

ABSTRACTS OF THESES

Accepted for the award of post-graduate degrees in the University of Agricultural Sciences, Dharwad

DOCTOR OF PHILOSOPHY

AGRICULTURAL ECONOMICS

Socio-economic evaluation of women self help groups in northern Karnataka

S. D. DABALI

2010

MAJOR ADVISOR : Dr. (Mrs.) J. A. HANDIGOL

The study aimed at evaluation of the socio-economic impact of Bank-linked SHGs in northern Karnataka. Credit-linked SHGs grew at a CGR of 73.18 per cent, bank loans at 98.57 per cent, refinance at 80.26 per cent and cumulative finance at 91.87 per cent in Karnataka during the period 1992-93 to 2007-08. On an average a SHG saved Rs.8716, disbursed 29 loans in a year totalling to Rs.57,177 with an average recovery of 93 percent. 42 percent of the loans were for consumption and the rest for productive purposes with agriculture claiming 44 per cent of the latter. The Gini coefficient was 0.055 in the case of distribution of number of loans among members and 0.095 in the case of distribution of amount of loan. In the Principal Component Analysis totally four components namely 'resource mobilization', 'receipts', 'business' and 'equity' together explained

82 percent variation in the SHG's performance. The Kendall's Coefficient of Concordance was higher among NGOs and financial institutions and lower among *prathinidhis*. Consequent to SHG association members' liabilities were reduced by 50 percent and incomes increased by 25 percent among 75 percent of the members families. Employment, investment, consumption and assets had increased by 15, 9, 5 and 4 percent respectively among 48, 61, 30 and 85 per cent of the member families in that order of parameters. In the Step-wise Canonical Discriminant Function analysis, savings and employment of the SHG member's family contributed 70 and 24 per cent to respectively to the Discriminant score. The SHGs had symbiotic linkages with NGOs, banks and occasionally with other organizations. NABARD formulated comprehensive and strategic policies, schemes with the Centre, RBI and the State acting in synergy.

AGRICULTURAL ENTOMOLOGY

Bioecology and management of mealybug, *Phenacoccus solenopsis* tinsley (hemiptera: pseudococcidae) on Bt cotton

SHIVANAND G. HANCHINAL

2010

MAJOR ADVISOR : Dr. B. V. PATIL

Investigations were carried out on survey, seasonal fluctuation of mealybug, *Phenacoccus solenopsis* Tinsley and its natural enemies, crop loss assessment, estimation of EIL, biology of mealybug, biology of the predator *Cryptolaemus montrouzieri* Muls. and efficacy of insecticides including biological agents against mealybugs were undertaken during 2008-09 and 2009-10 at MARS, Raichur and Department of Entomology, College of Agriculture, Dharwad. Mealybug incidence was moderate to severe in Raichur, Bellary and Gulbarga districts while its incidence was low in Dharwad, Haveri and Belgaum districts of North Karnataka on Bt cotton. Mean per cent parasitoid emergence from mealybugs collected at various places was highest in TBP and UKP areas as compared to other districts in both the years. *Abutilon indicum* L. (Malvaceae) and *Parthenium hysterophorus* L. (Asteraceae) were the major alternate weed hosts. Steep increase in the mealybug population was observed from January

and reached peak in March in both the years of study. Initially parasitoid population was low and peak activity started during first week of January which gradually increased up to 34.62 and 34.64% during the last week of March 2008-09 and 2009-10 seasons, respectively. Among different parasitoids, *Aenasius bambawalei* Hayat was the dominant species. Total life cycle of *P. solenopsis* female and male was 38.47 and 20.33 days, respectively. Crop loss estimation due to mealybug damage indicated that cotton plants did not survive at all the damage levels at 60 DAS in both the years. Estimation of EIL due to mealybug damage on Bt cotton under irrigated ecosystem resulted in 20, 27, 44 and 51 mealybugs/plant at 60, 90, 120 and 150 DAS, respectively. Profenophos 50EC @ 2000 ml/ha and buprofezin 25SC @ 1500 ml/ha were effective in reducing the mealybug population and recorded significantly maximum seed cotton yield with higher net returns in both the seasons of study.

Seasonal incidence and management of brinjal mite, *Tetranychus* spp.

A. SITHARAMA SARMA

2010

MAJOR ADVISOR : Dr. B. S. NANDIHALLI

Investigations on seasonal incidence, screening of brinjal varieties for their reaction against brinjal mite, *Tetranychus* spp., effect of temperature and relative humidity on the biology of *T. macfarlanei*, relative toxicity of acaricides under laboratory conditions and screening of acaricides under field conditions against *Tetranychus* spp. and resurgence studies on brinjal mite, *Tetranychus* spp. were carried out during 2005-07. Studies on seasonal incidence of brinjal mite, *Tetranychus* spp. revealed that their incidence was more during summer followed by *rabi* and *kharif* seasons and the natural enemies also followed the same trend reaching their peak with peak infestation of the mites. Studies on biology of *T. macfarlanei* at different temperatures and relative humidities revealed that the duration of different stages, fecundity and adult longevity decreased with increase in temperature and decrease in relative humidity. Life table studies of *T. macfarlanei* revealed that the net reproductive rate (Ro), the mean generation time (Tc) and the innate capacity for increase in numbers

(rm) increased with increase in temperature. Among the twelve varieties screened for their reaction against *Tetranychus* spp., Arka Nidhi recorded lowest mite population during both the years and also recorded on par yield with the best yielded variety Kalyan. The varieties, Arka Nidhi and Arka Keshav were moderately resistant. From the relative toxicity studies, it can be summarized that dicofol was the most effective acaricide (LC₅₀=206.177 ppm) followed by spiromesifen (LC₅₀=1061.64 ppm), propargite (LC₅₀=2061.64 ppm), milbemectin (LC₅₀=2652.87 ppm) and diafenthiuron (LC₅₀=3306.34 ppm). The field screening of acaricides revealed that spiromesifen 240 SC has recorded the lowest mite population of 5.90 mites/6.25 cm² leaf area followed by diafenthiuron and dicofol and the net returns were highest in spiromesifen (Rs. 1,04,500/-) followed by dicofol (Rs. 82,800/-). The resurgence percentages indicated that bifenthrin caused more resurgence (16.65%) followed by cypermethrin (15.53%) and fenvalerate (13.36%).

Evaluation of EPN formulations, their shelf life and efficacy of *Heterorhabditis indica* (RCR) (Heterorhabditidae: Nematoda) against economically important insect pests

SHIVALEELA

2010

MAJOR ADVISOR : Dr. P. S. HUGAR

Investigations were carried out on shelf life of different nematode formulations of locally isolated EPN *Heterorhabditis indica* (RCR), to

standardize the density and temperature for long storage period and bio efficacy of different nematode formulations against economically

important insect pests under laboratory and field conditions during 2005-08 at the Department of Entomology, College of Agriculture, Raichur. The studies revealed that in aqueous formulation the best combination of temperature, population density and duration of storage was 10°C, 10000 IJs/ml and 120 days of storage period, respectively. The corresponding values for talc formulation was 20°C, 10000 IJs/ml and 120 days of storage period. Similar studies in sponge and alginate formulations also showed encouraging results. The production and duration of emergence studies revealed that one to four week old IJs stored at 10 and 15 °C was most appropriate for maximum production in aqueous and alginate formulations and the time taken for emergence was shorter. Among the

different formulations aqueous formulation revealed maximum larval mortality of *H.armigera* when exposed to 90 days old IJs stored at lower temperatures. Maximum larval mortality of *S. litura* was recorded from aqueous (spray) and alginate (bait) formulations when exposed to 30, 60 and 90 days old IJs stored at lower temperatures. Efficacy of different nematode formulations evaluated against *H. armigera* in chickpea ecosystem revealed that the plots treated with talc formulation @ 8000 and 10,000 IJs/g recorded maximum yield with minimum pod damage. Among the various formulations evaluated against *C. partellus* infesting sorghum, the aqueous form of whorl application was superior followed by talc and spray form.

Insect pest management in desi cotton

C. M. RAFAEE

2010

MAJOR ADVISOR : Dr. S. LINGAPPA

The study was carried out to study the interaction of *Gossypium herbaceum* and *Gossypium arboreum* and *Gossypium hirsutum* to pave way for designing strategies for development of IPM for desi cottons. Peak activity of aphids, leaf hoppers and thrips was at 105, 75 and 75 DAS, respectively. *Gossypium hirsutum* was susceptible to sucking pests Susceptibility to bollworms was *G. hirsutum* > *G. herbaceum* > *G. arboreum*. Peak activity of ABW, SBW and PBW was at 105, 90 and 105 DAS. Coccinellid and chrysopid population was corresponding to aphids. Helicoverpa armigera preferred *G. herbaceum* over *G. arboreum*. Preference for plant parts was leaves> bracts> stem> petiole. *Trichogramma chilonis* preferred *G. arboreum* cultivars over *G. herbaceum*. It was most efficient followed by *T. achaea*, *T. japonicum*, *T. pretiosum* and *T. brasiliensis*. Chrysopid preferred hairy genotypes for oviposition and not for feeding. Cotton with cowpea, sorghum and bhendi reduced the

population of aphids and leaf hoppers in *G. arboreum* and *G. herbaceum*. Bhendi and cowpea had favourable influence to lower thrips activity. Drastic decline of *H. armigera* population was noticed when *G. arboreum* and *G. herbaceum* were intercropped with cowpea, sorghum and bhendi. Higher population of Coccinellids and Chrysopids was noticed in *G. arboreum* cotton with cowpea, sorghum and bhendi. Significant higher cotton yield of 5.06, 4.73, 4.70 and 5.18, 5.05 and 4.62 q/ha in AK-235 and Jayadhar, respectively in above crop combinations. Highest B:C ratio was from bhendi, cowpea and sorghum intercrops combinations. Recommended package of practices recorded higher seed cotton yield followed by seed treatment + *T. chilonis* @ 2.0 lakh/ha at 90 and 110 DAS in *G. arboreum* and *G. herbaceum*, respectively. Residual toxicity of imidacloprid treatment to seed was upto 75, 60 and 45 days to leaf hoppers, aphids and thrips, respectively.

