

Abstracts of Thesis Accepted for the Award of Post-Graduate Degrees in the University of Agricultural Sciences, Dharwad

DOCTOR OF PHILOSOPHY

AGRONOMY

Effect of Physico-Chemical Modification of Soil Through Set Furrow Amendments on Crop Productivity, Soil Fertility and Water Balance in Pearlmillet/Sorghum Based Cropping Systems

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2008

MAJOR ADVISOR : Dr. M. B. GULED

Three field experiments were conducted at RARS, Bijapur, to study the a) effect of tank silt+crop residue in set furrows and row spacing on pearlmillet-sunflower sequence cropping system, b) effect of green leaf manure+crop residue in set furrows on pearlmillet-sunflower sequence cropping system in Vertic-Inceptisol and c) effect of gravel sand, crop residue in set furrows on sunflower-rabi sorghum + chickpea cropping system in Vertisols under dryland condition during 2004-05, 2005-06 and 2006-07. All the experiments were laid out in randomized block design. Pearlmillet equivalent yield was significantly higher with the application of tank silt+CR in set furrows with wider row spacing (4135 kg/ha) than farmers' practice (1995 kg/ha) and was on par with the tank silt+crop residue application in set furrows with paired row planting of 45-90-45cm and 45-135-45cm (4000 kg/ha and 4090 kg/ha, respectively). Incorporation of GLM+CR+100 per cent RDF in set furrows registered

significantly higher pearlmillet equivalent yield (3482 kg/ha) as compared to other treatments. However, it was on par with incorporation of GLM+CR+50 per cent RDF+50 per cent FYM in set furrows (3321 kg/ha). Application of tank silt, green leaf manures and crop residue in set furrows improved the soil moisture, soil fertility and economic status in Vertic-Inceptisol. Rabi sorghum equivalent yield was significantly higher in sunflower-rabi sorghum+chickpea (2:4) sequence cropping system under set row cultivation with crop residue (5696 kg/ha) as compared to rest of the treatments. Incorporation of crop residue in set furrows increased the available soil moisture and improved the soil fertility and economic status. The set row cultivation reduced the runoff and soil loss. The overall effect on water balance study provides a lead for assessing the carrying capacity of the system for macro level planning.

Effect of Sowing Time, Nitrogen and Irrigation Levels on Yield, Fibre Quality and Cry Protein Concentration in Bt-Cotton

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To find out the nitrogen requirement, schedule of nitrogen application, feasibility of detopping, irrigation level and date of planting for Bt-cotton and to assess their effects on growth, yield, cry protein concentration and fibre quality parameters, two field experiments and two pot culture studies were undertaken at Agriculture Research Station, Dharwad for two years (2005-06 and 2006-07) under irrigated conditions. Mean of two years results indicated that increasing level of N from 80 to 120 and further to 160 kg/ha significantly improved seed cotton yield by 12 and 18.6 per cent, respectively. Application of N with recommended practice of three splits as well as N applied in seven splits at 15 days interval produced on par yields. However, more number of split application was beneficial at higher doses of N. Detopping of Bt-cotton at 80 DAS had no significant influence on seed cotton yield. N fertilization significantly affected the cry protein levels at various stages. At 60 DAS, increase in level of N from 80 to 120 kg increased cry protein by 9.3 per cent and further increase in N application to 160 kg/ha improved the cry

protein by 14.8 per cent. Leaf nitrogen concentration and spad readings were followed same pattern as that of cry protein concentration. N levels and management techniques have little influence on quality parameters. Fibre length improved with N application up to 120 kg per ha. Economic analysis of Bt-cotton production indicated that N up to 120 kg per hectare applied with present recommended practice without detopping recorded significantly highest net returns. Response of Bt-cotton to date of sowing indicated that yield reduction to the extent of 18.8 and 54.9 per cent was noticed when sowing was delayed from June to July and further to August, respectively. Irrigation at 0.8 IW/CPE ratio produced significantly more seed cotton yield (1807 kg/ha) as compared to unirrigated and 0.4 IW/CPE ratio. However, it was on par with 0.6 IW/CPE ratio. Early sowing in June with irrigation at 0.6 IW/CPE ratio recorded significantly highest yield, net returns which can also produce highest fibre length, fibre strength, uniformity percentage and maturity ratio of Bt-cotton in transitional tract of Dharwad.

Response of Safed Musli (*Chlorophytum borivilianum*) to NPK, FYM and Mulching in North-East Transitional Zone of Karnataka

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Two field experiments were conducted during *kharif* season of 2004 and 2005 on red sandy loam soils in farmers field in north-east transitional zone of Karnataka to study the effect of different levels of NPK, manuring and polyethylene mulching on performance of safed musli (*Chlorophytum borivilianum*). Application of 50 kg N/ha recorded significantly higher dry root yield (622 kg/ha), yield components and growth parameters, nutrient content, uptake and total saponin content (%) compared to control and was on par with 100 kg N per ha. Significantly higher dry root yield (617 kg/ha), yield components and growth parameters, nutrient content, uptake and total saponin content (%) was recorded in kg P₂O₅/ha compared to control and was on par with 100 kg P₂O₅/ha. Application of 100 kg K₂O/ha recorded significantly higher yield component, yield and growth parameters, nutrient content, uptake and total saponin content (%) compared to control. However it was on par with 50 kg K₂O/ha. The treatment combination N₅₀P₅₀K₅₀ recorded significantly higher dry root yield (673 kg/ha), yield components, growth parameters, nutrient contents, uptake and total saponin content (%) and

was on par with N₅₀P₅₀K₅₀ and N₅₀P₁₀₀K₁₀₀. Among different mulching, black polyethylene mulching recorded significantly higher growth parameters, yield components and yield (726 kg/ha) compared to the red transparent polyethylene mulching and control. Nutrient uptake and content followed the same trend. Significantly higher growth parameters, yield components and yield (660.19 kg/ha), nutrient content and uptake was noticed with application of FYM @ 40 t/ha and was on par with FYM @ 30 t/ha. Interaction effects revealed that black polyethylene mulching combination with FYM @ 40 t/ha (M₁F₄) recorded significantly higher dry root yield (820 kg/ha), yield components, growth parameters, nutrient content, uptake, gross and net returns compared to the other treatments. However, it was on par with black polyethylene mulching combination with FYM @ 30 t/ha (M₁F₃). No significant difference was noticed in total saponin content (%) due to colour polyethylene mulching and interaction of polyethylene mulching and FYM. However, among FYM levels, FYM @ 40 t/ha and 30 t/ha recorded higher total saponin content (29.24 and 29.03% respectively).

Effect of Spacing, Time of Harvest and NPK Levels on Growth, Yield and Quality of Medicinal Coleus (*Coleus forskohlii* Briq.) Under Irrigated Condition

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Field experiments were carried out to study the response of medicinal coleus to spacing (60 cm x 30 cm, 75 cm x 20 cm, 45 cm x 30 cm and 60 cm x 20 cm), time of harvest (140, 160 and 180 DAP) and different levels of N (50, 100 and 150 kg/ha) P (50 and 100 kg P_2O_5 /ha) K (50, 100 and 150 kg K_2O /ha) during kharif 2004 and 2005 under irrigated condition at Kittur Rani Channamma College of Horticulture, Arabhavi. Results revealed that the spacing of 60 cm x 20 cm produced significantly higher dry tuber (1.57 t/ha) and forskolin yield, net returns (Rs. 56,822/ha) and B: C ratio than other spacing levels. The crop harvested at 180 and 160 days after planting (DAP) recorded significantly higher tuber (1.45 and 1.39 t/ha, respectively) and forskolin yield (149.09 and 158.4 mg/plant, respectively), net returns (Rs. 52,279 and 49,609/ha, respectively) and B: C ratio than 140 DAP. However, forskolin yield per hectare was significantly higher at 180 DAP than other harvesting times. Among the interactions, harvesting at 160 or 180 DAP and spacing of 60 cm x 20 cm recorded significantly higher tuber yield, quality and net returns. Application of N at 50 kg per hectare recorded significantly higher tuber (1.65 t/ha) and forskolin yield, net returns and B: C ratio than

other N levels. Application of 100 kg P_2O_5 per hectare recorded significantly higher tuber yield (1.45 t/ha), quality, net returns and B: C ratio than 50 kg P_2O_5 per hectare. Potassium application @ 50 and 100 kg K_2O per hectare produced significantly higher tuber yield (1.49 and 1.36 t/ha, respectively), quality and net returns than 150 kg K_2O per hectare. Among interactions, $N_{50}P_{100}K_{100}$ and $N_{50}P_{100}K_{100}$ recorded significantly higher tuber yield than other interactions however, they were on par with $N_{50}P_{50}K_{50}$ and $N_{50}P_{100}K_{150}$. Net returns and B: C ratio in $N_{50}P_{50}K_{50}$, $N_{50}P_{100}K_{50}$ and $N_{50}P_{100}K_{100}$, and forskolin yield in $N_{50}P_{50}K_{100}$ were significantly higher than other treatment combinations. However, the forskolin yield in $N_{50}P_{100}K_{100}$ was also on par with $N_{50}P_{50}K_{50}$. On the contrary, the total biomass production (14.18 t/ha) and its accumulation in top portion was significantly higher in $N_{150}P_{50}K_{150}$ and $N_{150}P_{50}K_{50}$ than other nutrient combinations. Similarly, uptake of N, P and K was also higher in the highest order of interaction ($N_{150}P_{100}K_{150}$). The study indicated that planting the crop at the spacing of 60 cm x 20 cm, harvesting at 160 DAP and nutrients application in the combination of $N_{50}P_{50}K_{50}$ was found optimum for higher tuber yield, quality and returns under irrigated condition.

In Situ Green Manuring of Intercropped Legumes on the Performance of Maize - Chickpea / Safflower Cropping System Under Rainfed Condition

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Field experiments were conducted on black clay soil during kharif and rabi seasons of 2000-01 and 2001-02 to study the effect of green manuring of intercropped legumes on the performance of maize-chickpea/safflower cropping system at College of Agriculture, Dharwad. Three annual (cowpea, sunnhemp and dhaincha) and multicut (lucerne, *Stylosanthes hamata* and *S. scabra*) legumes were grown as intercrops in maize in 2:1 row ratio along with sole maize during kharif. Green manures were cut at ground level and incorporated in the field. Chickpea/safflower were sown during rabi season with nine levels of N and P in split-plot design with three replications. Among the different annual green manures as intercrop in maize, sunnhemp performed better in terms of biomass (2.02 t/ha) and N yield (60.08 kg/ha) than cowpea and dhaincha. Maize crop did not differ significantly with respect to growth, yield attributes and grain yield from that of sole maize in the year of normal rainfall. But, green manures affected the yield of maize significantly when the rainfall was below normal. Sunnhemp green manuring with no fertilizer to chickpea (10.12 q/ha) was comparable to chickpea with same green manure coupled with 25:50 kg NP per ha (11.44 q/ha) and 12.5:25 kg NP per ha (12.38 q/ha) with respect to seed yield resulting in saving of 100 per cent recommended dose of N and P. Intercropping with cowpea or dhaincha in maize saved entire recommended dose of N and 50 per cent recommended

dose of P of succeeding chickpea crop. Green manuring of sunnhemp recorded significantly higher soil organic carbon, available N and P after harvest of chickpea. Economic analysis revealed that, higher net return was with recommended dose of N and P under cowpea/dhaincha green manuring. While, B:C ratio was higher with recommended dose of N and P under no green manuring during favourable rainfall year. Among the different multicut green manures, lucerne performed better in respect of biomass (1.08 t/ha) and N yield (34.36 kg/ha) than *S. hamata* and *S. scabra* on pooled basis. Maize grown in association with multicut legumes did not differ significantly with respect to growth, yield attributes and grain yield than sole maize in the year of normal rainfall, but was significantly lower in the year of stress and inadequate rainfall. Lucerne green manuring coupled with 20 kg N per ha to safflower (8.91 q/ha) was comparable to safflower with recommended dose of N and P without green manuring (8.92 q/ha) in terms of seed yield resulting in saving of nearly 20 kg N and 50 kg P per ha in the year of favourable rainfall. Green manuring of lucerne recorded significantly higher soil organic carbon, available N and P after harvest of safflower. Economic analysis revealed that higher gross return, net return and B:C ratio were recorded with 40:50 kg NP per ha (no-green manure) treatment on pooled basis.

Agrotechniques to Enhance the Productivity of Ashwagandha Vetisol of (*Withania somnifera* Dunal) in Northern Dry Zone of Karnataka

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Two field experiments were conducted during late kharif seasons of 2004-05 to 2005-06 on vertisols of Agricultural Research Station, Annigeri, University of Agricultural Sciences, Dharwad to study the effect of date of sowing, stage of harvesting, spacings and fertilizer levels on ashwagandha. The crop sown on September 15th and harvested at 180 DAS recorded significantly higher root yield (1622 kg ha⁻¹), root length (41.3 cm), root diameter (1.05 cm), fresh root weight (8.295 g plant⁻¹), dry root weight (2.712 g plant⁻¹), total dry matter production (21.543 g plant⁻¹) and dry matter accumulation in roots of ashwagandha (2.712 g plant⁻¹) compared to other treatment combinations. Significantly higher total withanolide content (0.620%) in roots of ashwagandha and total withanolide yield (10.059 kg ha⁻¹) were recorded by the crop sown on September 15th and harvested at 180 DAS. The crop sown on September 15th and harvested at 180 DAS realized significantly higher net returns

(Rs. 54,880 ha⁻¹) and B:C ratio (6.49) compared to other treatment combinations. The root yield of ashwagandha was significantly higher (1543 kg/ha) with plant geometry of 15 cm x 10 cm supplied with 24:48 kg N and P_2O_5 per ha compared to others and was on par with 15 cm x 10 cm with 18 : 36 kg N and P_2O_5 per ha (1528 kg ha⁻¹). The treatment combination of 15 cm x 10 cm with 24:48 kg N and P_2O_5 per ha recorded significantly higher uptake of N (24.1 kg ha⁻¹) P (2.72 kg ha⁻¹), K (39.5 kg ha⁻¹) by roots, total withanolide content (0.620%) in roots and total withanolide yield (9.559 kg/ha) of ashwagandha compared to others and was on par with that of 15 cm x 10 cm spacing along with 18 : 36 kg N and P_2O_5 per ha. The plant geometry of 15 cm x 10 cm supplied with 24:48 kg N and P_2O_5 per ha realized significantly higher net returns (Rs. 51,747 ha⁻¹) compared to others and was on par with 15 cm x 10 cm with 18 : 36 kg N and P_2O_5 per ha.

AGRICULTURAL ECONOMICS

Economics of Irrigation Induced Land Degradation and its Reclamation in Upper Krishna Project Command Area

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The present study was conducted to assess economic impact of waterlogging and soil salinity and viability of reclamation of such degraded soils using subsurface drainage (SSD) system in Upper Krishna Project command area in Karnataka during the cropping year 2004-05. It was found that, the cropping pattern adopted by farmers was more diversified before soil degradation whereas, after degradation, the farmers of degraded and normal soils allocated more area under water intensive crop like paddy ignoring the suggested cropping pattern. The production activities were highly limited on different degraded soils where, a large (55 to 83%) proportion of the total area was abandoned from production and thereby reducing cropping intensity in these soils. The crop yields in degraded soils were significantly lower over normal soils. The reduction in yield of paddy over normal soils was very high (between 50 to 67%) due to degradation and thereby resulting in negative returns. This reduced on-farm employment opportunities and led to labour migration to distant paces for livelihood. The MVP and MFC ratios implied that, majority of the resources used in affected soils was constrained by land degradation.

The decomposition analysis indicated that, salinity depressed paddy yield (93.51 %) during *kharif* while, waterlogging depressed (64.45%) it during *rabi*/summer. The Timmer measure of technical efficiency in paddy revealed that, the proportion of farmers in the high technical efficiency level were more in normal soils whereas, majority of them in degraded soils were operating in low technical efficiency levels. The Kopp measure of technical efficiency showed that, extent of excess resources used by farmers on all degraded soils were higher than were used in normal soils. The aggregate annual monetary loss due to loss in production for the entire command was estimated at Rs.201.10 crores. The economic viability of reclamation of degraded soils showed improvement in land use and cropping intensity, crop yield, input utilization and returns. Among 30 and 50 m drain spacings, pipe SSD system of singular type with 50m spacing at an investment cost of Rs.24,674/ha was found to be economically feasible and cost effective. The B-C ratio was found to be 1.56 for paddy-paddy rotation, the net present worth was high at Rs.1,76,518 and IRR of over 50 per cent at current cost (2004-05 prices) and a recovery period of investment in four years was observed.

GENETICS AND PLANT BREEDING

Molecular Tagging and Mapping of Resistance to Late Leaf Spot and Rust in Groundnut (*Arachis hypogaea* L.)

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Groundnut (*Arachis hypogaea* L.) is an important oilseed crop of the world. Late leaf spot (*Phaeoisariopsis personata* [(Berk. and Curt.) Deighton] and rust (*Puccinia arachidis* Speg.) are the major destructive diseases of the crop. The use of resistant cultivars is the preferred strategy to surmount the losses but resistance breeding has not been completely successful. Molecular dissection of resistance traits using QTL analysis can improve the efficiency of resistance breeding. The present study was aimed at construction of genetic linkage map, identification of markers / QTL associated with resistance to LLS and rust besides various yield related traits. Two hundred and sixty eight RILs (TAG 24 × GPBD 4) segregating for late leaf spot and rust were used to undertake QTL analysis. Phenotyping of the population was carried out under artificial disease

epiphytotics. Parents were assessed using 1089 SSR markers, of them 67 (6.15%) were found polymorphic. Single marker analysis revealed 34 markers associated with LLS (1.12 to 5.78%) and 11 markers with rust (1.26 to 40.58%). Among the nine agronomic traits, 45 markers were associated with contribution ranging from 1.1 to 10.23 per cent to variation. The study yielded first ever partial linkage map of the cultivated groundnut with 59 SSR markers on 13 LGs covering 909.40 cM (32%) and ten QTL for LLS (1.4 to 6.2%), one QTL for rust (4.6 - 4.7%) and six QTL (3.2 - 11.3%) for different yield related traits with the contribution of favorable alleles from GPBD 4 for resistance and TAG 24 for yield related traits. The investigation revealed a need for further saturation of genetic map for complete dissection of traits through QTL approach.

Genetic Diversity, Heterosis and Combining Ability Studies Involving Diverse Sources of Cytoplasmic Genetic Male Sterility in Pearl Millet [*Pennisetum glaucum* (L.) R.Br.]

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A total of 105 germplasm lines were crossed with three diverse sources of cytoplasmic genetic male sterility viz., A_1 , A_4 and A_5 to identify the restorers and to characterize the cytoplasmic difference based on restorations pattern on three sources of male sterility systems. The study revealed that, out of 105 lines, 36 lines (34.28%) on A_1 , 63 lines (60%) on A_4 and 47 lines (44.76%) on A_5 cytoplasm restored fertility. The seed set percent was high and stable on A_4 (>70%), where as <60% on A_5 and A_1 cytoplasm. Seed set per cent was comparatively high in *kharif* than summer irrespective of cytoplasmic sources. Genetic diversity among the lines tested, restorers+ maintainers (105), restorers (61) and maintainers (44) revealed that, genetic diversity was adequate among the genotypes of all the three genotypes which fell into 22 (restorers + maintainers), 11 (maintainers) and 19 (restorers) clusters. D^2 values were in general high in

restorers group followed by combined and maintainers group. Among the twelve quantitative characters studied the most important traits contributing to the divergence was days to maturity in all the three groups. Information on heterosis and combining ability was sought through two sets of $L \times T$ experiments (I-involving three diverse sources cytoplasm, II- A_1 source only). In both the experiments considerable heterosis was observed for grain yield and its components. The heterosis for grain yield was largely due to ear length, ear girth, ear weight and seed weight and most productive crosses figure out as most heterotic crosses and vice versa in both the experiments. Combining ability revealed that, majority of the characters are under the control of non-additive gene action. A study on the inheritance pattern of rust resistance in F_2 crosses indicated that the rust resistance is monogenic dominant genes governs the susceptibility.

Isolation and Early Generation Evaluation of Inbred Lines Derived from Yellow Pool Population of Maize (*Zea mays* L.)

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An investigation was undertaken to isolate and to evaluate the inbred lines which were derived from the newly constituted yellow pool population. The 800 ear-to-ear progenies selected from base population showed platykurtic distribution for cob weight and grain yield per plant

with high mode values than their respective mean indicating the presence of high proportion of superior progenies for these traits. The analysis of variance due to genotype was highly significant for all the traits under study involving 400 S_1 progenies which suggested presence of high degree

of variability. The analysis of variance involving 350 S_2 lines revealed the presence of highly significant differences among these lines for growth and yield related traits. Out of 350 top crosses, 13 crosses recorded more than 10 per cent higher grain yield over the standard check. In general superiority of these crosses was due to higher grain number per plant and lower pith weight. Line x tester analysis involving 25 best lines selected based on top cross performance and four tester indicated presence of significant variability among the genotypes for yield and yield contributing

traits. Among the crosses, ARYP-24 x CM-111 and ARYP-15 x CM-111 were the superior crosses for grain yield over best check hybrid. The analysis of combining ability revealed that SCA variance was higher than GCA indicating predominance of non-additive variance for majority of the traits. Out of 25 lines, ARYP-3, ARYP-19, ARYP-20, ARYP-24 and ARYP-25 were the good general combiners. It is proposed to evaluate two crosses viz., ARYP-24 x CM-111 and ARYP-15 x CM-111 on large scale over locations and seasons to confirm their potentiality for exploitation of hybrid vigour.

SEED SCIENCE AND TECHNOLOGY

Standardization of Hybrid Seed Production Techniques in Chilli (*Capsicum annuum* L.) Hybrid HCH-9646

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Four field and one laboratory experiments were conducted to standardize hybrid seed production technology in chilli HCH-9646 at Agricultural Research Station, Bailhongal (northern transitional zone-8), University of Agricultural Sciences, Dharwad, during late *kharif* 2006 and *kharif* 2007. The pollination at 9.00 am to 12.00 noon on one day after emasculation recorded significantly higher fruit set (53.63%), seed yield (7.08 g), germination (88.20%), field emergence (85.55%) and seedling vigour index (1534) over early and late emasculation and pollination time. Use of fresh pollen recorded significantly higher pollen germination (87.60%), pollen tube length (1034.2 mm), fruit set (33.06%) and seed yield (6.95 g/plant), seed germination (87.41%) and seedling vigour index (1451) followed by pollen stored in refrigerator for one day (86.47%, 963.1 mm, 33.02%, 6.94 g/plant, 86.17% and 1426, respectively). Significantly highest pollen germination (79.88%) and tube length (984.5

mm) were recorded with M_1 (75% pollen + 25% filler mixture). Fresh pollens (75%) along with filler mixture (25%) showed higher pollen germination (89.8%) and pollen tube length (1219.5 mm) over other treatments. Significantly higher fruit set (43.34%), seed yield (9.09 g/plant) were observed in plants sprayed with 20 ppm NAA and crossing period of 60 days. While, seed germination (85.37%) was significantly more in plants sprayed with 20 ppm NAA and crossing period of 45 days. In an experiment to know the effect of fertilizer level and seedling age of parents on field performance transplanting of 25 days old seedlings with higher fertilizer level (75:100:100 kg/ha) showed significantly higher seed yield (8.88 g/plant, 7.16 g/plant and 765.5 kg/ha, 672 kg/ha), seed germination (87.13 and 87.32%), field emergence (82.54 and 82.94%) and seedling vigour index (1489 and 1513) in both female (VN-2) and male (Arka Lohit) parents, respectively.

Studies on Organics and Integrated Nutrients on Seed Production and Storability of Scented Rice cv. Mugad Sugandha

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Two field experiments (2005 and 2006 *kharif*) and one seed storage experiment in laboratory were conducted at Agricultural Research Station, Mugad, University of Agricultural Sciences, Dharwad to investigate the influence of organics and integrated nutrient and pest management on seed yield and quality and storability of scented rice cv. Mugad Sugandha. Among the several management practices, integrated nutrient and pest management (50:50:50 kg NPK /ha + 50% RDN through FYM) recorded better crop growth and higher seed yield (3775 kg/ha), seed quality traits, net returns (Rs. 51,868/ha) and benefit cost ratio (3.15) over organic nutrient and pest management and conventional (farmers management) practices. Hence, it is economically feasible and viable. Integration of organics (farm yard manure, vermicompost, poultry manure and green leaf manure) with inorganic fertilizer (50:50:50 kg NPK + 50% recommended dose of N in the form of FYM/ha) realized higher seed yield

(3335 kg/ha). Better quality traits like germination (97.8%), field emergence (93%) and seedling vigour index (1516) compared to the application of organic and nutrients alone. The seed storage experiment results of scented rice revealed that seeds grown either organically or higher integrated nutrient management and treated with insecticide (malathion @ 10 g/kg of seed) and fungicide (thiram @ 2 g/kg of seed)/calcium oxychloride (5 g/kg seed), arappu leaf powder (25 g/kg seed) stored in 0.1 mm thick polythene bag retained seed germination more than minimum seed certification standard and higher vigour index more than 20 months of storage under ambient conditions of Dharwad (Mugad). Among the botanicals tested for seed treatment for storage of arappu leaf powder (*Albizia amara*) was found to be better in maintaining seed viability and vigour of scented rice up to 20th month of storage.

Morphological and Molecular Characterization and Effect of Sowing Dates and Seed Pelleting on Seed Production of French Bean (*Phaseolus vulgaris* L.)

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Studies on morphological and molecular characterization and effect of sowing dates and seed pelleting on seed production of French bean (*Phaseolus vulgaris* L.) were conducted during rabi/summer seasons of 2006-07 and 2007-08 in the Department of Seed Science and Technology and Institute for Agri Bio-Technology, University of Agricultural Sciences, Dharwad. The field study conducted on effect of five dates of sowing on seed yield and quality often French bean genotypes revealed that among the dates of sowings, first week of October sowing of DWD-FB-I, DWD-FB-57 and DWD-FB-53 genotypes recorded higher seed yield (2270, 2187 and 2124 kg/ha respectively) with higher growth, yield components and seed quality parameters and was followed by first week of September sowing. Studies on seed pelleting revealed that seeds pelleted with Borax (100 mg), $ZnSO_4$ (250 mg) per kg of seed and $ZnSO_4$ + Borax recorded higher seed yield (2412, 2247 and 2240 kg/ha), seed recovery (94.70, 92.93 and 91.45 %, respectively), seed germination and

seedling vigour index. Morphological characterization of French bean genotypes based on seed coat colour, shape, test weight, seed length, phenological, seedling characters was found to be more reliable for varietal identification. Chemical tests, viz. Phenol, Modified phenol, $FeSO_4$, KOH and NaOH tests did not show any reaction to the chemicals and hence they were found unsuitable for characterization of varieties in French bean. In RAPD studies, 33 primers produced 72 amplicons, of which 53 levels showed polymorphism amongst ten genotypes. Based on sample matching co-efficient, a genetic similarity was constructed by using RAPD data to access genetic relatedness. All the ten genotypes were grouped in three clusters. DWD-FB 9, DWD-FB-8 and DWD-FB-18 in Cluster-I, DWD-FB-27, DWD-FB-6 and DWD-FB-I in Cluster-II and DWD-FB-57, DWD-FB-53, IIHR-909 and Contender in Cluster-III. Genetic dissimilarity co-efficient varied between 0.039 and 0.06.

CROP PHYSIOLOGY

Effect of Plant Growth Regulators on Morpho-Physiological, Biophysical and Anatomical Characters in Cotton

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2008

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Field experiments were conducted at Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif 2005-06 and 2006-07 to find out the effect of plant growth regulators on morphological, biophysical and anatomical characters in cotton. The experiments were laid out in randomized block design with three replications. Significant differences were observed in all parameters studied during two years. Application of NAA 30 ppm significantly increased the plant height as compared to other treatments. Significantly, higher number of sympodial branches and number of nodes were recorded in NAA 30 ppm sprayed at 60 DAS as compared to other treatments, while it was least in CCC 80 ppm sprayed at 70 + 90 DAS and MC 100 ppm sprayed at 70 + 90 DAS. Application of NAA (10, 20, 30 ppm) sprayed at 60 DAS recorded higher dry matter in different plant parts, whereas, it was least in

CCC 80 ppm sprayed at 70 + 90 DAS and MC 100 ppm sprayed at 70 + 90 DAS. Application of NA (10, 20, 30 ppm) sprayed at 60 DAS increased the leaf area, leaf area index and leaf area duration significantly over the treatments. Application of growth retardants significantly higher chlorophyll content and SLW as compared to other treatments. The treatment NAA 30 ppm recorded significantly more seed cotton yield, boll weight and boll numbers compared to other growth retardant treatments, water spray and control. Anatomical studies showed that relatively thicker palisade parenchyma spongy parenchyma and upper epidermis was observed in leaf treated with CCC. Whereas, in NAA and control, thinner palisade parenchyma, spongy parenchyma and upper epidermis were observed.

Seasonal Influence on Productivity Potential in Mothbean Genotypes [*Vigna aconitifolia* (Jacq.) Marechal]

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2008

MAJOR ADVISOR : Dr. B. C. PATIL

Field experiments were conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif and rabi seasons of 2005. to find out the seasonal influence on productivity potential in mothbean genotypes. During both seasons, 18 genotypes were evaluated for various morpho-physiological, growth biophysical, biochemical, yield and yield components. The experiments were laid out in randomized block design with three replications. Significant differences were observed in all parameters studied during both seasons. The high yielding genotypes possessed significantly higher plant height, number of branches, number of nodes compared to low yielding genotypes besides having higher values for LAI, CGR, LAD and BMD. These genotypes were also efficient with respect to production and partitioning of total dry matter. Significantly higher photosynthetic rate and nitrate reductase

activity were also recorded in high yielding group. The important yield components i.e. number of flowers, pods, seeds per pod, 100-seed weight were significantly higher in high yielding group. All the above traits recorded significant positive association with seed yield. The important morpho-physiological traits associated with higher production in mothbean are higher plant height, higher TDM, LAI, CGR, LAD, BMD, photosynthetic rate, nitrate reductase activity, number of seeds per pod and 100-seed weight. These traits may be considered important for developing an ideotype concept in mothbean. Among the genotypes RMM-12 (branch) and RMM-104 were found physiologically efficient and possessed significantly higher values for all the above traits during both seasons and may be used as a genetic source for improvement of yield potential in mothbean.

Physiological Approaches for Drought Tolerance in Sugarcane (*Saccharum officinarum* L.)

R.P. PATIL

2008

MAJOR ADVISOR : M.B. CHETTI

Field experiments were conducted at Research and Development Farm of the Ugar Sugar Works Ltd., Ugarkhurd (Belgaum District), Karnataka during 2004-05 and 2005-06 to study the influence of different agro-chemicals on various morphophysiological, biochemical and yield and yield components in sugarcane under moisture stress conditions. The experiments were laid out in randomized block design with 13 treatments and three replications. The morphological parameters, viz., plant height, length and girth of internodes were significantly higher with the soil application of K_2O (75 kg/ha) followed by foliar spray of KCl (3%) and foliar spray of KCl (3%) + urea (3%) compared to control. Significantly higher number of tillers per hill were observed with the foliar spray of methanol (2%) compared to all other treatments. Among various biochemical parameters, chlorophyll 'a', chlorophyll 'b' and total chlorophyll contents were found to be significantly higher with the soil

application of K_2O (75 kg/ha) followed by foliar spray of PMA (20 ppm) and foliar spray of methanol (2%) compared to moisture stress treatments. Whereas, proline content was significantly higher in water stress treatments compared to all other treatments. While, the NRA was found to be significantly lower in water stress treatment compared to other treatments. Among various growth parameters, LAI was found to be significantly higher with the foliar spray of PMA (20 ppm) compared to all other treatments. Whereas, LAD, SLW, AGR were found to be maximum in non-stress condition compared to all other stress treatments. Net millable canes were found to be significantly higher with the foliar spray of methanol (2%) followed by soil application of K_2O (75 kg/ha) and foliar spray of KCl (3%) + urea (3%) compared to control (water stress). Sugar production (t/ha) was significantly higher with the soil application of K_2O (75 kg/ha) compared to all other treatments.

PLANT PATHOLOGY

Etiology, Epidemiology and Management of Anthracnose of Grapevine

M. M. JAMADAR

2007

MAJOR ADVISOR : Dr. S. LINGARAJU

Investigations into etiology, epidemiology and management of anthracnose caused by *Elsinoe ampelina* (de Bary) Shear, a potentially important disease of grapevine revealed the involvement of *Sphaceloma ampelinum*, *Gloeosporium ampelophagum* and *Colletotrichum gloeosporioides* in the causation of the disease. These were isolated from different locations surveyed over northern parts of Karnataka, parts of Maharashtra and Andhra Pradesh states. The disease was severe during April pruning stage as compared to October pruning stage. The places Badachi, Jumna, Tidagundi, Hosur (all in Karnataka) and Sadashivpet (Andhra Pradesh) were identified as "hot spots" for this disease. Virulence

studies employing 'detached leaf technique' revealed that isolates Ea13, Ea20 and Ea21 were highly virulent whereas cultural studies showed vigorous growth of Ea11 and Ea8 isolates on Sabouraud's agar. Ea5 and Ea21 produced the highest mycelial growth on host extract medium. RAPD analysis of 12 anthracnose isolates showed two clusters and revealed significant molecular variability. The isolates exhibited 100 per cent polymorphism with OPF-12, OPF-14 and OPF-19 primers. Sensitivity tests to carbendazim by poisoned food technique as well as inhibition of spore germination revealed Ea11 to be the most sensitive isolate while Ea15 was found to be the most resistant. Further it was observed that the

isolates were more sensitive to hexaconazole than other chemicals and Ea15, a carbendazim resistant isolate exhibited cross resistance. The pathogen survived in old grape stalks for more than 2_{1/2} years. The spore trap studies in relation to weather factors and disease incidence revealed a positive influence of rainfall and relative humidity. September-October period was highly conducive for disease development. A forecasting model $D = -1.4 + 2.6RH + 2.0 S$ was developed. Chlorothalonil 75 WP (non-

systemic) and hexaconazole 5E (systemic) and onion extract 10% (botanical) as well as *Trichoderma harzianum* (bioagent) inhibited the anthracnose pathogen in vitro. Alternate spray of hexaconazole 0.05% and mancozeb 0.2% was significantly superior in the management of the disease under field conditions. Genotypes Arka Majestic and Bangalore Blue were highly resistant under natural infection conditions.

Plant Growth Promoting Rhizobacteria, their Characterization and Mechanisms in the Suppression of Soil Borne Pathogens of Coleus and Ashwagandha

S. B. MALLESH

2008

MAJOR ADVISOR : Dr. S. LINGARAJU

Major coleus and ashwagandha growing districts of Karnataka were surveyed for the prevalence of wilt/root-knot complex in these crops. Survey revealed the association of *Fusarium chlamydosporum*, *Ralstonia solanacearum* and *Meloidogyne incognita* with coleus and ashwagandha. As many as fifty native plant growth promoting rhizobacterial (PGPR) strains from healthy coleus and ashwagandha rhizospheres were isolated, maintained and screened *in vitro* against *F. chlamydosporum*, *R. solanacearum* and *M. incognita* causing wilt/root knot complex. Of them 19, 17 and 17 strains were respectively found to be highly potent antagonists. Among these strains seven highly effective strains commonly inhibitory to all the pathogens were selected and characterized as *Pseudomonas* spp. and used further. When assessed for their mechanism of biocontrol, these potent antagonists produced at least one antimicrobial antibiotic, siderophore, HCN, IAA, fluorescein, pyocyanin and volatile metabolites. Molecular variability through RAPD-

PCR showed highest (84 per cent) similarity between rhizobacterial strains RB31 and RB50, though these were isolated from geographically diverse locations. A greenhouse experiment was conducted to assess the plant growth promotion and vigour index by potent antagonists in coleus and ashwagandha. Talc-based bioformulations were prepared for the promising strains and their efficacy was tested under pot and field conditions. Bioformulations containing PGPR strains were evaluated against species of *Fusarium*, *Ralstonia* and *Meloidogyne* (either individually or in combination) for their efficacy to reduce the disease incidence and induced systemic resistance in coleus and ashwagandha under glasshouse condition. Among the various bioformulations, strains RB50 and RB31 were found to be effective in increasing plant growth parameters, viz. plant height, number of branches, fresh and dry weight of shoot and root, length of root, yield of coleus and ashwagandha plants and also in decreasing number of galls (RKI) and disease incidence in glasshouse and field conditions.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Studies on Distribution and Transformation of Soil Zinc and Response of Rice to Nutrients in Traditional and System of Rice Intensification (SRI) Methods of Cultivation

D. M. D. IRANIE WIJEBANDARA

2007

MAJOR ADVISOR : Dr. G. S. DASOG

A study was conducted on the "Distribution and transformation of soil zinc and response of rice to nutrients in traditional and System of Rice Intensification (SRI) methods of cultivation". Soil samples were analysed from paddy growing areas of Gangavati taluk in Northern Dry zone (zone 3) and Hangal taluk in Hilly zone (zone 9) of Karnataka to find out the distribution of zinc fractions and their relationship with soil properties. The order of magnitude of different zinc fractions was water soluble plus exchangeable zinc < organically bound zinc < crystalline sesquioxide bound zinc < amorphous sesquioxide bound zinc < manganese oxide bound zinc < residual zinc. An incubation study was conducted in the laboratory to know the transformation of applied zinc (10 kg ZnSO₄ and 25 kg ZnSO₄ ha⁻¹) in Gangavati and Hangal soils under field capacity and submergence moisture regime for 120 days. Water soluble plus exchangeable, organically bound and crystalline sesquioxide bound forms of Zn showed a decrease and manganese oxide bound, amorphous sesquioxide bound and residual forms of zinc showed an increase with increase of incubation period in both moisture regimes. Hence, the magnitude of decrease and increase was more under submergence than

field capacity moisture condition. A field experiment was carried out on a Calciustert to know the response of rice to different methods of cultivation and nutrient levels. Significantly taller plants with higher number of tillers and higher dry matter production were noticed in SRI method of cultivation at all the growth stages as compared to traditional method. SRI method recorded significantly higher yield attributes and grain and straw yield compared to traditional method of cultivation. Significantly higher concentration and uptake of plant N, P, K and Zn and residual available N, P, K and Zn in soils were recorded in SRI method as compared to traditional method. Application of 75 per cent RDF + biofertilizers with 25 kg ZnSO₄ per ha resulted in significantly taller plants, higher number of tillers, higher dry matter and higher grain and straw yield and yield attributes. Significantly higher concentration and uptake of plant N, P, K and Zn and residual available N, P and Zn in soil were recorded in treatment receiving 75 per cent RDF + biofertilizers with 25 kg ZnSO₄ per ha. The 75 per cent RDF + biofertilizer with 25 kg ZnSO₄ per ha under SRI method of cultivation was found to be the best treatment which recorded the highest yield of rice.

Studies on Sugarcane Based Industrial Wastes on Maize Chickpea Cropping Sequence in Vertisols of North Karnataka

H. M. PRADEEP

2008

MAJOR ADVISOR : Dr. N. S. HEBSUR

A study was carried out during 2005-07 to know the utility and effect of sugarcane based industrial wastes on maize-chickpea cropping sequence in Vertisol. A slight increase in pH, organic carbon and higher increase in EC was recorded in distillery spentwash irrigated soils. Available nitrogen, phosphorus and micronutrient status of spentwash irrigated profiles also increased slightly while, available potassium increased substantially than normal water irrigation. A available nitrogen release was higher in integrated treatments than organics alone at initial stages of incubation while, it was reverse in later stages. Treatments involving spentwash recorded higher release both in organic and integrated treatments. Field experiments revealed that among the treatments, 50% RDN (urea) + 50% RDN (BSW) was superior in terms of growth, yield, nitrogen and phosphorus uptake of maize. The uptake of potassium and

sodium was higher with application of 100% RDN (BSW). The residual effect of 100% RDN (BSW) was superior in terms of growth and yield of chickpea. The uptake of N, P, K and Na was highest in 100% RDN (BSW) and lowest in 100% RDN (urea). The 100% RDN through organics alone also recorded higher uptake of nutrients than integrated treatments. The EC values differed significantly but were less than 1 dSm⁻¹. The available N, P, K and S contents of soil also differed significantly. Treatments, 100% RDN (BSW) and 100% RDN (urea) recorded highest and lowest nutrient status except P status which was highest in 100% RDN (BC). The organic treatments resulted in higher micronutrient status in soil than the other treatments. The dehydrogenase, phosphatase and urease activities in soil also showed significant differences.

AGRIL. ENTOMOLOGY

Response of Field Populations of *Helicoverpa armigera* (Hubner) to Bt Cotton (Cry1Ac) and Its Management

BHEEMANNA

2008

MAJOR ADVISOR : Dr. B.V. PATIL

Studies on response of *Helicoverpa armigera* collected from different cotton growing areas of Karnataka to Cry1Ac, synchrony in *H. armigera* adult emergence from Bt cotton and other alternate hosts, estimation of crop yield gain in Bt cotton against bollworms, validation of integrated resistance management (IRM) strategy to Bt cotton and exploitation of Bt cotton as a trap crop in conventional cotton pest management were carried out at Regional Agricultural Research Station, Raichur. The maximum LC₅₀ of 0.028 µg/ml of diet was recorded in early season Raichur population. In late season, higher LC₅₀ values of 0.037 and 0.026 µg/ml of diet were recorded in Dharwad and Raichur populations, respectively. But there was no significant difference among six different populations of *H. armigera* response to Cry1Ac toxin. Total number of *H. armigera* moths emerged from Bt and non Bt cotton were 6.60 per cent and 42.80 per cent, respectively and total emergence of *H. armigera* moths from red gram was maximum (95.60%). In late season, moths

emerged from Bt cotton were very less (10.80%). On cultivated Bt cotton, larval survivability was from zero to 0.16 larvae per plant as compared to 0.00 to 1.56 larvae/plant in non Bt cotton. Reaction of different Bt cotton hybrids against bollworms indicated that RCH-144Bt recorded maximum GOB per plant (59.17/plant) which was on par with RCH-371Bt (55.71/plant) and RCH-2Bt (54.67/plant). Significantly highest seed cotton yield of 19.60q/ha was recorded in RCH-144Bt. Bt IRM recorded significantly superior seed cotton (38.73 q/ha) yield compared to Bt farmers practice (35.92 q/ha). The net profit per ha was maximum in Bt IRM module (Rs. 68392/ha) as compared to Bt farmers practice (Rs. 59875/ha). Cotton IPM plot and Bt border trap crop treatment recorded maximum good opened bolls (41.93 and 42.11/plant) with least bad opened bolls (9.17 and 10.22/plant). These two treatments registered higher seed cotton yield of 20.60 and 20.60 q/ha respectively.

Investigations on Tritrophic Interaction in Integrated Management of Okra Pod Borer Complex

G. S. GURUPRASAD

2008

MAJOR ADVISOR : Dr. L. KRISHNA NAIK

Investigations on tritrophic interaction, screening of okra accessions against pod borers, bio-efficacy of biorationals, evaluation of marigold as trap crop and development of IPM modules for the management of okra pod borer complex were carried out at Agriculture Research Station, Main Agriculture Research Station and Narendra village of Dharwad district during 2004-05 and 2005-06. In tri-trophic relationship, parabhani kranti, Shakti-303, Shagun and Rasi-5 were least preferred hosts for oviposition for all three pests and permitted greatest parasitism by the egg parasitoid, thereby resulted in least per cent egg hatching. However, on the contrary Mahalaxmi-Amisha, Ankur and L-177 supported highest oviposition and least parasitism by the parasitoid due to their higher trichome density. Irrespective of accessions trichome density was positively correlated with oviposition preference while parasitism was negatively correlated. Among different accessions screened,

accessions shakti-303, Shagun and Rasi-5 were recorded lowest pod borer incidence and produced 33.38, 26.41 and 22.95 per cent increase in yield over commercial check Arka Anamika. Among different bio-rationals, NSKE 5%, econeem plus (1000 ppm), *Beauveria bassiana* + econeem plus (1000 ppm) and *B. bassiana* @ 2g/l were found to be superior by registering less number of eggs and larvae of *Earias vittella* (Fab.) and *Helicoverpa armigera* (Hubner) which resulted in lowest per cent pod damage and highest yield of 68.91, 67.78, 67.44 and 60.57 q/ha, respectively and were comparable with the standard check malathion 50 EC (71.17 q/ha). Among different row proportions used, okra + marigold @ 10:2 and 10:1 proved to be effective in reducing the pod damage and produced highest yield of 61.28 and 54.97 q/ha, respectively. Adaptable IPM (M₂) module involving biorationals and selective insecticide was found to be effective and resulted higher net profit of Rs.57926 compared to rest of the modules tested.

Molecular Characterization of Earthworms, Nutrient Assessment and use of Vermitechnologies in Pest Management

R. MEENATCHI

2008

MAJOR ADVISOR : Dr. R. S. GIRADDI

Laboratory and field studies were conducted at UAS, Dharwad during 2006-08 to characterize epigeic and endogeic earthworms and to assess the genetic diversity in earthworm strains by RAPD-PCR technique, nutrient estimations of vermicompost and vermiwash and to assess utility of vermitechnologies in pest management. RAPD-PCR technique was successfully employed for molecular characterization of earthworms. Both endogeic (arable land) and epigeic (vermicomposting) earthworms exhibited interspecific genetic diversity. Maximum molecular diversity of 63 per cent was observed between *E. eugeniae* and *L. mauritii*. The primers namely, OPA - 4, OPA-7, OP A-8, DH-2 and L-14 showed 100 per cent polymorphism. The strains of *E. eugeniae* sourced from different geographical locations indicated significant genetic diversity. Maximum genetic similarity value of 1.00 between Dharwad and Bijapur strains and minimum of 0.40 between Nagpur and Bangalore strains and Nagpur and

Coimbatore strains were observed. Earthworm species sourced from different crop ecosystems also exhibited significantly genetic variation. Intraspecific genetic diversity was observed among the strains of *E. eugeniae*, sourced from six locations of South India. Food substrate had significant effect on nutritive strength as well as microbial load of vermicompost and vermiwash. Combination of soybean harvest waste + *E. eugeniae* and paddy straw + *P. excavatus* emerged as the best with respect to nutrients and microbial biomass. Soil amendment with vermicompost (2 T / ha) + vermiwash (1:1) was the treatment that was effective in suppressing soybean defoliators and pod borer. They also registered higher yield. Similarly, soil amendment with vermicompost (2 T/ ha) + vermiwash (1:1) as well as *in situ* vermiculture @ 1.25 lakh / ha were the treatments found promising against jasmine thrips and bud borer.

FAMILY RESOURCE MANAGEMENT

Ergonomic Evaluation of Harvest and Post Harvest Activities Performed by Female Labourers in Sorghum Crop with Agricultural Tools

Mrs. RENUKA Y. BUDIHAI

2007

MAJOR ADVISOR : Dr (Mrs). SUSHEELA P. SAWKAR

The investigation entitled "Ergonomic Evaluation of Harvest and Post Harvest Activities Performed by Female Labourers in Sorghum Crop with Agricultural Tools" was carried out during 2005- 07 in Dharwad district of Karnataka state. A total of 160 respondents were selected randomly for the study. Further, the identified maximum drudgery prone activity was ergonomically evaluated by the 30 healthy female labourers

for cutting stalks and threshing of sorghum crop using traditional and improved tools. Cutting stalk and threshing was identified as maximum drudgery prone activities among harvest and post harvest operations. The mean working heart rate of the female labourers while working with the improved 1-104 sickle was found to be least (123.22 beats/ min) compared to traditional sickle (130.72 beats/min). Rating of perceived

Abstracts of Thesis

exertion by the female labourers for cutting stalks by sickle 1-104 was less compared to other improved sickles. The mean working heart rate of the female labourers was higher (118.42beats/min) for threshing with thresher compared with the wooden beater (108.30beats/min). Threshing activity was perceived as higher drudgery prone by the respondents with the thresher over wooden beater. Majority of the female labourers expressed exertion while cutting stalks with CIAE Bhopal sickle as very heavy. The total postural changes made by the respondents with improved sickle CIAE Bhopal were higher compared to traditional and other

improved sickles in cutting stalks. Majority of the respondents (53.3 %) expressed very severe pain in wrist/hand with the use of traditional sickle. The musculoskeletal problems expressed by the female labourers were found to be high with the thresher for threshing of ~orghum crop. The larger area and maximum output in cutting stalks was found with improved sickle 1-104 (30.70 sq.mts and 94.95 kg). The output was found to be more for threshing with the thresher (ear heads - 301.82 kg and seeds 237.10 kg).

HORTICULTURE

Molecular Diversity and Phenotyping of Selected Cashew Genotypes of Goa, and Physiological Response of cv. Goa-1 to *in Situ* Moisture Conservation

ADAVIRAO DESAI

2008

MAJOR ADVISOR : Dr. A. N. MOKASHI

Evaluation of 57 cashew genotypes revealed significant differences among them with respect to growth and yield attributes. Genotypes such as Karapur-1, Karapur-2, Tiswadi-3, Ganje-2 and Red Local were the prominent genotypes with vigorous growth habit under the tall group. Sattari Dwarf and Tiswadi-4 showed less vigorous growth rate under dwarf group. Tiswadi-3, Agonda-1, Bardez-9, KN-2/98, Valpoi-7 were observed to show promising results with respect to yield and yield related characters. Variability studies revealed higher heritability, coupled with higher GCV, PCV and genetic advance (GA) over mean for number of panicles, sex ratio, nut weight and number of flowering shoots per m² canopy. Tree height, canopy spread, number of leaves per twig, total leaf area per twig, number of flowering shoots per m² canopy, flowering intensity, number of nuts per panicle and nut weight showed strong and significant positive correlation with nut yield per tree both at genotypic and phenotypic levels and hence useful in enhancement of the genetic

stock in cashew. Nut and kernel characters in PC1, apple characters in PC2, flowering factors in PC3 and growth and yield factors in PC4 accounted for >50 per cent of total variability. Of the six clusters based on PCA, cluster IV had genotypes with highest nut weight, apple weight, kernel weight and sex ratio, which included Tiswadi-3, Balli-1, Bardez-9, Agonda-1, KN-2/98 and Valpoi-7. RAPD analysis could differentiate all genotypes into two broad groups. While, first group comprised of 35 and other comprised of 22 genotypes which in turn grouped the genotypes into eight and three sub-clusters. The comparative analysis of clustering pattern based on morphometric and molecular diversity data reflected rather a partial consensus. Cultivar Goa-1 showed enhanced physiological response to *in situ* moisture conservation measures, which was reflected in nut yield differences between the various conservation measures and control.

AGRIL. EXTENSION EDUCATION

A Study on Constraint Analysis of Grape Exporting Farmers of Maharashtra State

ATUL B. PATIL

2008

MAJOR ADVISOR : Dr. K. V. NATIKAR

The Study was conducted in Nasik and Sangli districts of Maharashtra during the year 2004-07. Totally, 110 farmers who have exported their grapes in the year 2003-04 were purposively selected for the study. The data were collected from the respondent by using questionnaire and were scored, tabulated and analysed by suitable statistical tools. The results indicated that, majority of the respondents had knowledge about pre-production procedure for export; most of them had knowledge about quality production for the grape export and had low knowledge about post harvest practices for export. Cultivation practices like girdling, thinning, hormone management, nutrient management, water management, disease and pest management practices to meet export standards were adopted by majority of the respondents. The major constraints faced by the respondents were; difficult to replace the varieties after plantation (production constraint), high rate of interest for the loan

availed (financial constraint), more incidence of pests and diseases, irregular supply of electricity (general constraints), high initial investment for garden establishment (constraint related to cost), and difficult to meet exports standards of grape (export constraint). It was found that respondents used informal sources with high intensity than formal sources. More than one third of the respondents use MAHAGRAPHES as regular source of information. Respondents were depending on private consultant and private exporter for exporting their grape produce. Majority of the respondents used friend as regular source of information. The profile analysis of respondents revealed that, they belonged to the all the three age groups, all of them had education upto middle school and above, more than one third of them belonged to small land holding category, majority of them belonged to medium extension participation category and belonged to medium risk orientation, medium economic orientation, medium innovativeness and medium to high management orientation.

