMENT; SOLANUM MELONGENA; POPULATION DYNAMICS; ACARINA; TETRANCHUS CINNABARINUS; INFESTATION; BRINJAL; PUNJAB.

Seasonal abundance of both phytophagous and predatory mites on brinjal was studied. The pest mite, Tetranychus cinnabarinus (Boisd.) was found throughout the year with high populations in March-April, July and December. Predatory mites were maximum in March, July and September.

574. Kapur-Ghai, J. (Punjab Agricultural University, Ludhiana (India). Dept. of Entomology); Kaur, M. (Punjab Agricultural University, Ludhiana (India). Dept. of Zoology)). Biochemical basis of differential susceptibility of citrus cultivars to infestation with the citrus mite, Eutetranychus orientalis (Klein) . Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 235-240 KEYWORDS: EUTETRANYCHUS ORIENTALIS; INFESTATION; CITRUS; VARIETIES; ACARINA; PEST RESISTANCE; LEAVES; TISSUE ANALYSIS; CHEMICAL COMPOSITION.

Differential susceptibility of various cultivars of citrus to infestation with Eutetranychus orientalis, indicating that Baramasi lemon was the most heavily infested, followed by kaghzi lime and grape fruit being least infested, has been reported. In the present studies, an attempt has been made to find out the biochemical basis ofthis differential susceptibility'l3iochemical analysis ofI~aves ofthese cultivars indicated that Baramasi lemon contained the highest amount of proteins, followed by grape fruit and bigh,zi lime having the least amount, that is, protein concentration was positively correlated with the mite infestation. Regarding phenols and free amino acids, Baramasi lemon contained the least amount, that is, both these constituents seemed to be negatively correlated with the mite infestation. Significance of these findings in the development of various strategies viz., nutritional manipulation in the form of fertilizers or breeding resistant varieties, etc. for effective control and management of this and other related mite pests has been discussed.

575. Gautam, R.D.; Chander, S.; Sharma, V.K.; Ram, J.; Singh, R. (Indian Agricultural Research Institute, New Delhi (India). Div. of Entomology). Feeding potential and preference of larval Cocinella septempunctata Linn. preying on aphids. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 1-3 KEYWORDS: APHIDOIDEA; PREDATION; COCCINELLIDAE; PREDATOR PREYRELATION; FEEDING HABITS; LARVAE; FEEDING PREFERENCES.

A grub of Coccinella septempunctata L, consumed 281 aphids (mixed population of Lipapnis erysimi Kaltenbach and Myzus persicae (Sulzer) during its larval period of 9 days under lab conditions. Prey consumption by a grub on a particular day of its age was significantly greater than that on preceding day. Wheat aphid, Rhopa/osiphum maidis (Fitch) was the most preferred prey of the grubs followed by mustard aphhid, L. erysimi and saffower aphid, Uroleucon sp.

576. Karnatak, A.K.; Bhoopathi, R.; Kanaujia, K.R. (Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (India). Dept. of Entomology). Population dynamics nature of damage of sugarcane black bug, Cavelerius sweeti Dist. [Lygaeidae : Hemiptera). Annals of Agricultural Research (India). (Sep 2002) v. 23(2) p. 567-569 KEYWORDS: POPULATION DYNAMICS; HETEROPTERA; DAMAGE; SUGARCANE; PEST CONTROL.

The population dynamics of sugarcane black bug Cavelerius sweeti was studied on sugarcane crop [Co Pant 90223] during the year 2000 at Pantnagar. The Nymphal population of black bug Cavelerius sweeti was found from March and reached at it's peak in July/August. Both nymphal and adult stage was found in July-August, which, cause more damage. After mid August, the population started declining. Hence is management practice should be adopted before it reaches its peak period. As it sucks the sap from the under surface of leaves and remains from dusk to dawn hidden, in the leaf whorl, the management must be planned accordingly.

577. Chakravarty, N.V.K.; Neog, P.; Singh, D.; Kumar, S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Physics); Prasad, S.K. (Indian Agricultural Research Institute, New Delhi (India). Div. of Entomology). Thermal time and aphic growth on mustard varieities under a semi-arid environment. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 664-668 KEYWORDS: APHIDOIDEA; LIPAPHIS ERYSIMI; MUSTARD; BRASSICA; VARIETIES; THERMOREGULATION; GROWTH PERIOD; SEASONAL VARIATION; SEMIARID ZONES; POPULATION GROWTH.

Field experiments were conducted on the sandy loam soils df the Indian Agricultural Research lnstitute research farm area, representing a semi arid environment during the. rabi 200 1-02 crop season to develop suitable relationship/nomogram between the mustard aphid intestation and the thermal time (growing degree-clays). Two brassica varieties viz., Pusa Jaikisan and Varuna were sown on ten different days at weekly intervals starting from 1st October 2001 till3rd December 2001 in a split plot design with two replicates. The growing degrees accumulated from the January I st showed highly significant (at I per cent) correlation with the aphid infestation. Hence, nomograms were initialized which would eventually be useful in crop simulation modeling besides being useful in developing - forewarning systems tor this important pest viz., mustard aphid:

H20 Plant Diseases

578. Pathak, D. (Assam Agricultural University, Nagaon (India). Regional Agricultural Research Stn.); Srivastava, M.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Pathology). Effect of edaphic and environmental factors on charcoal rot development in sunflower. Annals of Biology (India). (Jan 2001) v. 17(1) p. 75-77 KEYWORDS: EDAPHIC FACTORS; ENVIRONMENTAL FACTORS; HELIANTHUS ANNUS; CARCOAL; ROTS; PLANT DISEASES; MACROPHOMINA PHASEOLINA.

Effect of edaphic factors viz., soil moisture and soil temperature, and enwomnental factors viz., ellviromnental temperature, relative humidity and rainfall was studied on the development of charcoal rot of sunflower caused by Rhizoctonia bataticola " (Taub.) Butler [Macrophomina phaseolif1a (Tassi) Goid]. The experiment was laid out in the field of CCS Haryana Agricultural .university, Hisar. Soil moisture and soil temperature had cumulative effect pn the development of charcoal rot in sunflower. When soil moismre increased the per cent incidence of charcoal rot decreased. With ihe decrease of soil temperature, there was decrease of disease development i. e. with the increase of soil temperature, the disease also increased. Environmental temperature had a positive relation with the disease. When the

temperature increased, disease incidence also increased correspondingly. Relative lnunidity had negative relation with the disease. Disease incidence decreased with the increase of relative humidity. Rainfall had no linear relation with the development of the disease.