Ecology and management of chilli insect pests and pesticide residue estimation

M. H. TATAGAR

2010

MAJOR ADVISOR : Dr. J. S. AWAKNAVAR

Investigations were undertaken at Agricultural Research Station, Devihosur, Haveri district, Karnataka on the survey of chilli pests, specially chilli thrips, mites and natural enemies and also alternate hosts for *Scirtothrips dorsalis* during off season, role of border crop for the management of chilli pests during 2006-07 and 2007-08, pesticide residue estimation of recommended chemicals in package of practices both in green and dry chilli and also monitoring of pesticide residue levels from high pesticide usage area. Survey carried out revealed that Antur-Bentur variety was found to be least susceptible to thrips and mites compared to Byadagi kaddi, Byadagi dabbi and Annigeri delux. Among several natural enemies, coccinellids were found to be more predominant followed by phytoseiid mites and chrysoperla. Alternate hosts for *S. dorsalis* during off season survey revealed that chilli thrips was recorded on plants belonging to 12 families. In majority of chilli growing belts, *S. dorsalis* is known to survive on plants belonging to Papilionaceae, Meliaceae, Mimosaceae, Asclepidaceae and Caesalpinaceae. The treatment schedule included chilli with two rows of maize all along the border at every 0.5

acre with two interventions of spray, first spray with neemazal 1% @ 2.0 ml per l at 7 WAT followed by second spray with difenthiuron 50 WP @ 0.75 g per l at 9 WAT recorded highest yield (6.90 q/ha) with lowest leaf curl damage due to thrips (0.70 LCI/plant) and mites (0.19 LCI/plant), least number of larvae per plant (0.34/plant) and least per cent fruit damage and was found to be the most effective treatment combination in reducing the incidence of chilli pests. Pesticide residue studies of the chemicals recommended in package of practices carried out in green chilli and dry chilli indicated that none of the insecticide residues were detected both in green and dry chilli and were found safe. Pesticide residue estimation of dry chilli samples collected from high pesticide usage area revealed that sample collected from Mariyamma camp contaminated with monocrotophos 36 SL (7.23 mg/kg) was above the maximum residue level, whereas remaining samples contained pesticides viz., acephate 70 SP, dicofol 18.5 EC, indoxcarb 14.5 SC, chlorpyrifos 20 EC and cypermethrin 10 EC were found below the maximum residue level.

AGRICULTURAL MICROBIOLOGY

Molecular diversity of arbuscular mycorrhizal fungi and pink pigmented facultative methylotrophic bacteria and their influence on grapevine (*Vitis vinifera*)

P. JONES NIRMALNATH

2010

MAJOR ADVISOR : Dr. J. H. KULKARNI

Investigations were carried out to study the diversity of native AM fungi and Pink Pigmented Facultative Methylotroph (PPFM) from four ecological zones of Northern and their growth promoting potentials in grapevine. The highest composition of 23 AMF species was recorded from the Western Ghats. The ITS region of efficient AM fungi was analysed with data base using BLAST. Based on the results of BLAST the native isolates AMF 60, 528C, 251SP, 135M, 22A and 235A were grouped in the same cluster of *Glomus mosseae* (DQ 400160). The other two isolates viz., G7 and G3 were found to be closely related to *Glomus mosseae* (DQ 400141) but formed a separate cluster. The Isolate AMF T25, has shown close homology to *Glomus geosporum* (AF 413088). The authenticity of PPFM isolates was confirmed by screening for the presence of *mxhF*

gene by amplifying a single fragment of 555 bp in all the native isolates. To understand the genetic diversity in these isolates, restriction digestion of amplified 16S rDNA gene was done. The sequence analysis of the 16S rDNA has clearly indicated PPFM 365, 120, 61 and 242 to be very close to *M. radiotolerance* JCM 2831 (D32227). Further, PPFM G4 isolated from the rhizosphere of vineyards showed close homology with *M. fujisawwaense* (AJ 250801). PPFM 23 isolate from the saline soils of Northeastern dry zone had very close homology with *M. thiocyanatum* (U58018). However, PPFM 117 with MPS activity isolated from the Western Ghats emerged in a separate clad. The study has brought out the diversity of AMF and PPFM and their importance in the growth promotional ability in the grapevine.

AGRONOMY

Response of maize (*Zea mays* L.) and chickpea (*Cicer arietinum* L.) to site specific nutrient management (SSNM) through targeted yield approach

JEMAL ABDULAH

2010

MAJOR ADVISOR : Dr. G. B. SHASHIDHARA

Field experiments were conducted at A. R. S. Belvatagi, University of Agricultural Sciences, Dharwad during *kharif* and *rabi* 2008-09 to study the "Response of Maize (*Zea mays* L.) and Chickpea (*Cicer arietinum* L.) to Site Specific Nutrient Management (SSNM) Through Targeted Yield Approach" under irrigated conditions in Malaprabaha Command area of zone III of . The treatments comprise of two hybrids/varieties (Cargil 900 M and EH-434042 of maize hybrids and JG-11 and A-1 of chickpea varieties) with four targeted yield levels (60, 75, 90 q ha⁻¹ with RDF for maize and 20, 30 and 40 q ha⁻¹ with RDF for chickpea). Among the maize hybrids, Cargil 900 M recorded significantly higher grain yield (88.86 q ha⁻¹) over EH-434042 (712.62 q ha⁻¹) in mother trial (at research station). Similar increase in yield also observed in baby trial (at farmers field). Application of higher fertilizer dose (216:216:322 NPK kg ha⁻¹) for 90 q ha⁻¹ targeted yield level recorded significantly higher grain yield of maize (94.59 q ha⁻¹) over RDF (70.05 q ha⁻¹) and lower targeted yield levels (60 q ha⁻¹ and 75 q ha⁻¹). Interaction between hybrids and targeted yield revealed that Cargil 900-M with 90 q ha⁻¹ targeted yield levels recorded 105.39 q

ha⁻¹ of grain yield which was 38.45% higher than RDF with the same hybrid. Similarly EH-434042 with 90 q ha⁻¹ targeted yield recorded 30.94% higher yield than application RDF, which resulted in to an additional income of Rs. 23,387 and Rs. 14,424 over RDF respectively. The achieved grain yield of maize was significantly superior over targeted yield level treatments of 60 q ha⁻¹ (73.80 q ha⁻¹) 75 q ha⁻¹ (84.52 q ha⁻¹) and 90 q ha⁻¹ (94.59 q ha⁻¹) as per the t-test of significance for unequal variance. The growth, yield components, NPK uptake and soil status after harvest of the crops increased significantly with both the hybrids with 90 q ha⁻¹ targeted yield level as compared to RDF and lower targeted yield levels.

Both the chickpea varieties responded significantly to the application of higher dose of fertilizers (220:199:260 kg NPK for 40 q ha⁻¹). The JG-II and A-1 with 40 q ha⁻¹ targeted yield levels increased the grain yield by 61.14 and 77.70% with an additional income of Rs. 25,745 ha⁻¹ and Rs 29356 ha⁻¹ over RDF. The growth, yield components and uptake of NPK were also higher with both the varieties at higher targeted yield levels.

Spectral characterization, acreage and production estimation through remote sensing and management of pod borer (*Helicoverpa armigera*) through polycropping in pigeonpea

M. P. POTDAR

2010

MAJOR ADVISOR : Dr. B. M. CHITTAPUR

Investigations were carried out on 'spectral characterization, acreage and production estimation through remote sensing and management of pod borer (*Helicoverpa armigera*) through polycropping in pigeonpea' during 2005-06 to 2007-08 in Gulbarga district, Karnataka. The spectral reflectance values of crop measured through ground truth radiometer at different ground truth sites located in the study area (Chitapur taluk) were the lowest in blue and highest in near infrared (NIR) regions with moderate and low in green and red regions respectively while, satellite derived reflectance was moderate in green, low in red, peak in NIR and a further decline in SWIR regions. The satellite derived NDVI ranged from 0.21 to 0.23, 0.43 to 0.53 and 0.25 to 0.29 at vegetative, flowering and at maturity stages respectively. The acreage estimates deviated merely by 7.84 and 4.58 per cent from DES estimates during 2006-07 and 2007-08, respectively. However, the production estimates derived through satellite mean NDVI and LAI model at flowering stage during the

corresponding periods deviated to an extent of 47.60 and 15.55 per cent respectively. Further, the study on polycropping at Agricultural Research Station, Gulbarga revealed reduced *Helicoverpa* damage and higher pigeonpea equivalent yield (1472 kg ha⁻¹) with pigeonpea + sunflower (6:1 row proportions) system as compared to sole pigeonpea (1310 kg ha⁻¹) or other intercropping systems except pigeonpea + mesta (1448 kg ha⁻¹). Population dynamics of insects was found to be greatly influenced under sunflower intercropping due to creation of favourable microclimate (temperature and relative humidity) in the system for predator and parasitoid insect's proliferation. Besides, standing sunflower stalks retained in the field after harvest of heads acted as animate perch for alighting predatory bird black drongo. Consequent to these benefits the system registered higher monetary advantages (Rs. 29,445, 20,643 and 3.43 of gross return, net return and B:C ratio respectively).