MASTER OF SCIENCE

AGRICULTURAL MICROBIOLOGY

Response of Jasmine (*Jasminum auriculatum*) to Biofertilizer Application

N. JAYAMMA

2008

MAJOR ADVISOR : Dr. K. S. JAGADEESH

Field experiments were conducted one each on the University Farm and a farmer's field at Chigateri village, Harapanahalli Taluk, Davanagere District to study the effect of biofertilizers on growth, yield, quality and nutrient content in Jasmine with different levels of chemical fertilizers. The biofertilizers used included the lignite based cultures of *Azospirillum*, *Pseudomonas striata*, *Pseudomonas fluorescens* and *Trichoderma viridae*. Biofertilizer application enhanced various growth parameters at all stages of growth compared to chemical fertilizer application alone. Application of biofertilizers along with 50 per cent NPK brought about results on par with 100 per cent NPK fertilizer with respect to chlorophyll content, floral characteristics such as days taken to 50 per cent flowering, number and weight of flowers per plant, diameter of flowers, ten flower weight, flower yield per plant and shelf life of flowers, indicating replacement of NPK chemical fertilizers to the extent

of 50 per cent. Biofertilizer application improved chlorophyll content by 4.7 per cent, shelf-life of the loose flowers by over 33 per cent when compared to 100 per cent NPK treatment. Flower diameter, stalk length and petal length were increased by 8.6 per cent, 11.2 per cent and 13.4 per cent respectively due to T_6 treatment (50% RDF+biofertilizers). Biofertilizer application improved the total microbial population in the rhizosphere by several times. T_6 treatment resulted in the highest colonization of N_2 fixers, P-solubilizers, *P. fluorescens* and *T. viridae* in the rhizosphere of jasmine when compared to all other treatments. In addition to 50 per cent savings on chemical fertilizers, about 10 per cent increase in flower yield was obtained due to T_6 treatment. T_6 treatment exhibited significantly higher activities of urease, dehydrogenase and phosphatase at all stages when compared to T_1 treatment (100% RDF).

Pretreatment of Agro-Residues for Bioethanol Production

B. D. NAROTHAMA PRASAD

2008

MAJOR ADVISOR : Dr. GEETA SHIRNALLI

In view of the continuously rising petroleum costs and dependence upon fossil fuel resources, considerable attention has been focused on alternative energy resources. Production of ethanol from biomass is one way to reduce consumption of crude oil, environmental pollution and reduce build up of carbon dioxide. Biomass is preferred as it is a cheap renewable resource and available in large quantities. Moreover, the use of gasohol (ethanol and gasoline mixture) as an alternative motor fuel has been steadily increasing around the world. Hence, the research on this area is a pressing need. The study revealed that the pretreatment of

the substrates with 5 per cent alkali level irrespective of the exposure time delignified maximum and yielded maximum cellulose in 500 m sized substrates. The crude cellulase of *Aspergillus sidowia* (0.82 U/ml) and *Trichoderma reesei* (0.81 U/ml) showed maximum cellulase activity. But, commercial cellulase enzyme treatment yielded maximum amount of reducing sugars compared to crude cellulase. *Zymomonas mobilis* produced maximum ethanol followed by *Pachysolen tannophilus* and *Candida shehatae*.

Studies on Potassium Solubilizing Bacteria

D. S. ARCHANA

2007

MAJOR ADVISOR : Dr. V. P. SAVALAGI

Attempts were made to isolate potassium solubilizing bacteria from rhizosphere soil of different crops from Dharwad and Belgaum districts. A total of 30 bacteria isolates were tested for K solubilization and characterized upto genus level based on morphological and biochemical characters. The mechanisms involved in K solubilization and other agronomical beneficial traits were also analyzed for selected efficient strains. *In vitro* K solubilization by bacteria ranged from 2.41 mg/ml to 44.49 mg/ml. Oxalic acid, citric acid were the chief organic acids produced by the KSB isolates. All the isolates tested for other beneficial traits like solubilization of insoluble phosphate and production of growth promoting substance. The amount of Pi released by the isolates from TCP ranged from 5.72 to 12.27 per cent. The amount of IAA produced by the strains

ranged from 1.10 to 16.50 and that of GA ranged from 0.60 to 3.29 mg/25 ml broth. Nine efficient gram positive K solubilizing bacteria were also examined for their influence on growth, K uptake and yield of maize plants under glass house condition. All the inoculated treatment with bacteria were found to increase growth parameters and yield components compare to absolute control and 25 per cent of RDK control *Bacillus* sp. KSB 11 recorded the highest yield (51.33 g/plant) and other parameters followed by KSB 62 and KSB 42. Three strains of present study viz., KSB 11, KSB 62 and KSB 42 showed high potential among the KSB isolates. Thus it can be inferred that potassium solubilizing bacteria have the potential to use as bioinoculants.

Performance of Methylobacteria in Soybean (*Glycine max* (L.) Merrill) Under Field Conditions

B. C. MEENAKSHI

2008

MAJOR ADVISOR : Dr. V. P. SAVALAGI

A field experiment was conducted during kharif 2007-08 at Main Agricultural Research Station, Dharwad (Karnataka) to study the effect of combined inoculation of methylobacteria and *B. japonicum* and foliar spray of methylobacterium isolates on plant growth in soybean under field conditions. Seed inoculation of *Methylobacterium* isolates in combination with *Bradyrhizobium japonicum* strain (SB₁₂₀) and further foliar spraying with *Methylobacterium* isolates had significant influence on different plant growth parameters. Among the inoculation treatments, co-inoculation performed better than control, whereas, co-inoculation and foliar spray with *Methylobacterium* isolates performed better over combined inoculation with dual culture. The results of our studies indicate that the combined inoculation of methylobacteria with *B. japonicum* and foliar spray exert more favourable effect on growth and productivity of soybean than dual inoculations. Treatment T_7 (seed inoculation with

ML₅₅ + *B. japonicum* and FS with ML₅₅) showed 17.43 per cent increase in plant height when compared to control. There was increase in nodule number both at 45 and 60 DAS in treatment receiving seed inoculation plus foliar spray compared to control which received seed inoculation only with *B. japonicum*. There was increase in total dry matter of soybean plants in T_9 by 41.67 per cent when compared with control. The grain yield of soybean was increased in T_9 by 38 per cent over control which received seed inoculation with *B. japonicum* (SB₁₂₀ + reference strain) and further foliar spray with reference strain. Nutrient uptake was more in the treatment receiving both seed inoculation + foliar spray (T_9) by 37 per cent when compared with control. Dehydrogenase, urease and phosphatase activities in rhizosphere soil of soybean were significantly higher in treatment T_9 at all the stages of crop growth when compared with control and all other treatments receiving seed inoculation with dual culture.

PLANT BIOTECHNOLOGY

Isolation and Functional Characterization of Novel Constitutive Promoters from Rice

VIRUPAKSHI G. MEDI

2008

MAJOR ADVISOR : Dr. RAMESH BHAT

In this study, an effort was made to identify and validate novel promoters from rice by using a newly constructed promoter-probe vector with xylanase (*XynA*) reporter gene. Two novel promoters Os02g38050 (165bp) and Os02g38050 (478bp) were identified from rice genome sequence based on the previously available expression profile. These two promoter sequences were synthesized at GENEART, Regensburg, Germany. A promoter-probe vector (pVR37) was constructed in binary vector (pCAMBIA 1305.1) background with a codon-optimized xylanase (*XynA*). The multiple cloning site (MCS) in pVR37 included the target sequence for *HindIII*, *PstI*, *SalI*, *XbaI* and *BamHI* for cloning DNA sequence to be tested for promoter activity. The sequence and feature (annotation) information has been deposited at GenBank of NCBI with an accession number, EU744547. Promoter-probe vector was functionally validated by PCR cloning CaMV 35S promoter from pWBVec8 into the multiple cloning site of pVR37 to get pVR41. Similarly, two novel constitutive

promoters Os02g38050 and Os02g38050 were cloned into pVR37 to get pVR43 and pVR44, respectively. The recombinant promoter-probe vectors were transferred into *Agrobacterium tumefaciens* by tri-parental mating. Expression of *XynA* was observed in 30-day old calli derived from tobacco leaf discs co-cultivated with pVR41, pVR43 and pVR44. Xylanase enzyme (an endo-1, 4- α -glucanase) which catalyzes the cleavage of AZCL-xylan, releasing soluble dye- (AZCL-) labeled fragments, resulted in a blue colour change in the reaction solution, indicating that promoter-probe binary vector is functionally active. After 36hr of incubation, xylanase activity was found with CaMV 35S, Os08g38910 and Os02g38050 promoters. Xylanase activity increased linearly with time up to 36hr, indicating that xylanase was active and stable over a long time. Checking the nature and pattern of expression driven by Os08g38910 and Os02g38050 promoters is underway by developing the stable transformants.

Codon Optimization of *cry1ac* and its Expression in Tobacco

T. C. MOHAN

2008

MAJOR ADVISOR : Dr. M.S. KURUVINASHETTI

Bacillus thuringiensis (Bt) is known to produce a variety of insecticidal crystal proteins toxic to Lepidopteran, Dipteran and Coleopteran pests. Among cry proteins Cry1Ac is very effective against lepidopteran insects. Increased expression of *B. thuringiensis* genes in plants has been critical to the development of genetically improved plants with agronomically acceptable levels of insect resistance. In this investigation, native *cry1Ac* gene sequence from *B. thuringiensis* was *in silico* modified and artificially synthesized to overcome codon bias and other undesirable regulatory coding sequences for its improved expression in transgenic plants. Out of 3.5kb of native *cry1Ac* sequence, only toxic moiety (1.85kb) was considered for codon optimization. Out of 620 codons 259 were altered. After modification, GC content was increased from 37.80% in the native gene to 42.60% in the optimized gene, thus

removing the AT-rich regions that are typical for cry genes. Further specific undesirable eukaryotic regulatory sequences present before or generated after codon modification were removed using codon degeneracy. *In silico* modified truncated gene sequence was custom synthesized and confirmed through sequencing. The modified and native *cry1Ac* were expressed in *Saccharomyces cerevisiae* INVSc1, and expression was confirmed by using DesiGen Xpresstrips™, (MAHYCO, India). Expression of *cry1Ac* was better than that of native *cry1Ac*. After confirmation of expression in yeast, both modified and native *cry1Ac* were transferred to tobacco using *Agrobacterium*. Transgenic plants were confirmed by PCR using gene specific primers. And the expression of these genes was detected in leaves using DesiGen Xpresstrips™, (MAHYCO, India). *cry1Ac* showed relatively better expression than native *cry1Ac* transgenic tobacco.

Sorghum Transformation with Maize Ac and Ds for Functional Genomics

SHRIDHAR JAMBAGI

2008

MAJOR ADVISOR : Dr. RAMESH BHAT

This study aimed at transforming M 35-1, a *rabi* variety of sorghum with iAc (pKU352NA) and Ds/T-DNA (pUR224NA) vectors (Dr. N. M. Upadhyaya, CSIRO Plant Industry, Australia) by establishing a protocol for *Agrobacterium*-mediated transformation. Immature inflorescence at 2 mg/l 2,4-D resulted in highest callus induction (100%). Callus cultures were maintained on MS medium supplemented with 2 mg/l 2,4-D, where they produced fast growing, nodular, white, hard and embryogenic calli. *Agrobacterium* harbouring pUR224NA and pKU352NA were induced by acetosyringone (200 μ M), and used for Agroinfecting (20 min) 15 days old calli followed by three days co-cultivation in dark. Co-cultivated calli were washed with cefotaxime (200mg/l) for 8 min. The washed calli were transferred to the regeneration medium with hygromycin (20 mg/l). MS with 0.5mg/l BAP gave the highest regeneration percentage (70%) for both pKU352NA and pUR224NA. Whitish, hard, compact, nodular and organized calli normally responded well and differentiated into shoots. MS medium with 1mg/l NAA resulted in better rooting both

for pUR224NA- and pKU352NA- directed putative transformants. In total, 36 Ds/T-DNA and 25 iAc putative transgenic plants were obtained. Plant regeneration and establishment rates were higher for pUR224NA-directed transformation than that of pKU352NA. Ds-specific PCR produced an amplicon of 430bp in three out of six pUR224NA-derived plants tested, whereas iAc-specific PCR yielded an amplicon of 541bp in six out of eight pKU352NA-derived plants. Transformation efficiency (number of PCR positive plants per unit of explant co-cultivated) was 4.28 and 2.14% for pKU352NA and pUR224NA-directed transformation, respectively. Expression of SgfpS65T was evident in calli at 5 and 12 days after co-cultivation. Of the ten calli observed on 5th day after co-cultivation, one showed SgfpS65T, whereas of the ten calli observed on 12th day after co-cultivation, two showed SgfpS65T expression. Further, two out of three iAc-specific PCR positive plants also showed SgfpS65T expression in leaves.

Antisense Suppression of α -Cadinene Synthase Gene in Cotton

REVATHY CHARAGONDA

2008

MAJOR ADVISOR : I. S. KATAGERI

Cotton is the third largest field crop in terms of edible oilseed tonnage in the world. In addition to 21% oil, cottonseed is a source of relatively high-quality protein (23%). However, the ability to use this nutrient-rich resource for food is hampered by the presence of toxic gossypol. Post transcriptional silencing of α -cadinene synthase gene was envisaged as a way to activate silencing mechanism in cotton, thereby blocking the cadinene type sesquiterpenes pathway and abolishing gossypol production in the transformants. PTGS is a specific RNA degradation mechanism of any organism that takes care of aberrant unwanted excess

of its own or foreign RNA intracellularly, in a homology dependent manner. In this study, an attempt was made to develop construct for post transcriptional gene silencing of α -cadinene synthase gene, and analyse its expression in transgenic cotton. A 600bp DNA fragment was amplified using α -cad gene specific primer from ovules, 45 days after post anthesis. The amplicon was cloned in PTZ57R/T and transformed into *E. coli* DH5 α . Transformants were confirmed through PCR and restriction. The analysis of the sequence revealed maximum of 99.8% homology at nucleotide and 100% homology at amino acid level with reported sequence

in the database (U23205 & Q39760). Partial α -cadinene synthase gene was cloned in both sense and antisense direction in ihp vector. The expression cassette carrying insert from generic ihp vector was then subcloned into plant transformation vector pCambia 1305.1 to facilitate plant transformation. The recombinant clones were then mobilized into

Agrobacterium tumefaciens LBA4404 by tri parental mating. Then transformed into Sahana cotton genotype. T₀ transgenic plants were confirmed through PCR using *hptII* primers. Gossypol glands counted in control plants were 60-100 per cm² and in T₀ transgenic plant were 5 per cm². Further the gossypol content in control and transgenic plants were 5-8 μ g/mg and 0.07 μ g/mg respectively.

Designing Pathogen Inducible Synthetic Promoters and Functional Validation of A New Eukaryotic Promoter – Probe Vector

G. M. RAVEENDRA

2008

MAJOR ADVISOR : Dr. SUMANGALA BHAT

In this study, an attempt was made to design pathogen inducible promoters, and construct and functionally validate a new promoter-probe vector. W 2 X, GCC 2 X, GCC 3 X, S 2 X, Myb 2 X pathogen inducible promoters contained various pathogen-responsive *cis*-regulatory elements in multiple copies fused to a minimal promoter (-46 region of CaMv 35S promoter) at 3', with a spacer sequences in between. They were synthesized at GENEART, Germany. A promoter-probe vector (pRR21) was constructed in binary vector (pCambia 1305.1) background with an improved version (*SgfpS65T*) of GFP and Nos-ter. pRR21 carried a multiple cloning site with target sequences for *Bam*HI, *Xba*I, *Sal*I, *Pst*I and *Hind*III to clone any DNA fragment whose promoter activity is to be checked. Complete sequence and feature (annotation) information of pRR21 has been deposited at GenBank of NCBI with an accession number (EU760495).

This promoter-probe vector constructed with *SgfpS65T*. because pRR21 is in a binary vector background, it is expected to work in many plant systems. Promoter-probe vector was functionally validated by PCR cloning CaMv 35S promoter from pWBVec8 into the multiple cloning site of pRR21 to get pRR20. Similarly, all five synthetic pathogen inducible promoters were cloned into pRR21. The recombinant promoter-probe vectors were transferred into *Agrobacterium* by tri-parental mating. Of the 30 tobacco leaf discs co-cultivated with *Agrobacterium* carrying pRR20, 19 showed *SgfpS65T* expression when observed under the fluorescent microscope at wavelength of 480-520 nm. *De novo* calli formed from all *SgfpS65T* positive leaf discs also showed fluorescence. Functional validation and expression analysis of pathogen inducible synthetic promoter is to be carried out.

Expression and Antifungal Activity of *Trichoderma virens ech 42* in Tobacco

B.M. MURALI

2007

MAJOR ADVISOR : Dr. SUMANGALA BHAT

Endochitinase is a principal fungal phytopathogen cell wall chitin degrading enzyme utilized to develop transgenic crops resistance to diseases. The full length cDNA coding for endochitinase gene (*ech42*) was cloned from *Trichoderma virens* total RNA isolated from induced fungal mycelium. The amplicon obtained through RT-PCR using gene specific primers was cloned into pTZ57R/T vector and confirmed through PCR amplification, restriction analysis, and sequencing. Analysis of sequence has shown 99 per cent homology with the reported endochitinase gene at nucleotide and protein levels. Further, the endochitinase gene sequence was *in silico* modified and artificially synthesized to overcome codon bias and other undesirable regulatory coding sequences for its improved expression in tobacco. The purified endochitinase was obtained by

expressing the modified gene in *Escherichia coli* with His-tag fusion sequence facilitating Nickel agarose column chromatography. The transgenic tobacco plants with endochitinase gene (*ech42g*) were analyzed for its expression. Transgenic plants were PCR screened with marker (*nptII*) and endochitinase gene specific primers. Expression of *ech42g* at transcription level was confirmed through RT-PCR. Chitinase activity was analyzed through glycol chitin plate assay and reducing sugar estimation across three different growth stages. All the tested transgenic plants showed higher level of chitinase activity compared to untransformed control tobacco plants, and the variation was observed among the progenies of different transgenic lines. Transgenic expression of *ech42g* tobacco showed resistance against foliar pathogen *Alternaria* spp. causing leaf spot and soil borne pathogen *Sclerotium rolfsii* causing root rot.

Cloning and Characterization of *npr1* Gene from Chilli (*Capsicum annuum*) and Validation of Mustard *npr1* (*Brassica napus*) in Tomato (*Lycopersicon esculentum*)

S. CHANDRABANU

2008

MAJOR ADVISOR : Dr. SUMANGALA BHAT

The nonexpresser of PR genes (*npr1*) also known as *NIMI* and *SAII* is a key regulator of SA-mediated systemic acquired resistance (SAR) in plants. Over expression of *npr1* is known to provide enhanced resistance to diverse pathogens in several crops such as *Arabidopsis*, rice, tomato and papaya. In this study, an attempt was made to clone full-length gene encoding *npr1* from *Capsicum annuum* using specific primers. PCR product of 2800 bp was amplified and cloned in to pTZ57R/T and transferred into *E. coli* DH5 α . Sequencing of recombinant clone pSCB indicated the presence of 2800bp insert and blast result showed that out of 2800bp, a partial sequence of 591 bp has similarity with *npr1* of *Capsicum annuum*

and the remaining part did not show homology with any of the sequences in the data base. In order to validate the expression of *npr1* gene from mustard (previously cloned in the laboratory), the gene was transferred to tomato using *Agrobacterium* mediated transformation. Transformants were selected on kanamycin (200mg/l) and were confirmed further by PCR with *nptII* and *npr1* specific primers. Out of the 38 *nptII* positive plants screened, 7 plants were positive for *npr1* specific primers. Bio-assay was carried out using *Alternaria* spp in positive plants along with control. Only two plants showed enhanced resistance compared to control tomato plants.

Testing Promoter Trapping Activity of a New Vector (pNU435) in Tomato

S. S. BIRADAR

2008

MAJOR ADVISOR : RAMESH BHAT

This study aimed at transforming PUSA-RUBY, a cultivar of tomato with a new promoter trapping vector pNU435 using *Agrobacterium*-mediated transformation. The *Agrobacterium* strain LBA4404 carrying pNU435 when co-cultivated with tomato leaves, sixteen plantlets (T₁) were obtained of which 6 were found to be PCR positive and among them two PCR positive plants (PT4 and PT5) upon RB TAIL-PCR, produced amplicon of ~400bp which were cloned into pTZ57R/T by T/A cloning and sequence of the RB TAIL-PCR product with M13 F/R primers upon BLAST search showed homology to right

border of T-DNA. Progenies of PCR confirmed T₁ plants were found to be resistant to Basta at 10ppm of glufosinate ammonium. Progenies of PT4 and PT5 were *gus*-specific PCR positive and LB TAIL-PCR for T₂ plants from these two T₁ plants (PT4 and PT5) produced amplicon (~400bp), which were directly sequenced with primer, RB57_LBTAIL3. The flanking sequences from two plants were found to be one and the same, indicating that those plants resulted from the same transformation event and the BLAST search of these sequences against the tomato genome showed multiple hits, indicating that the query sequence has many homologous regions in the genome. A close search of the BLAST result showed that

none of the homologous regions were genic, instead matched to retrotransposons like Tork-1 and Jinling-2. Since the flanking sequence showed homology to a genome-wide repeat of the non-genic region, possibility of promoter trap could be very remote. This study demands

the need for generating and testing large number of independent transgenic events for promoter trapping. At the same time, these lines can be tested for promoter trapping under special conditions such as biotic and abiotic stresses.

Molecular Cloning and Expression of Lectin Gene (srl) from *Sclerotium rolfii* Sacc

T. M. CHANDRASHEKAR

2007

MAJOR ADVISOR : Dr. RAMESH BHAT

In the present study, an effort was made to clone srl gene encoding *Sclerotium rolfii* lectin, and express it in *Escherichia coli* and *Saccharomyces cerevisiae*. The presence of lectin in sclerotial bodies was confirmed by haemagglutination assay. Hapten inhibition assay indicated that it had sugar specificity for Mucin and Asialofetuin. A PCR product of -450bp amplified from *S. rolfii* DNA using degenerate primers was cloned into pTZ57R/T. The sequence showed an open reading frame (ORF) of 426bp, encoding 142 amino acids. BLASTp with deduced protein of srl (DP-srl) showed high homology with SRL, ABL (*Agaricus bisporus* lectin) and XCL (*Xerocomus chrysenteron*) confirming that it is a fungal lectin. DP-srl showed a maximum of 75% identity and 89% similarity with the SRL (Acc. No. 20FC _A). Structural comparison between deduced protein of srl (DP-srl) and SRL at primary (Tyr27, Ala28, Ser47, Gly48, His70, Asn71, Tyr72, Arg105) and secondary (Asp77, Ile78, Thr80, Arg101,

Tyr112, Val114) carbohydrate-binding sites showed no difference for primary structure. Of the 35 mismatches between DP-srl and SRL, 7 were conservative and 6 were ambiguous substitutions. Amino acid sequence alignment of related fungal lectins identified two conserved regions (Ser47 to Gly51 and Gly68 to Lys73). DP-srl had higher similarity (73%) with XCL than SRL (72%). Coding sequence of srl gene was cloned into pET-32b(+), the resulting vector (PCR29) was transferred to BL21(DE3)pLysS. Similarly, pCR14 yeast expression vector containing the SRL coding region in pYES2/CT and transferred to *S. cerevisiae* strain, INVSc 1. Quantity of heterologous protein produced in *E. coli* and yeast was 7.50 and 0.78 ug/ul respectively. SDSPAGE analysis of the purified heterologous proteins from pCR29 and pCR14 showed protein bands of corresponding sizes. Hemagglutination assay and hepten inhibition assay confirmed that the expressed protein is *Sclerotium rolfii* lectin.

Codon Optimization of *Serratia marcescens* chiA and its Expression in Tobacco

MALIK AHMED PASHA

2008

MAJOR ADVISOR : Dr. M. S. KURUVINASHETTI

Plant diseases are controlled by crop rotation, spraying chemical pesticides, resistant cultivars, applying microbial antagonists and introduction of resistance gene through genetic engineering. Majority of the plant diseases are caused by fungal pathogens and most of them contain chitin as their major cell wall component. Chitinase, a type-3 PR protein; catalyses the hydrolysis of chitin which leads to inhibition of hyphal elongation and lysis of cell. Almost all organisms including bacteria produce chitinases. Among bacteria, chitinases from *Serratia marcescens* have been studied well. It produces *chiA*, *chiB*, *chiC*, chitobiase and chitin binding protein of which *chiA* has been found to be most effective. In order to develop intrinsic resistance, genes from various sources have been cloned and expressed in plants. In most cases, the transgene failed to produce desired quantity of foreign protein in the heterologous system. Codon optimization is a general approach for improving expression of

gene in any heterologous system. The full length *chiA* from *Serratia marcescens* 141 (*sm141chiA*) was considered for removal of regulatory signals (partial optimized- *sm141chiApm*) and replacement of rare codons with preferred codons by tobacco (fully optimized- *sm141chiAfm*). Of 1692 bp, 22 and 432 nucleotides were altered to get partial and fully optimized genes, respectively. The synthesized gene was sub-cloned in different expression vectors and transferred to their respective hosts. As expected in SDS PAGE, the intensity of band produced by *sm141chiAfm* was faint compared to *sm141chiA* and *sm141chiApm*. The plants containing *sm141chiApm* produced 1.82 fold more reducing equivalents whereas plants containing *sm141chiAfm* produced 4.39 fold more reducing equivalents compared to the plants containing *sm141chiA*. The difference of 2.57 fold more reducing equivalents was attributed to the difference in codon preference between *Serratia marcescens* and tobacco.

Modification of Native *vip3A* from *Bacillus thuringiensis* and its Expression in Yeast and Tobacco (*Nicotiana glauca*)

RAJEEV KUMAR

2008

MAJOR ADVISOR : Dr. M.S. KURUVINASHETTI

Bacillus thuringiensis is known to produce a variety of insecticidal proteins which are toxic to insect of different orders. Vip3A codes for vegetative insecticidal protein (789-aa; 87 kDa). Vip3A is expressed in vegetative stage of growth starting at mid-log phase upto sporulation. Among different vegetative insecticidal proteins (Vip), Vip3A is very effective against lepidopteran insects. Increased expression of *vip3A* in plants may play a crucial role in the development of genetically improved plants with agronomically acceptable level of resistance. In this investigation native *vip3A* sequence from *B. thuringiensis* was *in silico* modified to suit expression in tobacco and artificially synthesized to overcome codon bias and other undesirable regulatory coding sequences for improved expression in transgenic plants. The full length native *vip3A* sequence was considered for partial (*vip3Apm*) and complete modification (*vip3Acm*). After modification, the partial modified *vip3A* gene showed 96.79 per cent and complete modified *vip3A* 75.82 per cent

homology to the native gene and relative change in GC content changed from 30.89 per cent in native *vip3A* gene to 33.70 per cent in partial modified and 39.24 per cent in complete modified gene, close to that of tobacco 43.62 per cent. The modified and native *vip3A* were cloned in *Saccharomyces cerevisiae* INVScI and the expression was confirmed by SDS-PAGE, with an expected molecular weight of 88 kDa. The protein activity were confirmed by bioassay against *Plutella xylostella* and mortality rate was highest in completely modified *vip3A* (86%) followed by partially modified (66%) and the least with the native *vip3A* (23%) at 72h. Expression of complete modified *vip3A* was better than that of partially modified *vip3A* and native *vip3A*. After confirmation of expression in yeast, both modified and native *vip3A* were transferred to tobacco by *Agrobacterium* mediated transformation method. Transgenic plants were confirmed by PCR using gene specific primers.

Transferability of Gene Based Markers and Population Structure Analyses of Groundnut Minicore

SIDDANNA SAVADI

2008

MAJOR ADVISOR : Dr. H. L. NADAF

Groundnut, *Arachis hypogaea* L., is an important oilseed crop grown all over the world because of its economic importance and nutritional value. The yield of the groundnut crop is low due to biotic and abiotic stresses and even breeding efforts are hindered due to the limited knowledge

of its genome. To improve the pace of breeding process, use of highly efficient markers is imperative and a new set of markers called EST-SSRs have been found advantageous in genetics and breeding as they are transferable. Through an analysis of Ah-RGA database a set of 21 RGAs

homologous to flax rust R gene was identified and clustered into six classes. A set of 8 AhRGA-STS primers were designed and PCR screened for polymorphisms in resistant and susceptible genotypes; primer pairs revealed seldom polymorphism in chosen genotypes. In order to identify new gene based markers resource a set of 411 Sb-EST-SSRs were screened for their transferability to groundnut where a set of 161 primer pairs amplified (39%) and a set of 24 (18%) found polymorphic in groundnut. Comparison of repeat motifs revealed predominance of di-(56.5%) and tri-(38%) nucleotide repeats. Twelve of the transferred SbEST-SSRs markers were used to understand the population genetic structure of 184

ground minicore accessions. Total of 51 alleles from 12 markers were available for analyses. Primer *iabtg384* was found to be the most informative marker and AMOVA among population was 2.2% and 97.8% respectively between and within population pairs. Dissimilarity dendrogram depicted five clusters. Population structure analysis using STRUCTURE software resulted 7 sub populations and with ancestry sharing of >70 per cent. Genetic distances between sub-populations ranged from 0.0844 to 0.3637 which is low compared to observed phenotypic difference among groundnut minicore accessions.

SOIL SCIENCE AND AGRIL. CHEMISTRY

Effect of Iron-EDTA on Yield and Quality of Red Chilli (*Capsicum annuum* L.) in a Calcareous Vertisol of Zone-8 of Karnataka

H.R. SAVITHA

2008

MAJOR ADVISOR : Dr. B.I. BIDARI

A field experiment was conducted to study the effect of iron-EDTA on yield and quality of red chilli (*Capsicum annuum* L.) in a calcareous Vertisol at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2007. The experiment was laid out in a randomized block design with twelve treatments and three replications. Soil application of Fe-EDTA equivalent to FeSO_4 at 20 kg/ha + 0.5% Fe-EDTA foliar spray at 50 DAT recorded higher fruit yield (10.5 q/ha), ascorbic acid (178.90 mg/100 g) and highest uptake of nitrogen and phosphorus at final picking stage. This was on par with all treatments receiving soil + foliar application of Fe-EDTA but, differed significantly

from control which recorded lowest values (7.65 q/ha, 127.61 mg/100 g). Highest colour value (228.73 ASTA units), oleoresin (16.76%), potassium, sulphur and iron uptake were recorded in treatment receiving soil application of Fe-EDTA equivalent to FeSO_4 at 20 kg/ha + 0.5% foliar spray of Fe-EDTA at 50 and 90 DAT. This was on par with all treatments receiving both soil + foliar application of Fe-EDTA but differed significantly from control (163.16 ASTA units and 13.03%). Total and ferrous iron contents analysed in dry and fresh green leaves on 5th day after Fe-EDTA foliar spray indicated a significant positive relationship with colour value and oleoresin contents.

Effect of Copper Nutrition on Yield and Quality of Chilli in a Vertisol of Zone-8, Karnataka

G. V. GANGAMRUTHA

2008

MAJOR ADVISOR : Dr. H. T. CHANNAL

A field experiment was conducted at Main Agricultural Research Station, UAS, Dharwad during *kharif* 2007 in a Vertisol to study the effect of copper nutrition on yield and quality of chilli (*Capsicum annuum* L.). There were 11 treatments in randomized block design with three replications. The treatment receiving combined application of CuCl_2 at 2.5 kg ha⁻¹ through soil and 0.25 per cent foliar spray recorded the significantly higher plant height number of branches and dry matter production with higher dry fruit yield (10.38 q ha⁻¹). Further, with increase in dose of foliar spray of CuCl_2 alone or along with soil application did not significantly influence the dry fruit yield. The number of fruits per plant, flower drop (252) and weight of 100 dry fruits also followed the same trend. Combined application of CuCl_2 at 2.5 kg ha⁻¹ through soil and 0.25 per cent foliar spray significantly increased the ascorbic acid content in

green chilli fruits (170.72 mg 100 g⁻¹), oleoresin content (16.56%) and total extractable colour (239.09 ASTA units) in red chilli fruits which were significantly higher than other treatments. The significantly lower per cent discoloured fruits (5.52%), anthracnose affected fruits (4.32%) and murda complex (8.23%) were recorded in the treatment receiving combined application of CuCl_2 at 2.5 kg ha⁻¹ through soil and 0.25 per cent foliar spray over the treatment receiving RDF alone. Higher concentration of N, P and K in chilli fruits were noticed in the treatment receiving combined application of CuCl_2 at 2.5 kg ha⁻¹ through soil and 0.25 per cent foliar spray. Uptake of major and micronutrients also followed the same trend. Economic analysis indicated that application of CuCl_2 at 2.5 kg ha⁻¹ through soil and 0.25 per cent foliar spray resulted in highest gross returns, net returns and benefit : cost ratio.

Characterization and Classification of Soils and Land Suitability of Micro-Watershed in Hanagal Taluk

M. MADHAN MOHAN

2008

MAJOR ADVISOR: Dr. G. S. DASOG

Ten Typical pedons representing upland, midland and lowland forms in a micro-watershed of Hanagal taluk in Haveri district were studied for their morphological characteristics and physico-chemical properties and suitability for locally preferred crops. The soils were deep to very deep (100-140+ cm), light olive brown to dark grayish brown (2.5 Y – 10 YR), excessive to poorly drained, moderately acidic to slightly alkaline (5.02 – 8.11), low to high in organic carbon (0.5 – 13.2 g/kg), low to medium in CEC (6.9 – 38.4 cmol(p+)/kg), moderately to high base saturated and sandy loam to sandy clay with variations in relation to physiography. The surface soils are low in available nitrogen (63 – 280 kg/ha), low to medium in available phosphorus (10.1 – 42.0 kg/ha), low to high in available potassium (97 – 331 kg/ha) and low to medium in available sulphur (6.4 – 18.4 ppm). The pedons 2, 5 of uplands exhibit the development of

argillic horizon (Bt). The pedons on midlands and lowlands have cambic horizon (Bw), classified as Alfisols and Inceptisols, respectively. At family level, P2 and P5 classified as fine loamy, mixed, isohyperthermic, Typic Haplustalfs and fine loamy, mixed, isohyperthermic, Inceptic Haplustalfs, respectively. The lowlands (P8, P9, P10), midlands (P6, P7) and uplands (P1, P3, P4) classified as fine, mixed, isohyperthermic Typic Haplustalfs. The major soil-site characteristics of the landscapes matched with the criteria for land capability classification and grouped into three land capability sub-classes viz., IIIsw, IIIsf and IVw. According to soil-site evaluation, the lowlands were moderately suitable for wheat, maize, cotton, soybean, sorghum, paddy, not suitable for groundnut, chilli and sunflower. The uplands marginally were suitable due to slope factor, midlands moderately suitable for wheat, maize, soybean, sorghum, groundnut and sunflower but not suitable for chilli, paddy and cotton.

Studies on Soil Physico-Chemical Properties Under Different Tree Species in Salt-Affected Vertisol

B.V. SHREENIVAS

2008

MAJOR ADVISOR : MANJUNATHA HEBBARA

Soil physico-chemical properties as influenced by trees after 16 years of planting was investigated during 2007 in terms of soil reaction, soil salinity, organic carbon, soil solution composition (calcium, magnesium, potassium, sodium, chloride, sulphate, bicarbonate), SAR, ESP, and calcium carbonate. Tree growth parameters were related with soil salinity to

understand their sensitiveness to salinity stress. In addition, changes in soil salinity, organic carbon and calcium carbonate over a period of time since planting were studied. Among the species, *A. nilotica* and *C. equisetifolia* were found the most promising after 16 years of planting based on growth parameters and biomass yield, though the establishment

rate was less in the latter species. The higher soil pH (8.87) and lower salinity (9.43 dSm⁻¹) was recorded under *A. nilotica*. Soil salinity was higher under *H. binata* (16.09 dSm⁻¹) followed by *A. indica* (12.08 dSm⁻¹). Both soil pH and salinity increased with increasing depth under *A. nilotica*. The soil organic carbon (1.23 g kg⁻¹) and CaCO₃ (8.19 g kg⁻¹) were higher under *C. equisetifolia*. Higher solution calcium (14.33 me L⁻¹) and magnesium (12.76 me L⁻¹) were recorded under *A. nilotica* and *A. indica*, respectively, which were higher in the surface and decreased with depth. Irrespective tree species, soil solution sodium and potassium were lower at

the surface and increased with increasing depth. Higher solution sodium (48.5 meL⁻¹), chloride (45.3 meL⁻¹) sulphate (23.0 meL⁻¹), SAR (14.31) and ESP_p (16.55) were recorded under *H. binata*. After 16 years of planting of tree species, soil salinity (16.6 dSm⁻¹) and organic carbon (1.31 g kg⁻¹) increased under all tree species, more under *H. binata* and *C. equisetifolia*, respectively. The CaCO₃ (5.67%) decreased under all tree species, more under *H. binata*. The overall performance of tree species under saline conditions, *A. nilotica* followed by *C. equisetifolia* out performed all other species.

Effect of INM on Yield, Nutrient Uptake and Quality of Chilli (Cv. Byadgi Dabbi) in a Vertisol

D. KONDAPANAIIDU

2008

MAJOR ADVISOR : Dr. B. M. RADDAR

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif*, 2007 to study the effect of INM on yield, nutrient uptake and quality of chilli (Cv. Byadgi dabbi) in a vertisol. The design adopted was randomized block design with ten treatments replicated thrice. The treatment that received 50 per cent RDN + 50 per cent N through FYM + BF + Panchagavya recorded significantly higher dry chilli yield (10.34 q ha⁻¹) over other treatments and was on par with 50 per cent RDN + 50 per cent N through VC + BF + Panchagavya (9.65 q ha⁻¹), 50 per cent RDN + 50 per cent N through FYM + BF (9.30q ha⁻¹) and 50 per cent RDN + 50 per cent N through VC + BF (9.18 ha⁻¹). The total dry matter production, number of fruits per plant per picking and 100-fruit weight were maximum in the

treatment that received 50 per cent RDN + 50 per cent N through FYM + BF + Panchagavya. Application of 50 per cent RDN + 50 per cent N through FYM + BF + Panchagavya recorded maximum ascorbic acid content (168.7 mg 100 g⁻¹) in green fruits and application of 50 per cent RDN + 50 per cent N through VC + BF + Panchagavya recorded maximum colour value (243.5 ASTA units) in red fruits. The highest uptake of N, P, K and micronutrients was recorded in the treatment that received, 50 per cent RDN + 50 per cent N through VC + BF + Panchagavya. Significant difference existed between different treatments with respect to available N, P, DTPA extractable micronutrients and dehydrogenase activity in soil after the harvest of chilli. Application of 50 per cent RDN + 50 per cent N through FYM + BF + Panchagavya has resulted in highest B:C ratio (1.78) in chilli.

Effect of FYM and Fermented Liquid Manures on Yield and Quality of Chilli (*Capsicum annum* L.)

M. CHANDRAKALA

2008

MAJOR ADVISOR : Dr. N. S. HEBSUR

A field experiment was conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad on a Vertisol to study the effect of FYM and fermented liquid manures on yield and quality of chilli during *kharif* 2007. The experiment consisted of 12 treatment combinations with two factors; factor one consisting of manures (FYM equivalent to RDN (M₁), RDF (M₂) and FYM equivalent to RDN+RDFYM (M₃)) and the factor two liquid manures (Beejamrut + Jeevamrut (L₁), Panchagavya (L₂), Beejamrut + Jeevamrut + Panchagavya (L₃) and Control (L₄). The treatments were replicated thrice and experiment was laid out in Randomized Complete Block Design. Application of manures and liquid manures recorded significantly higher growth, yield and quality parameters of chilli. Treatment M₂ recorded significantly higher dry chilli yield (8.33 q/ha) over rest of the manures. Among liquid manures, treatments L₃ and L₂ recorded significantly higher dry chilli yield

(8.52 and 8.01 q/ha, respectively) over control (6.40 q/ha), the values for growth and other yield components were also significantly higher in these treatments. Treatments M₃ and M₁ recorded higher quality parameters Viz., ascorbic acid content, oleoresin and colour value by 14.43: 9.19, 8.40: 5.33 and 14.18: 11.77 per cent, respectively over M₂. Among liquid manures, L₃ and L₂ recorded higher ascorbic acid, oleoresin and colour value by 8.02: 6.74, 7.89: 7.00 and 8.25: 7.17 per cent, respectively over control (121.89 mg/100g, 203.01 ASTA units and 301.71 ASTA units, respectively). A significantly higher dehydrogenase activity, available macro (N, P and K) and micronutrients (Cu, Zn, Fe and Mn) were recorded with M₃ and M₁. Dehydrogenase activity was also found to be significantly greater with liquid manures. Greater uptake of nutrients was recorded with M₂. However, M₂ and L₃ recorded significantly higher yield, net returns and B: C ratio.

Effect of Fertilizer and Irrigation Leves on Growth, Yield, Quality and Cry Protein Content of Bt Cotton

GHONGANE SAMADAN BHAI

2008

MAJOR ADVISOR : Dr. N.A YELEDHALLI

A field experiment was conducted at Agricultural College Farm, Raichur during the year 2007-08 to study the response of Bt cotton to fertilizers and irrigation levels. These were fifteen treatment combination comprising of five irrigation levels in man plots (I₀ No. irrigation, I₁ irrigation at 0.2 IW/CPE, I₂ irrigation at 0.4 IW/CPE, I₃ irrigation at 0.6 IW/CPE and I₄ irrigation at 0.8 IW/CPE) and three levels of fertilizers in sub plots (50,100 and 150 per cent RDF) Treatment were replicated thrice in split plot design. Among different treatments combinations, irrigation at 0.8 IW/CPE level recorded higher seed cotton yield per hectare at all the levels of fertilizers which was significantly superior over rest of treatment combination(3993.00, 3163.00 and 3184.67 kg ha⁻¹ at

50,100 and 150% RDF, respectively). However 0.8 IW/CPE level with 150 per cent RDF (3184.67 kg ha⁻¹) was on par with 0.6 IW/CPE level with 150 per cent RDF (3152.62 kg ha⁻¹) Irrigation at 0.8IW/CPE with 150 per cent RDF showed significantly higher TDM (558.78g plant⁻¹), leaf area (162.47 dm² plant⁻¹) good opened bolls (52.21 plant⁻¹) and per plant yield (166.00g) over other treatment combinations. Uptake of major nutrients (N, P₂O₅ and K₂O) showed the similar trend. Among quality parameters only mean fiber length was affected by fertilizers and irrigation levels and it was significantly higher in 0.8 IW/CPE with 150 per cent RDF (34.3mm). Soil moisture depletion increased with increase in irrigation and fertilizer levels at all the soil depths. Cry protein content in square and boll rind was significantly affected by fertilizer levels.

AGRICULTURAL ENTOMOLOGY

Evaluation of Indigenous Bee Attractants in Sunflower

SRIKANTA NATH

2008

MAJOR ADVISOR : SHASHIDHAR VIRAKTAMATH

Studies on the pollinator fauna of sunflower, impact of indigenous bee attractants on bee visitation and yield parameters in Morden variety and KBSH-1 hybrid sunflower were carried out in 2007 at Main

Agricultural Research Station, Dharwad. Hymenopterans were the most dominant pollinators and *Apis dorsata* constituted 97.33 per cent of the total pollinators in Morden variety and 96.14% in KBSH-1 hybrid.

Attractants did not show uniform efficacy in Morden variety during *kharif* season due to inclement weather. However during *rabi* season Fruit boost along with *Swertia densifolia* and citral Z enticed more bees. The bees spent significantly more time on sprayed crop. Spray of *Fagara budrunga* and *S. densifolia* recorded heavier heads (55.38 and 54.41 g) in Morden variety of sunflower. Per cent chaffiness was least in sugar solution and *F. budrunga* treated crop (4.33 and 5.00 %) while number of seeds per head was highest in *S. densifolia*, *F. budrunga* and citral Z treated crop. *Swertia densifolia* sprayed crop produced highest yield of 19.53 q/ha. Application of bee attractants had no effect on 100-seed weight, germination

percentage, root length, shoot length and vigour index to the treated crop. In KBSH-1 hybrid sunflower, higher 100-seed weight was recorded from Fruit boost (5.72 g), *S. densifolia* (5.46 g) and citral Z (5.44 g) sprayed crop. *Fagara budrunga* and Fruit boost sprayed crops produced higher number of seeds/head (278.75 and 244.17 seeds/head). Fruit boost (12.90 q/ha), citral Z (12.30 q/ha), *S. densifolia* (12.15 q/ha), citral E (11.80 q/ha), *F. budrunga* (11.15 q/ha) and sugar solution (11.05 q/ha) sprayed crops produced significantly higher yield as against control (7.77 q/ha). Application of attractants failed to improve head weight per plant and reduce per cent chaffiness in KBSH-1 crop.

Biology, Crop Loss Estimation and Management of Pod Bug, *Clavigralla gibbosa* Spinola. (Heteroptera: Coreidae) in Pigeonpea Ecosystem

SIDDHALINGESHA

2008

MAJOR ADVISOR : Dr. SUHAS YELSHETTY

Studies undertaken at Agricultural Research Station, Gulbarga during 2007-2008 on biology, loss estimation and management of pod bug, *Clavigralla gibbosa* (Spinola) in pigeonpea ecosystem indicated that the eggs were brown in color and changed to dark brown before hatching. The incubation period was 7.26 ± 0.66 days. The bug had five nymphal instars with a mean nymphal duration of 19.37 ± 3.19 days. The total life cycle of male and female was 50.4 ± 20.18 and 59.6 ± 22.27 days with a mean fecundity of 93.60 ± 24.50 eggs per female at room temperature. Studies on estimation of quantitative loss due to pod bug incidence in pigeonpea indicated that there was reduction in grain yield per plant as the population of pod bug increased per plant. However, significant variation was observed in five, 10, 15, 20, 25, 30, 35 and 40

bugs released per plant at both tender pod stage and at pod maturity stage. Screening of 39 early maturing genotypes and 69 medium maturing genotypes were against pod bug, *C. gibbosa*. The bug population per plant was significantly different among the genotypes and the per cent pod damage by pod borer and pod bug differed significantly. The early maturing genotype SKNP-505 as moderately resistant with 2.1 to 4.0 per cent pod damage. In case of medium maturing genotypes JSA-59 and VRG-17 were consistently promising as moderately resistant to pod bug. Among the different insecticides, botanicals and a bio-pesticide evaluated for their efficacy against pod bug, *C. gibbosa*. Oxydemeton methyl 25 EC at 375 g a.i ha⁻¹, dimethoate 30 EC at 500 g a.i ha⁻¹ and acephate 75 SP at g a.i ha⁻¹ were found to be most effective in reducing the pod bug population and recorded higher grain yield.

Management of Lesser Grain Borer, *Rhizopertha dominica* Fab. and Rice Weevil, *Sitophilus oryzae* Linn. in Stored Sorghum

DHAREPPA C. KUDACHI

2008

MAJOR ADVISOR : Dr. R. A. BALIKAI

Investigations on screening of different *rabi* sorghum genotypes against *Rhizopertha dominica* Fab. and *Sitophilus oryzae* Linn. and evaluation of seed protectants against these two pests were carried out under laboratory condition at the Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad, during 2007-08. Among twenty five *rabi* sorghum genotypes screened against *R. dominica* DJ 6514, CSV 8R, IS 18551, IS 2205, RS 29, IS 2312, SPV 489, SPV 570 and CSV 16R were found to be resistant by recording significantly minimum per cent seed damage, grain weight loss, pest population buildup and maximum germination percentage over six months of storage. While, RSE 03, 5-4-1, BRJ 358 and Dagadi Solapur were found to be susceptible and remaining genotypes showed moderate level of resistance. Where as RS 585, CSV 216R, SPV 570, BRJ 356, IS 2205, DJ 6514 and IS 2312

were resistant to *S. oryzae*, while, Y 75, RSE 03, Maulee, Dagadi Solapur and DSV 4 were susceptible. The genotypes DJ 6514, IS 2205 and IS 2312 showed multiple resistance to both *R. dominica* and *S. oryzae*. Among different botanicals evaluated for their efficacy against *R. dominica* over six months, *Acorus calamus* rhizome powder @ 1% was found to be superior with no damage to the seeds, no grain weight loss, higher seed germination and cent per cent adult mortality followed by *Azadirachta indica* seed powder @ 5%, *Annona squamosa* seed powder @ 5% and malathion 5 D @ 5% with significantly maximum adult mortality (97.15 to 97.85 %). *A. calamus* rhizome powder @ 1% resulted in 100 per cent mortality of adult weevils of *S. oryzae* followed by *A. indica* seed powder @ 5% (87.00%), malathion 5% D (84.97%), *A. squamosa* (80.67%), *Vitex negundo* (72.00%) and *Pongamia glabra* fruit powder @ 5% (70.67%) at 180 days after storage.

Impact of Irrigation and Fertilizer Levels on Cry1Ac Protein Content and Pest Status in Bt Cotton

L . RANJITH KUMAR

2008

MAJOR ADVISOR : Dr. B.V. PATIL

Studies on the impact of irrigation and fertilizer levels on Cry1Ac protein content and pest status of Bt cotton was undertaken at college of Agriculture and Regional Agricultural Research Station, Raichur, Karnataka during 2007-08 season using NCS-145 Bt (Bunny Bt) hybrid. Incidence of sucking pests increased with increase in irrigation and fertilizer levels. The interaction effect was found to be non significant. The natural enemies' population also increased with increase in irrigation and fertilizer levels due to increase in host density population. The number of bollworm eggs laid on central top growing shoot increased with increase in irrigation and fertilizer levels but the interaction was non significant. The larval population, fruiting bodies damage of *H. armigera*, *E. vittella* and incidence of pink bollworm larvae as rosette flowers and locule damage was non

significant with respect to irrigation levels but differed significantly with increase in the Cry protein content due to increase in fertilizer levels. Cry protein levels were high in squares and boll rind in early stages (90DAS) which goes on decreasing and reached negligible amount at 165 DAS of crop growth. Increase in the irrigation levels although increased the soil moisture the Cry protein expression was non significant but differed significantly and increased with increase in fertilizer levels from 50 to 150 per cent recommended dose of fertilizer (RDF). Overall in Bt cotton, soil moisture had no effect on Cry protein expression in deep black soils in case of intrahirsutum genotypes. Where as Cry protein levels increased and decreased with increase and decrease in fertilizer levels and the Cry protein levels recorded were sufficient to control bollworm complex at later stages of crop growth.

Seasonal Incidence, Biology and Management of Grape Mealy Bug, *Maconellicoccus hirsutus* (Green) (Homoptera: Pseudococcidae)

MAHESHKUMAR KATKE

2008

MAJOR ADVISOR: Dr. R.A. BALIKAI

The seasonal incidence of mealy bug over two seasons indicated that, the mealy bugs were noticed through out the year. Taking into consideration the entire season, mealy bug incidence correlated positively

and significantly with maximum temperature at one week lead time and during the week of observation. Where as, it correlated negatively and significantly with minimum temperature at one, two, three and four weeks

lead time. Similarly it also correlated negatively and significantly with morning and afternoon relative humidities that existed during the week of observation, one, two, three and four weeks lead time. Its incidence correlated negatively and significantly with the rainfall received during the week of observation, one, two, three and four weeks lead time. The female had three nymphal instars while the male had four. The total life cycle of grape mealy bug took more days during winter than summer. The nymphal period, adult longevity and fecundity were more during winter than summer irrespective of hosts. Similarly, the nymphal period, adult longevity and fecundity were more when reared on pumpkin as compared to sprouted potato irrespective of seasons. Dimethoate 30 EC at 1.7 ml +

Fish oil rosin soap at 5 g/l recorded highest net profits of Rs. 79,035/ha followed by Dimethoate 30 EC at 1.7 ml/l with Rs. 77,835/ha and were on par with each other. The latter treatment was on par with NSKE at 5% + soap powder at 1% (Rs. 39,227/ha). The next best treatments in this respect were *Verticillium lecanii* (WP) @ 2.0 g/l and Fish oil rosin soap at 25 g/l with Rs. 35,220/ha and Rs. 24,400/ha, respectively. The treatments viz., Dimethoate 30 EC at 1.7 ml/l, *V. lecanii* (WP) @ 2.0 g/l, *Metarhizium anisopliae* (WP) @ 2 g/l and *Clerodendron inerme* at 5% recorded the higher incremental cost benefit ratio of 58.0 and 46.2, 21.5 and 21.3, respectively.