579. Saikia, M.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Pathology (India); Das, D. (Chaudhary CharanSingh Haryana Agricultural University, Hisar (India). Dept. of Nematology). Integration of carbofuran with Paecilomyces lilacinus for the control of root knot nematode Meloidogyne incognita on brinjal. Annals of Biology (India). (Jan 2001) v. 17(1) p. 79-82 KEYWORDS: INTEGRATION; CARBOFURAN; PAECILOMYCES; MELODOGYNE INCOGNITA; MELOIDOGYNE; SOLANUM MELONGENA.

The hyphomycetous fungus Paecilomyces lilacinus was found parasitic to eggs of Meloidogyne incognita. Colonization of the eggs occurred by direct penetration of individual hyphae which proliferated within the eggs and formed conidiophores on seventh day of inoculation. In pots soil application of either P. lilacinus inoculwns 4 g per kg soil or carbofuran 2 kg per ha resulted in sufficient reduction of gall and egg-mass formation. Lower concentration of both P. lilacinus and carbofuran was less effective individually but when used in combination they were found highly effective in reducing the nematode activity as well as increasing plant growth.

580. Kumar, B. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Pathology); Kumar, S. (Sugarcane Research Institute, Pusa (India). Dept. of Plant Pathology). Seed mycoflora of fennel, their effect and control. Annals of Biology (India). (Jan 2001) v. 17(1) p. 83-86 KEYWORDS: FENNEL; FOENICULUM VULGARE; SEED; FUNGI; SEED BORNE ORGANISMS; MICROBIAL FLORA; FUNGICIDES; CULTURAL CONTROL; VIABILITY.

Aspergillus flavus, A. niger, Rhizopus stolonifer, Cladosporium cladosporiodes and Curvularia lunata isolated from felUlel seeds have caused seed infection and subsequently reduced the seed viability. Maximum reduction in seed viability (63.8 percent) was recorded with A. flavus due to maximum seed infection (78.3 percent), whereas R. stolonifer caused minimum seed infection (52.6 percent) resulting in the lowest reduction in seed viability (3.8 percent). Other test fungi produced the same effect but in intermediate extent. Cultural filtrates of these fungi also produced adverse effect on seeds. Maximum retardation in seed genninability was recorded with culture filtrate of A. flavus followed by A. niger, C. cladosporiodes, C. lunata and R. stolonifer. Fungal seed infection and losses in seed viability were minimised by treating the seeds with captan, thiram, difolatan or emisan-6 2.5 g/kg seed.

581. Gupta, D.; Chowfla, S.C.; Thakur, P.D.; Sharma, P. (Dr. Y.S. Parmar University of Horticulture and Forestry, Solan (India). Dept. of Mycology and Plant Pathology)). Host range of tomato leaf curl virus from Himachal Pradesh. Annals of Biology (India). (Dec 2001) v. 17(2) p. 199-201 KEYWORDS: HOST PLANTS; TOMATOES; LEAF CURLS; HOSTS; VIRUSES; BEMISIA TABACI; ALEYRODIDAE; HIMACHAL PRADESH.

Thidy-two plant species belonging to eight different families viz., Amaranthaceae, Chenopodiaceae, Asteraceae, Cruciferae, Cucurbitaceae, Leguminoseae, Malvaceae and Solanaceae were tested for host range of the virus using whitefly, Bemisia tabaci. It was fOlmd

that virus' could affect only a few plants belonging to the families Asteraceae and Solanaceae. The host range of the virus included Ageratum conyzoides, Zinnia elegans, Capsicum annuum, Datura metel, D. stramonium, Nicoliana tabacum var White Burley, N. rustica and Solanum nigrum.

582. Sharma, S.K.; Dang, J.K. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Plant Pathology); Ram, D. (Indian Council of Agricultural Research, New Delhi (India). Chemical control of powdery mildew of ber (Zizyphus mauritiana L.). Annals of Biology (India). (Dec 2001) v. 17(2) p. 203-206 KEYWORDS: FUNGICIDES; MILDEWS; CHEMICAL CONTROL; ZIZYPHUS.

The studies were undel1aken at Regional Research Station, Bawal of CCS Haryana Agricultural University, Hisar for six consecutive years stalting from 1994 to 1999 to evaluate different fungicides for the control of powdery mildew of ber and to develop a spray schedule for the same. Out of six fungicides tested, Bayleton 0.1 percent gave the highest disease control (90.5 percent) followed by Karathane (85.9 percent). On the basis of long telm experiments under field conditions, it was recom-mended that powdery mildew could be controlled effiectively by two foliar applications of either BayJeton or Karathane 0.1 percent. The first spray usually be done in the last week of October just at the appearance of the disease.

583. Dohare, S.; Mishra, M.M.; Kumar, B. (Sugarcane Research Institute, Samastipur (India). Dept. of Plant Pathology)). Effect of wilt on juice quality of sugarcane. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 183-186 KEYWORDS: SUGARCANE; GIBBERELLA FUJIKUROI; WILTS; SUGARCANE JUICE; QUALITY.

Wilt caused by Fusarium moniliforme var. subglutinans had a marked effect on the normal metabolism ,of sugarcane. It resulted in reduction ofbrix (5.5-6.0 percent), pol per cent (5.7-6.4), purity per cent (7.]-9.4), moisture content (3.7-6.0 percent) and pH (0.]-0.2), while an increase in reducing sugars (40.8-64.5 percent), total soluble salt (43.4-45.0 percent), titratable acidity (25.9-36.3 percent) and invertase activity (50.2-77.3 percent) in neutral medium and acidic medium (88.5-134.3 percent) depending upon the cultivars of sugarcane.

584. Tripathi, A.K. (R.A.K. College of Agriculture, Sehore (India); Bartaria, A.M.; Pandya, R.K.; Tripathi, M.L. (Jawaharlal Nehru Agricultural University, Gwalior (India). Dept. of Plant Pathology). Effect of cultural practices on stem gall disease of coriander. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 171-173 KEYWORDS: CORIANDER; CULTURAL CONTROL; PLANT DISEASES; EPIDEMICS; FERTILIZER APPLICATION; YIELDS; SEEDS; MORBIDITY; SOWING DATES.