CROP PHYSIOLOGY

Physiological investigations on legumes in teak based agroforestry system

H. Y. PATIL

2010

MAJOR ADVISOR : Dr. S. J. PATIL

A field experiment was conducted during *kharif*, 2007 and 2008 at Main Agricultural Research Station (MARS), UAS, Dharwad to study the performance of legumes and perennial vegetables in a teak based agroforestry systems, the experiment was laid out in factorial randomized block design with four replications. The investigations involved two experiments, the first one with teak as perennial component and four pulses as arable crops. The second one consisted of teak with two pulses along with two short rotation vegetables. The plant height, leaf, stem, pod and total dry matter in legumes were highest in sole crop treatment as compared to legume with teak and teak+perennial vegetable based agroforestry system and were superior in 2-4m distance from teak row. The growth parameters of legumes in both teak+legumes and teak with perennial vegetables, viz., LAI, LAD, AGR, CGR, NAR and SLW differed significantly due to influence of teak and perennial vegetables. Grain yield of legume was higher in teak+frenchbean (1042 kg ha⁻¹) followed

by teak+soybean (875 kg ha⁻¹). In teak perennial vegetable based agroforestry systems teak+curryleaf+soybean (766 kg ha⁻¹) followed by teak+curryleaf+greengram (307 kg ha⁻¹) had higher grain yield as compared to other agroforestry systems. The values of biochemical parameters (chlorophyll 'a', 'b', total chlorophyll and SPAD) were found to be higher in 2m distance from the tree base compared to 4m distance in teak+legumes and teak perennial vegetables in legume based agroforestry systems. Nitrate reductase activity was found to be higher at 4m distance from tree base compared to 2m distance in teak+legumes and teak+perennial vegetables based agroforestry systems. The biophysical parameters (photosynthetic rate, transpiration rate and relative water content) were decreased from 20 to 40 DAS, whereas, the stomatal conductance increased from 20 to 40 DAS in both teak+legumes and teak + perennial vegetables with legume based agroforestry systems.

GENETICS AND PLANT BREEDING

Genetic analysis of spot blotch resistance, yield and yield attributing traits through interspecific (*Triticum dicoccum* (Schrank) Schulb x *Triticum durum* Desf.) hybridization in tetraploid wheat

LAXMIC. PATIL

2010

MAJOR ADVISOR : Dr. R. R. HANCHINAL

Dicoccum wheat (*Triticum dicoccum* (Schrank) Schulb) is nutritionally superior compared to other wheats. Development of resistant

cultivars against spot blotch caused by *Bipolaris sorokiniana* is of prime requirement since it is the major disease that limits wheat production. Red

grain colour, husked seed also interferes with consumer preference. So to understand the genetics behind spot blotch resistance, pericarp colour and threshability, line x tester and six generation mean analysis was done. Line x tester analysis was done using ten susceptible dicoccum lines and four resistant durum testers. Six generation mean analysis was done in two crosses involving two susceptible dicoccums (DDK-1025 and DDK-1029) and one resistant durum (NIDW-295). In line x tester analysis of variance for parents and hybrids for agronomic traits were found significant for eight traits including disease scoring at 60 and 90 DAS. Grain yield/plant recorded highest heterosis and except for grain yield/plant all the traits reported SCA variance higher than GCA variance showing predominance of non-additive gene action. The top five crosses recorded, high per se performance and positive heterosis. Six generation mean analysis indicated

that disease score for spot blotch in F1 generation was lower than resistant parent (NIDW-295), indicating over dominance for the trait. Predominance of dominance component (h) and complementary epistasis was observed for spot blotch resistance. In the cross DDK-1025 x NIDW-295, 18F₂, 7BC₁P₁ and 12BC₁P₂ segregants and in cross DDK-1029 x NIDW-295, 14F₂, 10BC₁P₁ and 13BC₁P₂ segregants were reported with lower spot blotch disease and higher grain yield per plant. Pericarp colour and threshability is governed by single genes independently. Red pericarp is dominant over amber and free-threshability is dominant over non-free threshability. The biochemical studies revealed that total sugar and phenols are also positively associated with disease resistance. In the molecular parental RAPD polymorphism twelve primers were polymorphic.

HORTICULTURE

Standardisation of production technology in garland chrysanthemum (*Chrysanthemum coronarium* L.)

A. V. D. DORAJEE RAO

2010

MAJOR ADVISOR : Dr. A. N. MOKASHI

Garland chrysanthemum (*Chrysanthemum coronarium* L.) is an annual chrysanthemum species, capable of growing throughout the year, though there were seasonal differences in growth, yield and quality parameters. The present investigation was conducted during the years 2008 and 2009 in the Floriculture unit of Main Agricultural Research Station, Department of Horticulture, University of Agricultural Sciences, Dharwad, with the objective of evaluating the effect of nutrition, growth regulators, planting geometry and pinching on growth, yield and quality of garland chrysanthemum. The experiment on the effect of nutrition revealed that flower and seed yield per plant was found to be highest by the application of nitrogen at 150 kg ha⁻¹ + phosphorus at 100 kg ha⁻¹ both during *kharif* and *rabi* seasons with a constant dose of potassium at 100 kg ha⁻¹. This combination was superior in terms of maximum gross returns, net returns and benefit - cost ratio. From the study on the effect of planting geometry, it was found that the flower yield as well as seed yield per plot in terms of weight was found to be highest at 30 cm x 30 cm

level in both seasons. The number of flowers per plant was increasing as the plants were widely spaced, highest being recorded at 60 cm x 60 cm level. Studies on evaluation of growth regulators/chemicals on this crop showed that there was an increase in the flower yield as well as seed yield per plant by foliar application of gibberellic acid at 100 ppm, cycocel at 3000 ppm, salicylic acid at 100 ppm and paclobutrazol at 40 ppm. Flower quality in terms of average flower weight, flower diameter and vase life, and seed quality in terms of test weight were also at maximum by the pre-harvest application of gibberellic acid at 100 ppm. The effect of pinching time was found to be significant on this crop. The highest yield in terms of number of flowers and weight of seeds per plant was recorded by pinching at 20 days after sowing (nursery) which was on par with those plants pinched at 10 days after transplanting. The experiment on the effect of holding solutions on vase life revealed that sucrose solution of 4% strength plus 1 mM aluminium sulphate could prolong the vase life of garland chrysanthemum to 15 days during *rabi*.

Biometrical and transformation studies in tomato (*Solanum lycopersicum* L.)

R. M. HOSAMANI

2010

MAJOR ADVISOR : Dr. A. A. PATIL

Biometrical and transformation studies in tomato (*Solanum lycopersicum* L.) were conducted at the University of Agricultural Sciences, Dharwad, India during 2007-2010 to find high yielding genotypes, F1 hybrids and to develop genetic transformants. Variability, heritability, genetic advance, correlation, path analysis, genetic divergence, stability parameters were studied from evaluation of 41 tomato genotypes during *kharif* 2007, *kharif* 2008 and *rabi* 2008. Heterosis and combining ability was estimated from evaluating 25 F1'S developed in line x tester method during *rabi* 2008. Genetic transformants (T0) with 'TRP sas/ihp' gene construct to develop resistance against tomato leaf curl virus disease in 'DMT-2' variety were identified. Highly significant variation was observed amongst themselves for all the 19 characters in all seasons. High GCV, PCV, heritability and GAM were observed for plant height, fruits per cluster, fruits per plant, locules per fruit, TSS, fruit length and width in all the seasons. Yield had significant positive association with number of fruits per plant, TSS and number of fruits per cluster. Yield was directly affected mainly by single fruit weight and number of fruits per plant in positive direction. D² analysis indicated that number of fruits per plant,

single fruit weight, plant height, fruit length were major contributors to divergence over seasons. Genotypes were grouped into six, five and nine clusters in three seasons. Stability analysis showed that 'HADT-294', 'PAU-2371', 'Dwd-T-1' and 'Dwd-T-6' were well adapted to all the environments. 'PAU-2372', 'VR-35', 'HADT-294' and 'ALT-02-39' were higher yielders per hectare. 'VR-35' had high yield per plant and higher single fruit weight. The average heterosis in nineteen characters varied from -3.28 to 18.65 per cent. It was 15.86 per cent for yield per plant. Single fruit weight had highest *gea* and *sca* effect values. 'DVRT-2', 'H-24', 'Megha (L-15)', 'Dwd-T-3', and 'Dwd-T-6' were overall high general combiners. Among the F₁'s, DVRT-2 x VR-35 (48.47 t), Pant-T-10 x VR-35 (45.65 t), DVRT-2 x KS-227 (45.09 t) and DVRT-2 x Dwd-T-6 (43.71 t) were top yielders per hectare and incidentally yield per plant too was higher in these hybrids. The transgenic 'DMT-2' tomato plants (T0) were obtained through *Agrobacterium* mediated transformation with 'TRP sas/ihp' gene construct for silencing the transcription of ToLCV gene encoding replicase. The transgene integration in plant genome was confirmed through PCR amplification of *hpt* II gene.