Studies on Incidence and Management of Defoliator Pests of Soybean

G. HARISH

2008

MAJOR ADVISOR : Dr. R. H. PATIL

Investigations were carried out during *kharif* 2006-07 at Main Agricultural Research station (MARS), Dharwad, on incidence, varietal screening and management of major defoliator pests. Maximum larval population of spodoptera and semilooper (7.80, 12.00 and 12.80 larvae/mrl and 6.50, 6.20 and 8.60 larvae/mrl) was noticed during 08-06-06, 27-06-06 and 08-07-06 dates of sowing respectively. Early sown crop recorded the lower incidence of *S. litura*, *T. orichalcea* and *S. oblique* compared to that of late sown crop. Six species of short horned grasshoppers *Chrotogonus trachypterus* Blanchard, *Neorthacris nilgirensis* Uvarov, *Aiolopus thalassinus* (Fabricius), *Gastrimargus africanus* Saussure, *Morphocaris fasciata* (Thumberg), *Cyrtacantharis tatarica* recorded. Their incidence was sporadic in nature no economic injury was recorded. Coccinellids, Chrysopids and *N. rileyi* were recorded during crop sown at

all dates of sowing the incidence was recorded more in crop sown during late sown crop. KHSb-2, DSb-1 and Bragg were identified as highly resistant varieties against defoliation as they recorded 14.33 per cent, 21.33 per cent and 28.67 per cent defoliation respectively. The least per cent pod damage was noticed in Monetta (20.75%), JS (SH) 93-05 (21.21%), DSb-1 (26.41%), PK 1029 (26.67%), KHSb-2 (27.82%) which were on par with the standard check JS 335 (17.68%). Six genotypes namely JS 335, DSb-1, PK 1029, JS (SH) 93-05, Monetta and Bragg were rated as susceptible high yielding i.e. tolerant to insect pest complex. Emamectin benzoate found to be effective in controlling both *S. litura* and *T. orichalcea*. Least larval population, least per cent defoliation was recorded in emamectin benzoate treated plots (26.00%) emamectin benzoate and spinosad recorded least per cent pod damage 11.23 and 11.22 per cent and higher yields of 2276.67 and 2274.67 kg per ha, respectively.

Molecular Characterization and Efficacy of Native Isolates of *Bacillus thuringiensis* (Berliner) Against Cruciferous Pests with Special Reference to Diamondback Moth

S. A. MARUTHESH

2008

MAJOR ADVISOR : A. S. VASTRAD

Investigations were carried out to assess the efficacy of native isolates of *Bacillus thuringiensis* against cruciferous pests, like diamondback moth (DBM), cabbage leaf webber, tobacco caterpillar and mustard sawfly. The cry gene profile of selected isolates were also analyzed. The studies were carried out during 2006-07 at Department of Agricultural Entomology and Department of Biotechnology, University of Agricultural Sciences, Dharwad. One hundred native isolates from Chikamagalur (39), Goa (28) Belgaum (27) and Tamil Nadu (6) were bioassayed. Among these Chikamagalur isolate 2375/a, recorded the highest mortality of 83 per cent, Goa isolates, 1602/1 and 1606/2 the recorded maximum mortality of 90 per cent. Similarly, isolate 531/a and 796/1 of Belgaum and Tx29 of Tamil Nadu were also found promising against *P. xylostella* with 90 per cent mortality compared to standard check HD1 which recorded 86.60

per cent mortality. However, Diple 8L (commercial Bt) recorded cent per cent mortality. Out of four promising isolates which had performed well against DBM isolate 1606/2 recorded mortality of 90 per cent against *Crociodolomia binotalis* and was found on par with HD1. None of the isolates which were effective against DBM were not effective against *Spodoptera litura* (F.) and *Athelia proxima* (Lin.). The *cry1* gene amplified in eight native isolates out of 53, *cry2* was positive in 13 isolates and *cry2A* in eight isolates, *cry3* gene amplified in eight isolates, *cry4* in 24 isolates and *cry6* was positive in six isolates. None of the native *B. thuringiensis* isolates amplified for *cry20*. Under field condition none of the native isolates were effective in reducing the larval population of *P. xylostella* which may be due to inhibition of insecticidal proteins by high temperature and UV rays.

Management of Coconut Perianth Mite, *Aceria guerreronis* Keifer Through Nutrition and Botanicals

B. R. LOKESH

2008

MAJOR ADVISOR : Dr. B. S. NANDIHALLI

Investigations on surveillance of coconut perianth mite, *Aceria guerreronis* Keifer and its natural enemies around Dharwad area, efficacy of different neem products and efficacy of nutrition along with soil application of neem products in the management were carried out at the farmers' field near Dharwad during 2007-08. Surveillance of eriophyid mite on coconut palms indicated that the mite population occurred throughout the year with variation during different seasons of the year. The mite population was more or less constant from December 2007 to March 2008 and then started increasing and reached peak during May 2008 and decreased after wards. The extent of damage due to mite was more than 82 per cent falling in the damage grading of III. Predatory mites observed were *Neoseiulus baraki* Athias-Henriet, *Amblyseius paspalivorus* Deleon and one unidentified species belonged to family

Ascidae. Bioefficacy of neem products in the management of perianth mite indicated that among different neem products NSKE 5 per cent was found most effective at different intervals of observation in reducing the mite and egg population. Neem oil + garlic extract and nimbecidine were proved to be next best treatments. NSKE 5 per cent sprayed palms recorded less per cent damaged nuts 32.51 and less damaged grade of 1.50. Among the different nutrients applied to soil RDF + full dose of borax + $MgSO_4$ + gypsum + neem cake, RDF + half dose of borax + $MgSO_4$ + gypsum + neem cake and RDF + borax were the most effective and per cent reduction ranged from 34.11 to 42.10. RDF + full dose of borax + $MgSO_4$ + gypsum + neem cake, RDF + $MgSO_4$, RDF + half dose of borax + $MgSO_4$ + gypsum + neem cake and RDF + gypsum were the effective treatments and recorded 19.29 to 34.06 per cent damaged nuts and 1.56 to 1.83 damage grading.

Performance of Multivoltine and Bivoltine Breeds of Mulberry Silkworm, *Bombyx mori* L. Under North Eastern Dry Zone of Karnataka

M. RAVISHANKAR

2008

MAJOR ADVISOR : Dr. A. NAGANAGOUD

The studies on the performance of multivoltine and bivoltine breeds of mulberry silkworm, *Bombyx mori* L. under north eastern dry zone of Karnataka was conducted at the Department of Agricultural Entomology, College of Agriculture, Raichur during July-August, November- December and January-February months representing rainy, winter and summer seasons respectively. Significant differences were observed for all the characters studied. Further, the performance of KSO-1, NP-2, CSR-2, APS-4, APS-5 and APS-8 was superior for full grown larval weight, silk productivity, cocoon weight, shell weight, shell ratio, cocoon filament length, filament weight, pupal weight and fecundity. Among the multivoltine breeds, the performance of Tamil Nadu white, Nistari, Pure Mysore, C.nichi and MY-1 was superior for pupal duration, effective rate of rearing, cocoon yield by number, moth emergence, pupal melting and hatching percentage. All the multivoltine breeds were superior

in respect of fifth instar and total larval duration except Pure Mysore. The performance of silkworm breeds was better during November-December rearing and the same was lower in January- February rearing for all the traits. The evaluation index values for positive metric traits indicated that all the multivoltine and bivoltine breeds scored above 50. Among bivoltines, APS-5, APS-4, KSO-1, NP-2, CSR-2, APS-8 and NB4D2 were found promising and gave E I values above 61. Among multivoltine breeds, MH-1, APM-1, Kolar gold, BL-43, Kollegal Jawan and Pure Mysore were found promising with E I values more than 53. For survival traits, MH-1 ranked best followed by Tamil Nadu white, Nistari, Pure Mysore and C.nichi (71.25 to 72.68). Among bivoltines, APS series along with CSR-2 Exhibited higher E I values (61.42 to 64.50). For duration traits, E I values was lowest in MY-1(42.23) and the next best ones were Nistari, P2D1, C.nichi, Tamil Nadu white and G-race (45.12 to 49.71).

Evaluation of ITK Components against Major Insect Pests of Soybean (*Glycine max* [L.] Merrill)

M. N. SANTHOSH

2008

MAJOR ADVISER : Dr. R. H. PATIL

Investigations were carried out during *kharif* 2007 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad on the incidence, efficacy of ITK components against major insect pests and their influence on the activity of natural enemies in soybean ecosystem. Maximum larval population of *Spodoptera litura* (Fab.) and *Thysanoplusia orichalcea* (Fab.) (5.73, 7.31, 8.44 and 3.98, 5.91, 6.03 l/mrl, respectively) with least per cent pod damage (38.82, 49.64 and 58.77% pod damage) were noticed in crop sown on 16-06-2007, 03-07-2007 and 15-07-2007, respectively. Early sown crop recorded lower incidence as compared to late sown crop. Incidence of natural enemies was fluctuating among the different dates of sowing with higher incidence of coccinellids (3.02 beetles/mrl) in late sown crop. Whereas higher incidence of chrysopids (1.21/mrl) and spiders (1.36 /mrl) was noticed in the crop sown on 03-07-07. However, incidence of entomopathogen

Nomuraea rileyi (Farlow) was high (3.27 cadavers/mrl) on *S. litura* and *T. orichalcea* in the late sown crop. The laboratory studies revealed that NSKE (5%) was the most effective among indigenous products by recording 73.33 per cent larval mortality followed by agniasthra (63.33%) after 72 hrs of application. NSKE (5%) also recorded highest antifeedant activity with high per cent protection (63.37%) and was found on par with agniasthra (60.36%) after 42 hrs of application. The bio-efficacy studies of herbal asthras and extracts revealed the superiority of NSKE which recorded maximum larval reduction of *S. litura* and *T. orichalcea* (62.97, 84.81 and 62.98, 77.35 %, respectively, after first and second spray) and least per cent pod damage (23.59 %) with higher seed yield (22.27 q/ha) and C:B ratio (2.59). The next best treatment was agniasthra. All the indigenous products were safer to natural enemies viz., coccinellids, chrysopids, spiders except GCKE and agniasthra which were not detrimental to entomopathogen *N. rileyi*.

Bioefficacy of Entomopathogenic Fungal Formulations in the Management of Sucking Pests of Okra

R. HARISHCHANDRA NAIK

2008

MAJOR ADVISOR : R. SHEKHARAPA

The Bioefficacy of entomopathogenic fungal formulations in the management of sucking pests of okra was studied during *kharif* 2007-08 at University of Agricultural Sciences, Dharwad. The laboratory evaluation of oil based, wettable powder and crude formulation of all three fungi viz., *Beauveria bassiana* (Balsama) Vulli, *Metarhizium anisopliae* (Metschnikoff) Sorokin and *Verticillium lecanii* (Zimmermann) on sucking pests of okra revealed that the *B. bassiana* and *M. anisopliae* oil based formulation recorded 96.67% mortality of leaf hopper. Oil based formulation of *V. lecanii* recorded 96.77% and 97% mortality of aphids, and thrips and similarly *M. anisopliae* recorded 96.67% of mortality of mites, respectively at ten days after treatment. Field evaluation of different formulations revealed that, oil based formulation of *M. anisopliae* recorded 2.52 and 4.66 mean number of leafhopper/3 leaves, *V. lecanii* recorded 2.80 and 7.37 aphids, and 2.27 and 2.47 whiteflies/3 leaves after first and

second spray, respectively. Similarly oil based formulations of *B. bassiana* recorded 1.72 and 2.48 thrips and *M. anisopliae* recorded 7.08 and 8.08 mites/3 leaves after first and second spray, respectively. The yield of okra was significantly higher in oil based formulation of *M. anisopliae* (38.80 q/ha) and *V. lecanii* (38.50 q/ha) with monetary returns of Rs. 14720 and Rs. 14480/ha which was followed by *B. bassiana*. However, highest the benefit cost ratio of 18.48:1 and 16:8:1 recorded in *V. lecanii* and *M. anisopliae* wettable powder formulation, respectively because of low cost of wettable powder as compared to sunflower oil. The persistence of different formulations revealed that *V. lecanii* and *M. anisopliae* oil based recorded 0.180 and 0.177 and 0.176 and 0.120 CFU/5 leaves after first and second spray, respectively indicating the survivability of conidia upto ten days on foliage under field condition.

Studies on Seasonal Incidence and Integrated Management of Pink Bollworm, *Pectinophora gossypiella* (Saunders) in Interspecific Bt Cotton Hybrid

B. M. SANTHOSH

2008

MAJOR ADVISOR : Dr. S. B. PATIL

The investigations were carried out at Agriculture Research Station, University of Agricultural Sciences, Dharwad, during 2007-08 on population dynamics of pink bollworm in interspecific Bt and non-Bt cotton hybrids, assessment of Cry 1Ac protein and its impact on pink bollworm larval mortality and development of IPM module for interspecific Bt cotton hybrid. Among the Bt (DBtHB-05) and conventional cotton hybrids (DCH-32), significantly less number of rosette flowers (1.69%), number of live PBW larvae (3.35 larvae/ 30 bolls), green boll damage (9.08%) and locule damage (9.94%) were recorded in Bt cotton compared to conventional cotton hybrid (6.24%, 10.03 larvae/ 30 bolls, 23.59% and 20.18%, respectively). Decline in expression of Cry

1Ac protein was evident through ELISA quantification and bioassay studies. The dynamics of Cry 1Ac expression in leaves was very high followed by petals, sepals and squares. Further parts of fruiting structures viz boll rind, ovary and raw seed also have shown a considerable expression. The bio efficacy of PBW neonate larvae fed with flowers was 72.15 and 60.70 per cent at 70 and 85 DAS, respectively. The bio assay with the tiny bolls also indicated it declined from 89.53 per cent mortality at 85 DAS to 28.55 per cent at 160 DAS. Among the different modules developed and studied there was no significant difference with regard to incidence of sucking pests. Similarly natural enemy population appeared to be significantly

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higher in both Bt IPM and non-Bt IPM modules. As bollworm management is concerned both Bt IPM and Bt RPP were equally good in suppressing bollworm complex and their damage. The modules, Bt IPM and Bt RPP

registered higher seed cotton yield of 21.86 and 20.10 q/ha, respectively with net returns of Rs.41587 and Rs.37679/ha can be a best option for Bt cotton cultivation.

Investigations on Second Generation Bt Cotton Genotypes Against Insect Pest Complex

S. G. ONKARAMURTHY

2008

MAJOR ADVISOR : Dr. K. BASAVANA GOUD

Investigations were carried out on different Bt cotton genotypes, during 2007-08 at Main Agricultural Research Station, Dharwad. All the (BG-II, BG-I and non Bt) cotton genotypes responded similarly for sucking pests viz., thrips, leafhoppers, aphids, whiteflies, red cotton bugs and dusky cotton bugs under ETL based protection conditions. There was no much variation in the egg population of *Helicoverpa armigera* (Hubner) and *Earias vittella* (Fabricius) among BG-II, BG-I and non Bt cotton genotypes. All the second generation Bt cotton genotypes viz., MRC-7351BG-II, MRC-7201BG-II, KDCHH-621 BG-II, RCH-2 BG-II, RCH-530 BG-II, BUNNY Bt BG-II with *cry1Ac+cry2Ab* genes were found superior over RCH-2 Bt (BG-I), BUNNY Bt (BG-I) and RCH-2 NBt, DHH-11 NBt genotypes against bollworms under unprotected condition. Among BG-I genotypes Bunny Bt performed better over RCH-2 Bt. All

the BG-II genotypes (except RCH-2 BG-II and RCH-530 BG-II) were found superior with respect to GOB/plant, BOB/plant and seed cotton yield over BG-I as well as non-Bt genotypes viz., RCH-2 non-Bt and DHH-11. The activity of predatory populations viz., grub and adults of coccinellids, *Chrysoperla carnea* (Stephens) and spiders did not vary significantly among BG-II, BG-I and non-Bt cotton genotypes. The variation in the larval mortality to *cry1Ac* and *cry1Ac + cry2Ab* was evident through bioassay. Maximum larval mortality of *H. armigera*, *E. vittella*, *Pectinophora gossypiella* (Saunders) and *Spodoptera litura* (Fabricius) was recorded in RCH-2 BG-II compared to RCH-2 Bt, which provides an additional advantage of controlling *S. litura* apart from enhanced mortality of other bollworms.

Survey, Biology and Management of *Caryedon serratus* (Olivier) on Groundnut

B. S. KUMAR

2008

MAJOR ADVISOR : Mr. SOMASEKHAR

Studies on the Survey, Biology and Management of *Caryedon serratus* (Olivier) on groundnut was undertaken at College of Agriculture and Regional Agricultural Research Station (RARS), Raichur, Karnataka during 2007-08 season. Survey results indicated that *Caryedon serratus* was noticed only in Regional Agricultural Research station and Karnataka Oil Seeds Growers Federation (KOF) godowns of Raichur, while the secondary feeder, *Tribolium castaneum* was found in RARS, Raichur. The peak activity of both *C. serratus* and *T. castaneum* was found during the month of December 2007. In addition to groundnut *C. serratus* was recorded on *Albizia lebback* and *Tamarindus indica* during February and March, 2008 at Raichur. The eggs of *C. serratus* were white, translucent and oval shaped, laid singly on pods with a mean incubation period of 10.35 days. It had four larval instars with a mean larval duration of 47.10 days and the

pupa was dull whitish, papery and exarate with duration of 28.00 days. The mean total developmental period of *C. serratus* lasted for 84.25 days with a mean fecundity of 46.50 eggs per female. Among the different botanicals, *Acorus calamus* rhizome powder (5 gm/kg) was found to be effective in minimizing per cent pod damage and weight loss followed by neem seed kernel powder and neem leaf powder both at 5 gm/kg of groundnut pods. Among the different dust formulation insecticides evaluated malathion 5 D at 2.5 gm/kg and quinalphos 1.5 D at 2.5 gm/kg of groundnut pods were found to be most effective in minimizing per cent pod damage and weight loss. Among the different insecticides evaluated as surface treatment for gunny bags, beta-cyfluthrin 2.5 EC at 0.5 ml/ litre, lambda - cyhalothrin 5 EC and deltamethrin 10 EC at 0.5 ml/ litre were found to be most effective in minimizing per cent pod damage and weight loss.

Growth, Development and Economic Cocoon Parameters of ERI Silkworm *Samia cynthia ricini* Boisduval on New Hosts

C. MANJUNATHA NAIK

2008

MAJOR ADVISOR : Dr. G. M. PATIL

Studies on growth, development and economic cocoon parameters of eri silkworm *Samia cynthia ricini* Boisduval on new hosts were carried out at DBT Ericulture laboratory, Department of Agricultural Entomology, UAS, Dharwad during *rabi* and *summer* seasons of 2007-08. Among 23 plant species tried for ericulture, five plant species have been accepted by the eri silkworm. Out of five plant species, eri larvae had good feeding response and survivability on fountain tree, banyan tree and Indian almond, moderate response on carrot leaves and slight feeding response and survivability on jack fruit leaves. The new host plants significantly influenced the weight of chawki and grownup worms. The maximum larval weight of 0.018, 0.048 and 1.609 g were recorded with castor during I, II and III instars, respectively which were on par with carrot leaves (0.017, 0.469 and 1.553 g, respectively) and in late age worm the highest mature worm weight (4.55g) was registered with castor which was on par with fountain tree (4.45g). The maximum larval

weight was recorded during November-December (4.35g). Cocoon weight (2.74 g), pupal weight (2.33g), shell weight (0.35g) and shell ratio (12.95%) were significantly superior with castor leaves which was on par with fountain tree (2.72g, 2.32g, 0.344g and 12.64%, respectively). Maximum moth emergence (99.42%) was recorded with castor leaves which was on par with fountain tree (99.40%), banyan tree (99.35%) and Indian almond (99.30%). Adult wing expanse of male and female was maximum (10.98 and 11.98cm) with castor which was on par with fountain tree (10.95 and 11.98cm). Significantly longest adult longevity of male and female (7.40 and 9.83 days) was on castor which was on par with fountain tree (7.35 and 9.83 days) with respect to rearing season, significantly longest adult longevity of male and female (7.15 and 9.60 days) was registered during November-December. The carrot leaf is the best alternate new host for chawki worms and fountain tree leaves for grownup eri worms.

AGRIBUSINESS MANAGEMENT

Consumer Behaviour Towards Ready-to-Eat Food Products

RENUKA HIREKENCHANAGODAR

2008

MAJOR ADVISOR : DR. H.S. VIJAYAKUMAR

The present investigation made an attempt to analyze the buying behaviour of ready-to-eat food products by consumers of Hubli and Dharwad. A total sample of 200 respondents was selected for the study. Majority of the respondents were aware of Parle-G, Lays, Frooti and Amul brands in the cases of biscuits, chips, fruit juice and ice creams,

respectively. Television was the major source for getting information about various brands in all the four products. Biscuits were consumed by all the respondents because of their convenience to use as snacks. About 92 per cent, 93 per cent and 94 per cent of the respondents consumed chips, fruit juice and ice creams, respectively. Taste was the main driving

force for purchase of chips, fruit juice and ice creams. Health consciousness was the main factor for not purchasing chips among the respondents. Majority of the respondents did not purchase fruit juice because they preferred home made products. Dislike towards the product was the main reason for not purchasing ice creams. The average monthly expenditure on ready-to-eat food products was found to be highest in case of high income group. Planned purchase was common among majority of the respondents for biscuits and fruit juice. However, most of the respondents

did impulsive buying for chips and ice creams. Parle-G, Lays, Maaza and Amul brands were highly preferred brands of biscuits, chips, fruit juice and ice creams, respectively. The main factors influencing brand preference for biscuits, chips, fruit juice and ice creams were quality, taste and reasonable price. Most of the respondents would go to other shops if preferred brand in all the four products was not available. The study revealed that the younger generation preferred more ready-to-eat food products than the other age groups. The consumer behaviour also varies from product to product.

Production and Marketing of Vermicompost in Karnataka : A Case of Dharwad District

C. SHIVAKUMARA

2008

MAJOR ADVISOR : Dr. S. B. MAHAJANASHETTI

The present study on production and marketing of vermicompost was carried out during 2007-08 in Dharwad District of Karnataka. The study made an attempt to document schemes and training programmes, economics of vermicompost production, effect of vermicompost application on cotton yield and problems faced in vermicompost production and its marketing. Both primary and secondary data were collected to evaluate the study. Majority of vermicompost producers were illiterate and had nuclear families. Most of the respondents were found to produce vermicompost using heap method and sale of vermicompost was half yearly. There are totally seven schemes for the promotion of vermicompost production in Dharwad district which are launched in the district for the benefit of those who need financial assistance to take up vermicompost activity. The training programmes on the promotion of vermicompost sponsored by various institutes in Dharwad district can be broadly grouped into two categories, on-campus

and off-campus training programmes. More than 80 per cent of the farmers expressed that the training programmes were instrumental in acquisition of skills on vermicompost production. The results showed that the total cost of production of vermicompost per ton was Rs. 1337. The net returns per ton of vermicompost were Rs. 1215 in channel-I (Dharwad taluk) compared to Rs.1145 in channel-II (Kalaghatagi taluk). The net present value for the vermicompost production was Rs. 99827; the benefit cost ratio at 12 per cent discount rate was 3.44; internal rate of return was 38 per cent, and pay back period was 1.71 years. The results showed that vermicompost applied previously would have carry-over effect on the current yields. More than (80 per cent) of the respondents expressed that they lacked awareness regarding improved methods of vermicompost production, faced the problems of pest attack, lack of market information and low prices for vermicompost.

Futures Trade, Export and Direction of Trade in Soya : An Econometric Analysis

DILIP REDDY

2008

MAJOR ADVISOR : Dr. R. A. YELEDHALLI

Soyabean is a species of legume native to Eastern Asia and scientifically known as *Glycine max*. The word Soya is derived from Japanese word *Shoyu* which means Soya sauce and majority of the beans are classed as pulses where as Soyabean are classed as oilseeds. The widely traded forms of soyabeans are Mature Soyabeans, Soy Oil and Soy Meal. The secondary data were collected on daily futures price, spot prices, and volume of trade on exchanges from the official web site of Forward Market Commission (FMC), Mumbai and respective web sites of the National Level Commodity Exchanges in India. Highly significant growth rate was found in case of soyabean production representing growth rate of 20% per annum. While the export of soy meal showed growth rate of 14.71%. There is positive and highly significant relation between soyabean parameters to soy oil spot prices in the domestic market. The direction

of movement of soy spot prices with forecast prices of soyabean indicated highly significant association between spot prices of soyabean and NCDEX soyabean. Hence, there is close association of soyabean spot prices and NCDEX soyabean. The results of correlation analysis of soy oil spot prices with forecast prices by the NCDEX soyabean and NCDEX soy oil shows positive and significant association. This may be attributed to the fact that soy oil prices movement is mainly dependent on the international soy oil market that to at a higher levels with CBOT and BMDE. The price of this commodity fluctuates very often. The other factors which mostly influence the soy oil prices are the production and supply of soy oil by Argentina and Brazil, the price prevailing at CBOT market, FOB prices of Malaysian and Indonesian palm oil prices and government intervention through duties tariff rates.

A Study on Working of Modern and Traditional Retail Outlets: A Comparative Analysis

A.S. HEMASHREE

2008

MAJOR ADVISOR : Dr. N.N. KARNOOL

Globally, retailing is a big business. It is one of the largest industries in India and second largest employer after agriculture. The share of organized retail is more in developed countries but bulk of this business is unorganized (97%) in India. In recent times, retail sector has been growing rapidly with the multitude of factors viz., increasing sophistication, modernization of the life-style of households and increasing globalization of trade. Hence, an effort was made in the state to study the entire business aspects of organized food retailing particularly in supermarkets using both primary and secondary data collected from various sources. In both modern and traditional outlets rice, wheat, greengram, tur dal and groundnut was purchased from traders in APMC. Groundnut oil, sunflower oil, raisins and cashewnut was procured from distributors. Frequency of purchase was once in week in rice, wheat, greengram, tur dal, groundnut groundnut oil

and sunflower oil but it was 0.5 in case of raisins and cashewnut. Rice was procured in highest quantity 28.1qtls and 16.8 qtls both in modern traditional retail outlets. Since, for both type of retail outlets, the source of supply and mode of supply being the same, their could not be any significant difference in the value of procurement. Short time period inventories were observed in both modern and traditional retail outlets. The cost of preparation product in modern retail outlets was more as compared to traditional retail outlets. In the case of modern retail outlets the net value added was much higher than the traditional retail outlets in all the grocery items. Modern retail outlets gained higher profit compared to traditional retail outlets. Since, retailers undertook retailing business of several commodities and there was a quick turnover of business in modern retail out and hence economics in costs were achieved by them.

Supply Chain Management in Dairy Processing Units - A Comparative Analysis of Private and Co-Operative Units

R. R. NITHIN

2008

MAJOR ADVISOR : Dr. R. A. YELEDHALLI

Supply Chain Management (SCM) is the process of planning, implementing and controlling the operations of the supply chain as efficiently as possible. Milk supply chains are more concerned with controlling of milk quality and supply fluctuations. For the success of a

dairy industry, efficient supply chain management is a pre-requisite. Hence, an effort was made to assess the management of dairy processing units in co-operative and private sectors. The study revealed that both co-operative and private sector units procured highest quantity of raw milk during flush

season, due to high production. Of all the three sectors, the co-operative unit utilized maximum installed capacity compared to other sectors. The benefit cost ratio was also high in co-operative sector, followed by private small scale and private large scale units. The total quantity of milk processed and demanded was highest in co-operative unit, followed by private large scale and private small scale units. The large and small scale private units mainly concentrated on liquid milk, whereas the co-operative sector concentrated on many product lines such as curd, butter, pedha, ghee, paneer and khawa. The variable costs were the major cost component in processing of milk in all the three sectors. The total cost of marketing

of processed products was highest in co-operative unit, followed by private large scale and private small scale units, since co-operative unit had large area of operation and well established brand loyalty. Sales realization was more in co-operative sector unit compared to other units, because quantity sold was more. In co-operative unit processing was the most acute problem whereas in case of private (large and small scale) units, finance was the major problem. The major constraints observed in milk processing units were the lack of cost effective technology, irregular power supply and higher taxes for processed products.

Supply Chain Management in Vegetable Marketing : A Comparative Analysis

K. SHILPA

2008

MAJOR ADVISOR : BASAVARAJ BANAKAR

Supply chain management is more important in the sector of agribusiness because most of the agricultural products are perishable and have a very short shelf life. Bangalore city was selected as the study area because of different formats practicing supply chain. Mainly three models of supply chain techniques were selected, they were traditional, cooperative and modern supply chain. A total of 45 farmers, 4 intermediaries, 15 retail formats and 60 consumers were selected in aggregate from all the supply chain format models. For the homogeneity of the products in which these formats dealing 4 vegetables namely, tomato, cabbage, carrot and capsicum were selected because there were commonly dealt in large quantities in all the selected models of supply chain. Among the sample farmers highest marketing cost was incurred by farmers in traditional format of the supply chain i.e., Rs. 1.6 per kg as compared to cooperative and modern supply chain i.e., Rs. 0.83 per kg and Rs. 0.46 per kg respectively. The intermediaries were involved only in the traditional supply chain. Among the retail formats, the cost incurred per kg of

vegetables by traditional, cooperative and modern supply chain was found out to be Rs. 1.63, Rs. 1.01 and Rs. 0.80, respectively. But, the net return for one kg of vegetables was highest for cooperative retail format i.e., 1.90 followed by modern and traditional retail format Rs. 0.79 and Rs. 0.63 respectively. The index of marketing efficiency was found out to be 1.97, 2.10 and 4.32 for traditional, cooperative and modern supply chain respectively. Hence, modern supply chain was found out to be more efficient than cooperative and modern supply chain. With highest marketing cost incurred by farmers in traditional supply chain as compared to cooperative and modern supply chain. At the same time modern and cooperative supply chain is having the smallest price spread of Rs. 4.10 per kg and Rs. 4.10 per kg respectively. Hence these are found out to be efficient when compared to that of traditional supply chain which is having highest price spread i.e., Rs. 8.31 per kg. Hence it is advisable to the farmers to sell their produce through modern supply chain and cooperative supply chain.

Management of Contract Farming in Livestock : A Case of Poultry Industry

SHIRAZ ZAKIR

2008

MAJOR ADVISOR : BASAVARAJ BANAKAR

Poultry industry in India is facing large problems in recent years due to price fluctuation and high cost of feeds. Hence, different methods of management in the industry has been introduced. Hence, a study was undertaken with the aim of studying the management of contract farming activities in the poultry industry. To achieve the objective, the primary data was collected from the selected 30 poultry farmers in each category, spread across two districts i.e., Bangalore rural and Dharwad in Karnataka in view of concentration of poultry activities. The Principle component analysis was employed to analyse the factors influencing the farmers to enter a poultry contract and to assess the factors influencing the farmers not to enter in contract. In case of procurement management, the total value of inputs procured per bird was Rs. 48.89 in contract farmers' case and was Rs. 52.81 in non-contract farmers' case. The non-contract farmers procured their inputs through three sources viz., poultry dealers, integrators and local market. Under cost comparison, in case of

contract farming, the total cost incurred was Rs. 3.75 per bird. In case of non-contract total costs incurred per bird was Rs. 58.31. The net returns obtained per bird was Rs. 1.94 in case of contract and was Rs. 1.23 in case of non-contract. The Meet-feed price ratio was 1.74 in contract arrangements and it was 1.56 in case of non-contract. Similarly, the benefit-cost ratio in case of contract poultry farming was 1.52 and it was 1.02 in non-contract case. The various problems faced by contract and non-contract farmers were analyzed by employing cluster analysis and were grouped under high, medium and low aggregate clusters. The major problems in case of contract were that of delay in payment, non-availability of credit, inadequate capital and disease occurrence. On the other hand, the major problems faced by non-contract farmers were that of high initial investment, water scarcity, lack of technical guidance, and the diseases occurrence. The problems faced by the contracting firms were demand for the products and price fluctuations, problem of diseases, input diversion by the farmers and extra contractual sales.

Biopesticide Marketing and Usage in North Karnataka- A Case of Belgaum District

GURURAJ HONNUNASI

2007

MAJOR ADVISOR : Dr. S. B. MAHAJANASHETTI

High pesticide residues in food chain cause pesticide poisoning and deaths through organ disfunctions, immuno suppression, neurotoxicity, impairment of reproductive functions, carcinogenicity, tumorigenicity, paralysis etc. besides harming non-target beneficial flora and fauna. Rice accounts for another 23 per cent of pesticides application. Vegetables and fruits also have a significant share in pesticide usage in the country. Estimated equation indicated a positive trend in the use of bio pesticides, the highly significant intercept and slope coefficient as the ever increasing demand for bio pesticides in the state has been pushing up their sale over years in the state. The biopesticides dealers had competitive shares in the sale of biopesticides. Socio-economic factors influencing farmers choice between biopesticides and chemical pesticides were age of the farmer and knowledge about biopesticides. The same factors influenced farmers choice in respect of Cotton too. Total cost of Cabbage production happened to

be Rs. 36906 per ha with biopesticides application. However, the total cost when using chemical pesticides was higher at Rs. 37771 per ha. It is of particular interest to notice that the total cost of plant protection was lower when using biopesticides (Rs.6690) than when using chemical pesticides (Rs.7396). Total cost of Cotton production happened to be Rs. 19714.20 per ha with biopesticides application. However, the total cost when using chemical pesticides was higher at Rs. 20545.69 per ha. On returns front also Cotton cultivation with biopesticides application happened to be more attractive. Around 2/3rd of the interviewed dealers expressed that risk in investment and lack of awareness among farmers regarding biopesticides were major problems. Another important problem faced by more than 60 percent of the dealers was demand for credit sale by the farmers and inadequate trained personnel for marketing. Around 53 percent of the dealers.

A Study on Packaging and Value Addition in Traditional and Modern Consumer Retail Units: an Economic Analysis

J. P. PAVITHRA

2008

MAJOR ADVISOR : Dr. H. S. VIJAY KUMAR

Among the major developments in the modern competitive market system one is packaging. It is one of the recent innovations that has acquired a key place in consumer decision making. The Indian Packaging Industry is estimated at approximately \$14.7 B. Hence, an effort was made in the District to study the entire aspects of packaging and value addition in traditional and modern retail outlets using both primary and secondary data collected from various sources. The study found that packaging materials used in traditional and modern retail outlets were completely different except in some cases. The cost per kg of packaging was highest for Pp kirana cover in traditional outlets and Plastic PNP in modern outlets. Costs incurred on packaging materials followed by labour charges for cleaning and packaging constitute the major cost components in cost of packaging. Monthly costs incurred in procurement of packaging

materials was highest for Polythene films in both type of outlets due to its high cost. Two types of purchasing patterns such as bulk and retail were followed by retailers for procuring packaging materials. Three modes of purchase namely cash, credit and cash+credit was observed in retail outlets. Cost of value addition was found to be high in modern retail outlets compared to traditional outlets. It was found to be highest in raisins in modern outlets and milk in traditional outlets and least in rice in both the outlets. Quantity procured and sold in retail outlets was found to be high in milk. Most of the retailers faced the problem of high cost of packaging materials followed by non availability of good quality packaging materials. Finally, the prime-factors influencing consumers to purchase packed products were ready / timely availability, availability of quality products, reasonable price, cleaned products, working women and convenience.

A Study on Quality Grading and Prices of Important Pulse Crops Marketing in Gulbarga District: Karnataka

RAMAKRUSHNA

2008

MAJOR ADVISOR : Dr. N. N. KARNOOL

The technological break through in Indian agriculture has brought about rapid increase in the productivity levels of crops. This has generated new problems in marketing for which adequate attention has not been paid even though it has been recognized that the solution for these problems is a requisite condition for agricultural prosperity. The quality of pulses produce brought to the market by the farmers varies considerably from lot to lot. The variation in quality is due mainly to the differences in varieties, insect and pest damages, methods and time of harvesting, and agro-climate factors. Scientific grading should be based on important test factors so that the sellers would be able to describe the quality that they are offering, and the buyers should understand what is being offered. Both primary and secondary information were collected and used in the study. Gulbarga and Yadgir pulse markets were purposively selected for the study. These two markets are the terminal markets for redgram and bengalgram

in the Gulbarga district and bulk of the pulses are produced in these two important markets. A total of 120 samples were collected at random during the peak season (December to March) from two markets. It was hypothesized that the price depends on both quality and non-quality characteristics. The quality factors analyzed in the study were colour, carbohydrates, slightly damaged grains, test weight, crude fiber, immature grains, foreign matter and acid content. The non-quality characters were type of buyer, variety, soil type and lime of harvest. Stepwise multiple regressions, indexing/ranking techniques Tabular presentation, were employed in this study. It was hypothesized that eye sight grades deviate from scientific grades quite significantly and that they do not reflect actual quality of the produce. In order to test this hypothesis, it was necessary to determine scientific grades.

Dimensions of Farm Credit in Dharwad District of Karnataka

D. KRISHNAMOORTHY

2008

MAJOR ADVISOR: Dr. N.N. KARNOOL

A study on dimensions of farm credit in Dharwad district of Karnataka was carried out during 2007-2008 to analyse the farm credit status, sources of borrowings, extent of overdues, credit gap and the problems faced in availing the farm credit by different farm categories. Both primary and secondary data were collected to evaluate the study. The techniques of tabular analysis and compound growth rate analysis were adopted. The results revealed that majority of the farmers were illiterate and had nuclear families. The commercial banks held the maximum share in distribution of crops loans in the district, which was to the extent of 47.50 per cent. More than 80 per cent of the borrowed funds were sourced from the institutional sources by the farmers in the district. The percentage of farmers who borrowed both short term and term loans were found to be more in Kalaghatgi taluka (50.00%). The overall percentage of credit borrowed from the co-operatives and commercial banks in the

total borrowed credit were found to be higher in Kalaghatgi taluka. The non institutional source of borrowings was noticed more in the case of Kalaghatgi taluka. The results showed that the overall percentage of overdues was found to be higher in the Dharwad taluka (43.74%). In all, the amount of overdues increased with increase in land holdings in the study area for short term loans. However the medium and large farmers were held up with the maximum amount of overdues. The unproductive use of loans had been the important factor seemingly responsible for overdues in the medium farmer categories. The total overall per farm percentage of credit gap in the required amount was found to be more in the case of Kalaghatgi taluka (40.97%). Majority of the farmers opined poor loan supervision (more than 50%) rigid security norms and insufficient technical guidance.

A Study on Quality Grading and Prices of Jowar and Maize in Northern Karnataka

SOMANAGOUDA I. PATIL

2008

MAJOR ADVISOR : Dr. S. B. MAHAJANASHETI

Agriculture is the mainstay of the Indian economy. Agriculture sector contributes nearly 21 per cent to the Gross Domestic Product (GDP) of India, while about 65-70 per cent of the population is dependent on agriculture for their livelihood. The recent technological advances have tremendously helped in transforming the subsistence nature of agricultural sector with the introduction of high yielding varieties, expansion of irrigation facilities, increased application of yield enhancing inputs and farm mechanization. However, the overall economic condition of a vast majority of farmers is far from being satisfactory owing to their inability to realize reasonable returns from the output they produce. However, the deficiency that has been posing problem to both producers

and consumers in the marketing process without any appreciable solution is 'lack of grading of farm produce'. Grading is the process of sorting the unlike lot of the produce into uniform classes according to certain intrinsic quality factors and physical characteristics that include moisture content, foreign matter, admixture, extent of damage, extent of immature produce, pest infestation, weevil attack, and extent of shriveled produce. Jowar and maize are the two important cereal crops of northern Karnataka, which not only are the most important staple food for a majority of people, but also are source of income. The research conducted on quality, grading and prices of jowar and maize in northern Karnataka. Belgaum and Haveri are the two top maize producers of the state, while Bijapur is

the largest producer of jowar. Further, Dharwad is also an important jowar producer. Samples were collected during the crop year 2006-07. The total sample size was 120. For each cereal crops two leading varieties were selected and 30 samples from each variety were selected. It was hypothesized that, the price depends on both quality and non-quality characteristics. The quality factors analyzed in the study were colour, carbohydrates, slightly damaged grains, test weight, crude fiber, immatured grains, foreign matter and acid content. The non-quality characters were

type of buyer, variety, soil type, time of harvest and lot size of the produce. Stepwise multiple regressions, indexing/ranking techniques Tabular presentation, were employed in this study. It was hypothesized that eye sight grades deviate from scientific grades quite significantly and that they do not reflect actual quality of the produce. In order to test this hypothesis, it was necessary to determine scientific grades. This was accomplished on the basis of scientific measurements of all quality characteristics.

TEXTILE AND APPAREL DESIGNING

A Profile of Banaras Silk Sarees

AMRITA SINGH

2008

MAJOR ADVISOR : Dr. SHAILAJA D. NAIK

The present study on 'A profile of Banaras silk sarees' was conducted during 2006-08. In total 100 weavers were personally interviewed to collect information on historical background, prevailing weaving techniques, economic viability of various silk sarees and socio-economic status of weavers dwelling in Banaras city and three villages viz. Chalapur, Lohta, and Phulpur. Some where during 990 AD the brocades were woven on throw-shuttle pit looms with *Jala* and *Naksha* attachments. By 1930s elaborate and intricate designs were produced with Jacquard technique. Earlier, Hindus were the handloom weavers and then became traders after teaching brocade weaving to migrant Muslims. Thus, majority of the weavers are Muslims where this occupation is inherited. Most of them are wage weavers having joint family system with 4-6 members and

belong to middle income group. The basic raw materials are silk and zari purchased from Bangalore, Malda, China or local dealers on credit. The variegated sarees weighed from 500g to 1500g beautified with animal, floral, geometrical, paisley, *buttas* and *butis*. The most popular sarees woven are Brocade, Chiffon Jamdani, Jamdani, Jangla, Kora cut work, Resham buti, Satin border, Satin embossed, Tanchoi and Tissue, whose cost ranged from Rs. 1700 to Rs. 3800/- depending on the intricacy. On an average 1-4 sarees were produced on each loom per month. Some of the problems faced by the weavers were power supply, hike in price, inferior quality, untimely supply and scarcity of raw material, transportation, marketing and low wages.

HUMAN DEVELOPMENT

Intelligence among Attention Deficit Hyperactivity Disorder Children of Primary School

POORNIMA

2008

MAJOR ADVISOR : Dr. V. S. YADAV

This was an ex-post-facto research study aimed to identify the intelligence among Attention Deficit Hyperactive Disorder (ADHD) children. The study was conducted on a sample of 52 children comprised of 26 ADHD and 26 the Best children of V standard from eight randomly selected Government primary kannada medium schools of Dharwad city in Karnataka State. Their age ranged from 10 to 12 years. ADHD children were identified and assessed using Diagnostic and Statistical Manual of Mental Disorder by the class teachers. Correspondingly to compare the intelligence of ADHD children with the Best children, same number of boys and girls were selected by the class teachers from the same schools and classes to which ADHD girls and boys belonged. Wechsler Intelligence Scale for Children (WISC-III) was administered individually on ADHD and Best children to assess their intelligence. The results revealed that the

prevalence of ADHD among the children was around 6 per cent and the boys and the girls ratio was 3:1. The percentage of prevalence of inattention, hyperactivity/impulsivity and ADHD among the boys was higher compared to the girls. But the boys and the girls were similar in the intensity of expression of inattention, hyperactivity/impulsivity and ADHD. The boys and the girls of ADHD and the Best children were similar in their IQ within their own group. But the Best children were significantly superior in their verbal, performance and composite IQ compared to the children of ADHD. Similarly, the ADHD children fell in very low percentiles on verbal comprehension, perceptual organization, freedom from distractibility and processing speed compared to the Best children. Only perceptual organization of intelligence was positively and significantly related to ADHD.

Parental Relations and Behavioral Problems among Early Adolescents

KRUPA C. HIREMATH

2007

MAJOR ADVISOR : Dr. V. GOANKAR

Society provides norms of behavior for different stages of development; it also provides norms of behavior for specific environments. Whose behavior is inconsistent with the expectations of normal behavior, are regarded to have behavioral problems. To make proper adjustment and also to make significant achievements in one's span of life, it is necessary to develop proper behavior patterns at school age. So the study was designed to identify parental relations and behavioral problems among early adolescents (N=216), studying in 8th, 9th and 10th standards. The sample was selected from Government, aided and unaided private schools from Dharwad city, Karnataka state. To assess the behavioral problems of adolescents, emotional problem scale (EPS) developed by Prout and Strohmea (1985) was used and parent child relationship scale (PCRS) developed by Rao (1989) was used to know the parent child relationship. To collect the background information of adolescents, socio-economic status inventory developed by AICRP-CD (2002) and Aaron *et al* (1969)

was used. The data collected was subjected to chi-square and correlation test. The results revealed that majority of the adolescents was found to have the normal behavior, but 15-20 per cent of adolescents were found to have difficult behavior. Around 7 per cent of adolescents were observed in the problematic level. Behavioral problems were found more among government school adolescents as compared to private and aided school adolescents. However the results were found to be non-significant. There was significant association between gender and behavioral problems among adolescents. Where in boys had more externalizing problems and girls showed more of internalizing problems. There was no significant association between type of the family and religion with behavioral problems of early adolescents. There was also no significant relation between size of the family, education and occupation of parents, family income, parent-child relationship and behavioral problems among early adolescents.

Nutritional Status, Level of Intelligence and Participation in Extracurricular Activities of School Children

SUVARNA

2007

MAJOR ADVISOR : Dr. SUNANDA ITAGI

The study was conducted in Dharwad taluka to assess nutritional status, socio economic status, level of intelligence and participation in extracurricular activities of rural children of third standard ranging from 7 to 10 years. A total of 260 children were randomly selected from four villages. The socio economic status of the respondents was assessed by using combination scale given by Aron *et al.* (1969), Venkataramaiah (1983) and Hauser (1994). The nutritional status was assessed by anthropometric measurements. The children were categorized according to Waterlow classification (1972). The 39 per cent of total sample (102 children) representing three category of nutritional status were selected for assessment intelligence. The level of intelligence was assessed by Stanford Binet Intelligence Scale (1960). Participation of the children in extracurricular activities was assessed using self structured interview schedule. Suitable statistical tests were applied to find out the relations

between different variables. The results highlighted that 71.92 per cent of respondents belonged to normal nutritional status. While 14.32 per cent belonged to wasted (short duration malnutrition) and 13.42 per cent were stunted (long duration malnutrition). Irrespective of age, gender and nutritional status all the children performed successfully in vocabulary component of intelligence. Whereas, only 60-87 per cent of children performed successfully in quantitative, pattern analysis and memory for sentence component of intelligence test. The maximum number of children (65%) failed in comprehension component of intelligence test and only 35 per cent of children performed the successfully. The significant correlation ($r=0.31$ and 0.25) was found between socio-economic status, nutritional status and level of intelligence of children. Thus the increase in socio-economic status and nutritional status improved the level of intelligence and participation in extracurricular activities of the children.

Emotional Intelligence and Stressors Among Working Couples

ARATI S. ANGADI

2008

MAJOR ADVISOR : Dr. V. S. YADA V

This was an ex-post-facto study to analyse emotional intelligence and stress among working couples conducted on a sample of 310 working couples of Dharwad city. The age of the respondent ranged between 24 and 69 years. The couples (respondents) were selected based on the criteria that both of them should be working for atleast 5 years, either of the couples should be a primary school teachers, who had been married for atleast 5 years and having atleast one child. Emotional intelligence questionnaire developed by Dulewicz and Higgs (2001) was used to measure emotional intelligence. Stress scale developed by Bhagwatwar (2000) was used to measure stress. The results revealed that there was no significant relationship between demographic characteristics and emotional

intelligence and stress. On the basis of overall results of emotional intelligence it can be concluded that among the couples about 11, 7 and 82 per cent of them had developed lower, average and higher level of emotional intelligence, respectively. It was also found that there was a significant relationship between the couples on stressors. There was no significant relationship between emotional intelligence and stress. Even then emotional resilience and interpersonal sensitivity were negatively related to stress among the couples. Contrarily, intuitiveness and stress were positively related. But self-awareness, conscientiousness and overall emotional intelligence were not related to stress among the couples.

FOOD SCIENCE AND NUTRITION

Nutritional Quality and Value Addition to Jack Fruit Seed Flour

SAMATA AIRANI

2007

MAJOR ADVISOR : RAMA. K. NAIK

An investigation was undertaken with the objectives to document the physical and functional properties, proximate composition, nutritional quality, shelf-life and utilization of jack seed flour in convenience food. The seeds were lye peeled, dried and milled into flour. The functional properties and proximate compositions of the seed flour were analyzed by standard AOAC methods. The nutritional quality of seed flour was assessed in terms of starch and protein digestibility. The seed flour was stored both at ambient and refrigerated conditions and the moisture content of the stored sample was assessed. The total yield of the flour was documented as 67.50 grams. The functional properties indicated that the jack seed flour had 112.00 ml/100 g of water absorption and 126.90 ml/100 g of oil absorption capacity. The proximate compositions (g%) of seed flour recorded 14.07 of moisture, 9.03 protein, 1.10 of fat, 2.25 of

crude fibre, 3.01 total mineral matter and 70.26 of carbohydrates with the calorific value 376 K.cal. The protein and starch *in vitro* digestibility of seed flour recorded 78.17 and 69.30 per cent. An increase in the moisture content was evident during the ambient and refrigerated conditions. The sensory quality of flour based biscuits decreased with increased incorporation level of seed flour. The overall acceptability of biscuits with jack seed flour below 50 was judged as very good. The 20 per cent seed flour incorporated biscuits were on par with control with respect to sensory qualities. The colour of the biscuits with respect to 'l', 'a' and 'b' values indicated that, the control biscuits were significantly whiter than the rest and biscuits upto 30 per cent seed flour replacement made negligible difference. The adolescent girls in consumer trial rated the biscuits as very good.

A Study on Documentation and Evaluation of Indigenous Method of Preparation of *Papad* with Special Reference to Cereals and Millets

SHWETHA S. KAMAT

2008

MAJOR ADVISOR : Dr. NIRMALA YENAGI

The present investigation was undertaken to document and evaluate the indigenous method of *papad* preparation '*Nere happala*' with special reference to cereals and millets. A sample size of each 100 households and retail shops were selected purposively from local Dharwad. Indigenous methods of preparation, consumption pattern and its availability in the market were collected by personal interview method. *Nere happala* refers to rice *papad*. Fermented batter of soaked rice is used for preparation of *Nere happala* by spreading the batter into thin circular disc shape in an oil smeared plate. *Nere happala* prepared from different cereals and millets soaked for different durations were evaluated for total yield, number, unit weight, diameter of raw and fried *Nere happala* and

sensory evaluation. The production and cost analysis of rice *Nere happala* was also assessed in comparison with blackgram dhal *papad*. The traditional practice of *papad* preparation was still followed at household level. Pulses, cereals, processed cereals, fruits and tubers were used for preparation of *papads*. National brands like *lijjat* and MTR and also local brands were available in the local market. Blackgram dhal *papad* was most popular. Indigenous cereal *papad viz., Nere happala* and *mudde happala* were prepared from the gelatinized mass of fermented batter without addition of food additives. Long duration of soaking of cereal and millet grains improved the physical characteristics and sensory attributes of *Nere happala*. *Nere happala* prepared from soaked grains of three days were

highly acceptable for all the sensory attributes. Seven days of soaking affected the aroma and taste of bajra, maize and jowar *nere happala*. Ragi, rice and wheat *nere happala* were highly accepted by the consumers.