585. Ahamad, S.; Srivastava, M. (Chander Sekhar Azad University of Agriculture and Technology, Kanpur (India). Dept. of Plant Pathology). Fungi associated with ethopian mustard seeds, pathogenicity and chemical control. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 748-751 KEYWORDS: BRASSICA CARINATA; FUNGI; PATHOGENCITY; PLANT DISEASES; DISEASE CONTROL; CHEMICAL CONTROL; FUNGICIDES.

H60 Weeds and Weed Control

586. Singh, R.P.; Mukherjee, D.; Singh, R.K.; Sinha, A.K. (Banaras Hindu University, Varanasi (India). Dept. of Agronomy). Bioefficacy of herbicides in late sown wheat (Triticum aestivum). Indian Journal of Agronomy (India). (Sep 2003) v. 48(3) p. 196-198 KEYWORDS: TRITICUM AESTIVUM; HERBICIDES; WHEATS; SOWING DATE; WEEDS; WEED CONTROL; ORYZALIN; DICAMBA; PENDIMETHALIN.

A field study was conducted during winter (rab/) seasons of 2000-2002 at Varanasi, to study the bioefficacy of oryzalin (0.p5, 0.75,1.00,1.25 and 1.50 kglha), triasulfuron (0.015 and 0.020 kg/ha), pendimethalin (1.0 kglha) as pre-emerge,nce and dicamba (0.025 kg/ha) as post-emergence in late-sown wheat (Triticum aestivum L. emend. Fiori & Paol.). All the herbicide treatments reduced the density and dry weight of narrow and broad-leaved weeds significantly compared with weedy check. Pre-emergence application of oryzalin at 1.25 kg/ha had minimum population and dry weight of weeds compared with other herbicides and their doses. Oicamba at 0.025 kg/ha was the most effective against broad-leaved weeds compared with other herbicides. Triasulfuron at 0.020 kg/ha proved more effective than its lower dose (0.015 kglha) and control/ed both narrow and broad-leaved weeds. The maximum weed-control efficiency (76.65 percent) and grain yield (27,48 q/ha) were recorded with oryzalin at 1.25 kg/ha, followed by pendimethalin at 1.0 kg/ha and triagulfuron at 0.020 kg/ha.

587. Singh, C.J.; Bhullar, M.S.; Singh, C.B. (Punjab Agricultural University, Bathinda (India). Regional Research Station). Effect of weed infestation on the yield of mustard as s influenced by different levels of irrigation, nitrogen and hoeing. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 70-74 KEYWORDS: WEED CONTROL; INFESTATION; MUSTARD; HOEING; WEEDS; FERTILIZER APPLICATION; NITROGEN; YIELDS; WATER USE; IRRIGATION.

A field study on weed infestation in mustard under different levels of irrigation, nitrogen and hoeing revealed that the crop response to successive irrigation and nitrogen levels were diminished successively. Hoeing improved nitrogen use efficiency under all nitrogen levels and water expense efficiency ofthe crop. With two hoeings the optimal nitrogen use efficiency was for 100 and 150 kg N/ha. One hoeing was sufficient for mustard grown without irrigation with 50 kg N/ha and two hoeings for that grown with two irrigations as well as 100 and 150 kg N/ha. A decrease in dry matter of weeds by 37.3 per cent with one hoeing and 54.2 per cent with two hoeings increased the mustard yield by 13.1 and 18.1 per cent respectively.

588. Bhowmick, M.K.; Nayak, R.L.; Ray, D. (Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur (India). Dept. of Agronomy). Herbicide studies on weed management, crop phytotoxicity, growth and yield of dry season rice. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 116-122 KEYWORDS: WEED CONTROL; PHYTOTOXICITY; RICE; GROWTH; DRY SEASON; HERBICIDES; EFFICIENCY; YIELDS.

Field studies conducted at the Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal on transplanted rice during dry season of 1996-97 revealed that postemergence application of ethoxysulfuron 15 WSG at 0.02 kg a.i. ha-I + anilophos 30 EC at 0.375 kg a.i. ha-I (tank mix) at 10-12 days after transplanting (OAT) proved to be the most effective, selective and broad spectrum weed management tool. The same management practice effected high level of

economic and biological yield with satisfactory harvest index of 0.4618 and weed inde}: of 4.60 percent. The herbicide,ethoxysulfuron 15 WSG alone or in combinatiOn with anilophos 30 EC did not show any phytotoxic effect on rice crop. However, hand weeding twice at 20 and 40 OAT offered the highest weed control efficiency and proved at par with the herbicide combination of ethoxysulfuron + anilophos.

589. Singh, H. (Agricultural Research Station, Fatehpur-Shekhawari, Sikar (India); Singh, B.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Agronomy). Economics of weed management in Brassica species. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 174-176 KEYWORDS: WEED CONTROL; BRASSICA JUNCEA; VARIETIES; CONTROL METHOD; ECONOMICS; HERBICIDES.

590. Dhillon, A.S.; Raheja, R.K.; Gupata, T.R. (Punjab Agricultural University, Ludhiana (India). Dept. of Plant Breeding). Efficacy of atrazine application for controlling weeds in sugarcane - gobhi sarson intercrop. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 622-625 KEYWORDS: WEEDS; CONTROL METHODS; ATRAZINE; WEED CONTROL; HERBICIDES; INTERCROPPING; BRASSICA CAMPESTRIS; SUGARCANE; LIPID CONTENT; YIELDS.

A study was conducted to see the effect ofhigher dose ofatrazine (up to 2500 g/ha) on pure crop of gobhi sarson (Brassica napus)) and to work out economics of using this herbicide for controlling weeds in sugarcane-gobhi sarson intercrop. Highest mean yield of 20.22 q/ha was obtained when 2500 g/ha of atrazine was applied at preemergence stage on pure crop of gobhi sarson. Atrazine application checked the weeds most effectively and there was no adverse effect of such a high dose of atrazine on gobhi sarson. Seed yield of gobhi sarson intercrop was the highest with 1500 glha atrazine when applied at post-emergence stage, which was about 3q/ha higher as compared to unweeded control. Cost of cultivation of both the crops using atrazine spray was almost the same as compared to hand hoeings but was more in comparison to unweeded control: Increased net profit ofRs. 17168 per hactare was obtained when the crop was sprayed with 1500 glha atrazine at pre-emergence stage as compared to unweeded control.