Standardization of wine making technology in sapota (*Manilkara achras* (Mill) Forsberg)

C. D. PAWAR

2009

MAJOR ADVISOR : Dr. A. A. PATIL

An investigation was planned to standardize wine making technology in sapota under Ph.D. programme at the Department of Horticulture, UAS, Dharwad, in order to do value addition, reduce post harvest losses and generate higher returns to the farmers. The experiments were conducted at Dr. B.S.K.K.V. Dapoli (Maharashtra) to prepare wine from fruits of Kalipatti variety with different ripening stages, the raw material, treatment with pectinase, dilution of juice and blending of juice with mango juice. The wine so prepared was evaluated for their chemical composition and organoleptic properties immediately after preparation and six months after ageing at 13 to 15°C. Before wine preparation the

physico-chemical characteristics of sapota fruits were studied. From these studies it is seen that all the physico-chemical parameters could be considered as maturity indices to judge the ripening stages of sapota fruits. In all the experiments conducted, T.S.S. was found to decrease and titratable acidity increased during fermentation of must. Time taken for fermentation ranged between 14 and 38 days and wine recovery from must ranged between 51.62 and 99.52 per cent. From the findings of the experiments, it was observed that, standard quality wine could be prepared from the juice of half ripe, ripe and over ripe sapota fruits. However, among different ripening stages wine prepared from juice of ripe fruit was the

best. Acceptable quality wine could not be prepared from pulp either with or without skin of sapota fruit from different ripening stages. The 0.1 per cent pectinase treatment and 1:1 dilution of sapota juice of different ripening stages was found to increase quality of sapota wine. The blending of sapota juice with local mango and Alphonso mango juice in 1:0.5, 1:1, 1:1.5 and 1:2 proportions could not improve the quality of sapota wine.

Response of bell pepper to organic nutrition under different environments

VASANT M. GANIGER

2010

MAJOR ADVISOR : Dr. J. C. MATHAD

Field experiments on "Response of bell pepper to organic nutrition under different environments" were carried out at Agricultural Research Station, Gangavati, Karnataka during *rabi* 2005-06 and 2006-07. Two independent open and shade environment experiments were conducted by adopting split plot design with three replications. California Wonder (V_1) and Gangavati Local (V_2) bell peppers were used as main plot treatments and nine organic nutrient sources along with recommended package of practice nutrients and recommended inorganic nutrients as sub plot treatments (O_1 to O_{11}). Results revealed that variety California Wonder performed better with respect to growth, yield and fruit quality under both the environments. It yielded (20.21 and 16.92 t/ha) higher than local variety (16.18 and 12.91 t/ha under shade house and open field condition, respectively). Among the nutrient sources O_5 [FYM (50%) + poultry

manure (50%) equivalent 100% N RDN-basal] was found significantly superior for growth and yield (19.89 and 16.33 t/ha for shade and open condition, respectively). The next best treatment for these parameters was O_1 consisting of FYM and vermicompost. The fruits of O_5 treatment from shade house stored well under ambient condition and maintained high TSS, total titrable acidity, chlorophyll content and fruit colour. However the fruits from O_1 from open field were superior for these characters. There was improvement in the soil physico-chemical and biological properties in all the treatments wherever organics were the components of the treatments. The soils of O_5 had higher beneficial physico-chemical properties and better biological counts. Under open and shade environments, O_1 was most remunerative for bell pepper production with net returns of Rs. 1.41 and Rs. 1.83 lakhs/ha, respectively.

SOIL SCIENCE

Studies on forms and transformation of sulphur and response of rice to sulphur application in rice-rice cropping sequence

D. N. SAMARAWEERA

2009

MAJOR ADVISOR : Dr. H. T. CHANNAL

Soil characterization, incubation study and field experiments were conducted to study the distribution of S forms, transformation and direct and residual effect of sulphur on growth, yield and quality of rice-rice cropping system during *rabi*/summer and *kharif* seasons during 2007, respectively. In characterization study, there was lot of variations among sulphur forms in soils of eight selected locations. Correlation studies revealed that sulphate sulphur was significantly and positively correlated with EC and CEC, water soluble sulphur, organic sulphur and total sulphur. Water soluble sulphur significantly correlated with pH, EC, organic sulphur, non-sulphate sulphur and total sulphur. Results obtained from incubation study revealed that Factomphos increased sulphate sulphur and water soluble sulphur up to 32nd day of incubation and these fractions declined thereafter. Field investigations on response of rice to applied two sulphur

sources indicated that Factomphos was superior over gypsum and the highest grain and straw yield (57.09 and 63.63 q ha⁻¹), protein and methionine content (6.17% and 2.51 mg g⁻¹) were recorded with Factomphos applied @ 50 kg ha⁻¹, respectively. In succeeding rice, same treatment registered highest grain and straw yield (51.90 and 58.02 q ha⁻¹), protein and methionine content (5.92% and 2.18 mg g⁻¹), respectively. Economic analysis revealed that application of Factomphos @ 50 kg ha⁻¹ resulted the highest benefit:cost (B:C) ratio of 1.69 in first rice with net return of Rs. 16,847/ha which was 33.2 per cent increase over control (Rs. 12,647/ha). Similarly, the highest benefit:cost (B:C) ratio of 1.64 in succeeding rice with net return of Rs. 14,565.00/ha was recorded with the residual effect of the same treatment and that was 55.9 per cent increase over control (Rs. 9,343/ha).

PLANT PATHOLOGY

Studies on etiology, epidemiology and management of wilt complex of *Coleus forskohlii* (Wild.) Briq.

R. AMMAJAMMA

2010

MAJOR ADVISOR : Dr. Y ASHODA R. HEGDE

Coleus forskohlii is an important medicinal crop subjected to attack by several diseases among which wilt complex is becoming severe in recent years. Survey on disease incidence in different districts of Karnataka revealed 19 to 41.67 per cent incidence. Pathogenicity tests confirmed *Rhizoctonia bataticola*, *Fusarium chlamydosporum*, *Sclerotium rolfsii* and *Ralstonia solanacearum* were pathogenic. PDA, Richard's broth, sucrose and potassium nitrate supported the maximum mycelial growth of three fungal pathogens. I Growth period; 12, 16 and 10 days of incubation, pH; 6.5, 7.0 and 4.0, were required for maximum growth of *Rhizoctonia bataticola*, *Fusarium chlamydosporum* and *Sclerotium rolfsii* respectively. Fifteen isolates of *Rhizoctonia bataticola* were collected and categorized based on colony colour and texture. PCR - based RAPD analysis revealed cent per cent polymorphism in OPA02, OPB02, OPB04, OPF03, OPF07 and OPF10. Dendrogram indicated three major clusters. There was increase in total phenol and decrease of sugar contents due to infection. Inoculum of 12, 10 and 8 per cent was required

to get 100 per cent disease in *Rhizoctonia bataticola*, *Fusarium chlamydosporum* and *Sclerotium rolfsii* respectively. Pathogens survived saprophytically on host debris. Soil temperature of 30°C and 30 per cent soil moisture was required for maximum growth of *S. rolfsii*. Combined infection resulted in rapid wilting of the plants. However, in sequential inoculation, *Ralstonia* followed by *Rhizoctonia bataticola* caused more disease. *Trichoderma harzianum* showed stronger antagonistic activities against *Rhizoctonia bataticola* and *Sclerotium rolfsii*; *Trichoderma koningii* against *Fusarium chlamydosporum*. Eupatorium and ocimum leaf extracts at 10 per cent were effective against *Rhizoctonia bataticola* and *Fusarium chlamydosporum* respectively. In field, soil application of FYM@1 Ot/ha+ *Trichoderma harzianum*@25 kg/ha helps to manage disease effectively and to increase the yield. Equally effective is the soil drenching of carboxin+thiram @0.1 % for obtaining maximum yield with minimum disease.

Characterization, serodiagnosis and management of virus associated with bud blight of soybean in Karnataka

R. BASWARAJ

2010

MAJOR ADVISOR : Dr. A. S. BYADGI

Soybean bud blight, an important viral disease was studied with an objective of biological and molecular characterization and management including screening for resistant lines. Roving survey conducted in during 2007-09 showed minimum incidence during Kharif (1.6%; 2007) in

Dharwad district and maximum during Rabi (20.2%; 2008-09) in Belgaum district. Under field conditions, virus produced downward curving of terminal bud showing hook like appearance. Virus was partially purified and confirmed by electron microscopy, DAC-ELISA and by RT-PCR

using TSV-CP primer which confined the causal virus as *Tobacco Streak Virus*. The CP gene was cloned and was found 398bp in length. The CP gene shared 99.7 per cent sequence homology with already reported TSV from DWD-8, GWD-2, Latur, Beed, Solapur, Raichur and Coimbatore. Hence it was designated as TSV-Sb (Sb; soybean). Sap transmission of virus was successful by 0.05 M potassium phosphate buffer 7.0 pH containing 0.1 per cent 2- Mercaptoethanol. The virus was not seed borne. Among insects only thrips could transmit the virus. TSV-Sb has thermal inactivation point of 50°C, dilution end point of 1×10^{-4} and longevity *in vitro* was 8 hours. Other than soybean, TSV-Sb can infect *Helianthus annuus* (L.)

Arachis hypogaea (L.), *Glycine max* (L.), *Vigna unguiculata* (L.), *Chenopodium quinoa* (L.), *Lycopersicon esculentum* (Mill) and *Capsicum annuum* (L.) not *Cucumis melo* (L.). Antiserum was produced against TSV-Sb by immunizing rabbit with partially purified virus preparation and was cross adsorbed. The purified antiserum found positive in slide agglutination, micro precipitation, immunodiffusion tests and DASELISA. The titer of the antiserum raised against TSV-Sb was 1:512. Management studies showed border cropping with sorghum plus imidacloprid (@ 0.25 ml/lit) spray will reduce the disease. None of the genotypes screened were immune but NRCS 7, MAUS 71 showed resistant and can be used under integrated disease management schedule.