Fabrication of Soya Based Health Food and It's Impact on Climacteric Symptoms of Perimenopausal Women

SHIKHA S. GOYAL

2008

MAJOR ADVISOR : Dr. USHA MALAGI

An investigation was undertaken with an objective to fabricate soya based health food and to assess it's impact on climacteric symptoms of perimenopausal women. Soya health food suitable for perimenopausal women was developed and analyzed for nutrients. Thirty perimenopausal women experiencing climacteric symptoms and having irregular periods were selected, 15 women were taken as experimental and equal number of them were age matched and considered as control. Presence of climacteric symptoms were recorded by using self structured questionnaire. The nutritional status was assessed by dietary, anthropometric and biochemical methods. All the selected perimenopausal women perceived one or the other symptoms related to collagen, bones, physiological and psychological problems. The soya based health food was fabricated by using appropriate processing techniques viz., soaking in water along with soda (0.1%) and

The returns per rupee spent on rice *nere happala* (1.55) was higher than blackgram dhal *papad* (1.36). There is a thrust to introduce such easily adoptable cost effective indigenous technology.

salt (2%), drying in shade for 24 hours and roasting on hot sand for 3 - 5 minutes and addition of spices with oil. The soya health food was evaluated for sensory qualities by trained panel of judges (n=10) and consumers (n=200). The health food contained 200mg total isoflavones, protein 43.39g, calcium 238.66mg and iron 10.52mg per 100 gram. About 40g of soya food was given to perimenopausal women for the period of 90 days, the result showed a slight reduction in lipid profile of subjects (Total cholesterol 73.33%, Triglycerides 66.66% and LDL-C in 93.33% of women). Reduction in menopausal score, vasomotor and bladder problems were seen in all women. More than 50 per cent of women showed reduction in irritability, anxiety, formication, vaginal dryness, palpitation, flatulence, headache, gastrointestinal distress and vertigo at the end of the study. Thus, the fabricated soya health food showed an improvement in individual menopausal score and lipid profile and the overall wellbeing of women.

Assessment of Nutritional Status of Diabetes and Development of Dietary Guidelines with Special Reference to Renal Complications

RAJESHWARI R. HANCHINAL

2008

MAJOR ADVISOR : Dr. RAMA K. NAIK

An investigation was undertaken in the year 2007-08 to assess the nutritional status by anthropometry, dietary by standard procedures, clinical status of diabetics and dietary guidelines were developed with special reference to renal complications. Out of a target of 120 diabetics, 90 diabetics and 30 diabetics with renal complications were selected. Type I diabetics accounts to be more than type II with renal complication, with longer duration of diabetics, better dietary modification and less consumption of micro nutrients viz., minerals and vitamins compared to the counter parts. Poor glycemic control was seen by higher per cent of diabetics with complication as evidenced by FGB and PPBG. Majority of subjects also had poor serum creatinine, serum urea levels and albumin creatinine ratio. Female diabetics with and without complication were heavier than male and per cent adequacy of fuel nutrients was high in both the diabetic groups. Based on the launched observations among the selected diabetic subjects with and without renal complications, the dietary guidelines

were developed in detail for the practical use of affected persons both in English and vernacular language (Kannada). The information about diabetes mellitus, causes occurrence, incidence, symptoms, hereditary, tendency and treatment of type I diabetes, insulin, types of insulin action, storage, side effects of insulin, preparation for travel, types of diabetes, complication of diabetes more about kidney, functions of kidney, relation between diabetes and kidney diseases, kidney diseases associated with diabetes, dialysis and kinds, exercise, foot and skin care, diet suitable for diabetes with renal complications. Leaching, selection of food, packed lunch, food exchange list, guidelines to parents and counseling tips were included. The guidelines were distributed among doctors, nutrition experts, dietitians and diabetics to ascertain the validity and usefulness of developed dietary guidelines. The guidelines were found simple, readable with adequate useful contents and illustrations.

Consumption Pattern of Green Leafy Vegetables and Impact of Nutrition Education on Haemoglobin Status of Rural Adolescent Girls

JYOTI T. SAJJAN

2008

MAJOR ADVISOR : Dr. B. KASTURIBA

A total of 300 school going adolescent girls were selected in the age group of 13-16 years from the transitional and dry zones. From each zone two villages were selected at random. Seventy five girls were selected from each village, to know the consumption pattern of green leafy vegetables and impact of nutrition education on haemoglobin status of rural adolescent girls. Assessment of nutritional status was carried out by nutritional anthropometry, dietary survey, clinical examination and haemoglobin analysis. All the respondents were lighter and shorter compared to NCHS standards and had inadequate intake of all blood forming nutrients and showed anemia symptoms. Prevalence of anemia was found to be 100 percent. Specific information on the consumption pattern of green leafy vegetables indicated that the adequacy of green leafy vegetable was less than ten percent. Sixty anemic adolescent girls were selected for the nutrition education intervention by using "Child to Child nutrition education technique" for three months. The girls were divided into two

groups viz., experimental and control of 30 each. The experimental group was further divided into two groups as communicators (n=10) and communicatees (n=20). The communicators were given three days nutrition education training by nutrition experts on the identified areas such as importance of iron, functions of iron, blood forming nutrients etc. The educational materials like charts, posters, blow-ups, messages and power point presentations were used. The communicators were asked to pass on the learnt information to communicatees group. Nutrition education intervention resulted in significant increase in the mean knowledge scores in the experimental group compared to control group. Also a significant increase in the haemoglobin level in both the experimental group was observed compared to control group. Hence, from the study it can be concluded that, nutrition education is one of the appropriate, effective and sustainable approach to combat iron deficiency anemia.

Efficacy of Sorghum Based Supplementary Sports Food on Physical Endurance of Basket-Ball Players

ASHA S. LAMBOONAVAR

2008

MAJOR ADVISOR : Dr. B. KASTURIBA

A study was conducted to assess the "efficacy of sorghum based supplementary sports food on physical endurance of basket-ball players" during 2006-07. The sports food which mainly included sorghum and soy flour, skimmed milk powder and sugar powder was given as a test food for loading and supplementation study. A total of 32 professional basket-ball players of Dharwad city were selected purposively for the study. Anthropometric measurement and biochemical parameter viz., hemoglobin

level and endurance test on tread mill was estimated at the baseline study. In loading test 50 g of sports food was given in the form of porridge one hour before tread mill test and endurance capacity was observed in terms of calorie burnt, distance covered and time of exhaustion. In supplementation study out of 32 subjects 16 were taken as experimental group and rest as control group. Experimental group was supplemented with sports food (50 g) for a period of 30 days. The anthropometric,

biochemical parameters and endurance capacity were recorded in both control and experimental group before and after supplementation study. The results revealed that the endurance capacity of all the subjects enhanced significantly in terms of calorie burnt, distance covered and

time of exhaustion after loading test compared to supplementation test. Further, supplementation had shown an improvement in anthropometric characters and hemoglobin levels in the experimental group (12.23%) when compared to control group.

FAMILY RESOURCE MANAGEMENT

Factors Influencing Stress and Coping Strategies Among the Degree College Teachers of Dharwad City, Karnataka

JAYASHREE NAYAK

2008

MAJOR ADVISER : Dr. SUSHEELA P. SAWKAR

The study on factors influencing stress and coping strategies was conducted on a random sample of 200 (100 each of male and female) degree college teachers of Dharwad city. Questionnaire for Demographic characteristic and Coping Strategies were used along with Employment Organization Sources of Stressors scale (Telaprolu and George, 2005). Frequency, percentage, t-test, correlation and step wise regression were used for analysis. The factors that caused stress always were mainly due to the interference of the employment organizational responsibilities with their family organizational role, lack of their involvement in decision making that reduced their responsibilities and the participatory model in their organizational set up which enhanced their responsibilities to the point of exhaustion. Majority of the teachers revealed that stress was basically due to their laziness and also they were happy with fewer

responsibilities. The over all results of stress level revealed that, higher percentage of teachers were in low stress category. Genderwise significant difference was observed in case of personal development stressor and inter-personal relation stressors, while it was non significant in case of work, role and organizational climate stressors. Age was the influencing factor on the total stressors which was statistically highly significant. Keeping ready well a head, taking rest, avoiding strenuous posture, taking balanced diet, walking, using sleeping pills and hot water therapy were practiced by the teachers when they were physically stressed. Offering prayer, positive thinking, working in-group, avoiding painful reminders, delegating the tasks and listening songs were practiced when they were mentally stressed. There was no significant gender difference found with respect to physical stress management where as it was significant in case of mental stress management strategies.

Purchasing Pattern, Problems and Awareness of Welfare Programmes Among Farm Families of Gadag District

YALLAWWA UPPAR

2007

MAJOR ADVISOR : Dr. P. R. SUMANGALA

A study on purchasing pattern, problems and awareness of welfare programmes among farm families of Gadag district was undertaken during 2006-07. Fifty households were selected from each category of landholdings viz., landless agricultural labourers, small, medium and big farmers formed the total number of 200 households from the villages of Gadag, Naragund and Ron taluks of Gadag district. The results revealed that maximum number of households of all the categories purchased the food and clothing from shops located near by town. More number of families from medium and big farmers owned greater number of consumer durables. Maximum number of households from all the landholdings adopted cash payment system in purchasing of food, clothing and consumer durables. Neighbours and friends were the common source of information in purchasing of food, clothing and consumer durables from all the families of different landholdings. The important factors considered by families

of different groups in purchase of food (price, quality and appearance), clothing (colour, price and design) and consumer durables (manufacturing company, standard mark and service given by the shop). Adulteration, underweight and measures and high pricing in food, low quality material, high pricing and damaged cloth in clothing, non availability of spare parts, repair and service and low quality material in consumer durables were the problems faced by the farm families. Taking receipts always was the coping up practice adopted by higher percentage of families. More than 60.00 per cent of households from all the landholding were not aware of the unethical practices followed in selling of food, clothing and consumer durables, while more than 3/4th of the known respondents were not taken any action against such unethical practices. Majority of the respondent from different landholding were not aware of consumer welfare programmes. So they felt that they need consumer education on these aspects.

HORTICULTURE

Studies on Germplasm Evaluation and Induction of Autotetraploidy in Ashwagandha (*Withania somnifera* Dunal)

A. CHINAPOLAI AH

2008

MAJOR ADVISOR : Dr. LAXMINARAYAN HEGDE

Thirty six ashwagandha collections were evaluated in a field trial under randomized block design with three replications to study the genetic variability and character association at K.R.C. College of Horticulture, Arabhavi during 2007-08. Analysis of variance revealed highly significant differences among genotypes for 10 out of 18 growth, yield and quality characters studied. Significantly higher dry root yield per hectare (8.93q) was recorded in Acc.18 which was on par with accessions 6, 7 and 15 and minimum dry root yield (3.13q) was recorded in Acc.3. Total root alkaloid content ranged from 0.13 (Acc.1) to 0.64 (Acc. KAU) per cent. Wide genetic variation was evident as the values of genotypic and phenotypic coefficient of variations recorded high for dry weight of the root per plant followed by total root alkaloid content. High heritability coupled with high genetic advance over mean was observed for dry root yield per plot indicating the predominance of additive gene

component and indicated the ample scope for improving these characters through selection. Correlation studies showed significant and positive association of dry root yield per hectare with fresh weight of root per plant and leaf breadth. Path analysis studies revealed high direct effects of dry root yield per plot on dry root yield per hectare. In other experiment, three varieties viz., Poshita, Jawahar Ashgandh (JA-20) and KRC-11 were used for induction of autotetraploidy to create variability. The seeds were treated with aqueous colchicine at 0.25, 0.50 and 0.75 per cent for 4, 6, and 12 hours durations. The suspected autotetraploids were compared for leaf stomata and pollen size. Variety Poshita and JA-20 responded positively for 4h treatment of 0.50 per cent and 0.25 per cent colchicine, respectively while, KRC-11 responded well to 0.50 per cent for 6h duration treatment. Among three varieties, Poshita was more responsive for the induction of autotetraploidy.

Heterosis and Combining ability in Three-Way Crosses Involving Potential Sour Tomato [*Solanum lycopersicum* (Mill.) Wettst.] Hybrids

A. SANTOSH DHADDE

2008

MAJOR ADVISOR : Dr. R. V. PATIL

Field investigation was undertaken during the year 2007-08 in tomato (*Solanum lycopersicum* (Mill.) Wettst.) on identification of potential three-way cross population, potential parents for use in recurrent selection programme, isolation of economic segregants among the three

way cross population and on heterosis and combining ability. The experiment with 37 entries comprising of 10 parents (5 single cross F₁s + 5 open pollinated varieties), 25 three way cross F₁ hybrids and 2 checks (1 commercial check + 1 local check) was laid out in randomized block

design with two replications during April 2007. Among the 25 three way cross population, Hy-13 and Hy-23 expressed significant positive heterosis over best parent as well as commercial check. Hy-13 yielded 280.12% more over commercial check and 165.63% over best parent. The next best, Hy-23 recorded 191.50% more yield than the average of 25 three way cross F_3 s. It is suggested to exploit line 'D' as one of the potential base parent population to initiate the cycle of recurrent selection programme for yield per plant. Another parent which can act as base population is tester 'd' as it has significant positive gca effect and moderately lower mean performance. Hy-23 had higher frequency of transgressive segregants and Hy-13 higher economic segregant per cent for yield per

plant. The other important crosses which registered higher frequency of desirable transgressive segregants were Hy-13, Hy-21, Hy-19, Hy-14 and Hy-2. Further R2-Hy13-2/11, R2-Hy-11-2/12, R2-Hy14-2/12 and R2-Hy23-2/5 were isolated as important segregants. The following parents are identified as good general combiners for various traits: tester 'd' and line 'D' for yield per plant and number of fruits per plant; tester 'f', tester 'e' tester 'a' and line 'D' for pericarp thickness; line 'B' and tester 'a' for titrable acidity; and line 'B' and tester 'd' for higher TSS. The TWC hybrid combinations with maximum significant sca effect for different traits were; Hy-13 for yield per plant and number of fruits per plant; Hy-14 for average fruit weight and Hy-22 for titratable acidity and TSS.

Genetic Variability Studies in Tomato (*Solanum lycopersicon* (Mill.) Wettst.)

SHASHIKANTH

2008

MAJOR ADVISOR : Dr. N. BASAVARAJ

A field experiment was conducted during *kharif* 2006 to study the genetic variability, correlation, path coefficient analysis and genetic diversity for quantitative and qualitative traits in tomato (*Solanum lycopersicon* (Mill.) Wettst.) with 30 genotypes including two checks in randomized block design with three replications. Considerable amount of variability was noticed for the 19 quantitative characters as indicated by the analysis of variance. Moderate to high GCV and PCV, high heritability with high genetic advance as per cent mean was observed for most of the yield attributing characters. Fruit yield per plant had highly significant positive association with number of fruits per plant and number of branches/plant, revealing that selection based on these traits would ultimately improve the fruit yield. Path coefficient analysis revealed that number of flowers/cluster and number of branches/plant had the highest positive direct effect on fruit yield at both the genotypic and phenotypic levels. Hence, thrust has to be given for these characters in future breeding

programme to improve the yield in tomato. Mahalanobis D^2 analysis revealed that the maximum diversity was observed between cluster VIII and X among 10 clusters. The maximum contribution of characters towards diversity was observed by days to 50% flowering, total soluble solids, number of fruits/cluster and fruit yield/plant. Thus, these traits may be given high emphasis while selecting the lines for hybridization. Screening for pest and diseases tolerance revealed that, the 21 genotypes were found moderately resistant and nine were susceptible to fruit borer, while 25 were moderately resistant and five genotypes *viz.*, ATL-02-39, SB-10, DVRT-2, H-36 and Pant-T-8 found resistant to bacterial wilt. For ToLCV SB-10 was found to be resistant, 23 were moderately resistant and six were moderately susceptible. From the results it can be concluded that the following genotypes *viz.*, NDTTNR-76, NDTTNR-77 and pant-T-11 were identified as potential genotypes for higher yield in tomato.

Investigation on Production Techniques in Capsicum under Protected Cultivation

UMESH MOHAN ZENDE

2008

MAJOR ADVISOR : Dr. J. C. MATHAD

An experiment was carried out to study the effect of planting geometry and number of shoots on quality and yield of capsicum cv. Orobelle under two growing environments *viz.*, naturally ventilated polyhouse and shadehouse during summer of 2007 at Hi-Tech Horticulture Unit, Department of Horticulture, UAS, Dharwad. There were three spacings *viz.*, 45 × 30 cm (4.4 plants/m²), 45 × 45 cm (2.94 plants/m²) and 45 × 60 cm (2.22 plants/m²) and three levels of number of shoots per plant *viz.*, two shoots, three shoots and four shoots. The experiment was laid out in three factor strip plot design with three replications. The results revealed that the quality parameters like fruit length (8.50 cm), fruit breadth (8.16 cm), fruit weight (147.74 g), fruit volume (268.85 cc), shelf life (8.93 days) pericarp thickness (0.72 cm), and the yield parameters like number of fruits per plant (23.44), fruit yield (6.49 kg/m²) and fruit

yield (64.91 t/ha) was significantly higher under polyhouse than shadehouse. Among the different spacings tried, the maximum spacing 45 × 60 cm recorded significantly higher fruit length (8.62 cm), fruit breadth (8.34 cm), fruit weight (150.17 g), fruit volume (276.78 cc), shelf life (9.09 days), pericarp thickness (0.72 cm), number of fruits (22.96/plant) and fruit yield (2.15 kg/plant). The maximum fruit yield (73.26 t/ha) was recorded under spacing 45 × 30 cm. With regards to the number of shoots per plant, the treatment two shoots per plant recorded significantly higher fruit length (8.56 cm), fruit breadth (8.38 cm), fruit weight (149.06 g) fruit volume (273.28 cc), pericarp thickness (0.77 cm) and shelf life (9.11 days). Whereas retaining four shoots per plant recorded significantly higher number of fruits (25.19/plant), fruit yield (2.20 kg/plant), and fruit yield (67.84 t/ha).

Effect of Growth Regulators and Environments on Rooting of Stevia Cuttings (*Stevia rebaudiana* Bertoni)

MILIND R. INGLE

2008

MAJOR ADVISOR : Dr. C. K. VENUGOPAL

The investigation on rooting of stevia (*Stevia rebaudiana*) cuttings by using different growth regulators was carried out in mist and other environmental conditions at Medicinal and Aromatic Plant Unit, Division of Horticulture, University of Agricultural Sciences, Dharwad during 2007-08. As part of the first experiment, IBA and NAA were tried under mist. The study revealed that, IBA 500 ppm was effective in induction of better rooting (92.00%) as against 78.00 per cent in the control. The next best treatments were found to be IBA 400 and 300 ppm. However, the combination treatment of IBA and NAA was not found to be as effective as IBA alone. The best three treatments were selected from first experiment and tried under different environments. Among the different

environmental conditions, rooting of stevia cutting was found to be best in the mist environment (90.00%). It was followed by shaded polytunnel condition (88.78%), shade condition (81.11%) and open condition (72.56%). The interaction effect of growth regulators and growing condition was found to be significant. The interaction effect of the cuttings treated with IBA 500 ppm and in mist environment was found to be significant as evident by maximum percentage of rooting (94.67%). The studies revealed that the stevia cuttings can be propagated with high success by treatment of cuttings with IBA 500 ppm. Among the different environmental conditions, rooting of stevia cuttings treated with IBA 500 ppm under mist gave good results.

Studies on Organic Nutrition in Cabbage (*Brassica oleracea* var. *capitata*) Production

B.N. MUNDHE

2008

MAJOR ADVISOR : MR. V.D. GASTI

The investigation on organic nutrition in cabbage (*Brassica oleracea* var. *capitata*) was carried out in vegetable science department of Kittur Rani Channamma College of Horticulture, Arabhavi during *kharif*

2007 by adopting randomized block design with five treatments replicated five times. The treatments included meeting 75 per cent (T_1) and 100 per cent (T_2) nutrients through organic sources, integration of organic and

inorganic (50:50) nutrient sources (T_3), 100 per cent nutrient (RDF) through inorganic fertilizers (T_4) and 100 per cent RDF + recommended FYM (T_5). Cabbage plants in T_3 recorded highest plant height (27.10 cm) and number of outer and inner leaves (20.29 and 35.90, respectively) at 60 days after transplanting and at final harvest stage, respectively. Significantly higher dry matter (67.62 g/head) recorded in T_3 followed by T_2 . The T_4 plants took early head initiation (28.60 days) and early head maturity (60.02 days). The highest yield (34.78 t/ha) was recorded in T_3 , followed by T_2 (33.66 t/ha) and T_5 (30.08 t/ha). The higher core length and core weight (10.63 cm and 90.40g, respectively) and head diameter (15.61 cm) was recorded in T_3 followed by T_2 (10.33 cm, 89.20g and 15.31 cm, respectively). The cabbage head borer, number of DBM larvae and black rot incidence was least (2.58%, 3.58% and 3.95%, respectively) in the treatment T_3 . Among the organic sources, the incidence of head

borer and number of DBM larvae was least (5.31% and 6.31%, respectively) in the treatment T_2 , whereas black rot incidence was least (5.06%) in the treatment T_3 . The cabbage head leaves in T_2 recorded highest TSS (6.26° Brix), total sugar (0.919 g/100 g), chlorophyll content (1.88 mg/g) and ascorbic acid (42.94 mg/100g). The staying capacity (12.01 days), keeping quality (9.65 days) and compactness of head (38.85) were recorded in T_3 treatment. After the cropping season of cabbage, the soil from T_2 plots recorded the least bulk density (1.14 mg/m³), pH (7.28) with maximum water holding capacity (51.25%). Available N and P content of soil were higher in T_3 treatment, while K content was higher in T_1 treatment. The population of bacteria, fungi, actinomycetes and soil dehydrogenase activity is high in T_2 soil samples. The highest net income (Rs.1, 51,304 /ha) and cost benefit ratio (1:6.69) were obtained in T_3 followed by T_2 model of nutrient management.

Influence of Planting Methods and Nutrient Levels on Dry Chilli (*Capsicum annum L.*) Production under Irrigation

BHARAMAPPA P. NEGINAHAL

2008

MAJOR ADVISOR : Dr. REVANAPPA

Field experiment was undertaken to study the performance of dry chilli (var. Byadagi kaddi) to different planting methods and nutrient levels under irrigated condition at Agricultural College Farm, Bheemaranagudi during *rabi* 2007. Experiment was laid out in split-plot design with planting methods as main plot and nutrient levels as sub plot in three replications. Among different planting methods, transplanting two seedlings per hill recorded significantly higher dry fruit yield (17.96 q ha⁻¹) followed by drill sowing @ 5.0 and 7.5 kg seed rate ha⁻¹ (17.35 and 17.02 q ha⁻¹, respectively) and both were on par. The total dry matter production (111.79 g plant⁻¹), leaf area plant⁻¹ (1233.05 cm²), 100 dry fruit weight (75.82 g) and dry fruit weight plant⁻¹ (99.28 g) were higher and lowest leaf curl index (0.06) was recorded with transplanting one seedling per hill. Dry fruit yield increased significantly with increase in

the levels of nutrients from 150: 75: 75 to 300: 150: 150 kg NPK ha⁻¹ (15.42 to 16.18 q ha⁻¹). Similarly, nutrient uptake, total dry matter production, leaf area index, fruit length and girth and dry fruit weight plant⁻¹ increased with increase in nutrient levels. In all the planting methods, dry fruit weight plant⁻¹ increased significantly with increase in nutrient levels. Transplanting one seedling per hill recorded significantly higher dry fruit weight plant⁻¹ as compared to other planting methods at all the levels of nutrients (82.88, 97.92 and 117.03 g) followed by two seedlings per hill at same levels of nutrients. Drill sowing @ 5.0 kg seed rate per hectare along with application of 150: 75: 75 kg NPK ha⁻¹ recorded higher net returns (46,688 Rs. ha⁻¹) compared to other treatment combinations.

Studies on Microrrhizome Production in Turmeric

PRAMILA S. CHOUGULE

2008

MAJOR ADVISOR : Dr. RAMAKRISHNA V. HEGDE

The study was carried out to standardize protocol for rapid multiplication of shoot in turmeric *in vitro* condition and media and growing conditions for production of microrrhizomes under four experiments at Tissue Culture Laboratory, Department of Horticulture, College of Agriculture, Dharwad during 2006-08. Turmeric *Curcuma longa* L. cv. Salem was taken for the study. Sprouts were collected and washed in water containing Tween-20. These explants were surface sterilized with 0.1 per cent (W/V) HgCl₂ solution for 15 min followed by washing with sterile distilled water 6 times under aseptic conditions. Inoculation was carried out and inoculated explants and cultures were transferred to new medium after 25-30 days. Individual multiple shoots were transferred to microrrhizome induction media. Results revealed that MS media supplemented with BAP 4 mg/litre + NAA 0.1 mg/litre recorded more shoot length and higher number of leaves, indicating its superiority over other treatments in the study of influence of growth regulators on shoot

multiplication. Media having various concentration of BAP and NAA have been evaluated for induction of microrrhizome. BAP 2mg/litre + NAA 0.1 per cent mg/litre produced highest number of shoots producing microrrhizomes whereas early initiation of microrrhizomes was observed in MS with BAP 1mg/litre + NAA 0.2 mg/litre. BAP 1mg/litre alone resulted in highest number of microrrhizomes, weight of microrrhizomes and number of nodes per microrrhizome. Full strength of medium with 60g sucrose per litre followed by 90 g sucrose per litre showed positive influence on the initiation of microrrhizomes and highest number of shoots producing microrrhizomes. The effect of photoperiod on microrrhizome formation indicated complete dark condition gave earliest microrrhizome induction among the different photoperiod condition (4h, 8h, 16h). Number of shoots producing microrrhizome and number of microrrhizomes per shoot were highest in dark condition and liquid as well as semisolid medium.

Phenotypic and Molecular Characterization of Okra (*Abelmoschus esculentus* (L.) Moench) Genotypes through RAPD

V. RAMANJINAPPA

2008

MAJOR ADVISOR : M.G. PATIL

The study was undertaken to elicit the extent of genetic variability for yield and yield contributing characters, character association, direct and indirect contribution of yield and genetic diversity using RAPD markers. Seventeen genotypes were planted in randomized block design during *kharif* 2007 on black loamy soil at Department of Horticulture, College of Agriculture, Raichur. Seventeen genotypes showed significant differences for all the characters studied. The genetic variability study indicated wide range of variation for all the characters studied. The higher values of PCV and GCV have been obtained for plant height and number of branches per plant. Higher magnitude of PCV and GCV for these characters indicates the presence of high degree of variability and better scope for improvement. High heritability along with high genetic advance over mean (GAM) were observed for plant height, number of branches per plant, number of nodes per plant, internodal length, number

of fruits per plant, number of seeds per fruit, harvest index and total yield per plant. The simple correlation studies showed that positive and significant association of plant height, number of nodes per plant, number of fruits per plant and harvest index with total yield per plant indicating that direct selection for these characters will improve the yield per plant. Path analysis showed that number of fruits per plant, number of nodes per plant and harvest index had high direct effect on yield. Although plant height exhibited positive correlation with yield, but the path coefficient analysis revealed negative direct effect on yield, it is because of its indirect effect through other characters. The RAPD as molecular marker for estimation of genetic diversity in okra, the dendrogram clearly indicated that there are two major clusters and two sub clusters within a major cluster. Among all the genotypes Arka Abhay showed wide genetic divergence.

Studies on Integrated Nutrient Management in China Aster (*Callistephus chinensis* Nees, L.) Cv. Kamini

S. S. SUSHMA

2008

MAJOR ADVISOR : Dr. ASHOK HUGAR

A field experiment was conducted at new orchard, Regional Agricultural Research Station, Raichur during *kharif* season of 2007-08 to study the influence of integrated nutrient management on growth, flower and seed yield of china aster Cv Kamini. The experiment consisted of sixteen treatments laid out in randomized block design with three replications. Results revealed that the higher flower yield (11.56 t ha^{-1}) and seed yield ($571.00 \text{ kg ha}^{-1}$) were recorded in the treatment RDF + vermicompost @ 6 t ha^{-1} + Azospirillum @ 500 g ha^{-1} + PSB @ 500 g ha^{-1} (T_{12}). After this treatment, the treatments RDF + FYM @ 20 t ha^{-1} + Azospirillum @ 500 g ha^{-1} + PSB @ 500 g ha^{-1} (T_4) and RDF + Vermicompost @ 6 t ha^{-1} + PSB @ 500 g ha^{-1} (T_{11}) were also produced higher flower and seed yield per hectare when compared to the control.

The increase in the flower yield and seed yield in these treatments was associated with the increase in the growth parameters like plant height, number of branches per plant, number of leaves per plant, leaf area per plant and total dry weight and yield parameters like diameter of flower, weight of 10 flowers and number of flowers per plant. The economic analysis indicated the superiority of these treatments which recorded higher net returns (Rs. 84,370 ha^{-1} , Rs. 83,600 ha^{-1} and Rs. 63,430 ha^{-1} in T_{12} , T_4 and T_{11} , respectively) and B:C ratio (3.5, 4.5 and 2.9 in T_{12} , T_4 and T_{11} , respectively) as compared to other treatments. The more shelf life of flowers was recorded in the same treatments (6.67, 6.18 and 6.18 in T_{12} , T_4 and T_{11} , respectively). Seed quality parameters were also found better in the same treatments.

Clonal Variability Studies in Alphonso Mango (*Mangifera indica* L.) By Phenotypic Characters and Molecular Markers

MAKARAND DHONDU MANCHEKAR

2008

MAJOR ADVISOR : Dr. A. N. MOKASHI

The present investigation on "Clonal variability studies in Alphonso mango (*Mangifera indica* L.) by phenotypic characters and molecular markers" was conducted at the Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad during the year 2006-2008. The investigation comprised of two experiments. The first experiment was conducted to assess the genetic divergence among nine Alphonso clones of mango, collected from different pickets of both Maharashtra and Karnataka states in India, using Mahalanobis D^2 statistic over physico-chemical parameters of fruits. Analysis of variance revealed significant differences among the clones for all characters except stone thickness. The clones were grouped into two clusters. Cluster I, which consist of the clones DPL-I, RTN-I, DEV-I, VEN-I, DWR-I, DWR-II, DWR-III and BGM-II had the highest length of fruit, stone thickness, per cent of pulp, pulp to stone ratio, pulp to peel ratio and shelf life.

Cluster-II, comprising the clone BGM-I recorded significantly highest total fruit weight, diameter of fruit, weight of peel, weight of stone and weight of pulp. Regarding quality parameters, the highest values were observed for total soluble solids, ascorbic acid and total sugar in cluster-I. Similarly in cluster-II, highest values were recorded in titrable acidity and reducing sugar. No relationship between geographical origin and genetic diversity was established. In the second experiment nine Alphonso mango clones were examined using Random Amplified Polymorphic DNA (RAPD) markers with decamer primers of arbitrary sequence. Seven of the eight primers screened were informative and 36 amplified DNA bands were selected as RAPD markers. Clusters analyzed based on seven RAPD markers produced a dendrogram of the genetic relatedness among the nine Alphonso clones. The clones *viz.*, DEV-I, RTN-I, VEN-I, DPL-I, DWR-I, DWR-II and DWR-III were most similar and formed into one cluster, whereas BGM-I and BGM-II formed another.

Minimal Processing and Packaging Studies in Potato

MAHENDRA V. SURYAWANSHI

2008

MAJOR ADVISOR : Dr. K. RAMACHANDRA NAIK

Potato is the wholesome food and can be used for preparing various food products, like chips, cubes, flour, slices, French fries, granules, powder *etc.* But in country like India having tropical climatic conditions the packaging and storage of above processed products for longer period is posing a big problem. An investigation was carried out see the effect of different anti-browning chemicals (citric acid, KMS, NaCl) and packaging of minimally processed potato products *viz.*, slices and cubes by using 100, 160, 200, 300 gauge poly packs and aluminium foil on post harvest qualities of minimally processed products. Results indicated that potato slices and cubes pre-treated with Citric Acid 0.5% + KMS 0.2% and packed in 300 gauge polyethylene bag maintained significantly higher TSS,

ascorbic acid, acidity, starch and lower levels of reducing and total sugar and had longer storability, excellent sensory qualities till the end of storage period. The scores regarding the organoleptic parameters like colour, aroma, texture and overall acceptability of products were found to be excellent in the above treatment followed by potato products treated with citric acid (0.5%) + KMS (0.2%) + NaCl (2%) and packed in 300 gauge polyethylene bags. Further significant difference was recorded with the interaction effect of anti-browning chemicals and packaging at the end of ambient storage. However the products without any treatment (control) and the sample packed in lower gauge polypacks lost their acceptability thereby received least organoleptic scorings at the end of ambient storage.

Evaluation of Capsicum Hybrids under Different Protected Structures

KURUBETTA YELLAVVA

2008

MAJOR ADVISOR : Dr. A. A. PATIL

An experiment was carried out to study the performance of capsicum hybrids *viz.*, Orobelle, Bomby and Indra under different protected structures like naturally ventilated polyhouse, naturally ventilated shadow hall, shadehouse with misting and shadehouse without misting during summer of 2007 at Hi-Tech Horticulture Unit, Department of horticulture, UAS, Dharwad. The spacing followed was $45 \times 60 \text{ cm}$ (2.22 plants/ m^2). The experiment was laid out in three factor strip plot design with three replications comprising of a total twelve treatments. The results revealed that the quality parameters like fruit weight (160.00g), fruit volume (320.00 cc), rind thickness (0.91 cm) and shelf life (8.62 days) and yield parameters like number of fruits per plant (11.66), fruit yield per plant (3.62 kg), total fruit yield (72.52 t/ha) was significantly higher under naturally ventilated polyhouse than all other structures while naturally

ventilated shadow hall recorded the least. Among the different hybrids Bomby recorded significantly higher fruit weight (158.50g), fruit volume (310.00 cc) and shelf life (8.60 days) and there was non significant difference among the hybrids with respect to rind thickness. The maximum fruit yield per plant (2.63 kg) and fruit yield per hectare (58.49 t) was recorded by Indra. With respect to the interactions, the highest fruit weight (173.00 g/fruit), fruit volume (346.00 cc/fruit) were recorded by Bomby grown under naturally ventilated polyhouse (S_1H_2). There was non significant difference with respect to rind thickness and higher shelf life (9.01 days) was recorded by Indra grown under naturally ventilated polyhouse (S_1H_3). The maximum fruit yield (3.43 kg/plant) and fruit yield per hectare (76.22 t) were recorded by Indra grown under naturally ventilated polyhouse (S_1H_3).

Vegetative Propagation Studies in Woodapple (*Feronia limonia* L.)

RAGHAVENDRA V. NAIK

2008

MAJOR ADVISOR : Dr. S. G. ANGADI

A study on vegetative propagation studies in woodapple was conducted in the Department of Horticulture, UAS, Dharwad during 2007-08. The experiment results revealed that multiplication of woodapple plants by softwood grafting using different age rootstock under poly misthouse condition was found to be better than open condition. Early sprouting (23.8 days) was noticed when ten months old rootstocks (A_6) were used where as, highest (97.1) per cent success and maximum (96.2) survival percentage has noticed on eight months old rootstock (A_4). Maximum number of leaves (13.7) and leaf area (7.3 cm²) were recorded in nine months old rootstock (A_3), highest (27.6 cm) graft height and number of sprouts (5.6) were recorded in eight months old rootstock (A_4) after graft success. Multiplication of woodapple plants by budding budding in different aged rootstocks were used under poly misthouse condition proved to be better results than open condition. In nine months old

rootstock (A_3) minimum (23.4) number of days were required for sprout initiation, where as, eight months old rootstocks (A_4) has produced highest (92.8%) per cent success and maximum (90.0%) survival percentage after bud take. Maximum number of leaves (3.4), leaf area (5.9 cm²) and sprout length (2.7 cm) were recorded in eight months old rootstocks (A_4) after bud take. The interaction effects of age of root stock and growing condition were significant, the interaction effect consisting of ten months old rootstock in poly misthouse condition proved to be best as lowest number of days taken (19.4) were observed, where as, eight months old rootstocks (A_3C_2) has produced highest (97.1 and 96.2) per cent success and survival percentage respectively. In relation to budding, nine months old rootstock (A_3C_2) has taken minimum (20.6) number of days for sprouting, where as, eight months old rootstock (A_4C_2) has produced highest (99.3 and 93.3) per cent success and survival percentage respectively.

Heterosis and Combining Ability for Resistance Against Tospovirus in Tomato (*Solanum lycopersicum* Mill.)Wettsd''

K. H. Y ASHAVANTAKUMAR

2008

MAJOR ADVISOR : Dr. SATISH S. P ATIL

The investigation was conducted to asses the genetic diversity, magnitude of heterosis and combining ability for Tospovirus resistance, yield and related traits of tomato during 2007-08 at Vegetable Block, Department of Horticulture, UAS, Dharwad. The experimental material consisted of 70 genotypes for genetic divergence study. Twelve parents and thirty six F1 hybrids were produced in a line x tester mating design for heterosis and combining ability studies. Germplasm showed sufficient diversity for eleven characters as seven clusters were obtained. Genotypes of cluster - VI showed least per cent TSWV symptom severity and maximum fruit yield per plant and number of fruits per plant. Hybrids showed significant differences for all the twelve characters. Significant *per se* performance and economic heterosis in desirable direction was recorded in several crosses. The crosses S-05 x BFL, S-61 x Arka Alok, S-

61 x BFL and S-05 x DMT-1 were expressed significant heterosis over commercial checks (Lakshmi and NS-585) for economic characters like yield per plant and least symptom severity of TSWV. When the analysis of variance for combining ability with respect to yield was looked into, it revealed that line x tester contribution was higher than that of lines and testers contribution individually. Here sca variance was greater than gea indicating the predominance of non - additive gene action. S-61X BFL, S-05 x DMT and S-05 x BFL had significant negative sca effects for TSWV symptom severity. Thus the foregoing discussion reveals that heterosis breeding for development of tomato through exploitation of non - additive gene action is the most practicable approach for developing tomato cultivar for summer season.

Stability Studies in Processing Tomato (*Solanum lycopersicum* L.) Genotypes

H. K. JOTHI

2008

MAJOR ADVISOR : M.G. PATIL

The experimental material consisted of ten genotypes along with two checks of processing tomato were evaluated in Randomized Block Design (RBD) with three replications to study the stability of genotypes under three diverse environments. The environments include three seasons viz., *kharif* (2007), *rabi* (2007-08) and summer (2008) and were analyzed by Eberhart and Russell's model (1966) to identify the most stable varieties. The interaction between genotype x environment was found significant for the characters viz., plant height, number of branches per plant, fruit set per cluster, concentrated fruit ripening, number of fruits per plant, yield per plant, total acidity and lycopene. Genotypes PTR-1, PTR-4, PTR-6 and Arka Ashish could be considered as the most stable genotypes for yield. Further these were found well adaptable to all the three environments as they exhibited regression coefficient (bi)

value nearer to unity, mean yield higher than population mean and has non significant deviation from regression. PTR-8 and PTR-10 had regression co-efficient (bi) value nearer to unity with non significant deviation from regression and had mean yield value below population mean, thus indicating average stability and poor adoption to all the three environments. Where as, genotype PTR-7 exhibited mean yield as same as population mean with regression coefficient value (bi) more than unity and thus is an average stable genotype. All the genotypes were found stable for total acidity except PTR-7. Where as PTR-1, 4, 5, 6, 9, 10 and Arka Ashish for lycopene. Co-efficient of variation was calculated as one of the stability measure for number of flowers per cluster, number of locules per fruit, pericarp thickness, TSS, pH and per cent juice recovery where genotype x environment interaction is non significant.

Processing and Value Addition to Sapota Fruits

TIAKUM KICHU

2008

MAJOR ADVISOR : DR. A.K. ROKHADE

An investigation on processing of sapota fruits was carried out at the Department of Post harvest Technology, KRC College of Horticulture, Arabhavi during 2007-2008. Sapota juice can be preserved by addition of 0.25 per cent sorbic acid after pasteurization at 65°C for 10 minutes at refrigerated condition for 4months. Sapota juice can be successfully preserved in the form of a beverage having high TSS of 40°Brix + 0.10 per cent citric acid or 55°Brix + 0.15 per cent citric acid after pasteurization at 65°C for 10 minutes or with a TSS of 55°Brix + 0.15 per cent citric acid + 0.25 per cent sorbic acid without pasteurization. Good quality dehydrated sapota slices were obtained after steeping in 70°Brix sugar syrup containing 1.0 per cent citric acid and 0.2 per cent potassium metabisulphite for 12 hours. The maximum scores (out of 5.0) for colour and appearance (4.70), texture (4.45), taste and flavour (4.60) and overall acceptability (4.60)

were recorded in this treatment. Good quality sapota candy can be prepared by steeping the slices in 60°B sugar syrup containing 1.5 per cent citric acid maintained initially at boiling temperature followed by gradually raising the syrup strength to 70°8. The highest scores (out of 5.0) for colour and appearance (4.20), texture (4.67), taste and flavour (4.37) and overall acceptability (4.50) were recorded in this treatment. The candies can be stored well upto six months. Good quality jam can be prepared from sapota fruits with the recipe having 1 kg fresh pulp + 0.75 kg sugar + 3 g citric acid + 150 ml water. However, even a better quality jam can be prepared using sapota pomace, a byproduct obtained after extraction of juice from pulp, with a recipe having 1 kg fresh pomace + 1.0 kg sugar + 3 g citric acid + 1000 ml water.

Variability and Correlation Studies in Segregating Populations of Cucumber (*Cucumis sativus* L.)

K.H. ARUN KUMAR

2008

MAJOR ADVISOR : M.G. PATIL

The study was undertaken to elicit information on genetic variability, correlation and path analysis. The experiment was carried out at the Horticulture farm of Agriculture College, Bheemaranagudi. Four parents' viz., 1) BGD L 2) White Long 3) Hot Season 4) Hyderabad Cucumber, three F_2 's (1x2, 1x3 and 1x4) and commercial check were used for the study. The F_2 populations consisted of 600 plants from each crosses and 30 plants each in the parents and check were observed for 15 characters. The genetic variability study indicated wide range of variation for all the character studied. The higher values of PCV and GCV have been obtained for total number of fruits per vine, number of misshaped fruits per vine, number of good fruits per vine and number of branches per vine.

Higher magnitude of PCV and GCV for these characters indicates the presence of high degree of variability and better scope for improvement. High heritability with high GAM was recorded for number of branches per vine, number of good fruits per vine, total fruit yield per vine, vine length and number of nodes per vine in F_2 of BGD L x Hot Season and BGD L x Hyderabad Cucumber. Selection may be practiced in these two crosses to isolate high yielding. Total number of fruits per vine and average fruit weight had very high degree of positive association with yield. Path analysis also showed that these two characters had high direct effect on yield. Selection based on these two characters in the present material may result in greater improvement in yield.

EXTENSION AND COMMUNICATION MANAGEMENT**Coverage of Home Science Information in Popular Dailies**

PRIYANKA A. KAUSADIKAR

2008

MAJOR ADVISOR : Mrs. UMA S. HIREMATH

A study on "Coverage of home science information in popular dailies" was undertaken in the year 2007-08 in Parbhani district of Maharashtra state which consisted of two parts viz., content analysis of newspapers and survey research. In content analysis, total 1999 home science articles published in selected two national English (Times of India and Indian Express) and two regional Marathi dailies (Sakal and Lokmat) were taken. For survey research, 120 women including non-working (60) and working (60) reading selected dailies were considered. The data was collected with the help of pre-tested structured interview schedule. Out of total 1999 home science articles from all four newspapers, maximum articles belonged to human development (33.12%) followed by food science and nutrition (25.26%) and home science extension education (16.61%). Among sub areas cookery, paediatrics and child related concerns, consumerism, choice of clothing, eco-friendly measures and public health

concerns were covered most often. Majority of them published in the form of feature articles (34.31%) followed by news items (29.01%) and recipes (11.00%). Around half of them appeared in seventh and later pages and were having headline width less than two columns. Majority of the women readers were middle aged, graduate, married, living in small and joint families, belonging to medium annual income category and having high mass media participation. There was no significant difference between reading habit of non-working and working women. Majority of the women readers opined that the home science information published was readable, adequate, clear and timely. Diet and nutrition, family resource management and welfare programmes were the most preferred topics. Important suggestions were publication of home science information on special supplement, detailed information on particular topic, use of local and familiar language and more illustrations.

FORESTRY**Studies on Powdery Mildew of *Acacia auriculiformis* A. Cunn. under Nursery Conditions**

IMKONGSUNEP LONGCHAR

2008

MAJOR ADVISOR : Dr. S. T. NAIK

Acacia auriculiformis is one of the fast growing multipurpose tree species. Among various biotic factors powdery mildew caused by *Oidium sp.* is important causing major problem during nursery stage. Therefore, this disease has been studied in detail with different objectives aiming at the control of this disease. Survey conducted for powdery mildew of *A. auriculiformis* indicated that Kansur nursery under bio-climatic Zone VI and Oralagi nursery of Zone IV recorded highest disease incidence (100% each). Highest PDI was noticed in Kengre nursery of Zone I (59.44%) and lowest was recorded in Siddanakoppa (45.5%) of Zone IV. Powdery mildew affected 47.5%, 38.46% and 27.34% of height, collar diameter and phyllodes, respectively. Epidemiology studies revealed that maximum PDI was observed at 23rd standard week (51.13%). Rate of disease development was highest at 60 days (0.0314) and lowest at 90 days (0.0049) when the period coincided with heavy rain. Maximum area covered with disease was at 90 days -(49.91) when PDI was also highest

(51.13%) while minimum was recorded at 30 days (28.25) when PDI was the lowest (21.01 %). Cross inoculation studies indicated that after 8th day of inoculation symptoms appeared in both the species (*Acacia auriculiformis* and *Acacia mangium*). In the biochemical studies, phytoalexin diffusate showed 42.22% inhibition over control indicating the presence of antimicrobial compounds in the diffusate. PAL activity was found to be higher in the healthy source with mean absorbance value of 1.077. In vitro studies on fungicides and natural products indicated that Wettable sulphur @ 0.3% (82.87%) and Calixin @ 0.1 % (78.90%) were superior in spore inhibition, while Nimbecidine @ 0.2% showed moderate inhibition (62.50%). Under nursery conditions, treatment with Wettable sulphur @ 0.3% and Calixin @ 0.1% showed less PDI, rate of disease development, defoliation per cent and made positive influence on growth parameters and biomass of seedlings.

Characterization of Energy Utilization Pattern in Different Family Sizes in Uttara Kannada District

MAAJI BEERAPPA

2008

MAJOR ADVISOR : Dr. A. G. KOPPAD

India has a total forest area of about 76.29 million hectares, which forms about 23.80 per cent of the total geographical area. The total availability of fuel wood is 50 million tonnes against 125 million tonnes of actual requirements. Energy is the vital component, which plays a pivotal role in the development of society. The grouping or characterizing the available energy sources is necessary. Hence, the present study was conducted in three ecological regions (Plain, Ghat and Coastal) of Uttara Kannada district to assess energy usage from different sources by landless and different sized families. The study indicated that the landless families stood predominant users of forest biomass as they met their 100

per cent energy requirements through fuelwood only. Whereas, large sized families were using fuelwood to meet only 25 to 50 per cent their energy need and remaining requirement was met through biogas (50 to 75%) in all the regions. Where as, the medium sized families were met their energy requirement to the extent of 25 to 50 per cent through fuelwood in ghat and coastal region and 50 to 75 per cent in plain region. Most commonly used tree species for fuelwood in all the regions are *Terminalia alata*, *Xylia xylocarpa*, *Syzgium cumini*, *Mangifera indica*, *Adina cardifolia* and *Diospyros melenoxylon*. The source of fuelwood is only forests in all the regions and to some extent bettalands is also being used in ghat region.

The fuelwood species used from the forests near village is higher as compared to away from village as indicated by Shannon's Diversity Index. The biogas, LPG (Liquid Petroleum Gas) and solar heater are the alternative sources of energy in all the three regions. On an average the

energy met through biogas in small, medium and large sized families in all regions are 50, 56 and 71 per cent respectively. The energy met through LPG and solar energy is negligible in all the regions. The usage of alternate energy sources is plays a key role in retaining the forest resources.

Assessment of Floristic Structure and Composition of Kan Forests in Sirsi Division

K. M. CHANDRASHEKARA REDDY

2007

MAJOR ADVISOR : Dr. K. V. DEVAR

Kan forests are the complex landscapes in Sirsi Division represented by patches of evergreen and semi-evergreen vegetation and oldest forms of conserving forests which are known to harbour huge diversity of plant resources. The study area composed of 171 plant species distributed over 53 families. The flora was dominated by Anacardiaceae, Moraceae, Rutaceae and Rubiaceae members. Among various sized *Kan* forests across rainfall ranges, small *Kans* of low and medium *Kans* of moderate rainfall ranges were found to be richest in total tree species composition with 52 species each where as medium (12 sp.) and large (11 sp.) *Kans* of high rainfall range showed higher Rare, Endangered and Threatened (RET) medicinal tree species composition. The species diversity was highest in large (3.60) and small (3.47) *Kans* of low rainfall range indicating variation in ecological factors at local level. In case of RET medicinal tree species, diversity was higher in medium *Kans* of high and small *Kans* of low rainfall range (1.89). Among rainfall situations, *Kans* of low rainfall range showed highest tree species composition (87)

and diversity (3.89) where as high rainfall range showed higher RET medicinal species composition (17) and diversity (2.22). The density and basal area of species was highest in large (1097 trees/ha) and medium (98.10 m²/ha) *Kans* of high rainfall range across size class of *Kan* forests where as high rainfall range recorded highest (873 trees/ha & 57.82 m²/ha respectively) among rainfall ranges. *Hopea ponga* (203 trees/ha) and *Knema attenuata* (136.7 trees/ha) were recorded highest density in the study area. Totally, 17 RET medicinal tree species were recorded from entire study area of which *Dysoxylum malabaricum* and *Humboldtia vahliana* are under Endangered (Global) status had low population size and poor regeneration. Out of located 125 *Kan* forests, 41 were found to be large in size (>100 ha), 57 were medium (10-100 ha) and 27 were small (<10 ha) *Kan* forests and among these, 43 *Kan* forests were heavily disturbed. Among the various sizes of *Kans*, in small and medium *Kans*, the species composition and diversity was increased with size of the *Kan* forests and this may have important implications for attaching conservation values to the *Kan* forests.

Standardization of Nursery Techniques in *Terminalia chebula* Retz: an Important Medicinal Tree

S. L. LOKESH

2007

MAJOR ADVISOR : Dr. S. K. PATIL

Terminalia chebula Retz., is one of the medicinal tree which belongs to the family Combretaceae. It is commonly called as gall nut and its trade name is 'Chebulic myrobalans'. In this tree, fruits are economically important part having medicinal properties and tannin content of commercial importance. The fruit is used as a astringent and laxative, for local external application against chronic ulcers. Being a constituent of "Triphala" which is used as purgative and antihelmithic. In view of standardizing the nursery techniques the nursery techniques of this commercially important species a study on seed germination by pre-sowing treatments, effect of soil media and organic manures on seedling growth and vegetative propagation was carried out at College of Forestry, Sirsi during 2006-07. Out of different pre-sowing treatments tried, seeds treated with cow dung treatment for 30 days recorded maximum

germination per cent (63.33) and also with respect to mean daily germination, peak value, germination value and germination rate. The growth of *Terminalia chebula* was found better in the soil media constituting red soil, sand, FYM and vermicompost in 2:1:0.5:0.5 proportion and 20 g of poultry or fish manure. The poultry manure application increased the seedling growth attributes viz., seedling height, collar diameter and number of leaves by 73.5, 29.9 and 68.04 per cent, respectively. The poultry manure added treatments also showed the highest fresh weight (116.22 g) and dry weight (46.43 g) of seedlings. Out of two different vegetative propagation methods tried viz., cuttings and grafting, only grafting was found to be successful. Among four different grafting techniques tried, epicotyl grafting showed significantly higher survival per cent (66.67) compared to cleft, whip and whip and tongue grafting.

Survey, Characterization and Management of Diseases of *Jatropha curcas* L.