591. Pandey, J.; Mishra, B.N. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Effect of weed management practices in rice-wheat mungbean cropping system on weeds and yield of crops. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 646-650 KEYWORDS: WEED CONTROL; CONTROL METHODS; WEEDS; CROPPING SYSTEMS; SEQUENTIAL CROPPING; VIGNA RADIATA; ORYZA SATIVA; TRITICUM AESTIVUM; ISOPROTURON; PEDIMETHALIN.

An experiment to find out the effect of weed management practices on weed and productivity of rice (Oryza saliva L.) -)vheat (Triticum aeslivum emend florid & Poal)mungbean (Vigna radiata L.) grown in sequence was conducted at New Delhi during crop seasons of 1997-98 and 1998-99. Results revealed that the most prevalent weed species that invaded the field were Echinochloa colonum, E. cusgalli and Leplochloa chinensis in rice. fhalaris minor. Coronopus didymlls and Rumex sp. in wheat and Trianthama portulacastrum. C:yperus rotundus and E. coloflua in mungbean. Weed flora was almost similar in both the years. In rice, weed population and weed biomass were 1J1arked/y lower in handweeding, chemical

and chemical + cultural treatments, in wheat in handweedingand chemical treatments and in mungbean chemical + cultural and handweeding. Weed control treatments brought about significant increase in grain productivity of all the three crops. Handweeding. chemical and chemical + cultural effected significantly higher increase in rice productivity, handweeding and chemical in wheat and hand weeding and chemical + cultural in mungbean. Effect ofthcse treatments in increasing grain productivity of crops was almost alike in both the years. Crop yield reduction due to weed competition was to the tune of 44. 7 percent in rice. 28 percent in wheat and 46.5 percent in in moong bean.

592. Kewat, M.L. (Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (India). Dept. of Agronomy); Pandey, J. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agronomy). Persistence of metribuzin in soil in soybean-wheat sequence. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 651-653 KEYWORDS: HERBICIDES; METRIBUZIN; CROPPING SYSTEMS; SOYBEANS; WHEATS; RESIDUES; RESIDUAL EFFECTS.

An investigation was carried out at Indian Agricultural Research Institute, New Delhi during kharifseason of 1995 and 1996, to determine the persistence of metrubuziq in soil in soybean-wheat sequence following its pre-emergence application to soybean. In sandy loam soil of Delhi, the half life of metribuzin at 0.50 and 0.75 kglha ranged between 43 to 49 days respectively. The loss of metribuzin residues was not proportional to time as the rate dissipation of metribuzin did not follow first order kinetics at any rate of application. The dissipation of metribuzin was more acute durings first 15 days of application and thereafter it was. gradual. After one and half month of metribuzin application nearly 50 percent of the original value was last in 45, days at both the rates of application and ascertained safety to the following wheat crop as the metribuzil residues dissipates to a non-detectable level after the harvest of soybean crop.

P06 Renewable Energy Resources

593. Thakur, S.K.; Singh, K.D.N. (Rajendra Agricultural University, Samastipur (India). Dept. of Sugarcane Chemistry)). Anaerobic digestion of agricultural wastes and weeds for biogas production. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 245-249 KEYWORDS: BIOMASS; METHANE; WEEDS; BIOGAS; AGRICULTURAL WASTES; ANAEROBIC TREATMENT; PRODUCTION.

Batch digester studies were carried out to study the biogas production capacity of some agricultural wastes and weeds. The equal amount of feed materials 8 percent of total solid (480 g) was taken in 10 I bottles separately. The maximum gas production (118.65 I kg" TS) was recorded in banana stem as compared to other substrates (90.26 to 100.07 I kg-' TS). The methane content of gas in different" substrates varied between 73 to 84 percent. The loss in carbon and gain in nitrogen at 60 days of digestion lowered the C : N ratio.

P10 Water Resources and Management

594. Samra, J.S. (Indian Council of Agricultural Research, New Delhi (India). Participatory watershed management in India. Journal of the Indian Society of Soil Science (India). (Dec

2002) v. 50(4) p. 345-351 KEYWORDS: WATERSHED MANAGEMENT; INDIA; DROUGHT RESISTANCE.

Flow and distributions of natural fluxes of rainwater, nutrients, eroded soil, microflora, fauna and energy occurs within boundaries of a naturally defined hydro-geological unit of a watershed. Integrated management of all resources is called upon to harmonize their synergies for internalising maximum economic and conservation benefits. Biophysical applications of R&D during 1960s and 1970s provided limited livelihood and environmental securities. Importance of socioeconomic factors for further consolidation of sustainable development process was realized during 1980s. A practical participatory and demand-driven watershed development programme was launched in 1990s. Community organizations, NGOs and many registered institutions became competitor of the government agencies. Various strategies of grass root level empowerment and conflict resolution were experimented to internalize larger benefits of biophysical research. On an average Rs.1000 crores per annum was invested into this new paradigm of 'development during Ninth Plan (1997-2002) by different development agencies. This process has been accepted for rural development programmes and resource conservation for Tenth Plan period also with still higher level of investments. There are definite mechanisms for the participation of landless, disadvantaged sections of society and women to ensure equity of the process. Prioritization of research for further improvement and extension of the process based participatory development is called upon.

595. Dhaka, B.L.; Sharma, B.M. (S.K.N. College of Agriculture, Jobner (India). Dept. of Extension Education). Impact of watershed development programme on rainfed agriculture in semi-arid eastern plain of Rajasthan. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 61-64 KEYWORDS: WATERSHEDS; RAINFED FARMING; SEMI ARID ZONES; PLAINS; RAJASTHAN; PRODUCTIVITY.

The study undertaken to analyse the impact of watershed devoJopment programme on rainfed agriculture in Agarpura watershed area of semi-arid eastern plain of Rajasthan during 1998-99. A sample of 75 respondents comprising 50 beneficiaries and 25 non-beneficiaries was studied. It was revealed that average size of operated area, NCA, GCA, cropping intensity and irrigation intensity for beneficiaries were moderately higher than those for non-beneficiaries. The study indicated that watershed projects have helped significantly in raising the underground water-tablcin ffie area under study. A shift in area under low productive crops to high productive and more remunerative crop was observed in case of beneficiaries. The average productivity of almost all the crops was found to be higher side for beneficiaries than those non-beneficiaries.

P30 Soil Science and Management

596. Chhonkar, P.K. (Indian Society of Soil Science, New Delhi (India). Soil research in India : some oversights and failures. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 328-332 KEYWORDS: SOIL SCIENCE; MANAGEMENT; SOIL BIOLOGY; SOIL FERTILITY; ORGANIC AGRICULTURE.