Biological and molecular characterization and management of watermelon bud necrosis virus

T. RAJASEKHARAM

2010

MAJOR ADVISOR : Dr. M. S. PATIL

Survey carried out during 2006-08 revealed that the Watermelon bud necrosis virus (WBNV) was prevalent in Karnataka and Andhra Pradesh causing bud necrosis disease in watermelon, muskmelon, bitter melon, ridge gourd and bottle gourd. The WBNV incidence in Karnataka ranged from 0 to 100 per cent and in Andhra Pradesh it was 0 to 80 per cent. Maximum concentration of the virus was observed in leaves. Virus was detected up to 1:1000 dilutions in DBIA. WBNV was transmitted by sap using 2-mercaptoethanol in 0.05 M potassium phosphate buffer (pH 7.0), to Cowpea cv. C-152. Quasi spherical virus particles measuring 80-100 nm in diameter were observed under electron microscope. WBNV produced symptoms like chlorotic and necrotic spots on leaves, necrosis and dieback of buds and chlorotic and necrotic rings on fruit. WBNV could

infect 22 host plant species belonging to 15 genera in six families by mechanical sap inoculations. WBNV was successfully transmitted by *Thrips palmi*. On the basis of NP gene and protein sequence relationship, two tospovirus were identified, namely WBNV and GBNV. The sequenced region in WBNV and GBNV isolates contained a single open reading frame of 828 and 831 bases, respectively. Out of 20 cultivars screened against WBNV, none recorded resistance. Integrated disease management strategies was developed involving combination of practices viz., drip irrigation, seed treatment with Imidacloprid (5 g/kg), use of silver colour UV reflective mulch and alternate sprays of Spinosad (0.3 ml/l), Imidacloprid (0.3 ml/l) and Thiomethoxam (0.2 g/l) including bunds and keeping plot weed free up to flowering recorded least mean PDI (0.21).

Studies on chilli leaf curl complex disease

S. G. RAJU

2010

MAJOR ADVISOR : Dr. M. S. PATIL

Chilli (*Capsicum annuum* L.) is the most important and widely grown vegetable crop in the world. In India, is one of the major producers of chilli and grown during both kharif and summer seasons. Leaf curl complex is one of the most important diseases of chilli in northern and causes substantial losses every year. The disease is characterized by upward and downward curling, yellowing, puckering and crinkling of leaves and shortening of internodes with partial to complete sterility. Roving survey revealed the occurrence of leaf curl disease in parts of northern Karnataka districts. Chilli leaf curl (ChLCV) and tomato yellow leaf curl virus (TYLVC) specific primers failed to amplify in the infected chilli samples, however, tomato leaf curl virus (ToLCV) specific primers could detect the presence of tomato leaf curl virus. Electron microscopy studies revealed the presence of geminate icosahedral and flexuous rod shaped virus particles in infected chilli sample. Transmission studies revealed that leaf curl

complex could be transmitted by mechanical sap inoculation from infected to healthy plants. Among insects, whitefly species *Bemisia tabaci* were able to transmit the ToLCV from diseased to healthy seedlings. The leaves of severely infected Byadagi dabbi were analyzed for histopathological and histochemical changes. The histochemical studies revealed that the polysaccharides and proteins were highly reduced with increased nucleic acids in infected leaves. Studies on management aspects showed that the crop could be protected from disease incidence by spraying of insecticides *i.e.*, confider and vertimec at 15 and 45 days after transplanting which reduced vector population thereby there was low disease incidence. During 2002-03, sixty four and during 2004-05, forty four genotypes were tested against leaf curl complex. The results revealed that Arka Lohit, KDSC-510-10, CO-I, Paprika, Paprika-I, Phole-5, GPC-69, GPC-80 and KDC-1 were found to be moderately resistant to resistant.

Variability and management of charcoal rot of sorghum caused by *Macrophomina phaseolina* (Tassi) Goid.

H. VIRUPAKSHA PRABHU

2009

MAJOR ADVISOR : Dr. S. S. ADIVER

Charcoal rot of sorghum caused by *Macrophomina phaseolina*, is a severe disease particularly in *rabi* season grown crop. Thirty five infected sorghum stalk samples were collected from Karna taka, Maharashtra and Andhra Pradesh to assess the variability. Based on colony pigmentation, the cultures were assigned to four major groups on PDA and three groups on Czapek's medium. Studies on toxin variability showed the symptoms such as drooping of leaves, blackening of leaves which was initiated at four hours and continued upto fourteen hours, thus revealing the existence of variation among the isolates. The sensitivity of isolates to copper sulphate at three different levels of concentrations found to differ to various concentrations tested. But with Carbendazim, the growth of all isolates were completely inhibited. Highest growth was

observed in 7.0 pH, closely followed by 6.5 pH indicating preferential range to be between 6.5 and 7.00 pH. Peroxidase and Polyphenoloxidase enzyme analysis indicated that there was significant variation among the 35 isolates of *M. phaseolina*. RAPD data distinguished the 35 isolates into three major clusters. Management of charcoal rot of sorghum revealed that the seed treatment with carbendazim and seed treatment with *T. harzianum* + *P. fluorescens* showed superior results. Sixty four germplasm lines of sorghum screened. Charcoal rot was least in Dagadi Solapur, followed by GRS-1 and BCR-9. None of the genotypes showed resistant reaction. Employment of new source of resistance sources like local genotypes mentioned above can be effectively employed in resistance breeding programme to manage charcoal rot of sorghum.

SEED SCIENCE AND TECHNOLOGY

Characterisation and assessment of genetic purity through grow out test and molecular markers of DCH-32 cotton hybrid

SANGEETA MACHA

2010

MAJOR ADVISOR : Dr. N. K. BIRADAR PATIL

Characterization of varieties/hybrids is essentials in view of release of varieties and genetic purity testing. Hence, an experiment was carried out at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during 2006-08 for varietal characterization and genetic

purity testing through morphological, chemical, biochemical and molecular markers in DCH-32 hybrid cotton. The DCH-32 hybrid and its parental lines were grouped as cream (DS-28), yellow (DCH-32) and deep yellow colour petal, whereas anther colour were grouped into light yellow (DS-

28) and yellow (DCH-32) and SB(YF)-425 colour but petal spot was absent in DS-28 female parent. The DCH-32 hybrid showed more similarity (64%) with DS-28 female parent and less (57%) with SB(YF)-425 male parental line. The seeds were subjected to peroxidase test for characterization. Based on the colour of the solution, the genotypes were grouped as red, dark red and reddish orange colour. Among the parental lines and the hybrid, the DCH-32 (42.14%) was more responsive to GA3 and 2, 4-D (94.07%) test. The DCH-32 hybrid and its parental lines were characterized with SDS-PAGE of total soluble seed protein and 27 RAPD primers. Seven RAPD primers produced male parent specific marker,

which were used for genetic purity assessment in hybrid seed lots. The genetic purity of the 50 seed lots resulted through field GOT ranged from 75.7 (L27) to 98.7 per cent (L45). The genetic purity of selected hybrid seed lots (L1, L2 and L3) assessed through SDS-PAGE (91.5%, 80% and 94%), RAPD (90%, 78% and 93%) marker and field grow out test (92%, 81.6% and 96.5%) clearly indicated that there is similarity in the results indicating that the molecular markers can be used as supportive test for GOT. Though, the genetic purity assessment through molecular markers (Rs. 1442.50) is costly comparatively field GOT (Rs. 708) and the time taken for the test is very less (44 hrs) for assessing genetic purity.

MASTER OF SCIENCE

AGRICULTURAL BUSINESS MANAGEMENT

Marketing management of slaughter animals and their products- A case study in Madhya Pradesh

ANIL SINGH

2010

MAJOR ADVISOR: Dr. C. MURTHY

Livestock production contributes around 20 per cent of the agricultural output in nation and contributes about 5.26 per cent of the total GDP, with about 18 million people engaged in meat sector, namely trade of live animals, hides, bones, casings, horns and hooves etc. India has a major share in livestock population in world. The number of sheep/goat and buffalo procured per month by 40 sheep/goat and 20 buffalo meat retailers was 4463 and 782 respectively. Sheep/goat meat retailers had purchased maximum 92.01 and 95.02 per cent buffaloes on weekly basis. The category wise purchasing was maximum for medium being 60.96 per cent in sheep, goat 56 per cent and 52.05 per cent in buffaloes. Marketing efficiency was highest when sheep, goat and buffaloes were procured from farmers in the order for small, medium and large categories. All the municipality run slaughter houses did not have any modern facilities. They dispose off their waste in nalla and open dumping. These required

sanitary working facilities were not available in traditional slaughter houses. The increase in slaughtering every year was highest in goat (2062.68) followed by sheep (1668.0) and buffalo (570.21). Sheep, goat and buffalo were slaughtered maximum in December and January and lowest in the months of August and September. The overall cost of live sheep/goat and buffalo contributed maximum Rs. 2004.12. (91.38%) and 8067.33 (92.19%) in total cost. The overall net return per sheep/goat was Rs. 309.92 and buffalo Rs. 1115.08, byproducts sheep and goat were Rs. 228.54 and buffalo Rs.1037.17. Overall benefit cost ratio in sheep/goat and buffalo meat marketing were 1.15 and 1.13 respectively. In meat marketing retailers faced problem of high price of slaughter animals, competition among themselves and lack of storage facility, while in byproduct marketing all of them faced low price and lack of storage and processing facility.

Dynamics of spot and futures market prices of mustard and its derivatives in India

KULDEEP CHOUDHARY

2010

MAJOR ADVISOR : Dr. VILAS S. KULKARNI

Analysis of prices and forecasting the prices overtime is important for formulating a sound agricultural policy. Price instability is useful to farmers in order to decide the optimum time for disposing their produce to their best advantage. In view of this the present study was undertaken by collecting weekly prices of mustard in major mustard markets of India for a period of 6 years (2004-05 to 2009-10). The growth rate analysis revealed that production growth rate is highly significant. Hence, there is need to evolving some varieties with stable or sustain productivities for meeting future demand. An increasing trend in prices was observed in all the markets, but the quantum of increase varied from one market to another. Price of mustard was found to be highest during off season and lowest during harvest season. The higher weekly seasonal indices of prices

were observed during November to December, low during the months of March and April. Hence, the farmers should educate to plan their marketing particularly in these months. ARIMA analysis was employed to quantify the variation in prices and also to forecast mustard seed and mustard oil prices. The forecasted price in all the markets showed an increasing value. Analysis of zero order correlation showed that there existed a strong integration among all the mustard seed, mustard oil and mustard oilcake markets. Hence, mustard economy should take this advantage to encourage the production of mustard. The analysis revealed that, by storing mustard and selling during off season would help the producer in getting higher returns. Finally it was recommended to disseminate the forecasted prices to farmers for their advantage.