TIPPESHI L. CHAVHAN

2007

MAJOR ADVISOR : Dr. V. SURYNARAYANA

Survey for diseases in different plantations and hedge rows falling under Northern-dry zone and Northern-transition zone of Karnataka revealed the occurrence of leaf spot, root rot, stem canker, damping-off, mosaic and different leaf blights on *Jatropha curcas*. In Karnataka, *Pestalotiopsis* leaf blight on *Jatropha curcas* was highest in plantation of Hunumanmatti of Haveri district under Northern transitional zone with Disease Incidence (DI) and Disease Severity Index (DSI) of 97.85% and 1.98 respectively. Highest DI and DSI of *Cylindrocladium* white mold (55.92% and 0.98) was reorded in Hunumanmatti of Haveri district and lowest was in Prabhunagar of Dharwad district (41.14% and 0.67) respectively. Disease calendar of *J. curcas* conducted at fortnight interval in Hunumanmatti plantation from July, 2006 to June, 2007 revealed occurrence of six diseases. The pathogens causing different blights on *Jatropha* characterized were *Verticillium dahliae*, *Colletotrichum capsici*, *Colletotrichum gleosporoides* and *Pestalotiopsis versicolor*. The pathogen characterized for white mold was *Cylindrocladium jatrophae*

and it accounts to the list of new recorded from India. Under *in vitro* assays of fungitoxicants, 500 and 1000ppm of Mancozeb, Propiconazole, Penconazole and Tridemorph among fungicides tested resulted cent per cent mycelial growth inhibition of both *C. jatrophae* and *P. versicolor*. Like wise fresh leaf extract of *Lantana camara* (10%) among plant extracts and *Trichoderma harzianum* (1x10⁶ cfu/ml) among bio-agents tested were best in inhibiting the growth of both. Under *in vivo* management of *Cylindrocladium* white mold with Mancozeb, Tridemorph, Carbendazim, *Trichoderma harzianum*, *Bacillus subtilis* and *Lantana camara* fresh leaf extract are tried. Among these Mancozeb (0.1%) proved as the best by showing very low Disease Severity Index followed by *Trichoderma harzianum* (1x10⁶ cfu/ml) at 90 days of second spray. The rate of disease development (r) was lowest in Mancozeb (0.1%) and *Bacillus subtilis* (1x10⁶ cfu/ml) (0.0001) followed by *Trichoderma harzianum* and *Lantana camara* fresh leaf extract (0.0002), where as in Control recorded hoghest (0.0006).

Effect of Management of Bund Planted *Acacia auriculiformis* A .Cunn. on Growth and Yield of Black Gram (*Phseolus mungo*. Roxb)

MRITYUNJAYA B. PATIL

2007

MAJOR ADVISOR : DR .K.S. CHANNABASAPPA

Black gram can be considered as contingent crop for cotton, if cotton fails because of vagaries of monsoon in hill zone (9) of Karnataka. *Acacia auriculiformis* has been introduced to this unique agroclimatic situation and *Acacia auriculiformis* based agroforestry system has gained popularity in the recent past. With the increase in growth / age of *A. auriculiformis* trees, there is greater suppression of associated field crops. This competitive effect can be further increased in the absence of tree management. The present study was under taken to find out suitable management practice to reduce negative interaction in *A. auriculiformis* based agroforestry system. The growth and yield parameters of black gram were significantly higher due to tree management practices. Among various management practices higher seed yield was noticed in treatment receiving trenching (730 kg/ha). Significantly higher seed yield was recorded at 12 to 14 m distance from tree row (742 kg/ha). Combination of 50 per

cent branch pruning and 12 to 14 m distance from tree row recorded maximum seed yield (837 kg/ha). There was no significant variation in growth parameters of *Acacia auriculiformis*. However tree height was significantly higher in treaching treatment and 50 percent branch pruning. Net returns were significantly higher in treatment receiving trenching (Rs 24,141/ha).The highest net returns were recorded in 12 to 14 m distance from tree row (Rs 24,296 /ha). Combination of 50 per cent branch pruning and 14 m distance from tree row recorded higher net returns(Rs 26,266.00 /ha). Soil moisture content, light transmission ratio and relative crop yield were significantly higher due to tree management practices. Among various management practices trenching treatment recorded higher soil moisture (14.46 %). Higher light transmission ratio was noticed in 50 per cent branch pruning (90.80 %). relative crop yield was highest in trenching treatment (72.72 %).

Inter and Intra Population Variation for Fruit, Seed and Seedling Traits of *Garcinia gummi-gutta* (L.) Robs. : An Important NTFP Yielding Species

BHAGYAVANTH N. MASUDI

2007

MAJOR ADVISOR : Dr. R. VASUDEVA

Garcinia gummi-gutta is a moderate sized evergreen, Non Timber Forest Product (NTFP) yielding tree of Western Ghats known for its fruit of commercial importance. Farmers of the Western Ghats have shown interest in bringing the species under cultivation because of the Hydroxy Citric Acid (HCA) content of fruits. The study was aimed at assessing the variability for fruit and kernel traits of *Garcinia gummi-gutta* in ten geographically distinct populations of Uttara Kannada district of three altitudinal zones and to develop a set of descriptors for fruit/seed traits. All tree traits, fruit traits, seed traits and seedling traits were significantly influenced by the altitudinal zones. The trees of lower-ghat zone (0 – 200 m msl) were superior with respect to tree and seed parameters viz. tree height, bole height, canopy height, number of branches and branching angle. The fruit yield per tree did not differ among altitudinal zones and among populations. The fruits of up-ghat zone (>500 m msl)

were typically heavier, pulpier and contained more number of seeds in contrast to those of mid-ghat zone. Large and significant variation was observed among seedlings of different populations for shoot length, collar diameter, number of leaves and leaf area. Due to higher shoot length, larger leaves, the seedlings of Nilkunda population recorded larger amount of dry matter production. The values of heritability were moderately higher (0.33 to 0.63) for biomass characters, germination characters and seedling characters. Root weight recorded genetic gain. Perhaps for the first time a set of fruit and seed descriptors were developed and used to identify suitable 'ideotype' that combines highly desirable characteristics of potential commercial value. The web-diagrams revealed that the Malavalli population was highly variable with respect to all economically important traits considered which needs to be intensively selected. Fruit yield per tree was positively and significantly associated with tree girth, number branches per tree, number of fruits per branch and fruit rind.

Variability Studies of *Pongamia pinnata* (L.) Pierre in Agroclimatic Zones of Southern Karnataka

M.S. SANTHOSH KUMAR

2007

MAJOR ADVISOR : Dr. H. SHIVANNA

The investigation on "Variability studies of *Pongamia pinnata* (L.) Pierre in Agroclimatic Zones of Southern Karnataka" was conducted at the College of Forestry, Sirsi. The pods were collected from different agroclimatic zones (seed source) of Southern Karnataka and each seed source was assessed for pod, seed, germination, seedling traits and oil content. The genetic traits were also calibrated to assess the variation for easy selection of superior genotype for further breeding and /or afforestation works. The central dry zone seed source were found superior compared to other seed sources with pod length (50.08mm), pod width (26.10mm) and test weight (217.53 g), followed by seed length (23.13 mm), seed width (19.80 mm) and test weight (255.13 g). Similar trend was noticed with germination percent (100 %) with shoot length (34.10 cm) and root length (33.70 cm). whereas, the higher oil content was noticed in central dry zone (35.71 %). Whereas, the partitioning of variability in to

genotypic and phenotypic components indicated several points in all the attributes phenotypic coefficient of variance was higher than the genotypic coefficient of variance. The difference between phenotypic coefficient of variance and genotypic coefficient of variance were not largely suggesting the role of environment in these variations. The heritability was higher for pod test weight (99.85), followed by seed test weight (97.57) and pod width (95.10). Hence, the present study suggested that high heritability may be considered for improvement studies. Association studies showed that seed traits with its associative attributes like germination and seedling traits showed positive and highly significant correlations. Interestingly test weight was positively and significantly associated with germination and seedling height. This would be highly useful for quick selection superior planting material. Hence, the central dry zone was found to be most promising for selection among the seed sources.

Influence of Levels of Pruning and Fertilizers on Growth and Yield of *Jatropha curcas* (L.)

SUMED R. GAJARE

2007

MAJOR ADVISOR : Dr. S. K. PATIL

A field experiment was conducted at Agricultural Research Station, Prabhunagar (Dharwad) during 2005-06 on medium black soil to study the Influence of levels of pruning and fertilizers on growth and yield of *Jatropha curcas*. The experiment was laid out in factorial randomized block design with three replication. The experiment consisted of two factors viz fertilizers levels (40:40:40, 60:60:60, 80:80:80 N:P₂O₅:K₂O g

/ plant) and pruning levels at (1 m, 1.5m, 2m and no pruning) from base of the plant. The result revealed that application of fertilizers (80:80:80 g. N:P₂O₅:K₂O per plant) had recorded significant higher in number of branches, collar diameter, and seed yield (15.77, 18.71cm and 727.96 g per plant respectively) where compared to other levels. Number of branches and collar diameter of *Jatropha* were significantly higher in

pruning at 1 m and 1.5m height from base of the plant (16.94 and 17.04cm respectively) as compared to other pruning levels. The interaction F_3P_3 (80:80:80g N:P₂O₅:K₂O per plant) with pruning at 2m height from

base of the plant recorded maximum seed yield per plant (1142.95 g.) and per hectare (1903.68 kg.) respectively over other treatment combinations.

Management Strategies to Enhance Growth and Productivity of *Acacia auriculiformis*

MAHANTESH B. HULIKATTI

2008

MAJOR ADVISOR : Dr. S. L. MADIW ALAR

Acacia auriculiformis is widely used in plantations for forestry and wasteland development in the country. However, the plantations have lower productivity due to declining soil fertility and suppression of growth due to competing vegetation especially in the initial stages. Hence, there is a need to find out optimal quantity of nutrients and cost effective weed control method to boost the initial growth there by increasing productivity. Among the weed management strategies, chemical weed control (glyphosate @ 5 ml/l of water) exhibited superior performance in terms of improved growth parameters of *A. auriculiformis*. The per cent increase in growth parameters viz. plant height, collar diameter, crown spread and main stem volume at 10 months after treatment imposition (MAT) over normal practice was to the tune of 10.1, 18.3, 15.6 and 51.9 per cent, respectively. Higher total dry biomass production per plant was recorded with chemical weed control (469.21 g) which was 52.1 per cent

higher than normal practice (308.40g). Lower weed density (12.56) and dry weight (19.80 glm²) was recorded in chemical weed control treatment than in normal practice which was less by 49.5 and 49.4 per cent, respectively; whereas, weed control efficiency was 20.7 per cent higher. Number of branches per plant, dry matter accumulation in branches and leaves and total dry biomass production was significantly higher with application of FYM+NPK (2 kg +20:10:20g NPK per plant) over local practice. However, other growth parameters were unaffected. The weed density, dry weight of weeds and weed control efficiency were not influenced by nutrient applications. Significantly higher uptake of P (4.65 kg/ha) by *A. auriculiformis* was due to combination of FYM+NPK and chemical weed control; whereas, significantly higher N and K uptake by weeds was observed in unweeded check and FYM+NPK combination (86.79 and 24.45 kg/ha, respectively) than other combinations.

Variability Studies of *Pongamia pinnata* (L.) Pierre of Agroclimatic Zones of Northern Karnataka

VEERESHAGOUDA POLICE P ATIL

2007

MAJOR ADVISOR : Dr. H. SHIVANNA

In this study, five agroclimatic zones selected spread over in different districts of Northern Karnataka were evaluated for their pod, seed, seedling parameters and their oil content. Collections from Northern dry zone were higher pod thickness, pod test weight, seed length, seed thickness, seed test weight and seed volume. Maximum germination was recorded in seeds of Northern dry zone (91.00 %) followed by those of Hilly zone (82.00 %) and Coastal zone (73.00 %). Northern dry zone showed higher seedling height, collar diameter, number of leaves per plant (33.12 cm, 7.24 mm and 14.88 respectively). Also Northern dry zone showed higher vigour index, shoot dry weight (4.16 g), and root dry weight (3.37 g). Northern dry zone showed higher oil content (36.~6 %)

followed by North eastern dry zone (32.16 %). Whereas, lowest oil content was noticed in Coastal zone (21.37 %). Highest heritability was found in germination percent (0.893). While among growth attributes, the heritability was highest for root vigour index (0.980). A strong correlation between seed thickness and pod test weight, among all germination attributes studied and between root vigour index and shoot vigour index (0.928). This study identifies two best sources (Northern dry zone and Hilly zone) for *Pongamia pinnata* (L.) Pierre based upon pod, seed and seedling traits for those regions of Northern Karnataka which were sampled. Hence, seed source screening provides a great opportunity to the tree breeder to screen and capture natural variation for success of afforestation, besides providing information on the raw material.

AGRICULTURAL ECONOMICS

An Economic Evaluation of NWDPR and SUJALA Watershed Programme in Northern Karnataka- A Comparative Study

B.M. KALYAN KUMAR

2007

MAJOR ADVISOR : Dr. S.B. HOSAMANI

In India, 65 per cent of the arable land is rainfed and the increasing demand for food and feed has to be met from increased production from the rainfed areas. To attain this objective watershed approach has been considered as an important activity and to evaluate the impact the present study was planned. Dharwad and Ranebennur taluks were selected based on the highest number of micro watersheds. Among the selected taluks, six micro watersheds for NWDPR and SUJALA and for NWDPR and SUJALA were selected for in depth analyses. From selected micro watersheds, ten respondents were selected randomly and totally one hundred twenty respondents were selected for the study. For assessing quantitatively the objective of the study, tabular analysis, financial feasibility analysis techniques and output decomposition model were employed. The results revealed that the investment on agricultural activity was found to be most predominant followed by investment in horticulture and forest plantations in both the watersheds. Among the various soil and water conservation structures the investment on contour bunds was higher followed by other

structures like Bench terracing. Recharge pit, Boulder waste weir etc. The estimates of net present worth (Rs 4941635), benefit cost ratio (5.28), internal rate of return (93.34%) and pay back period (1.06 years) in NWDPR watershed was higher than SUJALA watershed which indicated that investment made is financially feasible and economically viable in watershed technology. The traditional cropping pattern adopted by farmers in both watershed areas. The total cultivated area, yields of the crops, output and returns obtained in all the selected crops, total employment and total income generated in the post implementation was considerably higher than prior to implementation of watershed project. The net contribution of watershed technology in enhancing the growth of gross returns was higher in NWDPR as compared to SUJALA watershed technology. Among the problems faced lack of capital, unawareness of the long term benefits and lack of knowledge were most important. Therefore, the implementation of watershed development programme needs to be continued and extended to other areas.

Sunflower Seed Production under Contract Farming in Haveri District, Karnataka – An Economic Analysis

NIRMALA M. SANDIGODMATH

2007

MAJOR ADVISOR : Dr. L. B. HUGAR

Seed is a vital input and dynamic instrument for increasing agricultural production. The seed production under contract farming system is very popular in this region. However, several apprehensions are raised

against the modus operandi and profitability of seed production under contract system. To address these issues, a study was carried out in hybrid sunflower in Haveri district of Karnataka since it one of district having

highest area under seed production. Haveri, Ranebennur and Hanagal taluks were selected based on the highest area under seed production in the district. The total sample farmers consisted of 90 including 30 from each taluka. The cultivation of hybrid sunflower seed production was profitable with per hectare net returns of Rs.34894 over total cost of Rs. 22969. The farmers obtained 1223.77 kg yield per hectare out of which good seed formed 77.50 per cent. The hybrid sunflower seed production was significantly influenced by variables like human labour, bullock labour, machine labour and organic manure. Whereas, other inputs like seeds, inorganic fertilizers like nitrogen, phosphorus and potash, plant protection chemicals and irrigation were non significant. The R^2 value of 0.77

indicated that the variables included explained 77 per cent of variation in sunflower seed production. The sum of elasticities indicated an increasing return to scale. The ratio of MVP to MFC in sunflower seed production explained that the inputs like human labour, bullock labour, organic manure, seeds, inorganic fertilizers like phosphorus and plant protection chemicals were underutilized. Inadequate irrigation water, non-availability of trained labour and difficulty in technical operations were major production constraints faced by farmers. It is suggested that institutional arrangements needs to be developed to take up seed production activities as the investment is economically feasible. Training to the farmers is necessary to improve the skill of farmers in seed production.

Performance of Dairy Cooperatives and Their Impact on Milk Production, Income and Employment in Kolar District – An Economic Analysis

K. N. SRIKANTH

2007

MAJOR ADVISOR : Dr. B. L. PATIL

The study was undertaken with specific objectives of evaluating the working of dairy cooperatives, to assess cost-return structure and their impact on milk production, income and employment in Kolar district of Karnataka. The Kolar milk union was purposively selected for the study. Entire district was divided into two areas (a) Above the average milk procurement area and (b) Below the average milk procurement area. Eight societies were selected at the rate of four each from the each selected area. Primary data were collected from the members and non members of the societies from 120 respondents for the year 2005-06. Secondary data were collected from the societies for the period of ten years from 1995-2005. Tabular analysis, percentages and compound growth rate analysis were worked out to meet the specific objectives. The members of the societies possess 125 buffaloes and 132 cows accounting for 48.64 percent and 51.36 percent respectively. On the whole, the cows were more in number (132) than the buffaloes (125) in the study area. The physical performance of the societies in the study area revealed that the overall physical indicators had an increasing trend except the number of employees working in the societies. The profits of both the areas also showed increasing trend. In area-I per animal rearing cost per annum

amounted to Rs.16,655.90. On an average an animal in the study area realized a milk yield of ten liters/day. In case of area-II per animal rearing cost amounted to Rs. 14,943.44 and milk production per day was eight litre. Net returns were more (Rs. 14,209.09/annum) than in area-II (Rs.10,095.92/annum). Important finding is the employment generation out of respondents was more in both the areas when compared with the employment creation out of non member respondent's *i.e.*, on an average 282.53 employment days from area-I as against 246.79 employment days from area-II. As per the opinion of members of societies, it was observed that the performance of area-I was better than area-II. The members in the area-I were highly satisfied regarding the correct weightment (70.00 percent) and transport problem is less severe (90.00 percent). When compared to area-I, for area-II the accessibility of transportation was less. Transportation was not good in area-II because of kachha and poor maintenance of roads. Hence the dairy should arrange proper transport facilities (milk routes) to all the societies including those situated in the interior villages to mitigate the hardship of the milk producer's vis-à-vis to boost up the milk procurement activity.

Woman Labour in Agriculture – An Economic Analysis

N. NISHA

2008

MAJOR ADVISOR : Dr. L.B.KUNNAL

The present study on 'Woman labour in agriculture-An economic analysis' was conducted in Palakkad district of Kerala state during 2007-08. A total of 120 women agricultural labourers were selected using multistage random sampling technique from three taluks namely Palakkad, Chittur and Alathur for collecting the required information. The data were collected from the respondents by personal interview method and it included general information, their season wise employment and unemployment days in agriculture, the pattern and composition of employment, the impact of off season unemployment etc. For the purpose of achieving the specific objectives of the study tabular presentation method with averages and percentages was employed. The results of the study showed that the women labourers got maximum employment in agriculture during *kharif* (57.62 days) and *rabi* season (54.91 days). The women labourers got 122.49 days of employment in agriculture in a

year. The labourers got maximum number of days of employment in weeding (46.28 days) followed by harvesting and post harvest operations (36.90 days). They received wages in cash for all operations except harvest and post harvest operations. They worked for 7-8 hours a day. The women labourers had maximum unemployed days in summer (110.04 days) as this is the off season for agriculture in the study area. The lack of employment opportunities in agriculture during off season compelled the women labourers to seek alternative employment sources like NREGS activities, construction works, tile making etc. The seasonal woman unemployment in agriculture has caused a severe impact on the income of labourers, family expenditure, their savings and debt position. It also caused migration of labourers to other activities and other places. The women labourers had some suggestions of their own to overcome the problem of unemployment.

Economics of Sugarcane Based Intercropping Systems in Raibag Taluk

NAMADEV A. SHINDE

2008

MAJOR ADVISOR : Dr. B. L. PATIL

Focus of the present study was on economic evaluation of the intercropping systems in Raibag taluk of Belgaum District. The impact of different intercropping systems on cost, returns and profit of different size groups of farmers would throw light on and enable the farmers to plan for the right intercropping system. A sample size of 120 farmers was selected using random sampling method and data were elicited for the agriculture year 2006-07 through survey method. The techniques of tabular and functional analysis were employed. CS-I (Sugarcane+Maize), CS-II (Sugarcane+Wheat), CS-III (Sugarcane+Chickpea) and CS-V (Sugarcane sole) were the four important Sugarcane based Intercropping Systems

followed in the study area. Under irrigated condition, it was found that, per hectare total cost of cultivation (Cost 'C') was found to be high in CS-I (Rs.73,718.25/ha), followed by CS-II (Rs.71,171.95/ha), CS-III (Rs.69,707.20/ha) and CS-IV (Rs.65,692.00/ha). The maximum net returns were found under CS-I (Rs.45,828.05/ha), followed by CS-III, CS-II and CS-IV (Rs.27,471.97, Rs.24,840.55 and Rs.13,287.17/ha, respectively). Returns per rupee of investment was found to be highest in CS-I (1.62), followed by CS-III, CS-II and CS-V with values of 1.39, 1.35 and 1.20, respectively. The results of the functional analysis revealed that the ratio of MVP to MFC was greater than unity and nearer to one for machine

labour, bullock labour and FYM in different intercropping systems, indicating further scope for using additional units of these inputs to increase gross income. With respect to employment generation, CS-II generated higher employment (213.2 mandays/ha), as it required more labour, followed by CS-III (208.31 mandays/ha), CS-IV (207.92 mandays/ha) and CS-I

(201.12 mandays/ha). Majority of the farmers faced the problems of low price of the produce. Therefore the scale of finance for the cultivation of sugarcane based intercropping system was Rs.50,000/ha. Whereas, per hectare material cost of sugarcane based intercropping system is about Rs.70,000. So, it is advocated to revise the scale of finance to the realistic level.

Performance of Stree Shakti Groups in Mandya District – An Economic Analysis

K. M. CHAITHRA

2008

MAJOR ADVISOR : Dr. JAYASHREE A. HANDIGOL

This study was undertaken to assess the performance of Stree Shakti Groups in Mandya and Maddur taluks of Mandya district. From both the taluk three groups were randomly selected under A, B and C grade of SSGs. From each selected groups ten members were selected randomly. Thus a total of 180 members formed the sample size. To assess the performance of Stree Shakti Groups tabular analysis, paired 't' test, B:C ratio for evaluating financial feasibility of major income generating activities, impact index, and multiple linear regression analysis were done. Findings of the study revealed that majority of the members in all the grades were middle aged, married, and illiterates. In A grade SSGs 100 per cent of the groups had savings above Rs.75,000. In case of 83.33 per cent of the groups with savings ranged between Rs.35,000 to Rs.75,000. In A grade 83.33 per cent of the groups availed additional revolving fund

benefit of Rs.20,000 and in C grade 66.60 per cent of the groups availed only initial revolving fund benefit of Rs.5,000. The B:C ratio worked out to 1.40, 1.26 and 1.33 in dairy, fish sale activity and sheep rearing activity respectively. The 't' value of economic indicators like investment, employment, income and savings of the SSG members in all the three grades of SSGs was significant at 1 per cent level. Investment, employment and savings were the major factors influencing the income level of SSG members in all the three grades of SSGs. The R^2 value was found to be 0.84, 0.82 and 0.78 in A, B and C grade SSGs respectively. The gain index of social empowerment was 55.62, 50.13 and 47.57 and economic empowerment was 41.12, 41.67 and 37.71 in A, B and C grade SSGs respectively.

Production and Marketing of Pineapple in Shimoga District – An Economic Analysis

H. R. KEERTHI

2008

MAJOR ADVISOR: Dr. BALACHANDRA K. NAIK

The study of economics of production and marketing of *Ananus comosus* is indispensable, since there is no proper farm business data on its cost of production and marketing. Economic analysis on production and marketing of pineapple was conducted in Shimoga district of Karnataka state. Primary data was collected from 60 farmers and 30 market functionaries spread over two taluks of Shimoga district. For analysis of data tabular analysis, compound growth rate analysis and financial ratio analysis were adopted. The per hectare total cost of establishment was Rs.214464.40. The total maintenance cost during bearing period was Rs.71876.89. The average yield of pineapple was 66 tonnes per hectare per year, which accounted for about Rs.533155.26. The average net return per hectare per year was Rs.461278.50. Financial feasibility analysis showed that NPV for orchard was Rs.532221.51 per hectare at 9 per cent discount rate. The B:C ratio at 9 per cent discount rate was 3.48. The IRR

was found to be 84.07 per cent. The pay back period after bearing period was 0.46 years. Functional analysis showed that 94.35 percent of variation in yield was explained by the variables included in the model, such as human labour, fertilizers, weedicides, growth regulators and planting material. Only planting material significantly contributed to the yield. MVP:MFC ratio indicated that almost all variables were over utilized in production process except planting material. Hence, still there is scope to increase the planting density to obtain the better yields. As the investment in pineapple orchard was financially feasible, the farmers, who wish to establish pineapple garden, may do so even if they have to borrow for establishing the orchards at the prevailing rate of interest from financial institutions. As the high density of planting yield higher returns, it is advisable for the farmers to go for high density planting.

Consumption Behaviour of Coffee and Tea in Karnataka

T. C. VARUN

2008

MAJOR ADVISOR : Dr. M.G. KERUTAGI

The present study on consumption behaviour of coffee and tea was carried out during 2007-08 in selected four districts of Karnataka, by following multi stage sampling. Totally 240 sample households were randomly selected accounting to 932 respondents. Information was obtained by personal interview method. The important findings of the study are education of the respondents in the urban areas; and family size and price per unit of coffee in the rural area were highly significant with respect to demand for coffee. In case of demand for tea, the total family income in the urban areas and the family size in the rural areas were found to be highly significant. Majority of the respondents in the urban and rural areas of Northern Karnataka consumed tea, while coffee was consumed by 81.70 per cent of the urban and 63.80 of the rural respondents in the

south. Bru and Nescafe were the two most preferred commercial brands of coffee and Red Label was the most preferred tea brand among the sample respondents. Quality, aroma, taste and flavour of coffee and tea obtained high index scores in both the urban and rural regions of Karnataka. Results of the Principal Component Analysis showed that celebrity endorsement and influence by retailers had little influence on the purchase of coffee/tea. Results of the conjoint analysis revealed that price of coffee and tea powder attained the highest relative importance. The doctors who were interviewed for the study recommended the consumption of coffee and tea only after the age of 16 years. Around 20 per cent of the doctors opined that coffee and tea act as a stimulant and also reduces cardiovascular diseases to some moderate extent.

Impact of Micro Finance on Empowerment of Rural Women – A Case Study of Dairy Enterprise in the Tank Management Project Area of North Karnataka

K. SURESH

2008

MAJOR ADVISOR : Dr. S. M. MUNDINAMANI

The present study attempted to analyse the impact of micro-finance on empowerment of rural women dairy entrepreneurs. The CBTMCP, among other activities introduced dairy enterprise as an income generating activity (IGA) in the selected tank command of Haveri and Bellary districts by providing financial support for 30 women beneficiaries

for purchase of dairy animals to poorest among poor women in villages of Haveri and Bellary districts (10 in Bellary and 20 in Haveri districts). The data collected was subjected to tabular, financial feasibility analysis, paired 't' test and empowerment index. The total cost per buffalo per annum was found to be Rs. 9,937.21 in Haveri district and Rs. 10,306.17 in

Bellary district. The net returns was found to be Rs. 3,945.48 and Rs. 4,959.02 per annum in Haveri and Bellary districts, respectively. The net present value was found positive and benefit cost ratio more than unity. The internal rate of return was higher than bank rate. The additional employment and income generated annually through dairy comprise was 176.56 mandays and Rs. 6089.65, respectively. All most all beneficiaries were regularly participated in SHG activities (100%). Majority of the beneficiaries have not practiced urea treatment to enrich the fodder quality (96.70%) and deworming of buffaloes and calves (46.67%). Major constraints faced by entrepreneurs were scientific storage facility (100%),

low price of milk (73.30%) and non-availability of veterinary services (66.70%). To promote dairy sector in the study area financial support should be provided to interested rural poor women in the villages. Establishment of veterinary hospitals, mobile clinics, development of high yield breeds and development of waste land to provide adequate grazing facility. Training regarding urea treatment, provision of short term loan for purchase of green fodder and concentrate and strengthening extension services were some of the policy measures suggested by the study.

Impact of Udyogini Scheme on Economic Empowerment of Women in Mandya District

SYEDA MAHBOOB ARSHIYA

2008

MAJOR ADVISOR : Dr. L. B. KUNNAL

This study was undertaken to assess the empowerment of women through Udyogini scheme. The study was conducted in Mandya district. The Udyogini scheme was implemented in all the seven taluks of the district 120 beneficiaries were selected randomly from all over the district for the study. To assess the impact of Udyogini scheme on socio-economic empowerment of women paired 't' test and impact index were done. Findings of the study revealed that majority of the members were middle aged, married, educated from nuclear family and belonging to general merit category. Dairy was the major activity carried out by 30.83 per cent of the beneficiaries followed by shop keeping (14.16%), tailoring (10.83%) and beauty parlor (9.16%). The cost and returns analysis of major income generating activities taken up by the beneficiaries of Udyogini scheme

analysis highest amount of net returns were found in beauty parlor and lowest net returns were observed in case of dairy enterprise. The highest B:C ratio was found in case of tailoring. The percentage change in investment (76.60%), savings (68.89%), income (65.25%), consumption (37.78%) and assets (33.64%) of the member after joining the scheme was calculated. The t-value calculated for the above were found to be significant at 1 per cent level. The gains index of social empowerment was 37.34 and economic empowerment was 52.46. Majority of the members opined (58.00%), scheme has increased their social participation and were in agreement with the opinion that it had helped them in the overall development of the family. Among the opinions of beneficiaries with respect to banks supporting Udyogini scheme, majority of the beneficiaries (53.33%) opined that repayment terms are easy.

An Economic Analysis of Participatory Irrigation Management in Tungabhadra Left Bank Canal Command Area

T. GOUTHAM

2008

MAJOR ADVISOR : Dr. L. B. HUGAR

The participatory irrigation management was studied at different locations (head, middle, tail) in Tungabhadra Left Bank Canal command area during the year 2007-08. The progress of WUCSs registered showed a substantial growth in TBP area across districts and locations in the initial years due to amendments made to the acts in the year 2000. However, the same progress was not made in entering into memorandum of understanding (MOU) between WUCSs and Water Resource Department for actual transfer of management. There was marginal (7%) improvement in actual irrigated area after formation of WUCSs. Further, financial progress of WUCSs in terms of share amount, grants and developmental charges over the years in different locations of command area was found to be fluctuating and declining over years. The secretaries of societies opined that, siltation (73.30%), soil salinity (70%) and water logging conditions (70%) were the serious problems due to lack of maintenance

work and unscientific water management by farmers. Similarly, lack of co-operation of members (63.30%) and inadequate supply of water (56.40%) were found to be serious organizational constraints in working of WUCSs. There was a marginal differences between farmers coming under functional and non-functional WUCSs with regard to socio-economic status, land holding pattern, cropping pattern, cost of cultivation, resource use efficiency and water management practices. The opinion survey noticed that officials of irrigation department were not showing much interest in transferring powers to farmers even though they suggested that it is necessary to handover WUCSs to farmers (63%) for better management of irrigation system. It is suggested that creating awareness, capacity building, volumetric distribution of water, involvement of farmers from planning stage, change in nomenclature of office bearers of WUCSs etc for successful operationalization of PIM in TBP area.

An Economic Analysis of Food Consumption Pattern in Karnataka with Special Reference to Mysore District

B. S. PAVITHRA

2008

MAJOR ADVISOR : Dr. H. BASAVARAJA

The objective of the present study was to analyze the food consumption pattern in Karnataka with special reference to Mysore district. The household consumer expenditure data of the 50th round and 61st round of the National Sample Survey Organization (NSSO) was used for the study. The primary data was collected from sample respondents located in urban area, semi-urban area and rural area of Mysore district. A total sample of 135 respondents (45 urban, 45 semi-urban and 45 rural households) formed the sample for the study. Percentage were calculated to analyze the changes in the pattern of food consumption. The monthly per capita cereal consumption has declined from 13.15 kgs to 10.73 kgs in rural areas, while the corresponding decrease in the urban sector was from 10.87 kgs to 9.70 kgs. Thus the consumption of cereals has declined in Karnataka over the periods. The monthly per capital consumption of pulses was almost stable over the two periods in rural and urban areas of Karnataka. The monthly per capita expenditure (MPCE) on food was

Rs.167 during 1993-94 in rural areas and it increased to Rs.283 during 2004-05. In urban area, the MPCE increased from Rs.236 to Rs.447. The expenditure elasticities for all food groups were less than unity in urban areas with the highest value being 0.96 for vegetables. The lowest expenditure elasticity was observed for cereals (0.70 in rural and 0.72 in urban areas). The monthly per capita food expenditure was Rs.730 for urban respondents Rs.601 for semi-urban respondents and Rs.483 for rural respondents of Mysore district. The total MPCE of the respondents was Rs.2000 for urban, Rs.1231 for semi-urban and Rs.1032 for rural respondents. The functional analysis carried out to study the factors influencing food expenditure revealed that there would be an increase in the annual family expenditure on food with every increase in the family size to the extent of Rs.11143 in the case of urban consumers and Rs.7292 in the case of rural consumers.

Operationalisation of Participatory Irrigation Management in Upper Krishna Project Command Area – An Economic Perspective
K. D. GANAPATHY. 2008 MAJOR ADVISOR : Dr. R.S. PODDAR

This study was conducted to know the performance of participatory irrigation management (PIM) in Upper Krishna Project (UKP) command area of Karnataka. In the state, an area of 1.5 m.ha was targeted to be brought under the PIM. However, the achievement has been only about 41 per cent, which reflected upon slow physical progress of PIM in Karnataka. There was only a marginal increase in irrigated area due to formation of Water Users Cooperatives (WUCs) in the UKP. With regard to financial progress, it was found that only 40 per cent of the societies collected the water charges from the users. Percentage of water charges recovered in UKP was found to be poor, which ranged from eight to 25 per cent among the sample WUCs. Less than half of the societies maintained the financial records and audited. There was a marginal difference between functional and non-functional WUCs with regard to socio-economic status, land holding pattern, cropping pattern, cost of

cultivation, resource use efficiency and water management practices. The opinion survey suggested that the officials were reluctant in transferring powers to farmers even though they agreed that it was necessary to handover WUCs to farmers. There were constraints in working of PIM, which included, *inter alia*, lack of leadership and coordination among the members and lack of cooperation from the officials and lack of enforcement as organizational constraints; lack of volumetric supply, poor canal condition and mono-cropping as physical constraints; and inadequate collection of water charges and lack of proper records as financial problems. As a policy it is suggested to reorganize the existing WUCs and enforce effective water rights. Capacity building of stake holders, supply of water on volumetric basis, installation of water measuring devices and involvement of farmers at all stages etc are recommended for effective operationalization of PIM.

Performance of Karnataka State Agricultural Produce Processing Export Corporation – An Economic Analysis

DEEPA TALLIKERI

2008

MAJOR ADVISOR : Dr. S. B. HOSAMANI

The objective of the study was to evaluate the performance of Karnataka state agricultural produce processing export corporation, Limited. Secondary data were used for the study for the period 1997-2007. The statistical tools like tabular analysis, ratio analysis, compound growth rate, principal component analysis and index method were used to evaluate the objectives of the study. The solvency ratio revealed that solvency position of the corporation was strong during the study period. Liquidity ratio showed that corporation maintained a reasonable level of liquidity position. The results of profitability ratio showed that the corporation has not maintained a fair level of profit because more importance was given to social obligation than the profit and the operation efficiency of the corporation was high. Compound growth rate of financial indicators like total liabilities (21.07), total assets (21.27), export value

of commodity (37.71), current assets (20.90), quick assets (-16.02) and net worth (3.74) were significant and total expenses (-3.09), operating expenses (-16.47), gross income (-6.50) were found to be non significant. The growth rate of Onion export was positive and significant, where as growth rate of Potato, Mango and Niger seeds were found to be negative and non significant. The compound growth rate in terms of quantity and value of domestic market, import market showed a negative growth rate but export market growth rate was positive with increasing trend over the years. Low financial assistance was one of the major constraints faced by KAPPEC. This was due to irregular supply of funds by the state Government and low productivity per unit area was another bottleneck to attain export competitiveness in the International market.

Economic Analysis of Integrated Pest Management in Redgram in Bidar District

CHANDERKANT PATIL

2008

MAJOR ADVISOR : Dr. N. R. MAMLE DESAI

The research study was conducted in Bidar District of Karnataka, a sample size of 60 IPM and 60 non-IPM farmers was selected using random sampling method and data were elicited for the agriculture year 2007-08 through survey method, estimated the per hectare cost of cultivation in IPM farmers category at cost A, B, C, and D as Rs.14671.03, Rs.20606.55, Rs.21635.62 and Rs.22205.41, respectively. In case of non-IPM farmers category, it was estimated to be, Rs. 12373.09, Rs.17493.67, Rs.18936.67 and Rs.19328.71, respectively. The net returns per hectare of Redgram in IPM farmers were Rs.12553.01 as against non-IPM farmers category Rs. 7257.99 and net additional benefits from IPM was Rs. 5295.02 per hectare. The B:C ratio in IPM farmers was higher 1:1.57 as compared to non-IPM farmers 1:1.38. The IPM farmers incurred Rs.2478.15 per hectare for IPM module components. The results of functional analysis revealed that the ratio of MVP to MFC was greater

than unity and nearer to one for seed, organic manure and chemical fertilizers under IPM and non-IPM farmers category, indicating further scope for using additional units of these inputs to increase gross returns. The multiple regression analysis in IPM farmers indicated that the variables included in the model had contributed to 87.00 per cent ($R^2=0.87$) whereas, in case of non-IPM farmers 92.00 per cent ($R^2=0.92$). The results of decomposition analysis indicated that total difference in output between IPM and non-IPM was 28.18 per cent and IPM technology component alone contributed 22.54 per cent. The different IPM components and their extent of adoption by IPM farmers was cultural components accounted to 97.77 per cent, Mechanical components 85.83 per cent and plant protection chemical components 65.24 per cent. Major reasons for non-adoption of IPM farmers were low adoption by neighbor hood farmers.

Consumption Pattern of Processed Horticultural Food Products in Dharwad District

U. L. SHILPA

2008

MAJOR ADVISOR : Dr. H. BASAVARAJA

The objective of the present study was to analyze the consumption pattern of processed horticultural food products in Dharwad district. The study is based on primary data collected from sample respondents located in urban area, semi-urban area and rural area of Dharwad district. A total sample of 180 respondents (60 urban, 60 semi-urban and 60 rural households) formed the sample for the study. Data was processed using tabular analysis, regression analysis and conjoint analysis. The products used by the consumers was mostly home made like pickles, chips, chilli powder. Majority of the consumers purchased unbranded

turmeric powder branded product is popular in the case of jam and sauce/ketchup. The annual consumption of jam and sauce/ketchup was highest by urban consumers i.e. 2.33 and 2.25 kgs respectively. Pickles and chips were consumed highest by rural consumers i.e. 10.96 and 12.15 kgs respectively and in the case of chilli and turmeric powder it was highest by semi-urban consumers 11.43 and 3.26 kgs respectively. The annual family expenditure on processed horticultural food products was nearly 2.5 to 3.1 per cent and ranged from Rs. 2165 (urban consumers) to Rs. 1745 (rural consumers). The factors influencing consumption of different

products was annual income in the case of jam, sauce/ketchup and chilli powder and family size in the case of pickles, chips and chilli and turmeric powder consumed. The consumer's preference was different for different processed horticultural food products i.e. in the case of jam and sauce/

ketchup they preferred price followed by taste and brand. In the case of pickles, chips and chilli and turmeric powder first preference was given to brand followed by price and taste. The most preferred product combination by the consumers was good taste, low priced and branded products.

Yield Gaps and Constraints in Cocoon Production in Karnataka: An Econometric Analysis

K. N. ANIL KUMAR YADAV

2008

MAJOR ADVISOR : Dr. VILAS S. KULKARNI

The present study was conducted to ascertain the yield gaps and constraints in cocoon production in Karnataka. Primary data from 120 respondents and secondary data from concerned research stations were collected for the agriculture year 2007-08. Growth rate analysis, tabular analysis and decomposition analysis were used for the analysis of data. The annual growth rates for mulberry area, multivoltine and total cocoon production showed decreasing trend for state (-5.74, -4.26 and -3.96, respectively), traditional districts (-5.17, -4.02 and -4.01, respectively) and non-traditional districts (-8.34, -3.20 and -1.11, respectively). In rearing 100 DFL farmers realized 65.63 Kg of cocoons and 7.95 quintals of litter, consuming 2049.00 kg of mulberry leaf and generated 28.14 mandays of labour. The total cost of rearing of 100 DFL was Rs.7280.22. The major costs were mulberry leaf (Rs.3670.53) and labour cost (1688.66). The gross returns obtained were Rs.9390.73. Net returns were

Rs.2110.48, B:C ratio being 1.29. The index of yield gap worked out to be 13.03, 11.95 and 12.49 per cent in Kolar, Chikkaballapur district and at overall level. Nearly 90 per cent of potential farm yield in silk cocoon production was realized by the sample farmers. The significance of Chow's F value confirmed that the structural difference in the production surfaces between the demonstration plots and the farmers' field. Decomposition analysis showed that difference in input use (10.04%) was the major contributing factor to the yield gap, highest being mountages (10.398%), while the difference in cultural practices between farmers' field and demonstration plots was contributing to an extent of 1.145 per cent to the yield gap in cocoon production. The analysis suggested that a large portion of the untapped potential farm yield could be exploited by using optimum inputs and by adopting appropriate production techniques without incurring additional cost.

AGRICULTURAL EXTENSION EDUCATION

Marketing Behaviour, Information Source Consultancy Pattern and Problems of Vegetable Growers in Bijapur District of Karnataka

S. P. SANTOSHKUMAR

2008

MAJOR ADVISOR : Dr. L. MANJUNATH

A study on marketing behaviour, information source consultancy pattern and problems of vegetable growers in Bijapur district of Karnataka state was carried out during 2006-07 by following proportionate random sampling procedure with 160 farmers as respondents and the data were collected by personal interview method. The important findings of the study were majority of the farmers (51.25%) belonged to middle age group, 16.25 per cent of them were illiterate, while majority (88.75%) of the respondents were dependent only on farming and 42.50 per cent of them were in high income group. Considerable 46.25 per cent of the farmers belonged to medium risk bearing ability, followed by 42.50, 57.50 and 40.00 per cent of them belonged to medium scientific orientation, medium achievement motivation and medium innovative proneness

categories, respectively. Majority of the respondents (81.25%) sold their produce because of financial urgency, 92.89 per cent of them sold their produce through wholesalers and 91.87 per cent of them sold their produce because of lack of time to engage themselves to sell directly to the consumers. Fluctuation in the market price (97.50%), markets are far away (91.25%) and high commission charges (88.12%) were the major problems experienced by farmers in the study area, about 88.75 per cent of the respondents suggested fixing minimum price for the produce. Display of the price lost at each market place (87.00%) and providing access to market information (37.50%) were the major suggestions expressed by the respondents.

Impact of Integrated Farming System on Socio-Economic Status of BAIF Beneficiary Farmers

B. MANGALA

2008

MAJOR ADVISOR : Dr. K. V. NATIKAR

The present study was conducted in the year 2007-08 in Dharwad district of Karnataka state with a sample size of 140 beneficiaries of IFS programme implemented by BAIF. The data was collected with the help of structured interview schedule. The results of the study revealed that, the IFS programme has resulted in significant increase in socio-economic status of the beneficiary farmers. The investigation identified that, there was increase in agriculture occupation from 89.29 per cent before to 94.29 percent after implementation of IFS programme. The respondents owning hut house as it decreased from 10.71 per cent before to 2.86 per cent after implementation of IFS programme. There was increase in number of farm ponds from 0.00 per cent before to 62.14 percent after implementation of IFS programme. It could be observed that in case of medium income group it was increased from 27.14 per cent before to 56.40 per cent after implementation of IFS programme. Majority

(62.14%) of the respondent's were adopted agriculture-horticulture-forestry-dairy-vermicompost Majority (70%) of the beneficiaries expressed their opinion that IFS practices helped in increasing the returns from farming. The results on personal characteristics showed that, majority belonged to middle age (36 years), education (illiterates), medium farming experience (33.58%) organizational participation (48.57%), sources of information (officials of BAIF organization), extension participation and economic motivation, risk orientation, innovativeness and mass media utilization belonged to medium level of participation. The findings revealed that, the financial assistance may be coupled with technical guidance for increasing the standard of living of rural people. The overall goal of the IFS programme was to reduce poverty and to enhance the opportunities to the people in IFS programme through, improved management and sustainable use of natural resources.

An Analytical Study on Sampoorana Grameen Rozgar Yojana (SGRY) in Gadag District of Karnataka State

S. M. KENCHANAGOUDRA

2007

MAJOR ADVISOR : Dr. JAGADISH G. ANGADI

The present study was conducted during 2006-07 in Gadag district of Karnataka state to ascertain wage employment generated by SGRY programme, assets/infrastructural facilities created as well as knowledge of beneficiaries regarding SGRY programme. One hundred and fifty beneficiaries of SGRY formed the sample for study. The data was collected

by personal interview with the help of structured schedule which was developed keeping the objectives of the study. Farm ponds, check dams, public latrines and community halls were the major assets created under SGRY programme. The extent of achievement of the target set for these assets was 88.75 per cent, 87.75 per cent, 75.00 per cent and 69.56 per

cent, respectively. The infrastructure facilities created were laying new roads and construction of school walls with an achievement percentage of 78.94 and 78.51 respectively. There was a lack of creation of 81,016 mandays of employment under this programme. Forty per cent of the beneficiaries belonged to 50-100 mandays of employment generated category followed by 42.00 per cent who belonged to 100-150 mandays.

A Study on Sustainable Livelihoods of Lambani Farmers in Hyderabad Karnataka

ANAND R. RATHOD

2007

MAJOR ADVISOR : Dr. S. N. HANCHINAL

The present study was conducted during 2006-07 as the Lambani population is more in this area. This covers the districts like Bidar, Gulbarga and Raichur. Among these Gulbarga district has more number of Lambani communities the ex-post facto research design was used for the study. A total sample comprising of 150 Lambani farmers were randomly selected. 58.67 percent of the farmers belong to middle age category followed by old age (25.33%) and young age (16 %). (19.33%) of the farmers were functionally literate followed by primary school (25.33%), middle school (16.67%), Illiterate (14.00%) high school (6.67%), college (4.67) and graduates (3.33%). (66.67%) had small family size followed by medium (18%) and large (15.33%) families. (23.33%) and high extension contact Nearly cent percent 98 percent of the farmers have expressed that 'depletion of ground water levels and ground water table' followed by

Forty four per cent of beneficiaries had medium knowledge about the programme. Annual family income and mass media exposure were found to be positively and significantly associated with knowledge of beneficiaries of SGRY programme. Age and annual family income were positively and significantly associated, while education was negatively and significantly associated with extent of employment generation under SGRY.

'erratic rainfall and cumulative droughts over years' (91.33%) and 'pest and disease prevalence is more (74.66%). (3.33%). (29.33%) and high urban contract (8.00%). (64.67%) was observed followed by good (18.00 %) and poor (17.33 %) labour availability. (91.33%) and 'pest and disease prevalence is more (74.66%)'. The study is to know the personal socio-economic and psychological factors i.e. independent variables of the Lambani farmers. The medium family size of majority of the Lambani farmers with 4-6 members might contribute more to the deprivation and a small family with a size below 3 indicates the practice of small family norms understanding the importance of the family planning. The data from the table 5 clearly indicates that there is a large variation in the expenditure pattern among the farmers. This trend clearly indicates that the farmers had low education and low exposure to more number of training programmes.

A Study on Impact of Income Generating Activities on Sustainable Rural Livelihoods of KAWAD Project Beneficiaries

BAS AVARAJ BIRADAR

2008

MAJOR ADVISOR : DR. L. MANJUNATH

The present study was conducted during 2007-08 in Bijapur and Bellary districts of Karnataka State to analyze the impact of income generating activities on rural livelihoods of Karnataka Watershed Development (KAWAD) project beneficiaries. The data was collected from randomly selected 120 beneficiaries. The percentage of respondents belonging to high overall livelihood status category (includes, human capital, physical capital, social capital, financial capital and food security) were increased from 22.67 to 60.50 per cent after undertaking income generating activities. Subsequently, there was a substantial decrease in the percentage of respondents in both medium and low overall livelihood status index category (83.33 to 31.50 per cent and 44.00 to 8.00 per cent, respectively). The calculated t-value was (6.13) significant at 1 per cent level. In general, annual income of beneficiaries was increased from

Rs.13590 to Rs.25697 after undertaking income generating activities. The average incremental income and employment generated was Rs.12107 and 119 man days per annum, respectively. Among various income generating activities, highest average differential annual income was generated from cow rearing (Rs.14686) with additional 136 man days of employment. Very high percentage of the respondents (84.17%) expressed the problems of lack of veterinary hospital facilities in the villages, followed by lengthy bank loan procedure (81.67%), lack of transportation facilities (80.00%), lack of remunerative prices for farm produce and high price fluctuation (69.17%), respectively. Majority of the beneficiaries (82.50%) suggested for providing veterinary hospital facilities in the villages, followed by simplification of procedures to get loans from the bank (77.50%) and supply of adequate electricity to villages (71.67%).

Impact of Krishi Vigyan Kendra Trainings (KVK) on use of Biofertilizers and Bio-Pesticides by Tur Farmers in Gulbarga District

J. S. BINKADAKATTI

2008

MAJOR ADVISOR : DR. S.N.HANCHINAL

The present research study was conducted in Gulbarga district of Karnataka during the year 2007-08. Gulbarga district was purposively selected for the study, since the pulses occupy the majority of the area in the district and is known as "Pulse Bowl of Karnataka". Four taluks namely, Gulbarga, chittapur, Aland and Sedam were purposively selected with one hundred and sixty respondents, because these taluks have maximum number of farmers trained under KVK on Bio-fertilizers and Bio-pesticides. Thus 160 farmers formed the sample for study (i.e. 80 trained and 80 untrained farmers). Study revealed that, majority of the trained respondents had correct overall knowledge about improved practices of Bio-fertilizers and Bio-pesticides as compared to untrained respondents. Whereas, knowledge about bio-fertilizer practices (53.15% and 17.5%) and bio-pesticides (46.25% and 18.70%) in case of trained and untrained respondents, respectively. It was observed that, education, land holding, mass media participation and extension participation of the trained and

untrained respondents had positive and significant relationship with adoption level. All other variables exhibited non-significant relationship with adoption level. Regarding adoption level of Rhizobium practices, 43.75 and 11.25 per cent of trained and untrained farmers were belonged to high adoption category, followed by NPV (45.00% and 13.75%), NSKE (50.00% and 15.00%), Trichoderma (68.75% and 10.00 %) and bio-digester (48.75% and 6.25%) practices with respect to trained and untrained respondents, respectively. but in case of Phosphorus Solubilizing Bacteria (PSB) (47.50 % and 90.00%) of trained and untrained respondents not adopted the recommended practices. Constraints like lack of knowledge about dosage, lack of guidelines about seed treatment, lack of training, awareness, non availability raw materials, non availability of bio-fertilizers and bio-pesticides in near by market and at appropriate time were expressed by the respondents.

A Study on Knowledge and Adoption of Integrated Crop Management (ICM) Practices by the Participants of Farmers Field School (FFS) in Bellary District

L. G. YASAWANTH KUMAR NAIK

2008

MAJOR ADVISOR : Dr. K. A. JAHAGIRDAR

The present investigation was carried out in Bellary district of Karnataka during the year 2007-08. Bellary district had highest number of FFS on maize and groundnut and contains seven taluks of which, only

taluks covered under KCBTNP project were selected. Accordingly, Kudligi, H. B. Halli and Hadagalli taluks were considered for the study. Three villages in Kudligi taluk, one in H. B. Halli and two villages in Hadagalli

taluk were selected with a sample of 200 farmers consisting of 100 FFS participants and 100 non-FFS participants for the study. Study revealed that, 42.00 per cent of maize FFS participants and 52.00 per cent groundnut FFS participants had 'medium knowledge about integrated crop management (ICM) practices in maize and groundnut production. Regarding adoption of overall ICM practices, very less number of maize FFS participants (8.00%) and groundnut FFS participants (12.00%) had fully adopted. It was observed that, thirty per cent of maize FFS participants were in 'high yield producer' category when compared to non FFS participants (20.00%). Further, forty-four per cent of the maize FFS participants were in 'high economic return' category when compared to

non-FFS participants (32.00%) indicating positive impact of FFS on maize yield levels and economic returns of the participants. With regard to groundnut FFS participants, 24 per cent of the respondents were in 'medium yield level' category, compared to non FFS participants (16.00%) and twenty-six per cent of the groundnut FFS participants were in 'high economic return' category when compared to non-FFS participants (16.00%). Loosing fertile land, labour problems, silt accumulation in tank are the major constraints faced by the both maize and groundnut FFS participants due to impact of Mining industry. Majority of the maize grower (68.00%) and groundnut growers (82.00%) suggested that government should take appropriate measures to control the mining industries.