597. Chammundeswari, N. (Regional Agricultural Research Station, Guntur (India); Aher, R.P. (Mahatma Phule Krishi Vidyapeeth, Rahuri (India). Dept. of Botany)). Character association and component analysis in soybean (Glycine max (L.) Merrill.). Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 199-203 KEYWORDS: GENETIC CORRELATION; SELECTION; YIELD COMPONENTS; SELECTION RESPONSES; STATISTICAL ANALYSIS; GLYCINE MAX; SOYBEAN; YIELDS.

In the improvement of seed yield per plant, emphasis should be given to selection of plants with high, harvest index, total biomass coupled with number of branches per plant, number of clusters per plant I and number of pods per plant in the breeding programme.

P32 Soil Classification and Genesis

598. Patra, D.D.; Kiran, U.; Kumar, S. (Central Institute of Medicinal and Aromatic Plants, Lucknow (India). Urease and nitrification inhibitors from natural source-Artemisia annua. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 508-510 KEYWORDS: SOIL CLASSIFICATION; ARTEMISIA AMMUA; UREASE; ORGANIC CHEMISTRY OF SOILS; NITRIFICATION INHIBITORS.

P33 Soil Chemistry and Physics

599. Pasricha, N.S. (Potash Research Institute of India, Gurgaon (India). Potassium dynamics in soils in relation to crop nutrition. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 333-344 KEYWORDS: SOIL STRUCTURE; POTASSIUM; NUTRITION PHYSIOLOGY.

600. Satisha, G.C.; Karthikakuttyamma, M. (Rubber Research Institute of India, Kottayam (India); Pal, T.K.; Dey, S.K. (Rubber Research Institute of India, Agartala (India). Regional Research Stn.); Varghese, Y.A. (Rubber Research Institute of India, Kottayam (India). Rubber growing soils of Northern Mizoram-their characteristics, and limitations. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 497-501 KEYWORDS: SOIL CHEMISTRY; PHYSICS; HEVEA BRASILIENSIS; SOIL CHARACTERISTICS; LAND SUITABILITY.

Seven representative soil sites of major rubber growing areas in northern Mizoram were identified and their climatic, soil and site characteristics were studied and asses~ed for suitability through limitation approach; The suitability criteria for rubber cultivation were developed with special reference to hilly terrain of Mizoram. The prevailing land characteristics of each site were compared with these diagnostic limitations. The steep slopes and low winter temperature of less than 10 DC are the major constraints in the region. Most of the soil-sites studied are moderately suitable except for soils of rolling hills with very high steep slope at 400 and 750 m above mean sea level are marginally suitable for rubber cultivation.

601. Tamgadge, D.B.; Gajbhiye, K.S.; Bankar, W.V. (National Bureau of Soil Survey and Land Use Planning, ICAR, Nagpur (India)). Estimation of whole soil organic matter stock (WSOMS) - A case study. Journal of the Indian Society of Soil Science (India). (Sep 2003) v. 51(3) p. 321-

323 KEYWORDS: SOIL ORGANIC MATTER; SOIL CHEMICOPHYSICAL PROPERTIES; SOIL ANALYSIS; SOIL FERTILITY.

602. Kumar, D.; Dahiya, D.J.; Singh, J.P.; Dahiya, S.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science)). Yield of wheat as influenced by rice straw management and nitrogen application rate. Journal of the Indian Society of Soil Science (India). (Sep 2003) v. 51(3) p. 324-325 KEYWORDS: SOIL CHEMISTRY; CROP RESIDUES; RICE STRAW; IMMOBILIZAITON; SOIL ANALYSIS; FERTILIZER APPLICATION; NITROGEN; ORGANIC MATTER; FARMYARD MANURE; TRITICUM AESTIVUM.

603. Mehta, S.C.; Grewal, K.S.; Singh, R.; Kuhad, M.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science)). Effect of texture and organic matter on the activity coefficients of adsorbed cations in K+-Ca++ and K+-Na+ systems. Annals of Biology (India). (Jan 2001) v. 17(1) p. 47-51 KEYWORDS: SOIL TEXTURE; ORGANIC MATTER; ADSORPTION; CATIONS; SOIL CHEMICOPHYSICAL PROPERTIES; SOIL ANALYSIS.

A laboratory experiment was conducted to study the effect of texture and organic matter on the activity coefficients of adsorbed K+, CaH and Na+. Exchange equilibria of K+-CaH and K+-Na+ were established on soils ~th different texture and organic matter content (0. M.). The data on the composition of the equilibrium solution and the exchange complex were used to calculate activity coefficient of ions on the adsorbed phase. The values of activity coefficients of adsorbed phase of Ca++/Na+ decreased, while that of K+ increased with increase in equivalent fIaction of K+ on the exchanger in K+-CaH and K+-Na+ systems. The values of activity coefficient of adsorbed potassiwn were higher in soil with higher O. M. content than in soil with lower O.M. content.

604. Mehta, S.C.; Grewal, K.S.; Sangwan, P.S.; Dahiya, S.S. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science)). Effect of pH on cation exchange capacity of soils from semi-arid and humid regions. Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 165-168 KEYWORDS: SOIL PH; ION EXCHANGE CAPACITY; CATIONS; SEMI ARID ZONES; HUMID ZONES; ARID SOILS; SOILS.

A laboratory expriment was conducted to study the effect of pH on cation exchange capacity of soil samples collected from semi-arid and humid regions of India. The pH of the soil was maintained using buffer solutions of pH 4 to 8. Cation exchange capacity of the soils increased with increase in pH. With the unit change of pH from 6 tp 7, the per cent change in cation exchange capacity of the soil was maximum i. e. about 25 in soil-2 and minimum about 4.2 in soil-6. The linear regression equation best described the data and a highly significant correlation was found between CEC and soil pH.

605. Singh, S.P. (Shambu Dayal College, Mathura (India). Dept. of Agricultural Chemistry and Soil Science); Singh, B. (Raja Balwant Singh College, Bichpuri (India). Dept. of Agricultural Chemistry and Soil Science). Effect of sodic water on yield, composition and uptake of nutritents by french bean (Phaseolus vulgaris L.) cultivars. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 57-60 KEYWORDS: PHASEOLUS VULGARIS; VARIETIES; SALINE

WATER; NUTRIENTS; NUTRIENT UPTAKE; NUTRITIVE VALUE; YIELDS; CHEMICAL COMPOSITION.