Market dynamics and price forecasting of sunflower in south Karnataka – an application of arima model

R. MADHUSUDAN

2010

MAJOR ADVISOR : Dr. VILAS S. KULKARNI

Analysis of price and market arrivals overtime is important for formulating a sound agricultural policy. Fluctuations in market arrivals largely contribute to price instability. Such an analysis is also useful to farmers in order to decide the optimum time for disposing their produce to their best advantage. In view of studying dynamics of market arrivals and prices, the present study was undertaken by collecting monthly prices and arrivals of sunflower in five major sunflower markets of south Karnataka for a period of 20 years (April-1989 to April-2009). An increasing trend in arrivals and prices was observed in all the markets, but the quantum of increase varied from one market to another. Price of sunflower was found to be highest during off season (April-September) and lowest during harvest season (September-March). Since sunflower can be grown during Kharif and Rabi seasons, the arrivals were high during September to March. The higher seasonal indices of prices were observed

during April to September during which the arrivals were found to be low. Uneven cycles were observed both in arrivals and prices in all the markets. Response of sunflower arrivals to prices in all the markets, both in long run and in short run, showed a positive relationship, which implied that as the price of sunflower increased, the arrivals also increased. ARIMA analysis was employed to quantify the variation in prices and also to forecast sunflower prices for the next 10 months. The forecasted prices in all the markets showed an increasing value. Analysis of zero order correlation showed that there existed a strong integration among all the sunflower markets. The analysis revealed that, storing sunflower and selling during off season would help the producer in getting higher returns. Finally it was recommended to disseminate the forecasted prices to farmers for their advantage.

Dynamics of prices and arrivals of pigeonpea in Karnataka-An econometric analysis

R. MANASA

2009

MAJOR ADVISOR : Dr. VILAS S. KULKARNI

Analysis of price and market arrivals overtime is important for formulating a sound agricultural policy. Fluctuations in market arrivals largely contribute to price instability. Such an analysis is also useful to farmers in order to decide the optimum time for disposing their produce to their best advantage. In view of this the present study was undertaken by collecting monthly prices and arrivals of pigeonpea in major pigeonpea markets of Karnataka for a period of 20 years (1987-88 to 2007-08). An increasing trend in arrivals and prices was observed in all the markets, but the quantum of increase varied from one market to another. Price of pigeonpea was found to be highest during off season and lowest during harvest season. Since pigeonpea is a Kharif crop, the arrivals were high during December to March. The higher seasonal indices of prices were

observed during August to October during which the arrivals were found to be low. Uneven cycles were observed both in arrivals and prices in all the markets. Response of pigeonpea arrivals to prices in all the markets, both in long run and in short run, showed a positive relationship, which implied that as the price of pigeonpea increased, the arrivals also increased. ARIMA analysis was employed to quantify the variation in prices and also to forecast pigeonpea prices. The forecasted price in all the markets showed an increasing value. Analysis of zero order correlation showed that there existed a strong integration among all the pigeonpea markets. The analysis revealed that, by storing pigeonpea and selling during off season would help the producer in getting higher returns. Finally it was recommended to disseminate the forecasted prices to farmers for their advantage.

Sanitary and phytosanitary compliance of fruit crops in north Karnataka

M. N. MANJUNATH

2010

MAJOR ADVISOR : Dr. C. MURTHY

India has made a fairly good progress on the horticulture Map of the world with a total annual production of the horticulture crops to over 149 Million tonnes. India has been with wide range of climate and Physio-geographical conditions and as such is most suitable for growing various kinds of horticultural crops such as fruits, vegetables, flowers, nuts, spices and plantation crops. For the selected fruit crops like mango 25 exporting growers and progressive farmers from Dharwad, for grape 25 exporting growers and progressive farmers from Bijapur and for pomegranate 25 exporting growers and progressive farmers from Koppal and Bagalkot were selected for the study. The study area possesses most congenial soil, climate and geophysical conditions necessary for better performance of fruits. A random sample of farmers of each fruit crops in Dharwad, Bagalkote, Bijapur and Koppal districts were selected and thus total sample size was 75. In order to analyze the pesticide residues of SPS chemical quality characteristics of mango, grapes and pomegranate were subjected to laboratory analysis. The analysis was carried out in the

laboratory of the Shriram Institute for Industrial Research at Bangalore. There are 91 pesticides were carried out by using standardized protocols for residues of unknown pesticides for selected fruits crops. The major pesticides used by the sample farmers in selected fruit cultivation. It was found that the farmers used more dosage of pesticide than the recommended dosage. Among these chlorpyrifos pesticide residual content is found out above limit of quantification for mango (0.10 mg/kg), in case of grape fruit above limit quantification Hexaconazole (1.35 mg/kg), Carbendazim (0.02 mg/kg), Myclobutanil (0.02 mg/kg), Chlorpyrifos (0.10 mg/kg), Monocrotophos (0.04 mg/kg), Metalaxyl (0.04 mg/kg) and Tridimenol (0.02 mg/kg). but in case of pomegranate pesticide residual quantification limit was not found. Farmers could be advised to go for non-cash inputs like increasing the pest and disease resistant variety which directly maintains the sanitary and phytosanitary measures. Proper packaging materials like corrugated fiber boxes should so, as to reduce the extent of damage or contamination to the produce.

Market dynamics and price forecasting of maize in north Karnataka - An application of arima model

SANDESH HARADI

2010

MAJOR ADVISOR : Dr. H. S. VIJAYAKUMAR

Analysis of price and market arrivals overtime is important for formulating a sound agricultural policy. Fluctuations in market arrivals largely contribute to price instability. Such an analysis is also useful to farmers in order to decide the optimum time for disposing their produce to their best advantage. In view of studying dynamics of market arrivals and prices, the present study was under taken by collecting monthly prices and arrivals of maize in five major maize markets of North for a period of 20 years (April-1989 to April-2009). An increasing trend in arrivals and prices was observed in all the markets, but the quantum of increase varied from one market to another. Price of maize was found to be highest during off season (June September) and lowest during harvest season (October-February). Since maize can be grown in all the seasons, the arrivals were high during September to March. The higher seasonal

indices of prices were observed during June to September during which the arrivals were found to be low. Uneven cycles were observed both in arrivals and prices in all the markets. Response of maize arrivals to prices in all the markets, both in long run and in short run, showed a positive relationship, which implied that as the price of maize increased, the arrivals also increased. ARIMA analysis was employed to quantify the variation in prices and also to forecast maize prices for the next 12 months. The price forecast in all the markets showed an increasing value. Analysis of zero order correlation showed that there existed a strong integration among all the maize markets. The analysis revealed that, storing maize and selling during off season would help the producer in getting higher returns. Finally it was recommended to disseminate the forecast prices to farmers for their advantage.

Marketing management of confectionery units in twin cities of Hubli- Dharwad

SHAGUPTA A. SHAIKH

2010

MAJOR ADVISOR : Dr. BALANCHANDRA K. NAIK

The present investigation made an attempt to analyze the buying behaviour of confectionery food products by consumers of Hubli and Dharwad with total sample of 300 respondents. In case of chikki, sonpapadi, banana chips, fried shenga and roasted dal local brands were most familiar. Golden Gokak, Thakur singh, Savanur brands of kardant, pedha and sevu were very popular brands. Hot bread, Family loaf and Big bread brands of bread, Baburao and Ayyangar brands of cake were very familiar brands among the respondents, since they were age old brands. Lays, Bingo and Daimond brands of potato chips were most popular among the respondents. Sweet items were bought by 94 percent of the respondents, chats were consumed by 98 percent of the respondents and 97 percent of the respondents were buying bakery items. Taste was the main reason for purchase of sweet items and chats. Impulsive buying was common among majority of the respondents for confectionery food

products. In case of chikki, mysorepak and sonpapadi, banana chips, fried shenga and roasted dal local brands were preferred by the respondents. Savanur brand of sevu, Hot bread and Big bread brands of bread, Baburao and Ayyangar brands of cakes were preferred by the respondents. While preferring a particular brand in case of confectionery items taste was considered as the foremost factor. Maximum numbers of respondents were loyal to Gokak kardant, Thakur Singh and Mishra pedha, Lays, Bingo and Daimond of brands of potato chips, Savanur brand of sevu, Diet, Hot bread and Big bread brands of bread, Baburao and Ayyangar brands of cakes. If they didn't get required brand they go for alternative purchase plans. Advertisement in telephone directory was most popular method adopted by confectionery retail-outlets for promoting their products was indicated from the study.