Impact of Community Based Tank Management Project on Socio-Economic Status of Beneficiary Farmers of Bidar District

SAVITA

2008

MAJOR ADVISOR : Dr. K. V. NATIKAR

The study entitled Impact of community based tank management project on socio-economic status of beneficiary farmers in Bidar district was carried out during 2007-08. Totally 150 respondents were selected by random sampling method from ten villages and data were collected by personal interview method. The results of the study revealed that, the community based tank management project has resulted in significant increase in socio-economic status like increase in 'agriculture occupation' from 90.66 to 97.34 per cent, 'Business' from 14.0 to 26.0 per cent, 'owning of two houses' increased from zero to 10.66 per cent, in case 'type of house' 'tiled roofed house' increased from 44.0 to 56.0 per cent and in case of 'concrete house' increased from 1.34 to 4.66 per cent. There was increase in medium land holding from 33.34 to 40.67 per cent. Whereas in respect source of irrigation 'wells' increased from 23.34 to 42.0 per cent. Further, there was increase in medium level of participation from

16.0 to 47.34 per cent. While, the 'land productivity' increased the yield of Sugarcane from 35 t/acre to 40 t/acre, Red gram from 3.5 q/acre to 6.0 q/acre, and Jowar from 8 q/ac to 13/acre. Whereas, the 'annual income' increased in respect of marginal farmers from Rs 8,000 to Rs 17,000, semi medium farmers from Rs 13,000 to Rs 26,000, medium farmers from Rs 19,000 to Rs 37,000 and in case of big farmers from Rs 29,000 to Rs 54,000. The results on personal characteristics showed that, majority belonged to middle age (36-50 years), education (illiterates), organizational participation (47.34%), risk orientation (65.34%), achievement motivation (52.67%), innovativeness (44.0%), organizational participation (47.34%). Therefore, the study revealed positive impact on its beneficiaries and hence, the financial assistance may be coupled with technical guidance for increasing the standard of living of rural people.

Knowledge and Adoption of Land Reclamation Practices by Farmers of Malaprabha Command Area

ASHOK DODDAMANI

2008

MAJOR ADVISOR : Dr. JAGADISH G. ANGADI

The present study was conducted during 2007-08 in Malaprabha command area of Karnataka. One hundred thirty five farmers formed the sample for the study. The main objective was to study the Knowledge and adoption of land reclamation practices by farmers. Knowledge and adoption items were framed by referring package of practices and also in consultation with soil science experts of University of Agricultural Sciences, Dharwad. As high as 49.63 per cent respondents had low level of knowledge about land reclamation practices, while, 37.78 per cent and 12.59 per cent respondents had medium and high level of knowledge, respectively. Reasons for ill effect of excess irrigation were correctly known to 40.75 per cent of farmers. Providing Surface drainage for reclamation of water logged soils was known to 48.15 per cent of farmers. The important practices—

micronutrients added to problematic soil and the amendments added to the soil were not known to as high as 89.63 per cent and 82.96 per cent of farmers, respectively. Majority (57.78%) of the respondents belonged to low adoption category. Surface drainage was adopted by 41.48 per cent farmers. Bio-drainage and sub-surface drainage were not adopted by farmers. Mass media participation and education were found to be significantly associated with knowledge of land reclamation practices. Only education had significant influence on adoption of land reclamation practices. High initial cost for undertaking land reclamation practices was major problem in adoption of land reclamation practices as it was expressed by 77.03 per cent of farmers. Inadequate availability of organic manures (72.59%) and no common out-let for removing surface drainage water (47.40%) were the other problems in adoption of land reclamation practices.

Analysis of Organic Farming Practices in Pigeonpea in Gulbarga District of Karnataka State

SIDRAM

2008

MAJOR ADVISOR : Dr. D. M. CHANDARGI

The research study was conducted in a purposively selected Gulbarga district of Karnataka state during the year 2007-08. The pulse occupy the majority of the area in the district and is known as "Pulse bowl of Karnataka". Two taluks namely, Gulbarga and Jewargi were purposively selected with 120 respondents because these taluks have maximum number of organic pigeon growers. The study revealed that majority of the respondents (63.33%) had medium level of knowledge about organic pigeonpea farming practices. With regard to individual organic farming practices, majority of the respondents had knowledge about recommended seed rate (81.60%), recommended sowing time (98.33%), application of FYM (100%), vermicompost (100%) and jeevamruth (98.33%), summer ploughing (100%), crop rotation (96.67%), pheromone traps (98.33%), NPV (100%) and NSKE (100%). It was observed that majority of the respondents had adopted the practices like recommended varieties namely, Maruti (81.83%) and BSMR (80.83%), PSB (68.33%) and biocontrol

practice, trichoderma (45.00%), recommended sowing time (92.50%), recommended spacing (31.67%), application of vermicompost (98.33%), jeevamruth (90.83%), FYM (89.17%), summer ploughing (100%), pheromone traps (81.67%), bird perches (63.35%), NSKE (100%) and NPV (96.67%). Large number of respondents were illiterates (81.62%) with joint family (59.17%), big land holder family (60.83%) and with medium entrepreneurial behaviour character (51.67%) with regard to marketing behaviour, majority of the respondents (71.67%) sold their produce when price was higher, sold their produce in regulated market (90.00%), through commission agents (77.50%) and no farmer sold the produce at a premium price. Majority of the respondents expressed that increased income (90.83%), reduced cost of cultivation (88.33%), improved soil structure/texture, productivity of soil improved (52.50%), quality of produce improved (81.67%) and pest incidence reduced (75.83%) due to adoption of organic farming practices.

SEEDSCIENCE ANDTECHNOLOGY

Investigation on Seed Yield and Quality as Influenced by Organics in Capsicum (*Capsicum annuum*)

PRAKASH V. PATIL

2008

MAJOR ADVISOR : Dr. ASHOK S. SAJJAN

A field experiment was conducted to study the effect of organic manures on growth, yield and quality of Capsicum (*Capsicum annuum*) at Agricultural Research Station Bagalkot, University of Agricultural Sciences, Dharwad during summer 2007-08. In experiment was laid out in RBD with factorial concept consisting of four organic source and their combinations while RDF + FYM kept as control. The soil application of FYM (50%)+vermicompost (50%)+biofertilizer (5 kg/ha *Azospirillum*+5 kg/ha PSB) produced higher seed and fruit yield (475.31 kg and 13.99t). The increase in seed yield due to more number of seeds per fruit (137.18), seed weight per plot (321.40 g) and number of fruits per plant (12.61), fruit yield per plant (380.57 g), fruit yield per plot (9.29 kg), respectively and also noticed lower leaf curl index (0.61 and 0.75 at 45 and 90 DAT) respectively. The foliar spray of NAA @ 10 ppm registered higher yield and seed yield parameters. This may be attributed increased number of

seeds (128.78/fruit), seed weight (11.93 g/plant), seed yield (280.67 g/plot) and seed yield (414.82 kg/ha). Number of fruits per plant (12.57), fruit yield per plant (361.52 g), fruit yield per plot (9.00 kg) and fruit yield/hectare (13.18 tonnes). The foliar spray of NAA recorded lower leaf curl index (0.66 and 0.76 at 45 and 90 DAT, respectively). The quality parameters like germination percentage root length, shoot length, seedling vigour index and electrical conductivity significantly influenced by organics. The higher seed germination (93.42%), shoot length (5.32 cm), root length (5.62 cm), seedling vigour index (1002) and electrical conductivity (0.366 dSm⁻¹) were recorded due to soil application of FYM 50% + vermicompost 50% + biofertilizers. The soil application of FYM 50%+vermicompost 50%+biofertilizers (5 kg/ha) coupled with foliar spray NAA (10 ppm) found to be superior over control.

Studies on Maximizing Seed Yield and Quality in Niger (*Guizotia abyssinica* Cass)

B. N. MOHAN KUMAR

2008

MAJOR ADVISOR : Dr. BASAVEGOWDA

An investigation was carried out to study the effects of dates of sowing on growth, yield and quality of niger Cv. No. 71 and RCR-18 during 2007-2008 at Main Agricultural Research Station, College of Agriculture, Dharwad. The experimental results revealed that plant height, number of leaves, number of primary and secondary branches and days to 50 per cent flowering were higher in June first fortnight sowing as compared to later sowings. Between the genotypes, RCR-18 recorded higher growth parameters like plant height, number of primary and secondary branches, number of leaves and early in days to 50 per cent flowering as compared to genotype No. 71. Among the different seasons, *kharif* season recorded higher growth parameters as compared to *rabi* and summer. The crop sown during second fortnight of February recorded significantly lower growth and yield parameters as compared to other dates of sowing. The

interaction (DxV) was significant for growth and yield parameters. Number of capitula, number of seeds per capitula, 1000 seed weight, seed yield per plant, seed yield kg per hectare were found to be higher in June first fortnight sowing as compared to other later sowings. The crop sown during second fortnight of February recorded the lower yield parameters like number of capitula, number of seeds per capitula, 1000 seed weight, seed yield per plant, seed yield kg per hectare. Seed quality parameters like germination percentage, root length, shoot length, field emergence and vigour index were maximum with June first fortnight as compared to other sowings. The crop sown during the second fortnight of February recorded the lower seed quality parameters like germination percentage, root length, shoot length, field emergence and vigour index. The interaction (DxV) was significant for seed quality parameters.

Standardization of Planting Ratio and Staggered Sowing of Male Parent in NHH-44 Bt. Cotton Hybrid Seed Production

PATIL SHIVAKANT SOPANRAO

2008

MAJOR ADVISOR : Dr. M. R. ESHANNA

An investigation was carried out for standardization of two planting ratio (2:1 and 4:1 female to male rows) and five staggered sowing of male parent in NHH-44 Bt. cotton hybrid seed production at Agricultural Research Station, Dharwad during the *kharif* season 2007. The planting ratio of 2:1 recorded higher number of flowers crossed (95.40), crossed bolls per plant (33.92) and seed yield (627 kg/ha) compare to 4:1 planting ratio (87.81, 32.36, 953 kg and 566 kg, respectively). The 4:1 planting ratio recorded higher seed weight per boll (2.09 g), seed index (8.81), germination (80.40%) and seedling vigour index (2621) compared to 2:1 planting ratio. Among the staggered planting, staggered sowing of male (25%) first male sowing, 100% female + 25% male seeds were sown 7 days after first male sowing, 50% male seeds were sown 7 days after second male sowing recorded higher number of flower crossed (96.27), crossed

boll per plant (34.80), seed cotton yield (1026 kg/ha), and seed yield (650 kg/ha) compared to all other staggered sowing treatments and also staggered sowing of male (25%) first male sowing, 100% female + 50% male seeds were sowing 10 days after first male sowing, 25% male seeds were sown 7 days after second male sowing recorded higher seed weight per boll (2.14 g), seed index (8.88), germination (80.67%), seedling vigour index (2668) compared to all other staggered sowing treatments. The planting ratio of 2:1 in combination with staggered sowing of (25% first male sowing, 100% female + 25% male to be sown 7 days after first male sowing, 50% male to be sown 7 days after second male sowing recorded higher number of flower crossed (99.90), crossed bolls per plant (36.83) and seed yield (692 kg/ha) compared to 4:1 planting ratio with other staggered sowing treatments.

Effect of Seed Priming on Storability, Seed Yield and Quality of Soybean [*Glycine max* (L.) Merrill]

MEWAEL KIROS ASSEFA

2008

MAJOR ADVISOR : Dr. RAVI HUNJE

Laboratory and field experiments were conducted to standardize the optimum duration for soybean seed priming and to study the effect of seed quality and seed priming chemicals on storability, seed yield and quality of soybean Cv. JS - 335 at Seed Research Laboratory, National Seed Project (Crops), University of Agricultural Sciences, Dharwad and at Water and Land Use Management Institute (WALMI) Farm, Dharwad, respectively. The lag phase (Phase-II) with little change in water content from 41.8 to 45.0% (14, 16 and 18 h) was found as a priming regime. The 14 h priming duration showed consistently higher performance with the

quality tests. Significantly higher germination (98.00-66.00 %), field emergence (94.90-58.79 %) and vigour index (3118-1418) were recorded in seeds of higher quality primed with CaCl₂.2H₂O (0.5%) followed by GA₃ (20ppm) and KH₂PO₄ (50ppm) primed seeds. Lower electrical conductivity were recorded in the seeds of higher quality primed with CaCl₂.2H₂O (0.5%)(0.214 - 1.471 dSm⁻¹) during the storage period. Significantly lower days to 50 % emergence was recorded in seeds of higher quality primed with GA₃ (20ppm) (6.00) which was on par with the same seeds primed with CaCl₂.2H₂O (0.5%) (6.67). Significantly higher field emergence (93.00

%) was recorded in seeds of higher quality primed with $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ (0.5%) which was on par with seeds of higher quality primed with GA_3 (20ppm) (92.00 %). Significantly higher yield per ha (23.67 q) was recorded in the plots sown with seeds of higher quality primed with $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ (0.5%), followed by those plots with GA_3 (20ppm) and KH_2PO_4 (50ppm). Seed

yield (q/ha) showed high positive and significant correlation with number of pods per plant (0.909**), number of seeds per pod (0.933**) and yield per plant (0.921**). Seed quality parameters were significantly higher in the progeny seeds harvested from lower quality seed primed with $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$, GA_3 and KH_2PO_4 .

Influence of Seed Tapes on Nursery Performance and Seed Pelleting on Seed Yield and Storage Potential in Paprika Chilli (*Capsicum annuum* L.) cv. Kt-PI-19

S. N. MANJUNATHA

2008

MAJOR ADVISOR : Dr. V. K. DESHPANDE

Field and laboratory experiments were carried out to evaluate the performance of pelleted seed tapes in nursery and seed pelleting on seed yield (*kharif* 2007) and storage potential (July 2007 to April 2008) of paprika chilli cv. Kt-PI-19 at MARS, UAS, Dharwad. Among the different seed tapes and pelleting chemicals, seed tapes made up of tissue paper fastened with seeds pelleted with ZnSO_4 (300 mg/kg) + captan (2.5 g/kg) + imidacloprid (2.5 g/kg) recorded significantly higher mean speed of emergence (11.47) and seedling vigour index at 30 DAS (1206) followed by hand sown control. The next best treatment was newspaper seed tapes with ZnSO_4 + captan pelleted seeds. In field, significantly higher growth parameters viz., plant height (58.90 and 67.93 cm), number of branches (20.67 and 22.70) at 90 DAT and at harvest, early 50% flowering (40.34 days) and crop maturity (101.34 days), higher seed yield and its components

such as fruit length (10.96 cm), fruit girth (3.36 cm), number of fruits per plant (33), fruit yield per hectare (219 q), number of seeds per fruit (171.34), seed weight per fruit (2.53 g), seed yield per plant (14.73 g), seed yield per hectare (546 kg), seed:fruit ratio (14.17) and 100-seed weight (5.96 g) and higher seed quality parameters after harvest germination (94%), root length (7.85 cm), shoot length (10.64 cm), seedling vigour index (1737), seedling dry weight (43.94 mg), speed of germination (17.63) and lower electrical conductivity value (0.365 dS m⁻¹) were obtained in seeds pelleted with ZnSO_4 + captan + imidacloprid, seed pelleted with ZnSO_4 + captan was found next best treatment and all parameters were lowest in unpelleted control. The results revealed that seed pelleted with captan and imidacloprid recorded higher seed quality followed by ZnSO_4 + captan + imidacloprid against unpelleted control throughout the storage period.

Effect of Invigouration on Seed Quality, Field Performance and Storability in Sunflower Hybrid KBSH-1

A. B. NARAYANA REDDY

2008

MAJOR ADVISOR : Dr. N. K. BIRADARPATIL

The field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2007 to find the effect of invigouration on seed quality, field performance and storability in sunflower hybrid KBSH-1. Among the hydration treatments, the seeds soaked for 12 hours recorded significantly higher seed quality attributes viz., germination (99.0%), wet weight of seed (325.80 g), seedling dry weight (225.91 mg), seedling vigour index (2856) and lower electrical conductivity (0.288 dS/m). In high vigour seed lot, among the pre-sowing invigouration seed treatments, the seeds treated with 50 ppm GA_3 recorded significantly higher seed quality parameters viz., germination (99.6%), seedling vigour index (3066) and lower electrical conductivity (0.390 dS/m) and it also recorded higher field emergence (93.50%), plant height at harvest (204.60 cm), took least number of days to 50% flowering (55.3 days), head diameter (16.32

cm), test weight (5.82 g) and yield per ha (15.58 q/ha) followed by CaCl_2 and water hydration. Whereas in low vigour seed lot, the seeds treated with two per cent CaCl_2 recorded significantly higher germination (86.6%), seedling vigour index (2243) and lower electrical conductivity (0.534 dS/m) and it also recorded significantly higher field emergence (81.50%), plant height at harvest (202.0 cm), took least number of days to 50% flowering (58.2 days), head diameter (15.42 cm), test weight (5.42 g) and yield per ha (11.83 q/ha) followed by GA_3 and water hydration. The storage studies conducted in National Seed Project (NSP) Laboratory, University of Agricultural Sciences, Dharwad during August 2007 to April 2008, revealed that PEG (200 g/1000 ml) treated seeds recorded significantly higher germination (71.3%), speed of germination (31.56), seedling dry weight (165.85 mg), seedling vigour index (1738) and lower electrical conductivity (0.470 dS/m) followed by CaCl_2 at the end of 8 months of storage period.

Effect of Seed Source, Growing Season and Genotypes on Seed Yield and Quality in Groundnut (*Arachis hypogaea* L.)

C. G. MAHESH

2007

MAJOR ADVISOR : Dr. BASAVEGOWDA

Two field experiments were carried out with ten genotypes viz., TMV-2, R-8808, Dh-3-30, JL-24, GPBD-4, TAG-24, Dh-86, TGLPS-3, Mutant-III and Dh-40 to understand the effect of seed source on field performance and seed quality during *kharif* 2006 and effect of growing season on seed yield and quality during *kharif* 2006 and *rabi*/summer 2007 at Oilseeds Scheme, Main Agricultural Research Station, Dharwad. Between two seed sources the *rabi*/summer seed source though exhibited higher growth parameters viz., number of primary and secondary branches (6.79 and 2.15), length of primary and secondary branches (31.22 and 12.95 cm), the yield components and pod yield/ha were higher in *kharif* seed source (3302 kg/ha), because of better field emergence and plant population per plot (212.2) which was due to its higher initial seed quality viz., germination (74.8%), root length (16.75 cm), shoot length (5.39 cm)

and electrical conductivity (0.293 dS/m). The second experiment was carried to understand the seasonal influence *kharif* season was found to be better for crop growth like, primary and secondary branches per plant (6.79 and 1.84) and length of primary and secondary branches (29.49 and 12.86 cm), yield and seed quality parameters as compared to *rabi*/summer, but yield parameters like, number of developed pods per plant (10.80), yield per plant (11.56 g) and yield (3376 kg/ha) were recorded highest in *rabi*/summer season. Among ten genotypes studied, GPBD-4 (3671 kg/ha) and Mutant-III (3641 kg/ha) in *kharif* and Dh-86 (3899 kg/ha) and TAG-24 (3798 kg/ha) in *rabi*/summer were found to be better for field performance. The *kharif* harvested seeds showed higher initial dormancy than *rabi*/summer. However, the complete dormancy was broken on seventh week after harvest recording maximum germination of 99 per cent in both the seasons.

Standardization of Seed Testing Procedures and Storage Studies in Selected Medicinal Crops

V. B. LALITH KUMAR BHARATH

2008

MAJOR ADVISOR : Dr. V. K. DESHPANDE

Tulsi (*Ocimum sanctum*), Ashwagandha (*Withania somnifera*), Periwinkle (*Catharanthus roseus*) and Kalmegh (*Andrographis paniculata*) were undertaken to standardize seed germination test requirements and storage behaviour in Dharwad. Experiment comprises of four temperature

ranges (15°C, 20°C, 25°C, 20/30°C), three medias (Between paper, Top paper and Sand) and three light treatments viz., light (24 hours), dark with and without KNO_3 (0.2%). In Tulsi, top of paper method with 20/30°C alternate temperature and light (24 h) recorded the highest germination

(84.80%). Between paper method at 25°C constant temperature with 24 h light was found suitable for germination test and recorded maximum germination (84.90%) in Ashwagandha. Periwinkle seeds recorded highest germination (90.70%) in between paper method at 20°C in dark with KNO₃. Top of paper at 15°C with 24 h light was found suitable for Kalmegh and recorded maximum germination (78.80%). Days to first and final count were fixed on 6th and 11th in Tulsi, 6th and 10th in Ashwagandha, 7th and 14th in periwinkle and 8th and 14th day in Kalmegh, respectively.

Influence of Seed Pelleting on Field Performance and Storability of Tomato (*Lycopersicon esculentum* Mill.)

M. S. SHASHIBHASKAR

2008

MAJOR ADVISOR : Dr. S. N. VASUDEVAN

The field and laboratory experiments were conducted to study the influence of seed pelleting on field performance and storability of tomato cv. PKM-1 during 2007-2008 at the Department Of Seed Science and Technology, University of Agricultural Sciences, Dharwad. The tomato seeds were pelleted as per the treatment combination using binder polyvinyl acetate (60 ml/kg) and filler material (saw dust 10 g/kg). The pelleted seeds were packed in cloth bag and polyethylene bag (700 gauge) and stored under ambient conditions for ten months. Among the seed pelleting treatments, seeds pelleted with ZnSO₄ (300 mg/kg) recorded higher field emergence (91%), plant height (84 cm at 90 DAS), number of leaves (75 at 90 DAS), less days to flower initiation and 50 per cent flowering (58, 64 respectively), higher number of fruits per plant (31), fruit yield per plant (1432), number of seeds per fruit (236), seed yield per plant (23.49 g), seed yield per hectare (564 kg) and 1000-seed weight

During ten months of storage study, fresh seeds performed better over old seeds in all four species. Seeds treated with KNO₃ (250 ppm) recorded significantly higher germination (81.50%), shoot (10.45 cm), root length (6.85 cm), vigour index (1225), nursery establishment (66.53%) and lower EC upto the 10th month of storage, while lower seed quality parameters (51.15%, 6.25 cm, 4.55 cm, 557, 42.15%) and higher EC (0.342 dS/m) and seed infection (20.40%) were recorded in untreated seeds other end of sixth months. Cow urine treated seeds performed better than untreated seeds upto six months.

Effect of Seed Priming on Storability and Field Performance in Okra (*Abelmoschus esculentus* (L.) Moench)

B. T. PUSHPALATHA

2008

MAJOR ADVISOR : Dr. T. A. MALABASARI

A laboratory experiment was conducted at Seed Unit (NSP), UAS, Dharwad. Seeds were soaked in water from two to 2 to 24 h and observations on seed quality were recorded at two hours interval. Seeds soaked for 12 h recorded maximum germination (88.67%), seedling dry weight (28.33 mg) and vigour index (2961) as compared to control and other durations of seed soaking. A field experiment was carried out during *kharif* 2007 at Main Agricultural Research Station, Dharwad with two different quality seeds viz., high quality seeds with germination above 85 per cent and low quality seeds with germination below 70 per cent as first factor and six priming treatments viz., water, KH₂PO₄ (5000 ppm), GA₃ (100 ppm), CaCl₂ (1%), KNO₃ (2%) and control as second factor and laid out in randomized block design with factorial concept. High quality seeds recorded less days to 50 per cent emergence, higher field emergence, plant height, less days to 50 per cent flowering and harvest maturity. Highest yield and yield components as compared to low quality seeds. The

seeds primed with GA₃ (100 ppm) taken less days to attain 50 per cent emergence (8.00 days), higher total field emergence (81.60%), plant height (22.79 cm), less days to 50 per cent flowering (41.28) along with higher number of fruits/plant (12.87), number of seeds/fruit (51.60), seed yield/plant (36.52 g) and per hectare (1292.90 kg) over unprimed seeds (10.83, 74.25%, 18.08 cm, 44.45, 9.07, 45.67, 27.58 g and 868 kg respectively). The primed seeds were stored in polythene bag (700 gauge) for 8 months from August 2007 to April 2008. The results on seed quality during storage indicated that high quality seeds recorded higher germination, seedling dry weight, vigour index and field emergence besides recording lower electrical conductivity at the end of 8th month of storage. While, the seeds primed with KNO₃ (2%) maintained higher germination, seedling dry weight, vigour index, field emergence with minimum electrical conductivity even at the end of 8 months of storage.

Effect of Organic Manures and Biofertilizers on Growth, Seed Yield and Quality in Tomato (*Lycopersicon esculentum* Mill.) cv. Megha

V. JAGADEESHA

2008

MAJOR ADVISOR : Dr. D. S. UPPAR

A field experiment was conducted at the University of Agricultural Sciences, Dharwad during *Kharif* season of 2007 to study the effect of organic manures and biofertilizers on plant growth, seed yield and quality parameters in tomato. The experiment consisted of 8 treatment combinations laid out in two factor randomized block design with three replication. Results of field experiment (*Kharif* 2007) revealed that, application of RDF (60:50:30 kg NPK/ha) + biofertilizer (*Azospirillum* and P solubilizing bacteria @ 2.5 kg/ha each) recorded higher plant height (64.37, 109.50 and 62.33 cm), number of leaves (92.50, 153.33 and 46.50), leaf area (898.05, 43 (4.31 and 4310.94 cm²) and leaf area index (898.05, 4314.31 and 4310.94 cm²) at 30, 60 and 90 DAT respectively and recorded lesser days to 50 per cent flowering (38.00)

followed by -FYM (50%) + vermicompost (50 kg) + biofertilizer. The application of RDF + biofertilizers recorded higher seed yield (106.87 kg/ha) followed by FYM (50%) + vermicompost (50%) (101.94 kg/ha) over FYM alone. The seed yield was significantly higher with the application of RDF + biofertilizers which was attributed to higher number of fruits per plant (45.22) number of seeds per fruit (109.45) fruit weight per plant (1280.98 g) and 1000 seed weight (2.84 g). Among the treatments, application of RDF + biofertilizer recorded significantly higher germination (96.73%), root length (11.73 cm), shoot length (12.54 cm), seedling vigour index (2348), seedling dry weight (25.93 mg) and lower electrical conductivity (0.286 dSm⁻¹) followed by FYM (50%) + vermicompost (50%) over FYM alone.

Effect of Hydropriming and Polymer Coating on Field Performance and Storability of Pearl Millet (*Pennisetum glaucum* (L.) B. CHANDRAVATHI

B. CHANDRAVATHI

2008

MAJOR ADVISOR : Dr. R. GURUMURTHY

The field and laboratory experiments to know the effect of hydropriming and polymer coating on field performance and storability of pearl millet cv. 'ICMV-221' were carried out at Agricultural College,

Bjapur Farm and the laboratory studies were carried out at Agriculture College, Dharwad during 2007-08. The field experiment consisted of two factors; two vigour levels viz., low (V₁) and high (V₂) as first factor and

nine hydropriming and polymer coating seed treatments as second factor. The soaking period of eight hours in respect of low vigour seeds of pearl millet cv. 'ICMV-221' was found to be optimum. Among different treatments, hydropriming + polymer coating + *Azospirillum* @ 125 g per kg seed (Ts) recorded significantly the highest field emergence (88.98%), plant stand (72.50 plants/plot), 1000-seed weight (13.71 g) and seed yield per ha (14.34 q). The hydropriming (T₁) took less number of days for days to 50 per cent flowering (44.75 days) as compared to control (T₀). Storage study of these treated seeds packed and stored in cloth bags under

ambient conditions of Dharwad for six months revealed that, high vigour seeds were superior for all the seed quality parameters during the entire storage period compared to low vigour seeds. Among the seed treatments hydropriming + polymer coating + Thiram 2.5 g per kg of seed + malathion 5% (T₃) recorded significantly the highest germination (83.45%), root length (17.40 cm), shoot length (8.21 cm), vigour index(2085), seedling dry Weight(78.47 mg), lowest electrical conductivity (0.718 dS/m) and field emergence (81.39%) as compared to untreated seeds (T₀) at the end of sixth months of storage period.

CROP PHYSIOLOGY

Evaluation of Induced Mutants for Phosphorus use Efficiency in Soybean [*Glycine max* (L.) Merrill]

SHRIKANT B. MORE

2008

MAJOR ADVISOR: Dr. R. V. KOTI

The present investigation on "Evaluation of induced mutants for Phosphorus Use Efficiency in soybean [*Glycine max* (L.) Merrill]" was conducted at the Department of Crop Physiology, College of Agriculture, University of Agricultural Sciences, Dharwad during the year 2007-2008. The investigation comprised of two experiments. A field experiment with 121 mutants of KHSb-2 (M₃ generation) was conducted during *Kharif* 2007 to evaluate for their phosphorus Use Efficiency (PUE). The leaf P content differed significantly among the mutants; however no mutant showed significantly higher kaf P content. The mutant K20 171-2 had numerically higher leaf P content and the mutants viz., K20 84-6, K20 58-5, KE 1-9, KE 14.27 had significantly lower leaf P content. Phosphorus uptake varied significantly, two mutants KE 4-15 and KE 8-30 had only significantly higher P uptake over parent. There was 48 per cent increase

in PUE in the mutant K20 110-1, K20 149-2 and K2041-3. When selected high PUE mutants were grown in TCP medium (insoluble P source) compared with NH₄H₂PO₄ (soluble P source), in the laboratory it was noticed that all the mutants and particularly the mutants KE 1-9, KE 6-6, KE 31-27, K 20 41-3, KE 8-48 dropped pH significantly compared to parent exhibiting distinct variation from the parent in obtaining phosphorus from TCP. The acid phosphatase activity was lower in the mutants with high P content and acid phosphatase activity was found to be the indicator of P sufficiency. The mutants viz., KE 14-27, K 20 58-9, K 20 84-6, KE 1-9, KE 6-6, K 20 48-19, K20 174-2, KE 31-27, K 20 41-3, K 20 149-2 were found superior to the parent in PUE. As regards seed yield, the mutants viz., KE 5-8, KE 23-2, K 20 43-8, KE 8-30. KE 8-28, KE 5-7, KE 10-24, KE 4-2 were found superior.

Physiological Investigations in Pop Sorghum

H. MAMATHA

2008

MAJOR ADVISOR : Dr. D. I. JIRALI

A field experiment was conducted at the University of Agricultural Sciences, Dharwad, farm during *rabi*, 2007-08 to findout the physiological basis of yield variations in different Pop sorghum genotypes. The experiment consisted of 12 genotypes laid out in randomized block design with three replications. The results of the investigations revealed a wide variation among the genotypes with respect to various morphological, bio-physical, bio-chemical, yield, yield components and quality characters studied. Among the genotypes, Koppal-3, Telkar-2, Byahatti-3 and Jeratagi-1 exhibited superiority over rest of the genotypes in yield while giving a better response to most of the yield contributing characters such as more number of leaves and higher distribution of dry matter into

reproductive parts, Higher LAI, LAD and CGR at later growth stages, Higher relative water content, Maximum number of stomates on abaxial surface, Higher total chlorophyll content, Lower chlorophyll stability index, Higher nitrate reductase activity, Higher harvest index and Higher grain yield. However, it was noted from the present study that cultivars had different adaptive mechanisms. It is inferred from the present investigations that by considering all the mechanisms and the relative performance of genotypes with respect to various characters, the genotypes Koppal-3, Telkar-2, Byahatti-3 and Jeratagi-1 are more efficient because of improved morpho-physiological, biophysical, biochemical and quality characters.

Effect of Plant Growth Regulators on Physiology and Quality in Bittergourd (*Momordica charantia* L.)

GEETAS. BIRADAR

2008

MAJOR ADVISOR : Dr. C.M. NAWALAGATTI

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during Rabi 2007-08 to study the effect of plant growth regulators on physiology and quality in bittergourd varieties (MHBI-15 and Chaman plus). The experiment consisted of seven treatments comprising of three plant growth regulators viz., three different levels of GA₃ (20, 40 and 60 ppm), NAA (50 ppm) and two levels of CCC (100 and 200 ppm) and control. It was laid out in factorial randomized block design with three replications. The results of the investigation indicated that the morpho-physiological traits viz., vine length, number of leaves, leaf area, number of female flowers per plant, increased significantly due to application of plant growth regulators (GA₃ 20 ppm). The biochemical parameters viz., chlorophyll

content (Chl a, Chl b and total chlorophyll), Nitrate Reductase Activity (NRA), sugar content (reducing, non-reducing and total sugars), and total phenol content increased significantly due to application of plant growth regulators. The yield and yield components were significantly influenced by growth regulators. Among the treatments GA₃ (20 ppm) recorded significantly higher fruit yield as compared to other treatments. However control recorded lowest fruit yield. The maximum fruit yield was mainly attributed to its close association with morphological characters viz., vine length, number of female flowers per plant, number of leaves, Leaf area and yield components viz., number of fruits per plant, percent fruit set thus it is inferred that application of GA₃ @ 20 ppm is most effective in increasing the fruit yield in bittergourd.

Morpho-Physiological and Molecular Diversity in *Jatropha curcas* (L.)

MOHAMAD ABDULLA JUBERA

2008

MAJOR ADVISOR : Dr. B. S. JANAGOUDAR

A field experiment with seven genotypes was laid out in randomized block design to find out the relationship of morpho-physiological characters with different genotypes of *Jatropha curcas*. Genotypes differed significantly with respect to male flowers per tree,

female to male flower ratio and total number of fruits per tree only. The male flowers recorded highest with DJS-1 and least was recorded with Neemuch genotype. The female to male flower ratio was highest with Neemuch genotype and lower recorded with DJS-1 and Rathlam genotypes.

While, the total number of fruits per tree recorded was higher with Neemuch and least was recorded with Rahuri genotype. Genotypes significantly differed with respect to various physiological parameters, except SPAD values. The genotypes, TNMC-5 recorded higher chlorophyll 'a' content (1.80 mg g^{-1} of fresh weight), proline content after irrigation ($56.98 \text{ } \mu\text{g g}^{-1}$ of fresh weight), RWC before (81.78%) and after irrigation (78.14%) and TNMC-7 recorded higher chlorophyll 'b' content (0.56 mg g^{-1} of fresh weight), total chlorophyll content (2.31 mg g^{-1} of fresh weight) and levels of leaf shedding (6.47). In the correlation studies, SPAD values showed positive correlation with the RWC before irrigation (+0.749), RWC after irrigation (+0.708), total chlorophyll content (+0.301) and proline content after irrigation (+0.310) and negative correlation ($r=-$

0.136) with SLW. PCR-based random amplified polymorphic DNA (RAPD) markers were employed to assess genetic diversity in seven *Jatropha curcas* (L.) genotypes. Four out of five random primers screened revealed polymorphism among the genotypes. Most of the primers revealed single polymorphic band and 78.69% of the products were polymorphic. Twenty eight scorable fragments were obtained with an average of 7.0 bands per primer and average number of polymorphic bands found to be 5.25. Genetic distance (%) based on Jaccard's similarity co-efficient ranged from 81.8-100, indicating narrow genetic variability among the genotypes based on RAPD markers and *Jatropha* genotypes formed two major clusters in the dendrogram.

Physiology and Quality of Muskmelon (*Cucumis melo* L.) as Influenced by Plant Growth Regulators

H. R. DEEPTHI

2008

MAJOR ADVISOR: Dr. M. B. CHETTI

A field study was conducted during rabi / summer, 2007 at College of Agriculture, University of Agricultural Sciences, Dharwad to study the growth, physiology and quality muskmelon (*Cucumis melo* L.) as influenced by plant growth regulators. The experiment was laid out in factorial randomized block design with two genotypes (Century and 7455) and seven treatments in three replications. The treatments included were foliar application of GA_3 (20, 40 and 60 ppm), NAA (50 ppm), CCC (100 ppm) and fruit dipping of GA_3 (20 ppm) and control. The treatments were imposed at 40 DAS. The results revealed that the application of GA_3 (60 ppm) recorded maximum vine length, number of leaves and leaf area. Initially (55 DAS), the maximum vine length, number of leaves and leaf area were recorded in Century than 7455; while at the later stages of crop growth, a reverse trend was observed. Biochemical parameters viz., chlorophyll 'a', chlorophyll 'b', total chlorophyll contents were

significantly higher with the application of GA_3 (20 ppm) fruit dipping. While, NRA was found to be superior with the application of GA_3 (60 ppm). Total carotenoids were recorded significantly higher with the application of GA_3 (60 ppm). Among the quality parameters, ascorbic acid content was found to be superior with GA_3 (60 ppm), while reducing, non-reducing and total sugars were found to be maximum with GA_3 (20 ppm) fruit dipping followed by GA_3 (60 ppm). Fruit density and rind thickness did not differ significantly between the treatments but varieties differed with Century having significantly higher values compared to 7455. The fruit yield was significantly higher with the foliar application of GA_3 (60 ppm) followed by GA_3 (20 ppm) fruit dip compared to control. The economics of the using different growth regulators revealed that the B : C ratio was maximum with GA_3 (60 ppm) followed by GA_3 (20 ppm) fruit dip.

PLANT PATHOLOGY

Studies on the Influence of Organics on Major Diseases of Paddy

D. SRIDHAR

2008

MAJOR ADVISOR : M. B. PATIL

Seed treatment with different organic treatments revealed that brahmastra. was found to be superior over others with 100 per cent seed germination and highest vigour index of 1540 followed by beejamrutha and jeevamrutha. There was a gradual reduction in the incidence of major foliar diseases of paddy viz., leaf blast, sheath blight, bacterial leaf blight and grain discolouration in all the treatments compared to control. However, T_7 was proved to be the best among all other treatments with lowest PDI for all the major foliar diseases. Increased activity of defense enzymes viz., phenols, peroxidases and phenylalanine ammonia lyase was observed in all the treatments compared to control. But a decreased

phenol and peroxidase activity was recorded in T_1 at 30 DAT and at harvest respectively over control. Yield parameters viz., number of panicles per hill and grain yield were found to be superior in farmer's practice (control/ T_6) with 14.33 panicles/hill and 55.5 q/ha respectively followed by T_7 . But highest 1000 grain weight was recorded in T_6 (15.30 g) and all other treatments were on par with each other. Isozyme analysis which was performed using PAGE (Poly Acryl amide Gel Electrophoresis) for peroxidase revealed that there was no variation with respect to number of bands. A slight variation was observed with respect to R_m (Relative mobility) values and thickness of bands.

Studies on Bud Blight Disease of Tomato Caused by Groundnut Bud Necrosis Virus

L. MANJUNATHA

2008

MAJOR ADVISOR : Dr. M. S. PATIL

Bud blight disease on tomato caused by groundnut bud necrosis virus (GBNV) is most important viral diseases of tomato in Karnataka and causes severe losses every year belongs to genus Tospovirus and the family *Bunyaviridae*. The survey was undertaken in parts of Belgaum, Dharwad, Haveri and Kolar districts during summer 2008. The bud blight was present in all the places where survey was carried out, the disease incidence ranged from 12.5 to 94.4%. The GBNV was mechanically transmitted. Cowpea, Datura, Chenopodium and Petunia were found to be good assay hosts. In the host range studies, 28 plant species tested, 14 were local lesion hosts, nine were local. systemic hosts, two were systemic latent hosts and three were non-hosts. The GBNV was transmitted by *Thrips palmi*. The GBNV was detected by DAC-ELISA. The GBNV coat protein gene was amplified by RT-PCR. The sequenced region contained 831 nucleotides potentially code for a coat protein of 276 amino acids.

Electron microscopy studies showed spherical of 80-100 nm diameter particle size. The effect of coconut and sorghum leaf extracts were studied to know the antiviral properties through induced systemic resistance (ISR). Spray of leaf extracts after 48 hours of inoculation, there was high ISR activities through higher production of PAL, PO, PPO compared to just inoculated plants. Of the 22 tomato varieties screened for resistance Under field conditions, none of the genotypes showed resistant reactions. In the management of GBNV in tomato, the seed treatment with imidachloprid (0.005%) followed by spray of interpid (0.5%), acetamiprid (0.02%), thiomethoxam (0.05%) found effective with low disease incidence (34.09) compared to control (92.22). Sequence homology with GBNV of other isolates indicated that the present bud blight disease caused by GBNV on tomato can be tentatively designated as a strain of groundnut bud necrosis virus on tomato.

ECO-Friendly Management of Soybean Rust Caused by *Phakopsora pachyrhizi* Syd.

MAHANTESH K. HURALI

2008

MAJOR ADVISOR : Dr. P. V. PATIL

Present investigation was undertaken to evaluate the ITK's, plant and protein based and a chemical fungicide both under *in vitro* and *in vivo* condition and further the harvested produce was subjected for quality analysis. Neem leaf extract among the 25 plant extracts, cristol 56 SL among the five commercially available plant and protein based products and cow urine among the five ITK's tested have shown maximum per cent inhibition of uredospore germination at higher concentrations. Field evaluation of ITK's, plant and protein based and a chemical fungicide alone and their combination spray schedule against soybean rust undertaken at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad and Research and Development Unit, Ugar -Khurd revealed that, least disease severity of 26.07 per cent was recorded in hexaconazole alone spray followed by cristo I 56SLhexaconazole - cristol 56 SL (27.71%) spray schedule. Whereas, neem oil hexaconazole - neem oil spray schedule recorded maximum (23.16 q/ha) seed yield followed by hexaconazole

(22.67 q/ha) and cow milk - hexaconazole - cow milk (22.66 q/ha) spray schedule. Estimation of oil and protein from the harvested produce of different spray schedule treatments indicated that cristol 56SL - hexaconazole - cristol 56SL spray schedule recorded maximum oil content (19.76%) followed by hexaconazole alone spray (19.62 %). Whereas, protein content was maximum in hexaconazole alone spray followed by cristol 56SL - hexaconazole - cristol 56SL (36.80%) spray schedule. Cow urine - hexaconazole - cow urine spray schedule recorded maximum linoleic acid (10.504%) content. Whereas, alone spray of cow milk recorded least linolenic acid (1.654%) content. But, ratio of linoleic and linolenic acid found maximum (6.285) in cow milk alone spray. Analysis of defense related enzymes in rust infected leaves of soybean revealed that maximum peroxidase and polyphenol oxidase activity was recorded in cow urine spray. Whereas, unsprayed control recorded maximum catalase activity.

Studies on Plant Growth Promoting Rhizobacteria for the Management of Root Knot Nematode (*Meloidogyne incognita*) of Tomato

DANG THUY LINH

2008

MAJOR ADVISOR : Dr. S. LINGARAJU

The ability of native strains of plant growth promoting rhizobacteria to suppress the juveniles of *Meloidogyne incognita* causing root knot disease of tomato was investigated *in vivo*. The most efficacious strains were characterized based on their morphology and biochemical tests. They were used *in vivo* studies in green house to see if they reduce the root knot disease on tomato. Nine strains (designated as St 1, St 2, so on and so forth) isolated from health tomato rhizospheres of Main Agricultural Research Station, Dharwad were tested for their efficacy: The highest mortality percentage was observed in the culture filtrate of St 2 (100), St 9 (100) and St 3 (79). Based on antagonistic effect on root knot nematode, three strains were identified as belonging to *Bacillus spp.* (St 2 and St 3) and one to *Micrococcus sp.* (St 9). They were selected for

testing their growth promotion activity and talc formulations were prepared and used for pot culture experiment. Three strains showed plant growth promotion in terms of seed germination in both roll towel and pot culture studies. Seedling vigour was improved due to seed inoculation with St 2 (1482), St 9 (1411) and St 3 (1311) at 15 days by roll towel method. But at 60 DAS in pot culture, only St 9 strain recorded improved in seedling vigour index (2615). The pot culture studies on the efficacy of talc based formulation of the isolates against *M. incognita* in tomato revealed that the inoculation with strains St 2 and St 9 significantly enhanced the plant growth parameters, viz. shoot length, root length and fresh weight. Significant reduction in root galls was observed in St 2 treatment which recorded reduced root knot index up to 80 per cent over control, followed by St 3 and St 9 treatments.

Integrated Management of Sclerotium Wilt of Potato Caused by *Sclerotium rolfii* Sacc.

BASAMMA

2008

MAJOR ADVISOR : K. S. NAIK

Potato (*Solanum tuberosum* L.) is one of the important vegetable crops of Karnataka. Sclerotium wilt of potato caused by *Sclerotium rolfii* Sacc. is one of the most important soil borne diseases which is attaining the major status in potato in Karnataka. Potato plants were raised in an inoculated pots and after 6th week a pure culture of *Sclerotium rolfii* was obtained from wilted plants and pathogenicity was proved successfully. Maximum dry mycelial weight was recorded on 10th day of inoculation. Among non-synthetic media tested against *Sclerotium rolfii*, potato dextrose agar, oat meal extract agar and Sabouroud's agar supported maximum radial growth. Among synthetic media tested, Richards's agar supported maximum growth. The temperature of 30°C, pH of 5.0 and 12 h light and 12 h darkness were found to be the best for fungal growth. Sucrose and potassium nitrate were found to be the best carbon and nitrogen sources respectively for the growth of the pathogen. Due to infection by

S. rolfii total phenol content was increased but reducing, non-reducing and total sugars were decreased. All the cultivars screened against *S. rolfii* showed highly susceptible reaction. Soil solarization increased the soil temperature maximum by 9.9°C over non-solarized. Reduction in soil microbial population i.e. fungi, bacteria, actinomycetes and *S. rolfii* was noticed in solarized plot. Among non-systemic fungicides, thiram, emisan and mancozeb recorded cent per cent inhibition at 0.1, 0.2 and 0.3 per cent concentrations. Among systemic fungicides difenconazole, hexaconazole and carboxin at 0.05, 0.1 and 0.2 per cent concentrations recorded cent per cent inhibition of *S. rolfii*. Among bioagents tested maximum inhibition of the pathogen was recorded in *Trichoderma harzianum*. Soil solarization in combination with carboxin + *Trichoderma harzianum* tuber treatment along with soil application of FYM and neem cake reduced the wilt incidence and increased yield of potato.

Evaluation of Aflatoxin Contamination and Pesticide Residues in Chilli Grown in Northern Karnataka Region

S. SUDHA

2008

MAJOR ADVISOR : M. K. NAIK

Aspergillus flavus incidence in chilli was maximum in Bellary with an average of 8.72 per cent followed by Raichur (6.04%) and the least was in Gulbarga district (5.74%). Among the sixteen isolates of *A. flavus*, the potency of aflatoxin production varied from 99.96 to 1639.10 µg/kg as detected by indirect competitive ELISA. The isolate AF10 obtained from Laxminagar camp-1 of Bellary produced highest aflatoxin (1639.10 µg/kg) and the least was noticed in AF14 (99.96 µg/kg) obtained from Somasamudra of Bellary. *A. flavus* population was maximum in Bellary with a range 493-1281 cfug⁻¹ soil, the highest population density of 1281 cfug⁻¹ soil was recorded in Bhagyanagar camp of Bellary district followed by Raichur with a range 413-953 cfug⁻¹ soil and the lowest was recorded in Gulbarga district (310-840 cfug⁻¹). The highest per cent colonization of

A. flavus was recorded on fig fruit (70.66) and the least was on paddy (17.66%). The chilli samples from Bellary had higher aflatoxin contamination AFB1 (24.64µg/kg) followed by Raichur (7.58µg/kg) and Gulbarga (2.84µg/kg). Among the various chilli products, only chilli powder encountered aflatoxin above permissible limit (>30µg/kg), where as Masala powder, Pullogare powder and Vangibath powder did not possess any aflatoxin. None of the insecticides and fungicides was detected in the chilli samples of farmers field collected from Raichur, Gulbarga, Bellary and adaptable IPM module. Of the 97 chilli genotypes screened using pin prick method, only BK-21-SPS-06 genotype showed resistant reaction to *A. flavus*. The infection of *A. flavus* in challenge inoculated chilli fruits

was least in captan (1.57%) followed by mancozeb (1.90%), NSKE (2.20%) and *Pseudomonas fluorescens* (2.0 %) treated fruits. Under field condition, least incidence of *A. flavus* was recorded in NSKE treated plot (1.65%).

Promoting Indigenous *Pseudomonas fluorescens* Isolates for Biocontrol and PGPR Activity

M .ANAND

2008

MAJOR ADVISOR : M. K. NAIK

Isolates of *Pseudomonas fluorescens* were collected from the rhizosphere of chilli, sunflower and cotton from Raichur, Karnataka. Twenty five colonies showing yellow pigmentation on King's B medium from different rhizosphere soil were picked up. Based on the pigment formation and fluorescens under UV light, finally six isolates from chilli (Pf1, Pf2, Pf3, Pf4, Pf5 and Pf6), one from sunflower (Pf8) and an isolate from TNAU (Pf7) were used for further study and comparison. The different indigenous isolates of *Pseudomonas fluorescens* were characterized and the efficacy of eight isolates of *P. fluorescens* was evaluated for biocontrol efficacy through dual culture technique. Among different *P. fluorescens* isolates, an indigenous isolate Pf4 recorded maximum inhibition of mycelial growth of *F. solani* (wilt of chilli), *C. gloeosporioides* (anthracnose of pomegranate), *A. alternata* (leaf spot of cotton) and *R. solani* (cotton root rot). Further the efficacy of *P. fluorescens* isolates in inducing resistance was tested against *F. solani*

The population *A. flavus* was reduced by 47.07 and 65.88 per cent at 90 days and 66.94 and 77.85 per cent at 120 days after soil application of neem cake and *T. harzianum* plots respectively.

(F121) causing wilt of chilli. Pf4 was proved to be best in induction of defense related enzymes viz., peroxidase, polyphenol oxidase, phenylalanine ammonia lyase, total phenol and b-1, 3- glucanase both at short durations (0, 1, 3, 5, 7 and 9th day) and long durations (30, 60 and 90th day). High vigour index was also noticed in Pf4 isolate. Different *P. fluorescens* isolates were tested for phenazine, HCN and salicylic acid production. Among the indigenous isolates Pf4 produced maximum amount of phenazine (7.92 absorbance at 367 nm). Of eight different *P. fluorescens* isolates tested, six isolates produced HCN. The isolates Pf3, Pf4 and Pf8 were high HCN producers whereas Pf2, Pf5 and Pf6 were the moderate HCN producers. Studies on the production of salicylic acid (SA) revealed that, only four isolates viz., Pf4, Pf5, Pf6 and Pf7 produced SA. The isolate Pf4 produced maximum SA (26.46 absorbance at 527 nm). Thus, the Pf4 isolate emerged out as the most potential bioagent.

Studies on Root-Knot and Wilt Complex in *Coleus forskohlii* (Wild.) Briq. Caused by *Meloidogyne incognita* (Kofoid and White) Chitwood and *Fusarium chlamydosporum* (Frag. and Cif.) Booth

B. KUMAR

2008

MAJOR ADVISOR : Dr. V. DEVAPPA

Coleus forskohlii is subjected to be attacked by several diseases, among them Root-knot and wilt complex caused by *Meloidogyne incognita* and *Fusarium chlamydosporum* is the most important. A survey on the occurrence of root-knot disease in northern districts of Karnataka revealed zero to 68.00 percent root-knot incidence conducted during 2007-08. Survey also indicated the association of *Meloidogyne* spp. with fungi namely *Fusarium chlamydosporum*, *Sclerotium rolfsii* and *Rhizoctonia bataticola* in most of locations surveyed with high frequency of occurrence of *Meloidogyne incognita* and *Fusarium chlamydosporum* from soil and root samples collected from Belgaum district. In interaction studies, simultaneous inoculation of *Meloidogyne incognita* and *Fusarium chlamydosporum* caused a greater reduction in plant growth parameters as well as nematode multiplication. However, individually, *Meloidogyne incognita* which caused greater reduction in plant growth parameters as well as nematode multiplication compared to *Fusarium chlamydosporum*.