A pot experiment was carried out for two years with 5 levels ofRSC viz. control, 2.5, 5.0,7.5 and 10.0 mmol L-) rich irrigation water and 3 varieties ofFrench.beali viz. PDR-14, HUR-137 and Contender on a sandy loam soil. The grain and straw yield were significantly decreased with increasing levels of sodic water irrigation. The increasing levels of RSC rich irrigation. Water decreased significantly the nitrogen, phosphorus, potassium, calcium and magnesium contents and their uptake values by grain and straw. The sodium content in grain and straw increased significantly with enhancing levels of RSC. However, the sodium uptake by grain and straw significantly increased at 5.0 to 7.5 mmol L-llevels ofRSC as compared to control, 2.5 and 10.0 mmol L-'. The HUR137 variety contained significantly higher nitrogen, phosphorus, potassium, calcium and magnesium contents and uptake in grain and straw as compared to PDR-14 and Contender varieties.

606. Das, M. (Water Technology Centre for Eastern Region, Bhubaneswar (India). Hydrological characteristics and irrigation planning of major soil types in Orissa. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 123-130 KEYWORDS: SOIL TYPES; SOIL CHEMICOPHYSICAL PROPERTIES; SOIL HYDRAULIC PROPERTIES; SOIL WATER RETENTION; IRRIGATION; ORISSA; SURFACE IRRIGATION.

Hydrological characterstics of twelve benchmark soils were determined. The soils were clay to sandy clay loam in texture, acidic to alkaline in reaction, mostly non-saline in nature. Water retention at any given suction was maximum in typic Ustochrept followed by Aquic Ustochrept-II (Soil no. 6) Vertic Ustochrept Aquic Ustochrept-I (4) Plinthustalf Aquic Haplustaff Ultic Haplustalf Aqtiic Ustiuvent Aeric Haplustalf Typic Haplustalf Udic Haplautalf and Typic Ustipsamment. Water retained It -0.003 and -1.5 MPa were negatively correlated with coarse sand but positively with organic carbon, EC and pH of soil. The unsaturated hydraulic, conductivity and soil water diffusivity greatly varied with and within the soil types. The study suggests for frequent and light irrigatiowfor typic Usipsamment and Aeric Haplustalf owing to their coarse texture, high Ks value and low waterretentioqc~acity. The same may also advocate for aquic Ustochrept-II and Udic Haplustalf. The high value ofK and moderate A WC determine surface irrigation with low to medium volume of water for Aquic Ustifluvent and Ultic Haplustalf. But occasional supply of water with excess amount mau be found suitable for Aquic Ustochrept-I and Typic Ustochrept as the soils were heavy in texture, had low Kand high available water capacity. Further owing were heavy in texture, had low K and high available water capacity. Further owing t,o have medium water retention capacity and hydraulic conductivity normal irrigation practice i.e sueface irrigation with 5 to 5 cm water is being advocated for rest of the other soil types. To ensure high water UJe efficiency drip or sprinkler irrigation may be followed for Typic Ustipsamment and Aeric Haplustalf.

607. Tiwari, S.; Sakal, R. (Rajendra Agricultural University, Samastipur (India). Dept. of Soil Science). Extractability of soil sulphur in relation to certain soil properties and plant parameters. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 146-154 KEYWORDS: SOIL ANALYSIS; SOIL CHEMICOPHYSICAL PROPERTIES; AGRONOMIC CHARACTERS; EXTRACTION; SULPHUR; YIELD COMPONENTS.

In a screenhouse experiment with old alluvial soils of south Bihar plain, it was observed that electrical conductivity (EC), cation exchange capacity (CEC), clay, silt and silt+clay have exhibited positive and significant correlation with the amount ofS extracted by a number of extractants. EC showed positive and significant correlation with 0.15 per cent CaCI2' NH40AC-NOAc, Ca (H2P04)2 and O.OOIm HCI extractable-S with corresponding r-values of 0.529*,0.490*,0.578** and 0.560*, respectively. Organic carbon showed significant positive correlation with NH4 Oac - HOAc (r-;=0:533*) and KH2PO 4 (r=0.519*) extractable - S. Silt content evinced significant positive correlation with 0.15 percent CaCI2 (r=519*), NH4 Oac-HOAc (r=0.517*), O.OOIMHCI (r=O.478*) and heat (r=0:460*) extractable-S. Different plant parameters have also shown significant positive correlation with all the extractants excepting 0.5 M Na BC03' For quantifying the impact of soil properties on extractability of S and influence of extractants on plant parameters,. the multiple regression analysis was carried out. Among; ioil properties. pH influenced in negative direction, whereas EC, silt and Fe2P3 showed positive influence on soil-S extractability. The plant parameters like dry matter yield, Bray's per cent yield, S concentration in leaf blade and S-uptake by rice shoot were largelYlnfluencedby 0.15 per cent CaCI2' NH4 Oac-HOAc, NOAc-HOAc and 0.00 I M HCI extractable-S.

608. Kar, D.N.; Ray, M.; Garnayak, L.M. (Orissa University of Agriculture and Technology, Bhubaneswar (India). Dept. of Agronomy). Effect of moisture stress on yield and water use by rabi groundnut. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 159-161 KEYWORDS: SOIL WATER CONTENT; STRESS; WATER USE; EFFICIENCY; GROUNDNUTS; ORISSA; YIELDS; YIELD COMPONENTS.

609. Sharma, M.P. (Narendra Deva University of Agriculture and Technology, Faizabad (India). Dept. of Soil Science). Effect of seepage on water table and soil properties. Annals of Agricultural Research (India). (Mar 2002) v. 23(1) p. 184-186 KEYWORDS: SOIL ANALYSIS; SOIL CHEMCOPHYSICAL PROPERTIES; WATER ANALYSIS; WATER LEVELS; GROUNDWATER TABLE.

P34 Soil Biology

610. Kumar, R. (Birsa Agricultural University, Dumka (India). Zonal Research Stn.); Singh, K.P.; Singh, S. (Birsa Agricultural University, Ranchi (India). Dept. of Soil Science and Agricultural Chemistry). Vertical distribution of sulphur fractgions and their relationships among carbon, nitrogen and sulphur in acidic soils of Jharkhand. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 502-505 KEYWORDS: SOIL BIOLOGY; SOIL CHEMISTRY; NITROGEN; SULPHUR; CARBON.