Business efficiency in rice mills- A comparative analysis of conventional and modern rice mills in Davangere district

M. K. SHWETHA

2010

MAJOR ADVISOR : Dr. S. B. MAHAJANASHETTI

India ranks second in production of rice next only to china. Rice milling is the oldest and the largest agro processing industry of the country. The present study had made an attempt to document investment pattern and financial feasibility, inventory management, processing and marketing management, cost and returns in both conventional and modern rice mills. Primary and secondary data were collected to evaluate the objectives of the study. Ineffective management on the part of the processors has led to the failure or poor performance of many rice milling units. Therefore the study focuses on the management aspects and its managerial lapses in order to evolve appropriate policies for improving the efficiency of the rice mills. Totally six rice mills in were selected in Davangere district of Karnataka. Further, they were categorized into conventional rice milling units and modern rice milling units based on the technology adopted. The

results showed that the total investment on modern rice mills was ten times higher (Rs 379.25 lakhs) as compared to conventional rice mills (Rs 36.97 lakhs). The Net Present Value for modern unit and conventional unit was Rs 408.35 and Rs 27.55, respectively. The capacity utilization was higher (68 %) in modern units in comparison with conventional units (44 %). The total returns obtained from both rice milling and poha making process were higher in modern rice units (Rs 1478) as compared to conventional units (Rs 1381). This showed that the modern rice mills were more efficient than the conventional rice mills. Procurement costs were lower when paddy was purchased directly from farmers instead of purchasing commission agents. Thus, mills would benefit from strong contractual arrangements with paddy growers.

Performance of Indian agricultural exports among SAARC countries

VAISHALI B. MHASKE

2010

MAJOR ADVISOR : Dr. R. A. YELEDHALLI

The South Asian Association for Regional Cooperation constituted by Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka. The study endeavours to documentation of trade policies, to analyse the performance of major agricultural commodities exports, to measure direction of trade and export competitiveness and identify bottlenecks in the trade policies of SAARC Countries. The study was undertaken on a macro framework based on secondary data. Major agricultural commodities such as Rice, Wheat, Mango and Onion were purposively selected. The yearly data on export quantity, value and unit value were compiled from various sources Food and Agricultural Organization (FAO) and Agricultural Processed Food Product Export Development Authority (APEDA) Annual Reports, etc. for the period 1991-2009. SAARC countries have taken initiative to promote intra-regional trade through implementation of South Asian Free Trade Agreement. Besides SAFTA, India has separate preferential and bilateral FTAs with the South Asian countries. The estimation of compound growth

rate of both export quantity and value terms found to be significant for rice, mango and onion except wheat for overall SAARC countries. Bangladesh is most stable market for all four commodities such as Rice, wheat, mango and onion reflected by retention probabilities 22.86, 45.40, 39.29 and 24.00 per cent respectively among the SAARC member countries during 2001-2009 period. Nepal is stable market for wheat and Mango with retention probabilities of 9.37 and 11.25 per cent respectively whereas Maldives was found stable market for Rice with retention probabilities of 41.54 per cent during 2001-2009 period. India has a comparative advantage in trading of rice, mango and onion with the NPCs values of 0.98, 0.975 and 0.893 respectively for the period 2008-09. Tariff-nontariff barriers, political conflicts, informal trade, border disputes, lack of communication and Infrastructural facilities, etc. these were major constraints which influenced the intra-regional trade among the SAARC member countries.

Market dynamics and price forecasting of maize in south Karnataka - An application of garch model

VISHAL M. TALAWAR

2010

MAJOR ADVISOR : Dr. H. S. VIJAYAKUMAR

Analysis of market arrivals and prices overtime helps in understanding their behaviour. Accurate forecasting of future prices helps the farmers to take meaningful decisions regarding production and sales of their produce. Such an analysis is useful to farmers to get remunerative prices for their produce and Government to frame appropriate agricultural policies. In view of this the present study was undertaken by collecting monthly data on arrivals and prices of maize in major markets of South for a period of 20 years (1989 to 2009). To know the replacement ratio of maize in four divisions of 19 years (1989-90 to 2007-08) area data was collected from Directorate of Economics and Statistics publications. In all the divisions of maize has replaced its competing crops. An increasing trend in arrivals and prices was observed in all the markets, but the quantum of increase varied from one market to another. Since

maize is a *Kharif* crop, the arrivals were high during October to January. Price of maize was found to be highest during off season and lowest during harvest season. However, this price difference remained less. The higher seasonal indices of prices were observed during June to August during which the arrivals were low. Uneven cycles were observed both in arrivals and prices in all the markets. GARCH model was employed to forecast maize prices. The forecast prices in all the markets showed a decreasing value. Analysis of zero order correlation showed all the maize markets are highly integrated. Percentage deviation in forecast prices from Delphi prices remained very less hence, forecast prices were accurate. The analysis revealed that, since price difference remained low it is better to go for immediate sale of produce and it is recommended to disseminate the forecast prices to farmers for their advantage.

AGRICULTURAL ECONOMICS**Economics of production and value addition to soybean in Madhya Pradesh**

ANKIT JAISWAL

2010

MAJOR ADVISOR : Dr. L. B. HUGAR

Soybean is known as the "golden bean", "miracle crop" etc., because of its several uses. The present utilization pattern of soybean in India indicated that 85 per cent used for oil extraction, 10 per cent for seed and only 5 per cent for food and feed. Therefore, processing is an important function of soybean. In recent years jowar and maize in rainfed areas have been competing with soybean in Madhya Pradesh. In the present study effort is made to study profitability of soybean vis-à-vis its competing crops in addition to value addition. The study indicated that net returns in soybean over jowar (868.72%) and maize (121.67%) were significantly higher. Similarly, benefit cost ratio over Cost C was higher in case of soybean (1.29) than that of maize (1.16) and jowar (1.05) which clearly indicated that soybean cultivation was more profitable than any of competing crops. For every rupee investment in soymilk and tofu processing, Rs. 1.42 was obtained as returns, indicating its profitability.

Benefit cost ratio was more than unity (1.18) showing profitability of converting soybean into soylfleur. In this regard, there is need to understand the profitability of soybean as whole pulse as well as processed soy products. Therefore, in the present study, an attempt is made to find out the economics of soybean production and its value addition in Madhya Pradesh state. An assessment of profitability of processing of soybean into different value added products clearly indicated that the processing units involved in processing soymilk and tofu together were more profitable than those involved in processing of soybean into soylfleur only. Since the value addition is profitable over raw soybean, farmers may be motivated to take up value addition to soybean. Further, small scale entrepreneurs may be encouraged to establish the above enterprises for widening the soybean industry.

Economics of land use and cropping pattern in northern transitional zone of Karnataka

ARAVIND KAMMAR

2010

MAJOR ADVISOR : Dr. H. BASAVARAJA

The information on land use pattern is necessary to develop future research strategies on land use planning and land use policies. The study aimed at analyzing the changes in land use and cropping pattern in Northern transitional zone of Karnataka. The necessary secondary data were collected for a period of 30 years from 1977-78 to 2006-07. Growth rate, Markov chain analysis, Multiple linear regression and Tabular analysis were employed to analyze the land use and cropping pattern. Area under forest, fallow, current fallow and land under miscellaneous tree crops showed positive growth during the study period. The land under non-agricultural uses registered a marginal increase. The majority of land use categories showed stability with respect to area change in period I (1977-78). Multiple regression analysis revealed that rainfall, population,

population density, literacy, motor vehicles and road length were the factors responsible for the changes in land use over the years. The cropping pattern in the zone was dominated by maize and the area shift towards maize and cotton was evident. The analysis of season wise changes in cropping pattern revealed that maize, cotton and sugarcane constituted the higher proportions of net area sown in *kharif* season. The summer crops are mainly dominated by paddy, jowar and maize. Multiple regression analysis revealed that price, number of commercial banks, number of co-operative societies, number of regulated markets, net irrigation, fertilizer consumption and rainfall were the factors responsible for the changes in cropping pattern. Increase in the forest cover through afforestation, expansion of area under cultivation for fallow and cultivable

waste, promotion of high yielding varieties under scientific management, ensuring remunerative prices for rice, wheat and jowar, efforts to utilize

barren and uncultivable land were the policy suggestions made by the study for better land use pattern in the zone.

Impact of non-timber forest products on tribal economy- An econometric analysis in western ghats of Karnataka

L. B. BHARATH KUMAR

2010

MAJOR ADVISOR : Dr. B. L. PATIL

Study on impact of non-timber forest products on Siddi's tribal economy in Uttara Kannada district was carried out in Karnataka during 2009-10. By following multistage random sampling four ranges of forest in Yellapur forest division, two blocks from each range, 80 respondents consisting of 40 from interior block, 40 from peripheral block were selected and necessary data were collected by pretested well structured schedule. This study also attempted to capture the probability of individual going for NTFPs collection, so necessary data from 80 non- collectors was elicited along with 80 collectors. The important findings of the study were; Siddi's derived significant income and employment (>50%) from collection of NTFPs. Men played a dominant role in collection and marketing of NTFPs except in the collection of fuel wood while women was dominant in processing activities. She spends more (>50%) time in collection of fuel wood only, however the role of children in collection

activities was less and in processing activities it was negligible. The increase in agriculture income and wage income tends to reduce the probability of a household going in for NTFPs collection. Hence, development of agriculture as an economic occupation and providing the households with more wage employment opportunities will not only add to the household income but will also reduce the pressure on NTFPs. Women spent more time (>50%) in collection of fuel wood, which was mainly for the purpose of food preparation and family support programmes. Hence if good supply of subsidized Gobar gas for the above said purpose would reduce the drudgery of women and collection of NTFPs and thus lead to environment protection. There are more than 180 different types of NTFPs were identified in Western Ghats, but this study encompasses only identified 30 different NTFPs leaving vast scope for future research on various products of forests.