In case of sequential inoculation of *Meloidogyne incognita* seven days prior to *Fusarium chlamydosporum* caused reduction in plant growth parameters. Genotypes viz., yellow tubers and Rabakavi local showed resistant reaction. Orange tubers and Nimbanur local genotype showed moderately resistant reaction and MannaEKhalli, Birur local, Gurlapur local, K-8, Yamakanamaradi, Local IIHR collection and Sunadolli local showed susceptible reaction against *Meloidogyne incognita* and *Fusarium chlamydosporum*. In the management study in pot culture, combined application of plant product (Neem seed kernel powder @ 5 g/kg of soil) + biocontrol agents (*Paecilomyces lilacinus*, *Trichoderma viride* + *Pseudomonas fluorescens* @ 10 g/kg of soil respectively) was found effective in reducing the number of galls, nematode population, number of egg masses, root- knot index, root- rot index and improving the plant growth parameters when compared to inoculated control.

Studies on Foot Rot of Black Pepper Caused by *Phytophthora capsici* Leonian, emend, Alizadeh and Tsao

S. SHASHIDHARA

2007

MAJOR ADVISOR : Dr. M. S. LOKESH

Black pepper is one of the most important spice crops, belongs to the family Piperaceae. It is known as king of spices. In India, black pepper is being cultivated in 2.2 lakh ha with a production of 70,000 tonnes during 2005-06 and exported 28,750 tonnes worth of Rs.206.2 crores. The cultivation and production of black pepper is limited by many diseases of which foot rot caused by *Phytophthora capsici* is the most important and serious disease. The symptoms were noticed on all parts of vine and in advanced stage leads to death of the entire vine. The survey report revealed a highest severity of the disease was in Mundigesara village of Sirsi taluk which was identified as hot spot for the disease. The pathogen *Phytophthora capsici* was isolated from the infected vines and characterized on the basis of morphological studies. The fungus was confirmed as *P. capsici* by proving pathogenicity on black pepper. *In vitro* evaluation of

antagonists revealed that *Trichoderma* sp. of Mundigesara, Yellapur and Edahalli isolates were found to be effective in inhibiting the growth of *P. capsici*. Among the plant extracts tested, garlic clove extract followed by *Duranta plumeri* Jacq., *Chromolaena odorata* King., *Azadirachta indica* A. Juss. and *Lantana camera* L. leaf extracts. The *Tridax procumbens* Linn. is found to be least effective followed by *Adathoda vesica* Nees. against test pathogen. *In vitro* evaluation of fungicides viz., Akomin Melody duo, Ridomil and Secure at 0.1%, 0.2% and 0.3% concentrations were found highly inhibitory to *Phytophthora capsici*. Integrated management of the disease in field condition revealed that Metalaxyl MZ 72 WP (Ridomil MZ 72 WP) as spray and drench at 0.125% in combination with *T. harzianum*, *P. fluorescens* along with neem cake application was found to be most effective in reducing the disease incidence.

Morphological and Genetic Variability and Host Resistance Response of Sorghum Recombinant Inbred Lines (RILs) to a Virulent Isolate of *Macrophomina phaseolina* (Tassi) Goid.

T. R. KAVITHA

2007

MAJOR ADVISOR : Dr. Y. D. NARAYANA

Twenty-six isolates of *Macrophomina phaseolina* causing charcoal rot of sorghum, collected from different parts of Karnataka, Maharashtra and Andhra Pradesh varied both morphologically and genetically, to understand the infection and movement, the selected virulent

isolates of the pathogen was used and to map the variability of charcoal rot component traits to D₃ isolate among RILs of IS 22380 X E36-1cross was used. Colony diameter varied from 60.0 mm to 90.0 mm among isolates. On the basis of colony colour, the isolates could be divided into

4 groups such as grayish white, blackish gray, deep black and cottony white. Majority of the isolates took 2-3 days for sclerotial body formation. Ramnagar isolate produced largest size of sclerotia (94.0 µm) followed by others. On the basis of shape of sclerotia, isolates were divided into 2 groups viz., round and oblong shape. Rahuri isolate produced highest number of sclerotia (60.3 sclerotia/microscopic field 10X) and 110, 135 and 180 sclerotia/9 mm disc during 2nd, 4th and 6th day after inoculation. Molecular profiling using randomly amplified polymorphic DNA (RAPD) markers revealed high level of the genetic diversity among the isolates of *M.*

phaseolina. Similarity coefficient and the resulting phenotypic tree was analyzed vis-à-vis morphometry and geographical origin of isolates maximum genetic similarity of 63 was observed between Jalna and Pune isolates. Root samples of sorghum seedlings inoculated with *M. phaseolina* were collected at intervals upto 10 days. Necrotic lesions were developed on roots 48 h after inoculation. Abundant hyphae were observed on the surface of root after 24 h of inoculation. To evaluate the charcoal rot incidence, 93 Recombinant Inbred Lines (RILs) derived from cross between IS22380 and E36-1 were evaluated. The contrasting behaviour of parents for charcoal rot resistance showed wide range of variability.

Studies on Bacterial Leaf Spot of Grape Caused by *Xanthomonas campestris* pv. *viticola* (Nayudu) Dye in Northern Karnataka

SHIVANANDA JAMBENAL

2008

MAJOR ADVISOR : Dr. M. R. RAVIKUMAR

Among the several diseases, bacterial leaf spot is one of the most destructive diseases of grape, which causes considerable loss in yield and quality of produce. The present investigations comprised of survey for bacterial leaf spot of grape in Northern parts of Karnataka, isolation, identification and pathogenicity, *in-vitro* and *in-vivo* evaluation different chemicals, bioagents and their combinations. Surveyed during 2007-08 both at April and October pruning stages revealed that the disease was severe during April pruning stage as compared to October pruning stage. The places like Tikota (Bijapur district) and Chikkapadasalagi (Bagalkot district) were identified as 'hot spots' for this disease. The bacterium isolated from infected leaves showing typical symptoms of bacterial spot yielded yellow, mucoid, shiny, slimy, convex colonies on nutrient agar medium. Based on the physiologic, biochemical and morphological characteristics, the bacterium was identified as *Xanthomonas campestris*

pv. *viticola*. Further, based on hypersensitive reaction on *Nicotiana tabacum* var. *samsun* and pathogenicity test on grape confirmed as *X. c.* pv. *viticola*. Among the various bactericides, antibiotics, bioagents alone and their combinations tested under *in-vitro* condition revealed the superiority of streptomycin (500 ppm) plus copper oxychloride (2000 ppm) and *Bacillus subtilis* (bioagent) were produced maximum inhibition zone against *X. c.* pv. *viticola*. *In vivo* studies also revealed superiority of streptomycin (500 ppm) plus copper oxychloride (2000 ppm) in managing the disease. Among the bioagents, *Bacillus subtilis* (5000 ppm) was gave good result. The yield and yield parameters like number of branches production and number of bunches infected per plant, weight of single bunch were significantly superior in case of streptomycin (5000 ppm) plus copper oxychloride (2000 ppm) compared over other treatments.

Studies on Seed Borne Aspects of Anthracnose of Chilli and Its Management

VINAYA HEMANNAVAR

2008

MAJOR ADVISOR : Dr. M.S. LAXMINARAYANARAO

The present investigation on studies on seed borne aspects of anthracnose of chilli and its management was conducted during 2006-08 which included testing of chilli seed samples for seed borne mycoflora, evaluation of seed health testing methods, seed to plant transmission studies, integrated management of anthracnose of chilli and management of seed mycoflora of chilli in storage. Seed health testing of chilli seed samples collected from different parts of northern Karnataka revealed the dominance of *Colletotrichum capsici*. Seed washing technique revealed only the presence of saprophytic fungi like *Aspergillus* sp. and *Penicillium* sp. Among the different seed health testing methods, standard blotter method was found to be good for detecting the seed-borne infection of *C. capsici* in chilli. Infected chilli seeds exhibited poor germination and

reduced vigour. The pathogenic ability of seed borne *C. capsici* was proved in seedling symptom test and transmission study. Component plating technique revealed that *C. capsici* is present both on pericarp and in embryo. Seed dressing fungicide viz., carboxin + thiram (Vitavax Power), bioagent *Pseudomonas fluorescens* and botanical *Azadirachta indica* were found most effective in eliminating seed-borne infection of *C. capsici* and other fungal contaminants. In the integrated seed treatment options, seed treatment with carboxin + thiram at 0.2 per cent concentration along with *P. fluorescens* at 0.6 per cent concentration followed by hexaconazole foliar spray of 0.1 per cent concentration recorded least per cent disease index maximum yield and maximum benefit cost ratio. In storage, chilli fruits stored in 700 gauge polyethylene bag and in metallic container recorded least per cent seed infection.

Studies on Anthracnose - A Postharvest Disease of Papaya

VINOD TASIWAL

2008

MAJOR ADVISOR : Dr. V.I. BENAGI

Papaya (*Carica papaya* L.) an important tropical and subtropical fruit crop, is being affected by several post-harvest diseases among which anthracnose caused by *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. Studies on *C. gloeosporioides* include isolation, identification and proving pathogenicity test. The conidia were cylindrical or oblong, hyaline and single celled with oil globules. Cultural studies revealed that among solid media, V-8 juice agar and oat meal agar were found to be good for radial growth and sporulation of *C. gloeosporioides* and among the liquid media, Richard's and Malt extract broth supported maximum dry mycelial weight of *C. gloeosporioides* on 10th day of incubation. Nutritional studies revealed that dextrose, potassium nitrate and magnesium sulphate were better source among the carbon, nitrogen and sulphur sources, respectively for growth, sporulation and yielded maximum dry mycelial weight of the pathogen. Physiological studies revealed that optimum pH of 6.5 was

favourable for growth and sporulation of pathogen. Maximum dry mycelial weight was obtained at optimum temperature of 30°C. Alternate cycles of 12 hours light and 12 hours darkness favoured the maximum radial growth and dry mycelial weight of *C. gloeosporioides* followed by continuous light. Under *in vitro* evaluation of botanicals, that *Lantana camara* and turmeric (5 and 7.5%) were found to be effective against *C. gloeosporioides*. Among the fungicides tested, carbendazim was found to be best per cent effective at all three concentrations (0.05, 0.1 and 0.15%) and among the biocontrol agent *Trichoderma virens* was found to be effective followed by *T. koningii*. Under *in vivo* evaluation of salt, bioagents and hot water, the minimum per cent disease index was observed in sodium chloride (5%) + hot water at 49°C at 15 minutes. Among the *in vivo* evaluation of fungicides, carbendazim was superior at 0.1% and found to be a least per cent disease index.

Studies on Molecular Variations in *Phaeoisoropsis personata* (Berk and M.A. Curtis) van Arx. Causing Late Leaf Spot of Groundnut (*Arachis hypogaea* L.)

KUMARI

2008

MAJOR ADVISER : Dr. S.S. ADIVER

The present investigation on molecular variability in *Phaeoisoropsis personata* was carried out during the period 2006-08 at the Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences, Dharwad. The study includes molecular variability in *P. personata* through isozyme and RAPD technique. Pathogenic isolates of *P. personata* were obtained from 15 commonly grown groundnut cultivars (resistant and susceptible genotypes) in MARS, UAS Dharwad and also collected in nine locations of Karnataka (Arabhavi, Annigere, Bijapur, Indalgi, Hammanamatti, Shirahatti, Nippani, Raichur and Dharwad) for investigation on molecular variability. Based on isozyme analysis of four enzymes (peroxidase, Polyphenol oxidase, catalase and super-oxide-dismutase) two major clusters were obtained which revealed little variation in their protein makeup. Based on isozyme bands it was possible to categorize the isolates into different groups. From the investigation it is clear that the isolates V14 (LSVT-1-2006-2) and HAN (Hanumanamatti) exhibited more peroxidase activity followed by isolates V15 (TAG-24)

and IND (Indalgi) from Dharwad and other locations respectively by expressing more number of bands. Based on RAPD data distinguished the fifteen isolates from Dharwad and eight isolates from other locations into two major clusters, A and B each. Among the isolates from Dharwad location, isolates V12 (ICGV-86950) and V13 (LSVT-1-2005-7) had maximum similarity, whereas isolates V8 (JL-24) and V1 (DH-212) showed least similarity. Among the isolates obtained from different locations; isolates from Annigere and Bijapur had maximum similarity whereas isolates from Raichur and Arabhavi showed least similarity. So the results obtained from the cluster analysis revealed that sub-cluster groups composed of isolates belonging to same geographical locations with certain variability. The present investigation revealed a great molecular variation existing among the isolates of *P. personata* which could be used to distinguish variation among the isolates of *P. personata*. The study also brought out that, the pathogen showed molecular variation over locations and also in a location depending on the genotypes grown there.

Investigations on Peanut Bud Necrosis Disease of Groundnut in Tungabhadra and Upper Krishna Project Areas

BASAVARAJ L. NAGOJI

2008

MAJOR ADVISOR: Dr. GURURAJ SUNKAD

Among the several diseases affecting the groundnut crop, peanut bud necrosis disease contributed more loss in yield. Survey on the incidence of peanut bud necrosis disease during *kharif* and *rabi*/summer 2007-08 in four major oilseed growing districts of north Karnataka revealed that the peanut bud necrosis disease was more severe during both seasons. The severity of peanut bud necrosis disease was more in *rabi*/summer season than *kharif*. Among the four districts, Raichur district recorded more severity for peanut bud necrosis disease. The maximum loss in growth parameters and yield parameters noticed at 30 days after sowing during *kharif*, 2007 and *rabi*/summer, 2007-08 seasons. Among the dates of

sowing the least incidence and best date of sowing for the *kharif* season is 1st June. The least incidence and best date of sowing for the *rabi*/summer season is 1st November. Biochemical parameters *viz.*, total sugar, reducing sugar, non reducing sugar, phenol content, ortho-dihydroxy phenol and protein contents were more in resistant genotypes than moderately resistant and susceptible genotypes. Among the 141 groundnut genotypes screened under field conditions 13 genotypes *viz.*, ICG -442, ICG-1668, ICG-7906, ICG-9842, ICG-10185, ICG-11687, ICG-12000, ICG-12189, CS-92, CS-107, CS-205, R-2001-2 and R-2001-3 were found resistant to peanut bud necrosis disease of groundnut.

Studies on Leaf Blight of Chrysanthemum Caused by *Alternaria alternata* (Fr.) Keissler

G. S. ARUNKUMAR

2008

MAJOR ADVISOR : Dr. B. C. KAMANNA

Among the several diseases, *Alternaria* leaf blight is one of the most destructive foliar disease which causes heavy loss in chrysanthemum. Survey during *kharif/rabi* 2007 revealed that *Alternaria* leaf blight was severe in all the four districts *viz.*, Dharwad, Haveri, Gadag and Koppal.. Isolation and morphological studies revealed *Alternaria alternata* (Fr.) Keissler as causal organism. The weather studies revealed that per cent disease index (PDI) was progressing at linear rate throughout the plant growth and it was negatively correlated with minimum temperature, relative humidity (morning and evening). While, positively correlated with maximum temperature and rainfall. The prediction model developed for PDI was linear i.e., $Y = a + bt$, where $a = 1.35$ and $b = -0.17$; with high R^2 value of 0.96. Out of nine different fungicides tested *in vitro*, Propiconazole

and Hexaconazole at all the concentrations (0.1%, 0.2% and 0.3%) completely inhibited the mycelial growth of *A. alternata*. Among the six bio-control agents tested against *A. alternata* under laboratory condition in dual culture, *Trichoderma harzianum* recorded highest inhibition of radial growth. *T. koningii*, *T. viridae*, and *T. virens* were next in order. Bacterial antagonists proved to be least effective. Out of six plant extracts tested against *A. alternata*, NSKE followed by neem leaf extract and garlic clove extracts were highly inhibitory to *A. alternata*, while tulasi leaf extract proved to be least inhibitor. In case of field evaluation of fungicides, botanicals and bio-agent Hexaconazole (0.1%) effectively controlled the disease incidence which recorded very less per cent disease index. followed by Chlorothalonil (0.2%) and Mancozeb (0.2%).

AGRONOMY

Response of Pigeonpea (*Cajanus cajan* (L.) Millsp.) to Planting Geometry under Different Nutrient and Irrigation Levels for Yield Maximization

K. S. SARITHA

2008

MAJOR ADVISOR : Dr. B.T. PUJARI

A field experiment was conducted at Agricultural College farm, Raichur, to study the response of pigeonpea to planting geometry under different nutrient and irrigation levels for yield maximization. The experiment was laid out in split-split plot design with 16 treatment combinations and three replications, comprising of four irrigation levels (I_0 - No irrigation, I_1 - One irrigation at flower initiation, I_2 - One irrigation at early pod formation and I_3 - Two irrigations, one at flower initiation and another at early pod formation), two planting geometry (S_1

- 150×90 cm and S_2 - 150×60 cm) and two nutrient levels (N_1 - 150 % RDF ha^{-1} + vermicompost @ 1 t ha^{-1} and N_2 - 200 % RDF ha^{-1} + vermicompost @ 2 t ha^{-1}). Among the irrigation levels, two irrigations each at flower initiation and early pod formation has recorded significantly superior yield components *viz.*, number of pods per plant (478.78) and test weight (12.32 g) when compared to one irrigation and control. Hence two irrigations gave significantly higher grain yield (16.72 q ha^{-1}) and BC ratio (3.22) when compared to other irrigation levels. The seed yield of

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pigeonpea recorded at 150 x 60 cm planting geometry was significantly higher (14.63 q ha⁻¹) than 150 x 90 cm (13.64 q ha⁻¹). Significantly higher seed yield at 150 x 60 cm planting geometry was mainly attributed to higher plant population per unit area in spite of significant lower yield components and it also recorded significantly higher BC ratio (3.28)

when compared to 150 x 90 cm. The nutrient treatments were found to be equally effective in respect of yield and yield attributes but significantly higher BC ratio (3.48) was accounted with 150 % RDF ha⁻¹ + vermicompost @ 1 t ha⁻¹. The interaction effect between treatments were found to be non significant.

Studies on the Effect of Mulches, Organics and Organic Solutions on Growth, Yield and Quality of Chilli (*Capsicum annuum* L.) Byadagi Dabbi in Northern Transition Zone of Karnataka

VENKANNA YADAHALLI

2008

MAJOR ADVISOR : Dr. G. B. SHASHIDHARA

A field experiment was conducted at Main Agricultural Research Station, UAS, Dharwad during *kharif* 2006 on vertisols to “Studies on the effect of mulches, organics and organic solutions on growth, yield and quality of chilli in Northern Transition Zone of Karnataka”. The treatments comprised of mulches (glyricidia lopping and crop residues) organics (FYM) and organic solutions (Amruthpani and Jeevamrut). Application of glyricidia loppings @ 10 t per ha, crop residues @ 10 t per ha along with FYM + organic solutions i.e., Amruthpani (860.70 kg/ha, 830.83 kg/ha, respectively) recorded on par yield as that of FYM @ 10 t per ha + RDF (935.45 kg/ha), with a net returns of Rs. 26,710 and 25,557

per ha respectively. Whereas, FYM @ 10t per ha with 100 per cent RDF recorded higher net returns of Rs. 29,941 per ha with a B:C ratio of 2.74. The growth, yield components and uptake of N, P, K at harvest recorded with FYM + RDF treatments compared to any of the other treatment combinations except glyricidia + FYM + Amruthpani. The quality parameters viz., ascorbic acid, percent oleoresin, oleoresin yield and colour value increased with application of mulches + organics + organic solutions compared to check treatment. The per cent and yield of discoloured fruits reduced with application of mulches + organics + organic solution combinations.

Effect of Planting Methods and Nutrient Management Practices on Growth and Yield of Sesame (*Sesamum indicum* L.) under Rainfed Situation

G. C. SHASHIDHARA

2007

MAJOR ADVISOR : Dr. L.H.MALLIGAWAD

A field experiment was conducted at Main Agricultural Research Station, University of Agriculture Sciences, Dharwad, during *kharif* 2007 to study the effect of planting methods and nutrient management practices on growth and yield of sesame (*Sesamum indicum* L.) (cv. DS-1) under rainfed situation. The experiment consisted of three main plot treatments (Methods of planting) and three sub plot treatments (Nutrient management practices) with three replications laid out in split plot design. The crop was raised with recommended agronomic practices. Rainfall during crop growth period was 352.9 mm (48 rainy days). Methods of planting showed significant differences with respect to morphological characters. 2:1 and 3:1 skip row + furrow method of planting produced significantly taller plants, more primary branches plant⁻¹ and thicker stems. Partitioning of dry matter in reproductive parts was also more in 2:1 and 3:1 skip row + furrow method of planting. 2:1 and 3:1 skip row + furrow methods of

planting produced similar seed yield of sesame (413 and 418 kg ha⁻¹, respectively) compared to flat bed method of planting (425 kg ha⁻¹). The yield components such as number of capsules plant⁻¹, seed weight plant⁻¹ and test weight were higher in 2:1 and 3:1 skip row + furrow method of planting. Integrated nutrient management practices produced taller plants, more branches plant⁻¹ and thicker stems compared to organic nutrient management but on par with inorganic nutrient management. Integrated nutrient management practices produced significantly higher seed and stalk yields (566 and 2910 kg ha⁻¹, respectively) compared to other nutrient management practices (211 to 480 and 1134 to 2749 kg ha⁻¹, respectively). Flat bed method of planting along with integrated nutrient management practices produced more seed yield (669 kg ha⁻¹), higher gross returns (Rs. 26771 ha⁻¹) and net returns (Rs. 17711 ha⁻¹) compared to other treatment combinations under excess rainfall situation.

Organic Nutrient Management and Plant Protection in Green Chickpea Production System

C. L. MUDDU KUMAR

2007

MAJOR ADVISOR : Dr. CHIDANAND P. MANSUR

An investigation was carried out to study the response of organic nutrient management and plant protection in green chickpea production system in black clay loam soil at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The experiment was laid out in split plot design with three replications. The main plot comprised of four nutrient management and subplots were of three plant protection treatments. Application of RDP in the form of vermicompost recorded significantly highest green chickpea yield (9.20 t/ha) which was higher by 16.19 per cent over application of recommended chemical fertilizer (7.71 t/ha). Growth and yield components of chickpea followed the similar trend as the yield. Among plant protection treatments organic plant protection I (NSKE 5% + HaNPV 100 LE + panchagavya) recorded significantly highest green chickpea yield (8.87 t/ha) as compared to organic plant protection II (chilli garlic extract) (8.07 t/ha) but it was on

par with the recommended chemical plant protection (8.65 t/ha). Soil available nitrogen, potassium, sulphur and micronutrients like Fe, Mn, Zn, Cu increased significantly by the application of organic nutrients as compared to application of recommended dose of chemical fertilizers. pH and bulk density decreased by the application of organic nutrients and soil microbial properties increased significantly by the application of organics (FYM and vermicompost) as compared to application of recommended chemical fertilizers. Significantly higher B:C ratio (4.05) was recorded by the application of recommended chemical fertilizers compared to application of RDP in the form of FYM (3.75). B:C ratio followed by chemical plant protection (3.20) and organic plant protection II (3.02). Application of RDP in the form of vermicompost, organic plant protection I was found better for realizing higher green chickpea yield (9.94 t/ha), gross income (Rs. 49,700/ha) and net returns (Rs. 32,121/ha) of green chickpea.

Performance of Bt-Cotton Hybrids as Influenced by Site Specific Nutrient Management Approach for Realising Target Yields

A. S. POLICE PATIL

2007

MAJOR ADVISOR : Dr. B. M. CHITTAPUR

A field experiment was conducted at Main Agricultural Research Station, UAS, Dharwad, during 2006-07 to study the performance of Bt-cotton hybrids as influenced by site specific nutrient management approach for realising target yields. Experiment consisted of four Bt-cotton hybrids

(MRC-6322, MRC-6918, MRC-7351 and MRC-7201) and three nutrient levels (F₁ - 145:39:99; F₂ - 181:49:124; and F₃ - 217:59:148 N P₂O₅ K₂O kg ha⁻¹) for target yields of 2.0, 2.5 and 3.0 t ha⁻¹ was laid out in RCBD. Among Bt-cotton hybrids, MRC-6322 recorded significantly higher dry

matter production, LA, LAI, number of sympodial branches, number of bolls, nutrient uptake and seed cotton yield (3286 kg ha⁻¹) over MRC-6918, however and was on par with MRC-7351 and MRC-7201. Seed cotton yield increased with increase in the fertilizer levels targeted from 2.0 to 3.0 t ha⁻¹. Improvement in seed cotton yield was in the order of 63.90, 15.60 and 7.30 per cent over their respective target yield levels. Significantly higher seed cotton yield was recorded with F₃ (3219 kg ha⁻¹) level over F₁ (2738 kg ha⁻¹) level. However, F₂ (2891 kg ha⁻¹) level was on par with F₃ level. At different levels of fertilizer for target yields, MRC-

6322 recorded higher seed cotton yield (3062, 3067 and 3730 kg ha⁻¹) than the other cotton hybrids. It also recorded significantly higher gross returns (Rs.83067/ha⁻¹), net returns (Rs.65620/ha⁻¹) and B: C ratio (3.76) at F₃ level. Among different Bt-cotton hybrids, MRC-7201, recorded significantly higher delta-endotoxin concentration (1.97 ìg g⁻¹ fw) than other cotton genotypes except MRC-7351. Delta-endotoxin concentration (2.04 ìg g⁻¹ fw) was the highest at F₃ level. MRC-6918 accounted for lower delta-endotoxin concentration irrespective of fertilizer levels among the genotypes tried.

Studies on Nutrient Management through Organics in Soybean – Wheat Cropping System

B. N. SHWETHA

2007

MAJOR ADVISOR : Dr. H. B. BABALAD

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad on vertisol during *kharif* and *rabi* seasons of 2006-07 to study the nutrient management through organics in soybean-wheat cropping system. The experiment comprises of 12 treatment combinations of organic manures (*viz.*, compost, vermicompost, GLM) and fermented organic manures (beejamrut, jeevamrut, panchagavya), with RDF + FYM as control. The treatments were replicated thrice and laid-out in Randomized Complete Block Design. Application of RDF + FYM, organic manures in combination with beejamrut + jeevamrut + panchagavya and compost + vermicompost + GLM alone recorded higher seed yield of soybean, wheat and soybean equivalent yield. Whereas, significantly lower seed yield was recorded with application of beejamrut + jeevamrut alone. Similarly, former treatments showed significant superiority in growth and yield components.

Nutrient uptake by both the crops was significantly higher with the application of RDF + FYM and organic manures + beejamrut + jeevamrut + panchagavya. Soil properties *viz.*, organic carbon and available soil nutrients (N, P₂O₅ and K₂O) after harvest of soybean and wheat crops were significantly higher with organic manures alone or in combination with fermented organics. However, microbial and enzymatic activity was significantly higher in treatments receiving organic manures with fermented organics over RDF + FYM and fermented organics alone. Significantly higher net returns and benefit cost ratio were realized with compost + vermicompost + GLM in soybean and wheat cropping system. The study reveals that compost + vermicompost + GLM, helps in increasing yield, net return and benefit per rupee investment comparable to RDF + FYM in soybean-wheat cropping system. Next best combinations were organic manures + beejamrut + jeevamrut + panchagavya. Whereas, fermented organic manures alone not able to support crop yield.

Response of Mustard [*Brassica juncea* (L.) Czernj and Cosson] Varieties to Date of Sowing and Row Spacing in Northern Transition Zone of Karnataka

VENKARADDI S. IRADDI

2008

MAJOR ADVISOR : Dr. C. P. MANSUR

A field experiment was conducted during *rabi* 2006 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the response of mustard varieties to date of sowing and row spacing. The soil texture of the experimental site was clay with medium available nitrogen (209 kg/ha), phosphorus (30 kg/ha) and potassium (338 kg/ha). There were 12 treatment combinations consisting of three varieties (Pusa Agram, Pusa Mahak and EJ-15), two sowing dates (II fortnight of September and I fortnight of October) and two row spacings (30 cm and 45 cm) and the experiment was laid out in Randomized Complete Block Design (RCBD) with factorial concept with three replications. The mustard variety Pusa Agram recorded significantly higher seed yield (1028 kg/ha) and oil yield (447.11 kg/ha). Early sowing during

II fortnight of September recorded significantly higher seed yield (888 kg/ha) and oil yield (387.74 kg/ha). Row spacing of 30 cm recorded significantly higher seed yield (874 kg/ha) and oil yield (383.56 kg/ha). The performance of mustard with respect to growth and yield parameters was significantly superior with variety Pusa Agram, II fortnight of September sowing and 30 cm row spacing. Significantly higher net returns and B:C ratio were recorded with variety Pusa Agram (16081 Rs./ha and 2.14), early sowing during II fortnight of September (13079 Rs./ha and 1.78) and 30 cm row spacing (12600 Rs./ha and 1.68). It can be concluded that mustard seed yield (1326 kg/ha), oil yield (570.03 kg/ha), net returns (23107 Rs./ha) and B:C ratio (3.12) were higher with variety Pusa Agram sown during II fortnight of September at 30 cm row spacing.

Development and Evaluation of Synthetic Seed in Sugarcane

SANDEEP BIRADAR

2008

MAJOR ADVISOR : Dr. D. P. BIRADAR

The present investigation was conducted at Department of Agronomy, University of Agricultural Sciences, Dharwad to develop an approach for rapid clonal propagation and somatic embryogenesis for production of synthetic seeds and establishment under controlled and greenhouse situations. The sugarcane cultivar CoC-671 was used in the study. In three levels of BAP (0.5, 1.0 and 2.0 mg/l), establishment of meristem culture was best at BAP @ 2.0 mg per l with 72.00 per cent. Maximum shoot multiplication was observed BAP @ 1 mg per l (21.84%). Rooting of shoots was higher with NAA @ 1.0 mg per l (70.00%) and 2 mg per l (80.00%). The superior friable callus was induced with 2, 4-D @ 5 mg per l (2.18 g/culture) 28 DAI. Maximum callus growth and survival was observed with 2, 4-D @ 4 mg per l + BAP @ 0.50 mg/l (1.53 g/culture). Callus was maintained by selecting green and regenerative part, for 1 month on MS medium supplemented with 2, 4-D @ 1.0 mg per l. The maximum transformation of callus to pro-embryogenic masses was observed with kinetin @ 0.3 mg per l (70.71%) and BAP @ 0.2 mg per l (63.50%). Somatic embryo induction was 81.00 per cent on MS medium

containing 2, 4-D (3 mg/l) alone and when 2, 4-D (2.5 mg/l) + Coconut water (100 µM) was used, it was 70.40 per cent. The synthetic seeds were produced by encapsulating the somatic embryos with sodium alginate (3%) and complexing with calcium chloride (100 µM). Incorporation of carbendazim (0.1%) and streptomycin (0.1%) to the encapsulating gel and sterilization resulted in good protection against both fungal and bacterial contamination. However, there was no germination, but addition of half strength MS nutrients to encapsulating gel, followed by sterilization given good protection against contaminations and resulted in 21.67 per cent germination after 10 days. Embryo's treated with ABA at 1.0 µM for 5 days prior to their harvest survived for 25 days of storage with 14.66 per cent. The maximum germination was observed on normal MS medium (80.00%) and 30.00 per cent of peat soil supplemented with MS nutrients was observed 15 DAS. The survival rate of synthetic seeds was 80 per cent whereas in micropropagated plants the survival rate was 72 per cent when they are established in green house after hardening.

Development of Synthetic Seed in Mulberry (*Morus indica* L.) cv. M-5 and Evaluation under Controlled Conditions

SANTOSHKUMAR KAMAREDDI

2008

MAJOR ADVISOR : Dr. V. C. PATIL

The investigation on "Development of synthetic seed in mulberry (*Morus indica* L.) cv. M-5 and evaluation under controlled conditions" was carried out in plant tissue culture laboratory, University of Agricultural Sciences, Dharwad during the year 2006-07. Among the various concentrations of mercuric chloride tried for surface disinfection, 70 per cent alcohol treated for 1 min followed by 0.1 per cent mercuric chloride treated for 15 min was the best treatment combination with lower per cent contamination (12.50) and higher per cent survival (80.00). Between the two growth regulators (BAP and 2, 4-D) at different concentrations, 2, 4-D @ 0.3 mg per l showed high frequency of sprouting (82.5), highest length of shoot (5.13 cm) and higher number of leaves (4.92). Among the different concentrations of BAP tried for induction of

multiple shoots, BAP @ 0.5 mg per l showed higher frequency of multiple shoot induction (78.75%) and higher number of multiple shoots induced per explant (3.30) and highest length of shoots (4.12 cm). Among the different auxins tried for rooting of microshoots, MS medium supplemented with 1 g per l IBA showed highest per cent rooting (87.50), higher number of roots (8.70) and highest length of primary root (3.67 cm). The synthetic seeds with synthetic endosperm constituents of MS nutrients, streptomycin sulphate (0.1%) and carbendazim (0.1%) gave not only good protection against contaminants, but also resulted in germination of nearly 60 per cent of encapsulated axillary buds. Between the two storage temperatures, storage of synthetic seeds at 5°C was most preferable as 55 per cent of the encapsulated axillary buds survived for as long as 30 days.

Studies on the Manipulation of Growth as a Means of Increasing Productivity of Bt Cotton (*Gossypium hirsutum* L.)

N. S. SHWETHA

2008

MAJOR ADVISOR: Dr. A. S. HALEPYATI

The field experiment was conducted during *kharif* 2007-08 at College of Agriculture Farm, Raichur to study the effect of manipulation of growth as a means of increasing productivity of Bt cotton. The experiment was laid out in split-split plot design with three replications. Detopping at 80 DAS and no detopping were tried in main plots. Removal of one, two and three monopodia and retaining all the monopodia were allotted to the sub plots. Sub-sub plots consisted of two spacings viz., 90 x 30 cm and 90 x 60 cm. The results indicated that detopping reduced plant height, number of sympodial branches per plant and total dry matter production over no detopping. But, topping significantly increased the number of bolls per plant (36.06), boll weight (4.78 g) and seed cotton yield per hectare (25.22 q ha⁻¹) over no detopping (23.37, 3.34 g and 23.51 q ha⁻¹, respectively). Mean fibre length and lint index were

significantly increased due to detopping. Detopping recorded significantly higher net returns (Rs. 45,251 ha⁻¹) over no detopping (Rs. 41,302 ha⁻¹). Removal of monopodia did not have significant influence on the plant height, sympodial branches per plant, total dry matter production and seed cotton yield. The effect of removal of monopodia was non significant on the quality parameters and net returns. The plant height, number of sympodial branches per plant, total dry matter production and yield components were significantly higher with 90 x 60 cm spacing. But seed cotton yield per ha was significantly higher with 90 x 30 cm (25.37 q ha⁻¹) than 90 x 60 cm (23.36 q ha⁻¹). Plant spacings did not have significant influence on the quality parameters. Significantly higher net return was obtained with plant spacing of 90 x 30 cm (Rs. 44,889 ha⁻¹) when compared to 90 x 60 cm spacing (Rs. 41,663 ha⁻¹).

Response of Transplanted Pigeonpea [*Cajanus cajan* (L.) Millsp.] to Different Planting Geometry

A. S. PAVAN

2008

MAJOR ADVISOR : SRI. V. P. NAGALIKAR

A field experiment was conducted at Agricultural College Farm, Raichur during *kharif* season of 2007-08 to evaluate the performance of transplanted pigeonpea, Asha (ICPL-87119) at different planting geometry in comparison to late sown pigeonpea. There were 11 treatment combinations comprising of ten spacings. The experiment was laid out in completely randomized block design with three replications. Significantly higher seed yield per hectare was noticed with dibbled pigeonpea at the spacing of 90 cm x 20 cm (1577 kg ha⁻¹) when compared to transplanted pigeonpea at different spacings. Eventhough yield attributing characters are lower in dibbled pigeonpea, the higher seed yield recorded was mainly attributed to higher plant population per unit area when compared to other spacings of transplanted pigeonpea. Significantly higher yield components obtained at spacing of 120 cm x 90 cm, 150 cm x 60 cm and 150 cm x 90 cm of transplanted pigeonpea

were attributed to better plant development resulting in more uniform distribution of plants over cropped area which was coupled with greater light interception, utilities of moisture, nutrients and solar energy under lower degree of inter and intra plant competitions. Dibbled pigeonpea and transplanted pigeonpea differed significantly with respect to growth parameters. Transplanted pigeonpea at the row spacing of 150 cm x 90 cm recorded significantly higher number of branches, number of leaves and dry matter production than dibbled pigeonpea. Among different row spacings, the row spacing of 90 cm x 20 cm of dibbled pigeonpea recorded significantly higher gross returns (Rs. 40,993 ha⁻¹) and net returns (Rs. 31,053 ha⁻¹) than other spacings of transplanted pigeonpea due to its higher seed yield. Benefit cost ratio was found to be significantly higher in a row spacing of 90 cm x 20 cm of dibbled pigeonpea (4.12) when compared to all other spacings of transplanted pigeonpea.

Response of Chilli (*Capsicum annum* L.) to Site Specific Nutrient Management through Targeted Yield Approach in Northern Zone of Karnataka

ABHILASH K. DESHMUKH

2008

MAJOR ADVISOR : Dr. G. B. SHASHIDHARA

A field experiment was conducted during the *kharif* season 2007 on farmers' fields at Rottigawada village, Kundgol taluk of Dharwad district to study the "Response of chilli (*Capsicum annum* L.) to Site Specific Nutrient Management Through Targeted Yield Approach in Northern Transition Zone of Karnataka". The treatments were targeted yield levels of 10 q/ha, 15 q/ha, 20 q/ha, 25 q/ha and 30 q/ha of chilli dry fruit. The application of higher doses of fertilizer significantly influenced the growth and yield components. The targeted yield level treatment of 30 q/ha recorded significantly higher growth and yield characters. The achieved dry fruit yield of chilli was significantly superior over targeted yield level treatments of 10 q/ha (12.50 q/ha) 15 q/ha (16.00 q/ha), 20 q/ha (21.06 q/ha) and 25 q/ha (27.43 q/ha) as per the t-test of significance for unequal variance. However, the higher targeted yield level of 30 q/ha was

significantly lower than the targeted yield level (28.43 q/ha). The total uptake of nutrients was recorded significantly higher in targeted yield level treatment of 30 q/ha. The same trend was followed with respect to available nutrient status of soil after harvest of the crop. The quality parameters such as Ascorbic acid (190.7 mg/100 g fruits), Oleoresin content (16.50%) and Colour value (319.0 ASTA units) was higher in the targeted yield level of 25 q/ha. The higher net return was recorded in the targeted yield level treatment of 30 q/ha (Rs. 1, 25,788 ha⁻¹). However, B: C ratio was higher in the targeted yield level treatment of 25 q/ha (2.58). The study revealed that the significantly higher targeted yield and improved quality and higher B: C ratio could be achieved up to targeted yield level of 25 q/ha under rain fed condition of Northern Transition Zone of Karnataka.

Mulberry Based Vegetable Intercropping Systems under Northern Transition Zone of Karnataka

LINGARAJ K. DIGGAON

2008

MAJOR ADVISOR : Dr. S.C. ALAGUNDAGI

A field experiment was conducted under irrigated conditions during 2007-08 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, to study the mulberry based vegetable intercropping systems, its potential yield, mulberry fodder quality and economics. The soil texture of the experimental site was sandy loam and was low in available nitrogen (173.6 kg/ha), available phosphorus (14.8 kg/ha) and medium in available potassium (153.8 kg/ha). There were 11 treatments with 10 paired mulberry and one normal planting of sole mulberry treatments. In paired mulberry (120 cm and 150 cm), there were 8 treatment combinations with 4 vegetables intercropped and two were paired sole mulberry. The cumulative mulberry fresh shoot yield was significantly higher in mulberry (60/120 x 30 cm) sole (17.2 t/ha) compared to rest of the treatment combinations except mulberry (60 / 120 x 30 cm) + peas which recorded significantly on par cumulative mulberry fresh shoot yield (16.6 t/ha). Among the intercropped treatments, significantly higher vegetable yield of carrot (3.23 t/ha) was recorded in mulberry (60/120 x 30 cm) + carrot compared to rest of the vegetable

intercropped treatments. However, french bean (2.37 t/ha) intercropped with 120 cm paired mulberry was on par with peas (2.27 t/ha) intercropped with 120 cm paired mulberry and carrot (1.82 t/ha) intercropped with 150 cm paired mulberry. Significantly higher mulberry equivalent yield of mulberry based vegetable intercropping systems (57.5 t/ha) was recorded in mulberry (60/120 x 30 cm) + peas compared to rest of the treatments. Significantly higher crude protein, ether extract and total ash content of mulberry on whole plant dry weight basis (19.0 %, 3.23 % and 10.8 %, respectively) was recorded in mulberry (90 / 150 x 60 cm) sole. Significantly lower crude fibre content of mulberry (15.9 %) was recorded in mulberry (60 / 120 x 30 cm) + french bean. Significantly higher mean mulberry fodder palatability (87 %) was recorded in mulberry (60/120 x 30 cm) + field bean. Significantly higher gross returns (Rs.77,753 /ha), net returns (Rs.26,744 /ha) and benefit cost ratio (1.52) was obtained in mulberry (60 / 120 x 30 cm) + peas intercropping *kharif* by utilizing mulberry for fodder *kharif* and silk worm rearing during rest of the year in the first (establishment) year of mulberry cultivation.

Response of Dicoccum Wheat Genotypes to Site Specific Nutrient Management (SSNM) for Targeted Yield

MURALIDHAR M. KULKARNI

2008

MAJOR ADVISOR : Dr. B. N. PATIL

A field experiment was conducted to study the response of dicoccum wheat genotypes to site specific nutrient management (SSNM) for targeted yield at All India Co-ordinated Wheat Improvement Project, Main Agricultural Research Station, Dharwad during *rabi* 2006-07. The experiment was laid out in split plot design assigning varieties to main plots and targeted yield levels to sub-plots with three replications. The highest total dry matter was recorded by DDK-1025 (187.42 g/m row length). At 90 DAS, 5.0 t per ha yield target caused for significantly higher TDM accumulation (193.33 g/m row length) over all other target yield levels. However, at 90 DAS, 5.0 t per ha yield target with DDK-1025 recorded significantly higher TDM accumulation (213.00 g/m row length) over all other treatment combinations. Among the varieties, DDK-1025 recorded significantly higher grain yield (3820 kg/ha) as compared to NP-

200. Application of nutrients based on SSNM approach recorded significantly higher grain yield at 4.0 t per ha (3661 kg/ha) due to better expression of yield components and higher nutrient uptake. DDK-1025 at 4.0 t per ha yield target recorded significantly higher grain yield (3968 kg/ha) than DDK-1009 at 3.0 and 4.0 t per ha target yield. Significantly higher protein content (14.10%) was recorded at 5.0 t per ha yield target with variety DDK-1025. Variety NO-200 and DDK-1025 at 4.0 t per ha yield target recorded significantly higher net returns (Rs. 27403 and Rs. 25262/ha, respectively). However, 4.0 t per ha yield target in combination with variety DDK-1025 recorded significantly higher net returns (Rs. 27403/ha). At 3.0 t per ha yield target, variety DDK-1025 recorded significantly higher B:C ratio (2.97), which was at par with 4.0 t per ha yield target (2.95).

Evaluation of Different Herbicides and Method of Application on Maize (*Zea mays* L.) under Northern Transition Zone of Karnataka

KUMAR R. TAMADADDI

2008

MAJOR ADVISOR : Dr. S.C. ALAGUNDAGI

A field experiment was conducted under rainfed conditions during *kharif* 2007 at Agricultural Research Station (Chilli), Devihosur, Haveri district, University of Agricultural Sciences, Dharwad, to study the evaluation of different herbicides and method of application on maize (*Zea mays* L.). The soil texture of the experimental site was clay loam and was low in available nitrogen (215.5 kg/ha), available phosphorus (18.2 kg/ha) and medium in available potassium (233.4 kg/ha). There were 12 treatments involving four pre-emergence herbicides viz., atrazine, butachlor, pendimethalin and alachlor @ 1.0 kg a.i per ha both as spray and sand broadcasting in conjunction with one intercultivation (IC) at 30 days after sowing (DAS), maize + fodder cowpea (1:1) intercropping and incorporation of fodder cowpea at 45 DAS, farmer's practice (one hand weeding at 30 DAS + two intercultivation at 30 and 45 DAS), weedy check and weed free check. The experiment was laid out in randomized complete block design with three replications. Pre emergence application

@ 1.0 kg a.i per ha spray + one IC at 30 DAS of atrazine as spray or sand broadcasting or butachlor as spray recorded significantly lower weed population, dry weight of weeds and higher weed control efficiency. Among the weed control treatments, significantly higher maize grain (5554 kg/ha) and stover (8886 kg/ha) yield was recorded with atrazine @ 1.0 kg a. i per ha spray + one IC at 30 DAS, which was on par with atrazine sand broadcasting, butachlor or alachlor as spray or sand broadcasting and farmers practice. Similar trend was followed with growth and yield parameters of maize. Among the weed control treatment, significantly higher net returns and benefit cost ratio was realized with pre emergence application of herbicide @ 1.0 kg a.i. per ha along with one intercultivation at 30 DAS with atrazine as spray (Rs. 20,718 /ha and 2.30, respectively) and as sand broadcasting (Rs. 19,144 /ha and 2.12, respectively), butachlor as a spray (Rs.19, 528 /ha and 2.25, respectively), alachlor as a spray (Rs.17, 911 /ha and 2.12, respectively).

Effect of Seed Priming on Field Performance of Maize Based Cropping Systems Under Rainfed Condition

P. PRIYA

2008

MAJOR ADVISOR : Dr. V. C. PATIL

A field experiment was conducted at Agricultural Research Station, Devihosur, University of Agricultural Sciences, Dharwad on clay loam soil to study the effect of cropping systems and seed priming on growth and yield of maize and sorghum under rainfed condition during *kharif* 2007. There were 18 treatment combinations consisting of three cropping systems viz., sole maize, sole sorghum and maize + sorghum (1: 1)

intercropping and six seed priming treatments such as hydropriming, osmo-priming, bio-priming, combination of hydro-priming and osmo-priming, combination of all priming methods and farmers practice (unprimed seeds). The treatments were replicated thrice and laid out in a split plot design. The cropping systems influenced significantly yield and yield attributes of maize and sorghum. Significantly higher seed yield was

obtained in sole cropping (67.40 q ha⁻¹ and 32.94 q ha⁻¹ in maize and sorghum, respectively). Similar trend was observed in yield attributes of maize and sorghum. Among seed priming practices, highest seed yield was obtained in bio-priming (58.35 and 29.48 q ha⁻¹ in maize and sorghum, respectively) and combination of all priming methods (58.85 and 29.59 q ha⁻¹ in maize and sorghum, respectively) as compared to farmers' practice (unprimed seeds). Similar results were obtained in growth, yield, physiological and microbiological parameters of maize and sorghum.

Studies on Planting Dates and Stage of Harvesting in Ashwagandha (*Withania somnifera* Dunal.)

SHAMARAJ

2008

A field experiment was conducted at Agricultural College Farm, Raichur, to study the planting dates and stage of harvesting in ashwagandha. There were 16 treatments comprising combinations of four planting dates (S₁ - II F.N. of July, S₂ - I F.N. of August, S₃ - II F.N. of August and S₄ - I F.N. of September), four stages of harvesting (50% flowering stage, 100% flowering stage, berry ripening stage and maturity stage). Treatments were replicated four times in split plot design. The fresh root and seed yield of ashwagandha planted on II F.N. of July (1737 kg ha⁻¹ and 341 kg ha⁻¹) and I F.N. of August (1706 kg ha⁻¹ and 310 kg ha⁻¹) were significantly higher over other planting dates. The higher yield with II F.N. of July and I F.N. of August planting was attributed to significantly higher yield components. The fresh root yield of ashwagandha harvested at maturity stage (1714 kg ha⁻¹) and berry ripening stage (1695 kg ha⁻¹) was significantly higher than other harvesting stages. The ashwagandha harvested at

Interaction effects of cropping systems x seed priming revealed that highest root : shoot ratio of maize and sorghum was obtained in sole cropping with biopriming and combination of all priming methods. Intercropping recorded significantly higher Land Equivalent Ratio (1.22) than sole cropping (1.00). However, sole cropping was beneficial in realizing higher maize equivalent yield, gross income, net income and B:C ratio. Bio-priming and combination of all priming methods resulted in higher economic returns than farmers' practice.

MAJOR ADVISOR : Dr. H.T. CHANDRANATH

maturity stage (325 kg ha⁻¹) recorded higher seed yield than berry ripening stage (260 kg ha⁻¹). The higher yield of ashwagandha harvested at maturity stage and berry ripening stage was attributed to significantly higher yield components. The ashwagandha harvested at 50% flowering stage (0.62%) and 100% flowering stage (0.59%) recorded significantly higher percentage of withanoloid content than other harvesting stages. The ashwagandha planted on II F.N. of July and I F.N. of August recorded significantly higher, net returns (Rs. 42,217 ha⁻¹ and Rs. 40,511 ha⁻¹ respectively) and benefit cost ratio (6.76 and 6.41 respectively) than other planting dates. The ashwagandha harvested at maturity stage and berry ripening stage recorded significantly higher, net returns (Rs. 43,067 ha⁻¹ and Rs. 41,662 ha⁻¹ respectively) and benefit cost ratio (6.68 and 6.48 respectively) than other harvesting stages.

Yield Maximisation Studies on Bt Cotton (*Gossypium hirsutum* L.) through Organics, Inorganics and Soluble Fertilizer in TBP Command Area

VINODAKUMAR S. NAIK

2008

A field experiment was conducted at Agricultural College Farm, Raichur on black soil during 2007-08 to study the response of Bt cotton to different organics, fertilizer levels and foliar nutrition of major nutrients under irrigation in TBP command area. There were 15 treatment combinations comprising of five different nutrient sources and growth regulators in main plots (100 and 150 per cent RDF, FYM, Vermicompost, NAA and 2% DAP spray) and three foliar sprays of N, P and K (control, spray at flower initiation and peak flowering stages) in sub plots. Treatments were replicated thrice in split plot design. Among different combinations, significantly higher seed cotton yield was recorded with 100% RDF + FYM @ 5 t ha⁻¹ (50%) + VC 0.5 t ha⁻¹ (50%) + NAA (10 ppm) + 2% DAP spray (2982 kg ha⁻¹) and it was on par with 100% RDF + FYM @ 10 t ha⁻¹ + NAA (10 ppm) + 2% DAP spray (2864 kg ha⁻¹) and 100% RDF + FYM @ 5 t ha⁻¹ (50%) + VC 0.5 t ha⁻¹ (50%) (2822 kg ha⁻¹).

MAJOR ADVISOR : Dr. B. K. DESAI

Application of 1 % foliar nutrition of NPK at flower initiation and peak flowering stage recorded significantly higher seed cotton yield (2919 kg ha⁻¹) as compared to 0.5% foliar nutrition of NPK at flower initiation (2685 kg ha⁻¹) and absolute control (2521 kg ha⁻¹). Uptake of major nutrients (N, P and K) showed the similar trend. Economic analysis indicated that 100% RDF + FYM @ 5 t ha⁻¹ (50%) + VC 0.5 t ha⁻¹ (50%) + NAA (10 ppm) + 2% DAP spray recorded significantly higher net returns (Rs. 56,760 ha⁻¹) compared to 100% RDF (Rs. 39,411 ha⁻¹). Net returns increased significantly with increase in the levels of NPK foliar nutrition from absolute control. Net returns recorded with 1% NPK at two stages were maximum (Rs. 56,471 ha⁻¹) and significantly higher over 0.5% foliar nutrition of NPK at flower initiation (Rs. 50,577 ha⁻¹) and control (Rs. 46,578 ha⁻¹) treatment.

Studies on Nutrient Management Practices through Organics in Sesame (*Sesamum indicum* L.)