611. Singh, G. (Punjab Agricultural University, Ludhiana (India). Dept. of Plant Breeding); Wright, D. (University of Wales, Gwynedd (United Kingdom). Application of the acetylene reduction assay for measuring nitrogenase activity . Annals of Biology (India). (Jan 2001) v. 17(1) p. 21-28 KEYWORDS: NITROGEN FIXATION; NITROGENASE; LEGUMES; MEASUREMENT; ACETYLENE; ENZYME ACTIVITY.

Each of the nitrogen fixation measurement methods viz., acetylene reduction assay, N-solute method, N-difference method, 15N emichment method, natural 15N abundance method, etc. has its own merits and limitations. The acetylene reduction assay is a cheap, simple and very sensitive method for measuring nitrogenase activity in legumes. TIlOugh due to some problems e. g. digging of roots, shaking and washing of roots, non-recovery of all nodules from the soil, removal of shoots, acetyleneinduced decline in nitrogenase activity, etc. nitrogenase activity decreases yet if used with care this method can provide good results. In situ measurement of nitrogenase activity on intact plants in case of pot experiments conducted in a porous medimn such as perlite or venniculite, and keeping the shoots intact while incubating nodulated roots in case of the plants obtained from field or from pots grown in soil and keeping the lenf"rth of incubation period to the shortest can provide reasonably accurate estimates of nitrogenase activity.

612. Ghosh, T.K.; Tyagi, M.K.; Duhan, J.S. (Regional Biofertilizer Development Centre, Hisar (India)). Evaluation of suitable combination of carrier among lignite, charcoal and vermiculite for survival of rhizobia at different storage temperature under both sterile and non sterile system of production. Annals of Biology (India). (Jan 2001) v. 17(1) p. 101-105 KEYWORDS: RHIZOBIUM; POLLUTANTS; STERILIZING; SOIL CHEMICOPHYSICAL PROPERTIES; VERMICULITIES; LIGNITE; CHARCOAL; INOCULATION.

The suitability of different combinations of lignite, charcoal and vermiculite (A-60 : 20 : 20, B-33 : 33 : 33, C-20 : 60 : 20, D-20 : 20 : 60, E-IOO : 0 : 0,In F-O : 100 : 0 and G-O : 0 : 100) as carrier to rhizobia 1 strain (M 1006) had been tested by studying rhizobia 1 survivality in cattier at one month interval upto a period of six months at 20, 28 and 48°C storage temperature in incubator by preparing the inoculant packet under both sterile and non-sterile sysJem of production. TIle physico-chemical properties viz., mesh size, water holding capacity, organic matter content, total nitrogen content as welI as level of contaminants (before and after sterilisation) of each carrier were also evaluated. Ihe rhizobial viability could be maintained at desired level of 108 only in single sterilised charcoal and vermiculite and in the carrier containing 60 percent charcoal, 20 percent lignite and 20 percent vermiculite upto a period of four months and thereafter it declined to the order of 10 both at 20 and 28°C under sterile condition only, while remaining other carrier combinations had failed to provide desired rhizobial viability of 108 even after 1st or 2nd month of storage at both 20 and 28°C under both sterile and non-sterile system of production. The rhizobial viability was found to range between 102 to 104 which was far below the desired level of population in all the carriers both under sterile and non-sterile condition when subjected to 48°C storage temperature. TIle integrated effects of lower level of bacterial contaminants in sterilised charcoal and higher water holding capacity in sterilised venniculite (20 percent) coupled with higher level of organic matter content in sterilised lignite (20 percent) could be assigned to provide optimwn carrier combination (20 : 60 : 20) for higher rhizobial viability, while desirable rhizobial count (108) in single sterilized charcoal upto 4th month could be ascertained due to its lower level of bacterial contaminant. Comparatively lower rhizobial COtUlts in lignite could be attributed to higher level of bacterial contaminants which could not be steam sterilised down to the satisfactory level of 105, while even steam sterilised

venniculite with lot of actinomycetes (1.3 x 106) could not maintain desirable COWlt even after three months both at 20 and 28°C due to poor organic matter content.

P35 Soil Fertility

613. Tiwari, K.N. (Potash Research Institute of Canada-India Programme, Gurgaon (India). Nutrient management for sustainable agriculture. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 374-397 KEYWORDS: NUTRIENT PHYSIOLOGY; NUTRIENT AVAILABILITY; SUSTAINABILITY; AGRICULTURE; SOIL FERTILITY.

614. Sarkar, D. (National Bureau of Soil Survey and Land Use Planning, Kolkata (India). Regional Centre). Soil resource information for meeting challenges of land degradation: a case study in Chotanagpur plateau region. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 414-437 KEYWORDS: SOIL ANALYSIS; SOIL CLASSIFICATION; ENVIRONMENTAL; DEGRADATION; SOIL CHEMISTRY; SOIL DEGRADATION.

615. Maitra, D.N.; Saha, S.; Saha, A.R.; Mukherjee, P.K. (Central Research Institute for Jute and Allied Fibres, Barrackpore (India). Dept. of Soil Science). Response of jute to different levels of nitrogen as influenced by genetic variability. Journal of the Indian Society of Soil Science (India). (Dec 2002) v. 50(4) p. 511-512 KEYWORDS: SOIL FERTILITY; JUTE; SOIL NUTRIENT CONTENT; NITROGEN; GENETICS.

616. Sangwan, P.S.; Kumar, V.; Mehta, S.C.; Singh, J.P. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Soil Science)). Effect of salinity and nitrogen levels on yield and nutrient uptake by wheat (Triticum aestivum L.). Annals of Biology (India). (Jul-Dec 2003) v. 19(2) p. 169-173 KEYWORDS: SALINITY; NITROGEN; SOIL SALINITY; DRY MATTER CONTENT; YIELDS; TRACE ELEMENTS; NUTRIENT UPTAKE; TRITICUM AESTIVUM; WHEAT.

A laboratory experiment was conducted to study the effect of salinity and nitrogen (N) levels on the performance of wheat in terms of dry matter yield and nutrient removal. To study the effect of salinity, i. e. 4,8 and 12 d'S/m were artificially created. The nitrogen levels were 0, 60, 120 and 150 mg/kg soil. Increasing levels of salinity decreased the dry matter of wheat. Application of nitrogen increased the dry matter yield of wheat upto moderate salinity. Total removal of macro and micronutrients by wheat dry matter significantly increased with the increase in N from 0 to 150 mg/kg. On the contrary, there was a significant decrease in nutrient uptake with the increase in soil salinity levels from 1.2 to 12 dS/ m.

617. Moafpouryan, G.R.; Shukla, L.M. (Indian Agricultural Research Institute, New Delhi (India). Div. of Soil Science and Agricultural Chemistry). Status of available boron in major soil series of Delhi. Annals of Agricultural Research (India). (Sep 2002) v. 23(4) p. 554-557 KEYWORDS: SOIL TYPES; SOIL ANALYSIS; BORON; SOIL FERTILITY; DELHI.

No information is available on the status of available boron in the cultivated soils of Delhi State. Therefore, two hundred and fifty surface (0-0.15 m) soil samples from ten major soil series (25 samples from each soil series) under the order 1nceptisol were collected from

cultivated fields of Delhi State to find out the status of available boron. Soil samples were extracted with hot 0.0 I M CaCI2 and analysed by azomethine-H colorimetric method. Considering the critical level of 0.5 mg kg-1, about 10 per cent of the soil samples were found deficient in available boron, while 39 and 51 per cent of the soil samples were cIassified in medium and sufficient range, respectively.

P40 Meteorology and Climatology

618. Neog, P. (B.N. College of Agriculture, Sonitpur (India); Sarma, R. (Assam Remote Sensing Application Centre, Guwahati (India); Gains, G.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Agrometeorology). Effect of temperature on grain growth period and grain yield of wheat (Triticum aestivum L.). Annals of Biology (India). (Jan 2001) v. 17(1) p. 111-114 KEYWORDS: TEMPERATURE; FLOWERING; GROWTH; GRAIN; TRITICUM AESTIVUM; YIELDS; MATURITY.

A study was conducted to know the effect of temperature on grain growth period and grain yield of wheat during the winter season of 1993~94 at Ludhiana. Wheat variety HD. 2329 was sown in five different micro-enviromnents which were created by manipulating sowing dates. Post-anthesis stages like flowering and grain filling of crop sown on different date were exposed to different temperature environments. Grain growth period (from anthesis to maturity) of. the crop was strongly responsive to the air temperature and it was, reduced significantly at high temperature. A linear relationship between average maximum and minimum air temperature and number of days from anthesis to maturity was found which explained 71 percent variation in grain growth period due to variation in maxnnum and minimum air temperature during this period. High temperature at reproductive growth stage reduced the number of grains per ear and test weight which were negatively and significantly associated with temperature which led to reduction in grain yield significantiy at high temperature.

619. Goswami, B.; Mahi, G.S.; Hundal, S.S. (Punjab Agricultural University, Ludhiana (India). Dept. of Agricultural Meteorology); Saikia, U.S. (Indian Agricultural Research Institute, New Delhi (India). Div. of Agricultural Physics). Climate based wheat yield models in Punjab. Annals of Agricultural Research (India). (Dec 2002) v. 23(4) p. 714-718 KEYWORDS: WHEATS; METEOROLOGICAL FACTORS; YIELDS; PUNJAB; CLIMATE; WEATHER DATA; TEMPERATURE.

This paper discusses the effect of various weather parameters on wheat yield of Punjab. Coefficient of determaination (R 2) value ofLudhiana for wheat was higher thalf any other location in the state. The yield variability of wheat in Ludhiana could be explained to the extent 01'85 per cent by maximum and miflimum temperature. R2 value for Ludhiana increased to 87 per cent with the use of Radiation along with maximl1ffi and minimum temperature. The R2 value of Amristar, Patiala, Jalandhar improved slightly due to addition of radiation, along with maximum and minimum temperatures. Similarly the addition of rainfall and sunshine hours into the regression equation developed for Ballowal has improved the value ofR2 from 75 to 79 per cent. R2 value of Kapurthala was lowest among all the stations.

Q02 Food Prcessing and Preservation

620. Sindhu, S.C.; Khetrapaul, N. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Foods and Nutrition)). Effect of probiotic fermentation on antinutrients in indigenously developed food mixture. Annals of Biology (India). (Jan 2001) v. 17(1) p. 127-131 KEYWORDS: FERMENTATION; PROBIOTICS; LACTOBACILLUS PLANTARUM; PROXIMATE COMPOSITION; LACTOBACILLUS CASEI.

Indigenously developed BWGT food mixture containing barley flour, whey, sprouted green gram paste and tomato pulp (2 : I : 1 : I w/w) was autoclaved (1.5 kg/cm2, 15 min, 121°C), cooled and fennented with 2 percent liquid culture (containing 106 cells/ml broth). Two types of fennentations were ca'Tied out i. e. single culture fennentation [L. casei, L. plantal1ln1 (37°C, 24 h)] and sequential culture fennentation [So bOlllardii (25°C, 24 h}+L. casei (3 ?DC, 24 h), S. bOlllardii (25°C, 24 h}+L. plantarlln1 (37°C, 24 h)]. All the fennentations drastically reduced the contents of phytic acid, polyphenols and trypsin inhibitor activity. Sequential culture fennentations brought about higher changes as compared to single culture fennentations.

621. Sindhu, S.C.; Khetrapaul, N. (Chaudhary Charan Singh Haryana Agricultural University, Hisar (India). Dept. of Foods and Nutrition)). Probiotic fermentation of indigenously developed BWGT food blend : effect on In vitro digestibilities of protein and starch. Annals of Biology (India). (Dec 2001) v. 17(2) p. 219-222 KEYWORDS: FERMENTATION; PROBIOTICS; DIGESTABILITY; IN VITRO EXPERIMENTATION; PROTEIN CONTENT; STARCH; LACTOBACILLUS CASEI; LACTOBACILLUS PLANTARUM.

Indigenously developed SWOT food mixture containing barley flour, whey, sprouted green gram paste and tomato pulp (2 : I : 1 : J, w/w) was autoclaved (1.5 kg/cm2, 15 min, 12°C), cooled and fermented with 2 percent liquid culture (containing 10" cells/ml broth). Two types of fennentations were canied out i. e. single culture fermentation [L. casei, L. plantarllm (37°C, 24 h)] and sequential culture fermentation). [S. boulardii (25°C, 24 h)+L. casei (37°C, 24 h); S. houlardii (25°C, 24 h)+L. /J/antarum (37°C, 24 h)]. All the fermentations significantly (P0.05) improved the in vitro digestibilities of starch and protein (49-92 percen). Sequential culture fermentations brought about higher changes as compared to single culture fermentations.