MUNJI RAVUSAHEB

2008

A field experiment to study the nutrient management practices through organics in sesame was conducted at the ARS, Hanumanamatti (Ranebennur), University of Agricultural Sciences, Dharwad on Alfisols during kharif 2007. The experiment comprised of five main plot treatments mainly, Beejamrut + Jeevamrut + mulching, with organic pest management (NM₁), FYM (1/3) + Vermicompost (1/3) + Green manuring (1/3) equivalent to RDN + organic pest management (NM₂), FYM (1/3) + Vermicompost (1/3) + Green manuring (1/3) equivalent to RDN + FYM + organic pest management (NM₃), RDF + FYM + Azospirillum + Trichoderma with IPM (NM₄), RDF alone with chemical plant protection (NM₅), and three sub plot treatments mainly, one spray of panchagavya at 30 DAS (PS₁), two sprays of panchagavya at 30 DAS and flowering stage (PS₂), and a control. The treatments were replicated thrice and experiment laid out in a split plot design. Integrated nutrient management (NM₄) recorded significantly higher sesame yield (296.52 kg/ha) over rest

MAJOR ADVISOR : Dr. H. B. BABALAD

of the manurial treatments. Among liquid manures, treatment PS₂ recorded significantly higher sesame yield (239 kg/ha) over control (231.61 kg/ha). The values for growth and other yield parameters were also significantly higher in these treatments. Among manurial treatments, NM₃ recorded significantly higher microbial population and available N, P₂O₅ and K₂O content in the soil. Among liquid manures, PS₂ recorded higher microbial population and available N, P₂O₅ and K₂O content in the soil. Economic analysis clearly indicated that net returns in sesame were significantly higher (Rs. 4860/ha) with NM₅ over rest of the treatments, whereas B: C ratio was significantly higher with NM₁ over rest of the treatments. As this is the first year trial, organics alone could not achieve the higher yield of sesame although it has beneficial effects on soil fertility and microbial activity. Hence, the integrated nutrient supply system provided an ideal nutrition for crop and produced higher yield in sesame.

GENETICS AND PLANT BREEDING

Genetic Transformation Studies in Sesame (*Sesamum indicum* L.)

B. C. VIVEK

2008

A protocol for efficient direct gene transfer through ballistic bombardment was evolved for Sesame (*Sesamum indicum* L. genotypes viz., E8, Gulbarga Local White and Brown and RT273 along with a wild species *Sesamum alatum* T.) for the first time in India. A preliminary

MAJOR ADVISOR : DR. R. LOKESHA

experiment was undertaken to study the endogenous level of Kanamycin resistance of *Sesamum genotypes* under varied concentrations of Kanamycin (0 to 150 mg/l). Both cultivated *S. indicum* and wild *S. alatum* genotypes were highly sensitive to Kanamycin exposure; seed germ inability

decreased with increase in Kanamycin concentration on MS media supplemented with growth regulators (NAA @ 0.5 mg/l, BAP @ 1.5 mg/l and Kinetin @ 1.5mg/l). Seedlings bleached and failed to induce callus irrespective of Kanamycin concentrations whilst the seedlings induced callus, which proliferated in the control. The well- grown callus failed to proliferate on MS with Kanamycin indicating the sensitivity of the callus for proliferation also. Callus derived through direct seeding method was transformed with pABC plasmid carrying *npt II* gene encoding Kanamycin resistance and *GUS* driven by CaMV 35S promoter. Transformants were

selected on MS supplemented with Kanamycin @ 25 mg/l and 50 mg/l of Kanamycin for first and second round of selection. E8 and Gulbarga Local White have shown positive response for Kanamycin selection with an average transformation percentage of 12.5 and 7.5 respectively irrespective of age of the calli, duration of osmotic treatment and target cell distance. Pre bombardment osmotic treatment of 4 hr and 9 cm target cell distance has given highest transformation percentage for both the genotypes. Though, the integration of transgenes in Sesame genome was confirmed by PCR amplification with recovery of 800 bp band from transformed callus, the *GUS* histochemical assay was negative.

Genetic Variability Studies in F_2 and F_3 Generations of Cowpea (*Vigna unguiculata* (L.) Walp)

SUASHIDHAR KURER

2007

MAJOR ADVISOR : Dr. S. GANGAPRASAD

The present investigation on cowpea (*Vigna unguiculata* (L.) Walp) was carried out to elicit the intonation on nature and amount of variability generated in respect of seed yield and its components in F_2 and F_3 populations constructed from cross between Goa Local and V -118. The F_2 and F_3 population were raised in *kharif* 2004 and summer 2005, respectively. In each population, 300 plants are chosen randomly to record the observations. Comparison of mean, range and variance in different segregating generations revealed that parents involved in construction of crosses significantly differ for the character under study. The amount of variability generated in F_2 and F_3 segregating generations for yield per plant and some of its components like number of pods per plant, pods per cluster and hundred seed weight was considerably high.

The estimates of GCV, heritability and genetic advance over mean (GAM) in different segregating generations indicated that the variability and other parameters like heritability and GAM values were less in F_3 population compared to F_2 population. A correlation study involving seed yield per plant with other traits indicated significant positive correlation of plant height in F_2 population only. Most of the populations showed positive significant association of number of branches per plant, number of clusters per plant, pods per clusters and pod length with seed yield per plant. Path analysis revealed that pods per plant showed maximum direct effect as well as indirect effect on seed yield in all the populations thus indicating that, pods per plant is the most important yield contributing trait in cowpea. Superior segregants identified in the present study can be advanced to the next generation to identify the better genotypes.

Studies on Inheritance of some Morphological Characters in Sunflower (*Helianthus annuus* L.)

KEDAR D. MARATHE

2008

MAJOR ADVISOR : Dr. I. SHANKER GOUD

The present investigation was carried to study the inheritance of some morphological characters viz, leaf shape, leaf colour, leaf serration, stem pigmentation, petiole pigmentation and seed colour using 12 crosses. The F_2 generation was raised during *rabi* season at the RARS, Raichur. The F_2 generation data revealed that leaf shape (RHA-275 X R-8297, R-8297 X RHA-275) was segregated into 3 cordate: 1 triangular and seed colour was segregated into 3 black: 1 black with white stripes (R-127 X RHA-275, RHA-275 X R-127, RHA-274 X R-127, R-127 X RHA-274) and 3 black: 1 brown (R-393 X RHA-275, RHA-275 X R-393) indicates these characters were govern by single gene. RHA-274 X R-393, R-393 X RHA-274, R-393 X R-8297, R-8297 X R-393 crosses were segregated for both these characters. The leaf serration was segregated 9 coarse: 7 medium (R-393 X R-8297, R-8297 X R-393, RHA-275 X R-8297, R-8297 X

RHA-275) and 9 coarse: 6 medium: 1 fine serration (RHA-274 X R-127, R-127 X RHA-274, R-127 X RHA-275, RHA-275 X R-127) indicating that this character is govern by two genes. The leaf colour was segregated into 9 dark: 7 medium (R-127 X RHA-275, RHA-275 X R-127), stem pigmentation (R-393 X R-8297, R-8297 X R-393) and petiole pigmentation (R-393 X RHA-275, RHA-275 X R-393, R-127 X RHA-275, RHA-275 X R-127) were segregated into 9 pigmented: 7 non-pigmented indicating these characters govern by two complementary genes. RHA-274 X R-393, R-393 X RHA-274, RHA-274 X R-127 and R-127 X RHA-274 crosses were segregated for leaf colour and stem pigmentation. RHA-275 X R-8297 and R-8297 X RHA-275 crosses were segregated for 3 characters viz., leaf colour, stem pigmentation and petiole pigmentation.

Development of Male Sterile Based Restorer Populations and Their Evaluation for Productivity and Fertility Restoration Parameters in Cotton

P. S. KIRANKUMAR

2008

MAJOR ADVISOR : Dr. S. S. PATIL

Present investigation carried out at ARS farm Dharwad during 2007-08. All the sixteen F_1 s exhibited significant superiority over check Bunny for seed cotton yield, within these hybrids RR-OI recorded highest (3749 kg/ha) seed cotton yield. The observed ratio of fertile to sterile plants in all the F_2 populations of RxR cross was 1:0. In F_2 populations AR-13, AR-33, AR-06 and AR-36 the observed ratio of fertile to sterile plants was in confirmation with 3:1 ratio, while F_2 populations AR -16, AR-33, AR-03 and AR-23 were found to have segregation ratio deviating from 3:1 ratio. Pollen germination medium for cotton was standardized in order to study the pollen germination of randomly selected individual fertile plants. In case of RxR F_2 populations pollen germination per cent was high compared to that of AxR cross F_2 populations. Range of pollen germination per cent recorded by the AxR cross F_2 populations was wider

compared to that of RxR F_2 populations. In general, both AxR and RxR cross segregating populations exhibited higher PCV and GCV values for seed cotton yield, number of bolls, boll weight, lint yield and number of monopodia. Wider difference was observed between GCV and PCV values for traits number of bolls, boll weight and seed cotton yield/plant. The F_2 population AR-13 exhibited highest heritability value for both number of bolls and boll weight, while RR-13 recorded high value of heritability for seed cotton yield/plant. The F_2 population RR-04 exhibited high genetic advance value for seed cotton yield/plant. Phenotypic correlation revealed significant positive association of seed cotton yield/plant with almost all the traits of AxR and RxR cross F_2 population. The path analysis revealed that the trait boll number, boll weight, lint yield had high and positive direct effect on seed cotton yield/plant in all the F_2 populations.

Breeding Investigations in Segregating Populations of Narrow Leaflet Genotypes in Soybean (*Glycine max* (L.) Merrill)

S. MANASA

2008

MAJOR ADVISOR : Dr. G. T. BASAVARAJ

An investigation was carried out to elucidate information on the performance of narrow leaflet genotypes in soybean for yield and its component traits and to classify the F_4 populations of two crosses viz., JS 93-05 x JS-335 and JS 93-05 x DSB-1 based on their leaflet shape during

kharif 2007 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. An attempt was also made to assess the stability of these F_4 populations across locations. Among two different experiments conducted experiment-I comprised of eight narrow leaflet

genotypes along with checks viz., JS-335, DSB-1, KHSb-2 and JS 93-05. Among these genotypes, Ace. No. 18-A recorded higher seed yield and significant superiority with respect to traits viz., plant height, days' to maturity specific leaf weight, number of seeds, number of four seeded pods and harvest index compared to checks. In experiment-II all the leaflet types viz., oval, ovate, lanceolate of both the crosses recorded wide range of variation for all traits indicating the presence of sufficient variation among the genotypes. High heritability coupled with high genetic advance was observed for traits viz., number of pods, number of seeds and seed yield. The association analysis revealed that seed yield had significant

positive association with plant height, number of pods, number of seeds and harvest index in all the leaflet types of both the crosses. In stability analysis, pooled ANOVA revealed significant differences among genotypes, environments and G x E interaction for all characters, indicating diverse nature of genotypes and environments evaluated and genotypes interacted significantly with environments. On the basis of stability parameters line 1 of cross JS 93-05 x JS-335 was identified as stable genotype for all the characters studied with higher mean performance across environments. However, line 4 of cross JS 93-05 x JS-335, was the highest yielder across environments.

Assessment of Genetic Diversity in Local Chilli Collections (*Capsicum annum* L.)

DANDUNAYAKA

2008

MAJOR ADVISOR : Dr. V. RUDRANAIK

A field experiment on chilli germplasm was carried out during *kharif* 2006-07 at ARS Annigeri. The principle of the objective in work was to assess the genetic variability and diversity in the available 60 germplasm collected from different northern parts of Karnataka. This germplasm were evaluated for 12 quantitative character and 6 quality character. Considerable variability for most of the character was indicated by analysis of variance high phenotypic and genotypic co-efficient of variation was observed in yield related traits, fruit per plant and fruit weight. These characters are of economic importance and there is scope for improvement through selection. High heritability coupled with high genetic advance as per cent mean was noticed for biochemical parameters, fruit per plant, dry fruit weight, fruit length, fruit diameter, secondary branches suggesting that involvement of additive gene action. Strong correlation of yield with number of fruit per plant, fruit weight, primary

branches per plant, secondary branches per plant, pericarp weight was observed. Biochemical characters were positively associated with fruit character viz. fruit length, fruit diameter and stem thickness. The path analysis indicated that number of fruit per plant, fruit weight and secondary branches per plant shown positive direct effect on yield. Genetic diversity in the available germplasm assessed by using D² statistic 60 genotypes were grouped in to 11 cluster which had high range of inter cluster D² value. Five character viz. secondary branches per plant fruit colour chlorophyll content, fruit diameter and days to 50 per cent flowering were the chief contribution towards diversity. Hybridization of cluster number III with cluster number IV suggested as it was most divergent from other clusters. Genotypes like ACA-8, ACA-28, ACA-33 and ACA-40 are desirable for fruit yield. Whereas ACA- 33, ACA-8, ACA-25 and ACA-26 are the desirable genotypes for export purpose.

Estimation of Heterosis, Combining Ability and Genetic Components for Yield and Yield Attributes in Sesame (*Sesamum indicum* L.)

YAMANURA

2008

MAJOR ADVISOR : Dr. MADHUSUDHAN K.

The present study was envisaged to know the performance of hybrids developed and to characterize the parents for their ability to transmit desirable genes to their progenies, and to know the type of gene action governing yield and yield components. The experiment was conducted with 90 hybrids with their (19) parents during summer, 2007 using two replications. High degree of desirable heterosis over better parent and commercial check was observed in many hybrids for most of the characters. The hybrid combinations GL-1xDS-1 recorded the highest positive heterosis over commercial check for plant height, DS-10xHalitil for total number of capsules/plant, GL-5xTSES-2 for 1000-seed weight, DS-16xE-8 for seed yield/plant, DS-7xTSES-3 for oil content and DS-13xWestern for seed yield/ha. The hybrids GL-5xHalitil and GL-4xAhutil recorded highest negative heterosis for days to 50% flowering and days to maturity. The analysis of variance revealed highly significant femalemale

interaction for all the traits. The parents, DS-13, DS-16, DS-10 (females) and E-8, TSES-2, TSES-4, DS-1 (males) were found to be good general combiners for seed yield/plant. On the basis of sca effects DS-9xWestern for plant height, DS-10xTSES-3 for days to 50% flowering, DS-9xTSES-4 for days to maturity, DS-10xHalitil for total number of capsules/plant, GL-5xTSES-2 for 1000 seed weight DS-16xE-8 for seed yield/plant and DS-16xTSES-2 for seed yield per plot and DS-10xDS-1 for oil content were found promising. Preponderance of additive gene action for 1000-seed weight and non-additive gene action for other quantitative traits were observed. On the basis of *per se* performance, exploitable heterosis, sca effects and gene action involved in the expression of seed yield and its components the hybrids DS-13xWestern, DS-16xE-8, DS-10xTSES-2 and GL-1xDS-1 were found promising for exploitation of heterosis and to derive better recombinants for these traits.

Induced Genetic Variability for Quantitative Traits in Soybean (*Glycine max* (L.) Merill.)

SHWETA GUPTA

2008

MAJOR ADVISOR : Dr. H. L. NADAF

An investigation was carried out to elucidate information on induced mutations in 123 mutants of JS-335 soybean genotype and 120 mutants of KHSb-2 soybean genotype and to assess the nature and extent of induced genetic variability, correlation and regression M₄ generation was evaluated in RCBd with two replications for 10 quantitative characters during 2007 *kharif* at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. Analysis of variance revealed the prevalence of significant differences among the mutants for all the ten characters under study. The characters viz., plant height, number of branches per plant, number of pods per plant, pod weight per plant and seed yield per plant showed high PCV, GCV, heritability and genetic advance expressed as per cent mean, whereas character like days to 50 per cent flowering,

days to maturity, protein content and oil content showed low PCV and GCV, high heritability coupled with moderate genetic advance expressed as per cent mean. Correlation and regression coefficient values with seed yield were significant and positive for character number of pods per plant, pod weight per plant and oil content whereas they were significantly negative for protein content. Pods per plant exerted maximum direct as well as in direct effects on seed yield. Induced polygenic variability was assessed in M₄ generation. In general, wide range of variability was created for most of the traits in all the treated populations compared to control, 20 KR gamma ray treatment were effective in the isolation of superior mutants. A number of superior mutants for individual as well as combination of characters had been isolated from the present investigation.

Combining Ability and Heterosis Studies in Experimental Hybrids of Cotton (*Gossypium hirsutum* L.)

K. J. YASHAVANTHA KUMAR

2008

MAJOR ADVISOR : Dr. RAJESH. S. PATIL

The present study was carried out at the Agricultural Research Station, Dharwad during *kharif* 2007-08. The experimental material comprised of 10 lines viz., P72-9-37, H-1-87, LH-2076, CPD-814, RHC-2022, ADL-903, CCH-1831, TCH-1705, L-766, 3 testers viz., RAH-

221, RACH-11, RCR-4 and 30 crosses generated by crossing the 10 lines with 3 testers in line x tester design. The ratio of GCA variance to SCA variance revealed predominance of non-additive gene action for all the characters. These traits can be improved through breeding methods

involving selection, intermating selects and reselection besides heterosis breeding. The studies on general combining ability of parents revealed that the tester RAH-221 was a good general combiner for seed cotton yield, number of bolls per plant, boll weight, plant height, number of seeds per boll, ginning out turn, lint index and micronaire. Among the lines, P72-9-37 was a good general combiner for number of seeds per boll, seed index, lint index and fibre strength. The line CCH-1831 was good general combiner for seed cotton yield, seed index and fibre strength. The cross LH-2076 x RACH-11 exhibited significant heterosis over mid-parent, better parent and standard checks for seed cotton yield. The genotypic

correlations revealed that number of bolls per plant, boll weight, number of sympodia, sympodial length at 50 per cent plant height and fibre strength showed significant correlation with seed cotton yield. The path analysis indicated that ginning out turn had highest direct effect on seed cotton yield. The present study identified LH-2076 x RACH-11 and ADL-903 x RAH-221 as promising hybrids combining high seed cotton yield with high seed oil yield. They were on par for fibre properties with the checks. These hybrids can be considered for commercial cultivation after thorough testing across environments. They can also be used to derive superior segregants in further generations.

Characterization of Avare (*Lablab purpureus* (L.) Sweet) Local Collections for Genetic Variability

B. N. SAVITHA

2008

MAJOR ADVISOR : Dr. R. L. RAVIKUMAR

Two field experiments-non-pendal (71 local genotypes) and pendal types (43 local genotypes) - were laid out in simple randomized complete block design with two replications at Botany Garden during *kharif* 2007-2008. The genotypes were scored for 20 quantitative and 26 qualitative traits. The study revealed a wide range of variability for all the traits. The genetic advance as percent mean in both pendal and non-pendal genotypes was moderate to high for days to 50% flowering, number of primary branches per plant, inflorescence characters, number of green pods per plant, test weight (fresh and dry), shelling percentage (fresh) and green pod yield per plant. The correlation studies revealed that days to 50% flowering, number green pods per plant, test weight, number of racemes per plant and shelling percentage (fresh), showed significant positive association with green pod and seed yield. In pendal types only the pod number recorded the significant positive association with green

pod yield per plant. Seventy one non-pendal genotypes were grouped into 13 divergent clusters, where as 43 pendal genotypes produced six clusters in D² analysis. The cluster II had highest number with 35 and 20 genotypes in non-pendal and pendal types respectively. The inter cluster distance observed was also high revealing the diversity in the local collections studied. Four determinate genotypes showed significantly higher yield over HA-3. In third experiment 11 genotypes comprising of pendal and non-pendal types, and one lima bean genotype were used for morphological and molecular diversity analysis. The cluster analysis using phenotypic traits resulted in formation of three independent clusters-one with lima bean, second with semi determinate and determinate types and third with only pendal types. On the other hand, limited molecular diversity was observed among avare genotypes. Further, the molecular diversity was not concurrent with morphological diversity.

Morphological and Molecular Characterization of Induced Mutants in Groundnut

VARSHAKUMARI

2008

MAJOR ADVISOR : Dr. M. V. C. GOWDA

Morphological and molecular characterization of induced mutants in groundnut was undertaken during *kharif*, 2007. The natural and mutants categories comprising of 21 genotypes representing four botanical types were assessed for morphological and molecular diversity. Mutants showed significant variation for sixteen qualitative and nineteen quantitative traits. Cluster analysis grouped parents and their mutants into separate clusters. Overall, association indicated contribution of yield components towards yield and pleiotropic influence of morphological traits on yield and resistance. Among the mutants VL 1, VL 3, M 28-2 and M 110 combined resistance to either rust or LLS with productivity. Molecular diversity in the mutants was assessed through RAPD analyses using 27 primers. The polymorphism ranged from 9.09 to 71.42% with an average

of 30.16 per cent. The primers OPB 19, OPJ 17, OPB9, OPB 13, OPB11, OPF 09, OPV16, OPA 12, OPK 18 and OPA 07 were highly polymorphic. Dice-coefficients indicated that mutants had 93 per cent of their RAPD fragments in common. Cluster analysis revealed relatively more diversity at morphological level as compared to molecular level and RAPD failed to differentiate different botanical types. AhMITE-specific primer showed polymorphism with respect of 242 bp fragment in mutants. It was present in all Spanish types but absent in all Valencia and Virginia types indicating its role in differentiation of botanical types in groundnut. Selected lines exhibiting high resistance and susceptibility were examined for the presence of AhMITE-specific marker and a strong association was evident with susceptibility to rust. Further validation of this association is suggested for its use in Marker Assisted Selection.

Assessment of Genetic Diversity in Local Collections of Field Bean [*Lablab purpureus* (L.) Sweet]

S. BHUVANESHWARI

2008

MAJOR ADVISOR : Dr. V. RUDRA NAIK

A study was conducted at Forage research scheme, Agriculture College, Dharwad during August 2007 to assess the genetic diversity in local collections of field bean [*Lablab purpureus* (L.) Sweet]. The study included a total of 68 genotypes from different parts of Karnataka and was evaluated for thirteen characters, viz., days to 50 per cent flowering, days to maturity, plant height, inflorescence length, number of inflorescence per plant, number of primary branches per plant, number of secondary branches per plant, pod length, number of pods per plant, number of seeds per pod, hundred seed weight, protein content and seed yield per plant. The study revealed wide range of variability and high heritability for all the characters. The expected genetic advance as per cent of mean was high for days to 50 per cent flowering, plant height, inflorescence length, number of inflorescence per plant, number of primary and secondary branches per plant, number of pods per plant,

protein content and seed yield per plant indicating additive gene action for these traits. From correlation studies, it was observed that seed yield was positively associated with all other characters except with pod length, number of seeds per pod and protein content at both genotypic and phenotypic level. The highest positive direct effect on seed yield at genotypic level was accounted by number of pods per plant. By D² analysis, 68 genotypes were grouped into eight divergent clusters. Pod length followed by protein content contributed maximum to the divergence. Cluster II contained genotypes with higher mean values for most of the characters studied, which could be utilized to develop promising elite varieties. In screening for pest and disease resistance, the genotypes DA-15 and DA-63 have shown resistance to pod borer and moderate resistance to anthracnose disease and suggested for further evaluation under artificial epiphytic condition.

Stability Analysis of Some Promising Bitter Gourd (*Momordica charantia* L.) Hybrids

SOMANATH C. AGASIMANI

2008

MAJOR ADVISOR: Dr. P. M. SALIMATH

A study was conducted to assess the magnitude of heterosis, stability analysis and genetic diversity involving six hybrids generated by crossing two lines with three testers along with a standard check (MBTH-101) in bitter gourd during rainy season of 2006-07. The experiment was conducted at three locations viz., Botany Garden, Department of Genetics and Plant Breeding, farmer's field in Parishwad and Yamkanamardi, villages belonging to Belgaum district. Observations were recorded on fruit yield per plant, important yield parameters and fruit quality traits. The analysis of variance indicated significant amount of variability among the test entries for all the 16 traits studied. Out of the six hybrids, GLA 1 x CGL exhibited positively significant standard heterosis for number of fruits per vine and for total fruit yield per vine, it showed positively significant mid-parent and better parent heterosis and positive but non significant heterosis over standard check in all the three locations. Pooled analysis of variance

revealed significant differences between environments for vine length at 60 DAS, internodal length at 60 DAS and fruit yield per vine. Genotype x Environment interactions were found to be significant for important yield related traits viz., number of fruits per vine, fruit length and fruit yield per vine. Based on the three models, hybrids GLA 1 x PV and GLA 1 x CGL can be regarded as the superior lines both for yield as well as stability. Genetic diversity studies revealed no much diversity among the genotypes. However, parent GLA 1 turned out to be a relatively genetically distant genotype compared to others. From this experiment, genotypes GLA 1, PV and CGL are recommended for future use in heterosis breeding and varietal improvement programmes. Hybrids, GLA 1 x PV and GLA 1 x CGL which proved out to be heterotic and stable with acceptable features can be put into commercial utilization.

Evaluation of Groundnut (*Arachis hypogaea* L.) Germplasm (Mini Core Collection)

KHALEED AHMED

2008

MAJOR ADVISOR : Prof. S. VIJAYAKUMAR

Cultivated groundnut (*Arachis hypogaea* L.) is one of the most important oil seed crops in the world. In India, it is cultivated on 7.6 m. ha with a production of 7.8 m. t and productivity of 1000 kg per hectare. For any crop improvement, it is important to evaluate germplasm accessions to identify superior sources. So in the present study, mini core collection of 184 accessions was evaluated at Raichur rainy and post rainy seasons and at Kawadimatti during post rainy season of 2006-07. Morphological characterization of mini core collection revealed erect type of growth habit, alternate and sequential branching pattern, absence of stem pigmentation, sub-glabrous hairs in one or two rows along main stem; green and light green leaf color; glabrous leaf surfaces; oblong elliptical leaf shapes; orange flower and dark orange streak color; presence of peg color; 2-1 seeded pods; slight beak, reticulation, absence of constriction and tan seed color dominated the mini core. Analysis of variance indicated genotypes as a major source of variation, mean, median and variance test

were significant and wider variations observed for almost all traits. High heritability and genetic advance were noticed for plant height, primary branches, pod length, pods per plant and yield per plant. Association of different traits revealed significant correlation with most of traits. Almost all traits exhibited moderate to high level of diversity and superior accessions identified were ICG-14106, ICG- 13856 for early maturity; ICG-3746, ICG-9905, ICG-14475, ICG-7000 for pods/plant; ICG-8517, ICG-9905, ICG-10185, ICG-11426 ICG-14475 ICG-14008, R 2001-3 for yield/plant; ICG-9905, ICG-6766 for 100-seed weight; ICG-442, ICG-3746, ICG-13723, ICG-4684 for shelling percentage; ICG-5327 for oil content and ICG-721, ICG-1668, ICG-14466 for peanut bud necrosis disease. These accessions can be used as parents to evolve superior lines/ varieties and accessions with acceptable agronomic characteristics can be released as cultivars.

Genetic Variability, Correlation, Morphological and Molecular Diversity in Byadgi Kaddi and Byadgi Dabbi Chillies (*Capsicum annum* L.) Accessions

SANDEEP

2007

MAJOR ADVISOR : H. D. MOHANKUMAR

An investigation was carried out to assess the genetic diversity in chilli during *kharif* 2006 at ARS Devihosur, Haveri. A set of 90 accessions each of Byadgi kaddi and Byadgi dabbi chilli cultivars were planted in the main field following RCBD with two replication. Observations were recorded on twelve quantitative and seven qualitative characters. Analysis of variance in Byadgi chilli accessions indicated highly significant difference among all the accessions for all characters under study. All the fruit and yield related characters in Byadgi chilli recorded high GCV and PCV values along with high heritability and genetic advance. Diversity analysis was made using D² and RAPD analysis. Correlation study in Byadgi kaddi accessions indicated significant positive association of dry fruit yield per plant with plant height, number of primary branches, number of secondary branches, fruit diameter and number of fruits per plants, whereas in Byadgi dabbi accessions, fruit yield showed correlation with plant height, number

of primary branches, fruit diameter. Genotypic path for yield per plant revealed that fruit diameter, number of primary branches, seed weight per fruit and plant height had positive direct effect on yield in Byadgi kaddi and seed number per fruit, number of primary branches, number of secondary branches, fruit length had direct positive effect on yield in Byadgi dabbi. Genotypic path for yield through biochemical traits revealed high direct effect of non-reducing sugar in Byadgi chilli. Genetic diversity study resulted 18 clusters in Byadgi kaddi and 14 clusters in Byadgi dabbi. Number of seeds per fruit contributed maximum to the diversity. Out of twenty primers used OPJ01, OPJ10 and OPC13 showed highest per cent polymorphism. Highest diversity was observed between accession BD19 and BK21. Among twenty accessions each of Byadgi kaddi and Byadgi dabbi 89 per cent of similarity was observed.

Investigations on Effect of Physical and Chemical Mutagens on Tetraploid Wheat

SHOBHA LAXANI

2008

MAJOR ADVISOR : Dr. S. A. DESAI

An investigation was carried out in two generations. First generation during *kharif* 2007 at IARI, RRS, Wellington, Tamil Nadu to assess the germination and survival percentage and mean plant height of M₁, F₁ and M₁F₁ populations. Second generation carried out during *rabi* 2007-08 at Wheat Improvement Project fields, UAS, Dharwad to assess the extent of genetic variability released by hybridization, mutagenesis, hybridization followed by mutagenesis. One cross, DDK1025 x HD4502 was used to generate F₂ and F₂M₂ generations and also M₂'s of DDK1025

and HD4502. The seven segregating populations were evaluated for eight quantitative traits including seed yield. In first generation g-ray induced more reduction in germination and survival percentage and mean plant height than EMS treated and control population. In second generation most of the characters exhibited positive shift in mean for M₂ population than F₂ and F₂M₂ populations. Wide range was observed in M₂ populations in comparison to F₂ and F₂M₂ populations. The irradiated populations revealed the highest PCV and GCV for all characters except for PH, SL

and SPS. Except SL all characters exhibited high heritability value. All populations showed high GAM for TGW and YPP. Highly significant positive correlation of NPTP with YPP for DDK1025 M₂ (g) population and SL with YPP for DDK1025 x HD4502 (CF₂) population was observed. The association pattern has been changed from F₂ to F₂M₂ either on favourable side or on unfavourable side. More number of favourable

correlation were observed in F₂M₂ (EMS) populations. Path analysis revealed DFF, NPTP, SL and SPS had high direct effect on grain yield in almost all populations. More number of potential genotypes were recorded in F₂M₂ (g) population compared to their corresponding F₂'s and F₂M₂ (EMS). It was observed that effectiveness of physical mutagen in creating potential genotypes were more than the chemical mutagen.

Studies on Genetic Variability in the Indian Mustard (*Brassica juncea* L. Czern and Coss) Germplasm and its Suitability to Northern Karnataka

DODDABHIMAPPA R. GANGAPUR

2008

MAJOR ADVISOR : Dr. B. G. PRAKASH

Forty-six germplasm lines were evaluated for seed yield and its components, separately under protected (chemical control against pest and disease) and unprotected conditions followed RBD design with two replication each powdery mildew reaction, aphid resistance during *rabi* season of 2007-08 at RARS, Bijapur. Seed yield per metre and seed yield/plant showed highest phenotypic and genotypic coefficient of variation under both protected and unprotected condition followed by biological yield/plant. Heritability in broadsense and GAM were higher for seed yield per metre followed by number of siliquae/plant, number of seeds per siliqua in both conditions suggesting less influence of environment in these characters. The correlation studies revealed that seed yield per metre had significant positive association with number of primary branches per plant, number of secondary branches per plant, number of siliquae per

plant, number of seeds per siliqua, 1000-seed weight in both protected and unprotected conditions at phenotypic and genotypic level. Path coefficient analysis revealed maximum positive direct effect of number of siliquae/plant on seed yield per metre and its indirect effects were through other characters *viz.*, biological yield/plant and harvest index. All the germplasm lines were grouped into seven cluster based on D² analysis in both the conditions. Clusters I and VII possessing high mean values for most of the desirable traits including yield are desired to be crossed with cluster II and V which possessed high mean values of oil content (%) and harvest index for exploitation of heterosis. Among the eight top performing germplasm lines *viz.*, GPM31, 64, 23 were common in both the conditions. The mustard lines *viz.*, Pusa Agaram, Pusa, Mahak, GPM46, EJ-15, JM-1, GPM108 and GPM25, GPM106, GPM65, GPM83, GPM58, GPM53 exhibited resistance to aphid and powdery mildew, respectively.

Genetic Variability and Correlation Studies in Biparental Mating Populations of Tomato (*Solanum lycopersicon* (Mill.) Wettst)

K. SIVAPRASAD

2008

MAJOR ADVISOR : Dr. O. SRIDEVI

An investigation was carried out during *kharif* and Summer seasons of 2007-08 at Botany Garden, College of Agriculture, University of Agricultural Sciences, Dharwad to study the nature and magnitude of variability generated and character association for different quantitative traits in the populations (J/S, S/J, J/G, G/J) obtained by attempting biparental mating among the selected plants of F₂ generation of three commercial tomato hybrids *i.e.* J.K. Desi (J), Shivaji (G) and Sasya-54 (S). In general, all populations exhibited high PCV, GCV for number of primary branches, fruits per plant, locules per fruit and fruit yield per plant, indicating scope for selection. Association of high heritability with moderate to high genetic advance for plant height, number of primary branches, number of fruiting clusters, fruit shape index, locules per fruit and pericarp thickness suggested the role of additive gene action and improvement through visual selection. Population G/J exhibited high PCV, GCV, heritability

and GA for main yield attributing traits, whereas, J/G for fruit related characters. Other two populations J/S and S/J did not differ much between themselves. Populations involving the parents J and G exhibited the highest between and within family variance for many traits, indicating the potentiality of these cross combinations to release variability. Whereas, the population S/J showed the lowest between and within family variance for fruit related traits. Per cent superior progenies was more in the populations J/G and G/J. Correlation studies revealed that plant height, number of primary branches, number of fruiting clusters per plant, fruits per truss, fruits per plant, average fruit weight and pericarp thickness exhibited high significant positive correlation with fruit yield, suggesting that these characters should be considered while selecting plants for fruit yield improvement. Path coefficient analysis revealed that number of fruits per plant and average fruit weight had high direct and indirect effect in all the populations.

Early Generation Testing for Combining ability in Maize (*Zea mays* L.)

C. K. SHASHIDHARA

2008

MAJOR ADVISOR : Dr. P. M. SALIMATH

An investigation on early generation testing for combining ability in maize was carried out at the Botany Garden of Agricultural College, Dharwad during *kharif* and *rabi*/summer seasons of 2007-08. The experimental material comprised of 30 S₃ lines derived from yellow pool, 3 testers and their 90 crosses generated by crossing them in line x tester design. Observations were recorded on days to 50% flowering, plant height, cob length, cob girth, number of kernel rows/cob, number of kernels/row, 100-grain weight, shelling percentage, grain yield/plant and grain yield/hectare. The combining ability analysis revealed the presence of higher magnitude of SCA than GCA variance for the characters under study. The ratio of additive to dominance variance was less than one for all the traits, indicating higher dominance variance than additive variance. Among the thirty lines, 327 was the best general combiner for days to 50% tasseling, cob length, cob girth, grain yield/plant and grain yield per ha. The line

172 was best general combiner for days to 50% tasseling, plant height, number of kernel rows/cob and 100 grain weight. Among testers (male parents) Prabha was the best general combiner for days to 50% tasseling, number of kernels/row, grain weight, grain yield/plant and grain yield/hectare. Out of 90 hybrids 172xPrabha, 328xPrabha, 205xPrabha, 226xPrabha, G-10xPrabha, G-15xCM-501, 191xCM-501, G-61xPrabha, 190xCM-501, 198xPrabha were top performers with high sca effects for grain yield. The grain yield/plant was significantly and positively associated with all the characters under study except for number of kernel rows at genotypic level. From the present investigation it is proposed to plan hybrid breeding programme with proper choice of promising material. Promising hybrids involving high x high parental gca effects for grain yield may be used for further improvement of lines by selection in advanced generations.

Early Generation Evaluation of Single and Double Cross Populations of Bhendi (*Abelmoschus esculentus* (L.) Moench)

AJJAPPA SOGALAD

2008

MAJOR ADVISOR : Dr. G. SHANTHAKUMAR

An investigation was carried out to elicit information on genetic variability, character association and path coefficient analysis for fruit yield and its component traits in three single cross and four double cross

F₃ populations of bhendi, at ARS, Hanumanamatti during 2007-08. Experiment was laid out in randomized block design with two replications. Observations were collected for eleven traits. High PCV and GCV values

were found for number of branches per plant, number of fruits per plant and fruit yield per plant. Moderate GCV and PCV values were recorded for internodal length, fruit length, fruit diameter and fruit weight in both single and double cross F_3 population indicates existence of wide range of genetic variability in the material evaluated. High heritability coupled with high genetic advance was observed for the characters viz., number of branches per plant, fruit length, number of fruits per plant and fruit yield per plant in both single and double cross F_3 population whereas, high heritability accompanied by high genetic advance noticed for internodal length and number of seeds per fruit in double cross F_3 population indicating additive gene action in the control of expression these

characters. Correlation studies revealed highly significant positive association of fruit yield per plant with plant height, number of branches per plant, fruit length, fruit weight, number of seeds per fruit and number of fruits per plant. Path analysis revealed high positive direct effect of number of fruits per plant, fruit weight and number of branches per plant on fruit yield per plant. Therefore, emphasis may be laid on these characters for improving fruit yield per plant. Analysis of productive segregants for important component traits revealed that more number of segregants were released in double cross population BH-16 followed by single cross population BH-13. These segregants were superior to commercial checks Sabjipuri and Arka Anamika.

Studies on Variability and Character Association in Selfed and Biparental Progenies in Bhendi (*Abelmoschus esculentus* (L.) Moench)

C. RAJU

2008

MAJOR ADVISOR : Dr. G. SHANTHAKUMAR

Okra (*Abelmoschus esculentus* (L.) Moench) is an important vegetable crop grown in the tropical and sub-tropical parts of the world. The present investigation was carried out during *kharif* and summer season 2007-08 at Agriculture Research Station, Hanumanamatti to study the nature and magnitude of variability generated for different quantitative traits in the population obtained by attempting crosses in F_2 generation of 4 commercial single cross private bhendi hybrids i.e. safal, rasi, seminis and ph101. The study was also aimed at to know relative efficiency of BIPs over F_3 generation. Crossing and selfing were attempted in the first season and evaluation was done in the next season. The results revealed that mean value were in high F_3 than BIPs because of wider variability

generated in BIPs. The magnitudes of GCV, PCV, heritability and genetic advance were enhanced in BIPs for all the characters studied except 100 seed weight than the selfed populations. Biparental mating also resulted in shift in the magnitude as well as direction of correlation coefficients. This approach will help in creating new population with high frequencies of rare recombinants which can not otherwise be realized in small segregating populations normally being raised through conventional method of breeding especially when desired genes are unfavourably linked. In addition to these, it will also help in maintaining a greater variability for selection to be effective for longer period and will thus avoid the early fixation of genes in homozygous state.

Relative Stability Analysis of Public and Private Bred Hybrids of Maize (*Zea mays* L.)

NAGABHUSHAN

2008

MAJOR ADVISOR : Dr. M. C. WALI

An experiment was carried out involving 15 hybrids of maize including five private bred maize hybrids during *kharif* 2007 at three locations to know the magnitude of variability present and to assess the stability of hybrids for productivity traits. The hybrids were also assessed for the nature of inter-relationships, path effects of different characters towards grain yield. Mean performance of hybrids indicated that Arabhavi was most favourable environment for better expression of most of the characters. Analysis of variance revealed significant differences among most of the characters. Genetic variability analysis revealed grain yield per plant and fodder yield per hectare had moderate variability, higher heritability and expected GAM. The association analysis revealed that grain yield per plant exhibited significant positive association with fodder yield per hectare at all the locations and path analysis indicated that

fodder yield per hectare exerted maximum direct effect at all the locations. The pooled analysis of variance revealed significant differences among the genotypes and environments for most of the characters indicating the genotypes and environments tested are diverse in nature. $G \times E$ interaction was significant for most of the characters suggesting genotypes interacted significantly with the environments. $G \times E$ (linear) interaction was significant for cob length, grain yield per plant, grain yield per hectare and fodder yield per hectare indicating significant rate of linear response of genotypes to environmental changes. The non-linear component was highly significant for all the traits indicating variance in terms of performance of genotypes is unpredictable. On the basis of stability parameters, ARBMH-2, ARBMH-6 and 900M were promising genotypes for maximum number of characters. While, ARBMH-2 was the best yielder for grain and fodder across the environments.

Evaluation of Segregating Populations for Productivity and Rust Resistance in Soybean (*Glycine max* (L.) Merrill)

M. SHIVAKUMAR

2008

MAJOR ADVISOR : Dr. G. T. BASAVARAJA

An investigation was carried out to elucidate information on genetic variability, correlation and path coefficient analysis for productivity traits and reaction to rust in F_3 populations of two crosses (JS 335 x EC 241780 and JS 93-05 x EC 241780) of soybean during *kharif* 2007 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The experiment was laid out in randomized complete block design (RCBD) with two replications. The observations were recorded on twelve traits such as days to flowering, plant height, number of branches per plant, pods per plant, pod length, pod weight, number of seeds per pod, number of seeds per plant, 100 seed weight, biomass, harvest index and seed yield for plant. Highest PCV and GCV values were observed for pod weight, number of seeds per plant, biomass and seed yield per plant in

cross JS 335 x EC 241780. Days to flowering and number of seeds per pod recorded low PCV and GCV values in both the crosses. High heritability coupled with high genetic advance was noticed for the traits viz., plant height, number of branches per plant, number of pods per plant, pod weight, number of seeds per plant, biomass and seeds per plant. Correlation studies revealed significant association of seed yield with number of branches per plant, pod length, pods per plant, pod weight, number of seeds per pod, number of seeds per plant, biomass and harvest index in both the crosses. The maximum positive direct effect on seed yield per plant was exhibited by biomass followed by harvest index in both the crosses. Screening studies under artificial condition revealed that one progeny line from cross JS 335 x EC 241780 and five progeny lines from cross JS 93-05 x EC 241780 exhibited resistant reaction to soybean rust.

Stability Analysis of Maize (*Zea mays* L.) Inbred Lines/Introductions for Yield Parameters

VIJAY KUMAR NADAGOUD

2008

MAJOR ADVISOR : Dr. R. C. JAGADEESHA

The present investigation was carried out to assess amount of variability, heritability, genetic diversity, correlation and path coefficient

analysis of characters and to assess the stability of genotypes. First experiment, consisting of 181 genotypes with 5 checks were evaluated

for 12 traits. The *per se* performance of lines revealed that the lines 2089, 2163, 2082, 2169, 2184, 2090, 2074, 2088, 2086, 2079, 2084, 2034, 2146, 2036, 2119, 2033, 2246, 2024, 2162 and 2242 were found good for grain yield per plant. Wide range of variation was observed for characters studied. Genotypes were grouped into 10 clusters, indicating the presence of diversity. The maximum intercluster distance was between cluster I and V, indicating genotypes present in both clusters differ entirely. Many characters under study showed positive significant association with grain yield per plant. Path analysis indicated 100-grain weight, cob girth, cob length, number of kernel per rows and number of kernel rows per cob should be considered as selection criteria for grain yield improvement in maize. In the second experiment, top 20 lines are selected from first

experiment based on *per se* performance and diversity study and were tested for stability along with 2 checks at Dharwad, Hagari and Arabhavi. The Observations were recorded for 14 traits. Pooled analysis of variance revealed, significant differences among the genotypes and environment for most of the characters. Similarly genotype x environment interaction showed significant difference for most of the traits. On the basis of stability parameters 2090, 2024, 2079, 2089 and 2119 were promising stable genotypes for majority of characters. Genetic variability analysis showed that grain yield/plant and fodder yield had high variability, h^2 and GAM. All the characters under study had high heritability. Days to 50 per cent tasseling and silking had lower variability and low GAM.

Heterosis and Combining Ability in Chilli (*Capsicum annum* L.)

DEEPAK CHADCHAN

2008

MAJOR ADVISOR : Dr. H. D. MOHANKUMAR

A study was undertaken to estimate the heterosis and combining ability by following diallel cross analysis in chilli. A total of 6 parents (VN-2, X-235, LAM-334, Harti local, Vaishnavi selection and Raichur local), 30 hybrids and two standard checks (Tejaswini and HY 9646) were evaluated during 2007-08 at Agricultural Research Station (Chilli), Devihosur, Haveri. Observations were recorded for 14 characters. The analysis of variance indicated significant amount of variability among the genotypes for majority of the traits studied. Significant and standard heterosis in desirable direction was recorded by majority (20) of the crosses for number of fruits per plant. The heterosis estimates revealed the predominance of additive gene action for days to 50% flowering, fruit length, fruit width, stalk length, stalk width, number of fruits per plant, green fruit yield per plant and ratio of fruit length to width. Among the

hybrids studied Raichur local x VN-2, Raichur local x LAM-334, VN-2 x LAM-334 and X-235 x VN-2 were found to be the best cross combinations for fruit yield and its components. In the analysis of variance for combining ability, the variance due to GCA was significant for eight out of the fourteen characters studied. The variances due to SCA were also significant for seven characters only. For the fruit length, the SCA variance was non-significant but had significant GCA variance whereas, for primary branches, fruit width, stalk length, stalk width, ascorbic acid content and percent capsaicin both GCA and SCA were non-significant. The present study indicated that among 6 parents VN-2 and X-235 are the good general combiners and Raichur local x VN-2, Raichur local x LAM-334, VN-2 x LAM-334 and X-235 x VN-2 were found to be having good SCA.

Induced Variability Studies on Productivity Related Traits in Desi Cotton

ANNARAY M. TALAWAR

2008

MAJOR ADVISOR : Dr. S. T. KAJJIDONI

An investigation was carried out at Main Agricultural Research Station, Dharwad during *kharif* 2007 to determine the extent variability generated and association pattern among the component traits of seed cotton yield by hybridization, combination of hybridization and irradiation and irradiation alone involving four F_2 , F_2M_2 and five M_2 progenies of desi cotton. A comparison of mean, range and variance of F_2 , F_2M_2 and M_2 progenies, indicated relatively higher mean performance of M_2 progenies and wide range values and higher variance of F_2M_2 progenies for most the character under study. The PCV, GCV, heritability and genetic advance in irradiated F_2M_2 and M_2 progenies were relatively higher compared to F_2 progenies for most of the characters. The study of phenotypic correlation indicated significant positive association of seed cotton yield per plant with number of bolls per plant and boll weight in F_2 , F_2M_2 and M_2 progenies,

except M_2 progenies of RAHS-14 for boll weight. The M_2 progenies of KS-16 exhibited significant association between seed cotton yield and halo length traits. Path analysis revealed that boll number and boll weight had high direct effect on seed cotton yield in all the progenies. Halo length had very low to even negative direct effect on seed cotton yield per plant in most of the F_2 progenies while it had positive direct effect in most of F_2M_2 and M_2 progenies. Out of four, crosses RDC-53 x 9747 F_2M_2 progenies produced high percentage of superior segregants for number of bolls per plant, boll weight and seed cotton yield per plant compared to F_2 progenies. Among irradiated parents the progenies of 9747 recorded higher percentage of superior segregants for boll weight trait. The F_2M_2 progenies of KS-16 x MB-3200 and M_2 progenies of KS-16 produced more number of superior segregants over Jayadhar for combination of seed cotton yield and halo length traits.

Genetic Variation for Phosphorus Uptake in Selected Genotypes of Blackgram (*Vigna mungo* L. Hepper)

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2008

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Blackgram is one of the fourth important pulse crops in India, which is grown in low fertile and marginal land. Phosphorus is one of the major nutrient elements to maximize the productivity of leguminous crops. But, the major problem is the uptake of applied P by plants through soil is very low owing to its fixation in soil. Genotypes exhibit variability for plant morphological, physiological and biochemical attributes under varying P levels. Therefore, a study was conducted during summer 2007 at UAS, Dharwad to estimate genetic variability for P-uptake in pot culture using vermiculite with eighteen genotypes under P-deficient and P-sufficient conditions. Shoot dry weight, leaf area, root surface area and total P-uptake under both P conditions and root volume under only P deficient condition at 45 DAS. Shoot P uptake, seed P uptake and total P uptake at the time harvesting exhibited high GCV, PCV and high heritability

with high genetic advance over mean. Total P uptake exhibited significant association with root volume, root dry weight and leaf area under both P-conditions and with plant height and root surface area under only deficient condition at 45 DAS. At the time of harvest, seed yield/plant and seed P-uptake under P-deficient condition and number of pods/plant, shoot and seed P-uptake under P sufficient condition exhibited significant association with total P uptake. Path coefficient analysis revealed that total P uptake had high direct positive effect by leaf area under P deficient condition and shoot dry weight under P sufficient condition at 45 DAS. At the time of harvesting under both P conditions seed P uptake had high direct effect on total P uptake. Biochemical study revealed that root exudates citric and oxalic acid under both the P conditions, but large amount of acids exudated only under P deficient condition.

Molecular Assessment of Diverse CMS Lines of Sunflower (*Helianthus annuus* L.) for Resistance to Alternaria Blight using RAPD

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2008

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Leaf spot disease caused by *Alternaria helianthi* (Hansf.) is an important fungal disease of sunflower in India and elsewhere. Non availability of known sources for resistance to Alternaria disease is a major constraint in sunflower breeding. Hence the present investigation was carried out on diverse CMS lines to identify genotypes for resistant to Alternaria blight in by using RAPD markers. Ten diversified CMS lines and one maintainer line were raised in the field during kharif 2007 under natural infestation of *Alternaria helianthi* for one season. The Alternaria blight disease was scored for ten diverse CMS lines and one maintainer line under field condition. The yield of genomic DNA extracted from miniprep method varied from 200ng to 1000ng among the diverse CMS lines. From ten random primers, 98 RAPD markers were generated in this study. The overall polymorphism across 11 CMS lines was 83.6%. Among the selected primers, OPC-13 produced maximum number of polymorphic

bands (i.e. 13 bands) followed by OPC-07 (12 bands), OPA-14 (11 bands) and OPA-06 (i.e. 10 bands) and lowest polymorphic bands was recorded in OPB-01 and OPB-05 (i.e. 4 bands each) Dendrogram was constructed using Ward's method of clustering and also dissimilarity matrix for 11 sunflower CMS lines was calculated in this study with 10 primers. Highest dissimilarity (54.4%) was observed in 1st cluster i.e. between 11 CMS lines and followed by 39% dissimilarity was observed in 2nd cluster includes seven CMS lines (i.e. between CMS PRUN-29, CMS DV-10, CMS PKUZ, CMS 104A, CMS PHIR-27, CMS-X and CMS E002-92) However lowest dissimilarity (10%) was observed in 7th cluster (i.e. between CMS-X and CMS E002-92). Identification of marker that could be associated with *Alternaria helianthi* tolerance was attempted by physically examining the RAPD gel profiles. From such an attempt, no marker is found associated with Alternaria blight resistance.

Breeding Investigations Involving Biparental Mating and Selection Approaches in Tomato [*Solanum lycopersicum* (Mill.) Wettst]

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2008

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Field investigations were conducted in Botany garden, College of Agriculture, Dharwad, to study the genetic variability, correlation and path coefficient analysis for different quantitative and quality traits in biparental and selfed populations of tomato. In one experiment, biparental progenies (derived from inter and intra-population mating) and selfed progenies were advanced through different methods of selection viz., individual plant selection (IPS) and bulk (BP) method to compare their efficiency to improve fruit yield and yield component traits along with checks. The results indicated that, the mean values and estimates of genetic parameters were high in inter-population mating compared to intra-population mating indicating that inter-population mating had resulted in releasing the concealed variability. Hence inter-population mating can be a better tool for exploiting the variability available in the crop and also to pool the desirable genes from both the populations. In all the crosses estimates of genetic parameters and frequency of superior

segregants were high in bulk method compared to IPS. In another experiment, forty-four genotypes including nine checks were evaluated for different quantitative and quality traits. The study revealed wide range of variability and high heritability for plant height, number of fruits per plant, average fruit weight and fruit yield per plant. High GAM was observed for number of primary branches, number of fruits per plant, average fruit weight and fruit yield per plant. Correlation studies revealed that fruit yield per plant was significantly associated with plant height, number of primary branches, fruits per truss, number of fruits per plant and average fruit weight in both the experiments. When biparental populations were advanced through different selection methods, change in the association pattern was observed for yield and its component characters indicating that biparental mating had resulted in breakage of undesirable associations and creation of larger variability in the populations.