An economic analysis of production and marketing of rapeseed-mustard in selected districts of Rajasthan

DINESH CHAND MEENA

2009

MAJOR ADVISOR : Dr. S. B. HOSAMANI

Rapeseed-mustard plays a pivotal role in the agricultural and industrial economy of Rajasthan state. The study on production and marketing of rapeseed-mustard was conducted in Alwar and Sri Ganganagar districts of Rajasthan state during 2007-08. Primary data were collected from 120 rapeseed-mustard growers spread over in the two districts. Secondary data were extensively used from sources like, District Statistical Offices and Directorate of Agriculture, Jaipur. For analysis of data tabular presentation, Compound growth rate, TSCI technique and Correlation analysis were adopted. Growth rate analysis for area, production and productivity has shown significant increase over a period of time for Alwar district, Sri Ganganagar district, Rajasthan state as a whole and India. Total cost of rapeseed-mustard cultivation were Rs. 21,370.87 per ha and Rs. 18,318.67 per ha and benefit-cost ratios were 1.67 and

1.91 in Alwar and Sri Ganganagar districts respectively, indicating the profitability of rapeseed-mustard crop. Four marketing channels were found in both the districts for disposing the produce, where in the share of producer in the consumer's rupee was higher when they sold their produce directly to processor. The indices of prices were not fluctuating as much as indices of arrivals. Slightly lower indices of price were noticed during heavy arrival months and vice-versa. The rapeseed-mustard markets in Rajasthan were well integrated with one another due to availability of good communication facilities and associated transportation infrastructure like rail and road. Lack of technical guidance and non-availability of fertilizer on time were the major problems in production and price information and fluctuations and delayed payments were the major problems in marketing of rapeseed-mustard faced by the farmers.

An economic analysis of organic farming in north Karnataka: A case study of organic villages

GANESH

2010

MAJOR ADVISOR : Dr. S. M. MUNDINAMANI

The present study analyzed the economic aspects of organic farming in selected organic villages of North-Karnataka. The primary data required for the study was collected (during 2007-08) from 240 farmers comprising 120 each of organic and conventional farmers. The data collected was subjected to tabular, partial budget and Cobb-Douglas production function analysis. The results revealed that the FYM and vermicompost together accounted for 68 per cent of the total input cost in organic farms whereas cost of fertilizers and pesticides accounted a major share (67 %) in conventional farms. The annual input cost of organic farm was 15.39 per cent less as compared to conventional farm. Organic farm was less expensive to the extent of 13.69 per cent in field crops under rainfed and 12.10 per cent under irrigated situations and was yielding more net returns (16.49 %) in perennial crops. Costs of production

in paddy, arecanut, jowar, soybean and chick pea was lower in organic farms. Cotton and onion were more profitable under conventional farming. The regression coefficients of fertilizer and pesticide were negative indicating over utilization of these inputs. Organic farming enhanced income of 70 per cent farmers and created employment for 81.67 per cent. In view of the above benefits revealed by the organic village farmers, organic village programme of the state government need to be further extended to Hobli-level in. Most of the organic produces were sold in conventional markets due to non availability of separate organic market in the locality. The study recommends creation of separate organic markets at taluk level for major commodities in the area. There is a need to provide premium price for organic produces.

Consumer chain store - An economic analysis

HARSHA. V. TORGAL

2010

MAJOR ADVISOR : Dr. S. B. HOSAMANI

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 consumer chain store in Dharwad and Belgaum using both primary and secondary data collected from various sources. Tabular analysis, Multiple linear regression, Logit and Discriminant analysis were employed to arrive at results. The percentages of visit of respondents were higher in the case of modern retail outlet when compared to traditional retail outlet in Dharwad district. Similarly in the case Belgaum district respondents which has

more per cent of visit in modern retail outlet. The consumers in Dharwad were more of simple living as compared to Belgaum and hence find difference in their visits to retail outlets making it as a habit or passion. However, more income was spent on modern retail outlet in Belgaum as compared to Dharwad that shows the cosmopolitan environment. Annual income followed by age which have positive and significant impact in Belgaum, while annual income and average expenditure found to have a positive and significant impact in Dharwad. Similarly average expenditure with stores have negative and significant influence in Belgaum while contact with stores and time spent during visiting found to have negative and significant influence in Dharwad. There is the lot of scope for the supermarket business to shift from traditional to modern form of retailing to cater the changing needs of the modern customers, the retail sector has

to adopt a new form of relationship with suppliers, and needs to develop a wide range of knowledge regarding the habits of different consumers demographical characteristics such as density of the population, average

food expenditure, income of households, average household size, number of stores in the area, size of the store etc., should be taken care before making pricing decisions were the policy suggestions made by the study

Production and export performance of major indian spices - An economic analysis

M. KRISHNADAS

2010

MAJOR ADVISOR : Dr. S. M. MUNDINAMANI

The production and export performance of major Indian spices viz. chilli, black pepper, turmeric, coriander and cumin were analysed for the period from 1979-80 to 2006-07 using state wise and national level time series data. The statistical tools namely, compound growth rate analysis, coefficient of variation, Hazell's decomposition analysis, Markov chain analysis and multiple regression analysis were employed. The results revealed that the growth in area under chilli was found to be negative, while production showed increasing growth due to increased productivity. The area, production and productivity of black pepper and turmeric showed positive and significant growth. The coriander area growth was found to be meagre, while production showed productivity led growth. The growth in productivity of cumin was found to be negative, while production showed area led growth. The black pepper and production were found to be stable than other spices. The exports of chilli, turmeric, cumin and

coriander in terms of quantity and value were found to be increasing. The growth of export earnings of black pepper was found to be increasing, while the volume of export was declining. The export shares of the spices to major destinations were also found to be declining. The exports of these spices were also unstable. The production and export of these spices were influenced by domestic and export price. Based on the findings of the study it can be concluded that the emphasis should be given for promotional programmes to augment the area under chilli and coriander. There is a need to improve productivity of spices by developing improved production technologies and suitable improved varieties. Productivity and area should be stabilised through crop insurance scheme for spices to protect the producers from price fluctuations. Appropriate measures should be taken to augment and stabilise the export earnings from spices.

Contract farming of gherkin under agri-export zone in Karnataka- An economic analysis

K. R. NETHRAYINI

2010

MAJOR ADVISOR : Dr. L. B. KUNNAL

The present study was conducted in Tumkur district of Karnataka. From the district two taluks were selected for the study. From each taluk three villages were selected for the study. Fifteen farmers were selected from each selected village, involving the total sample size of 90 farmers. The data pertained to kharif-2009. Tabular presentation method and Cobb-Douglas production function were employed for the analysis of data. The results revealed that the agreement between the farmers and the company was oral and informal for 77.7 per cent of the farmers and for the rest 22.2 per cent it was written and formal agreement. It was observed that all inputs needed for gherkin cultivation were supplied by company. Company provided no credit facilities and mechanization services to the farmers under contract farming system. Payments were made at an interval of fifteen days. The Marginal Value Product (MVP) to Marginal Factor

Cost (MFC) ratio showed that human labour (1.79), plant protection chemicals (3.18) and staking materials (2.66) were under utilized in gherkin cultivation. The MVP to MFC ratio for seeds and FYM and fertilizers was negative which indicated the over utilization of these resources. On an average from gherkin cultivation 1.26 pair days of bullock labour, 4.78 hr of tractor labour, 235.42 man days of men and 315.14 man days of women labour got employed per acre. In gherkin cultivation under contract farming on sample farms women labour employment (57.24 per cent) was more than men labour use (42.75 per cent). The average income was Rs. 11140.53 and Rs. 4436.25 in G-I and G-II system respectively. In G-I system fruits of all grades were procured by the contracting company where as in G-II system only the fruits of grade-II and grade-III were procured.

An economic evaluation of Kisan credit card scheme in Belgaum district of Karnataka and Sangli district of Maharashtra

SAJANE AJIT MAHAVIR

2010

MAJOR ADVISOR : Dr. H. BASAVARAJA

Kisan Credit Card (KCC) scheme was started by Government of India in year 1998-99 to provide adequate and timely support from the banking system to the farmers in a flexible and cost effective manner. The study has been undertaken to evaluate Kisan credit Card scheme in Belgaum district of Karnataka and Sangli district of Maharashtra. The study used both secondary data on KCC issued and amount sanctioned collected from District Lead Banks and primary data relating to production, income, borrowing, repayments, interest and cost of borrowing, opinion of borrower etc. collected from 60 KCC and 60 non-KCC sample borrowers. The results revealed that though the Kisan Credit Card scheme was initially restricted to the farmers who had good track record of repayment, later it was extended to those who have production

credit need of Rs.5000 and above. In the Belgaum district there was high negative growth in both the number of KCC issued (-393.38%) and amount sanctioned (-230.52%). On the other hand, in the Sangli district though there was positive growth in the number of KCC issued (36.18%), the amount sanctioned was found negative (-48.75%). The total credit cost as percentage of amount borrowed was higher in the non KCC category (11.06 %) as compare to that in the KCC (4.77 %). In all the major crops the credit provided under both KCC and non-KCC categories was found inadequate but the credit gap was less in KCC as compare to that in non-KCC category. The scheme of Kisan Credit Card should be extended to cover all the farmers which will help not only in reducing cost of credit but also to get adequate amount of credit.

Impact of land degradation in Malaprabha command area in Karnataka: An economic analysis

H. N. SATISH

2010

MAJOR ADVISOR : Dr. G. N. KULKARNI

Indiscriminate use of irrigation water has resulted in emergence of waterlogging and soil salinity in the command areas leading to decline in crop production, farm income and indirect economic losses. The study attempted to assess the economic impact of land degradation in the Malaprabha Command Area in Karnataka state during 2008-09. A multistage stratified random sampling technique was adopted to select the districts (Stage-I), taluks (Stage-II) and villages (Stage-III) in the command based on the largest area affected under waterlogging and soil salinity. A sample of 180 farmers comprising 45 normal and 135 problematic farms were selected for the study. Majority of the farms affected by twin problems were found to be located in the low lying areas while, the normal farms in the uplands. Maize, sunflower, cotton, groundnut, wheat and bengalgram were the major crops grown on the sample farms. About 61 per cent of the total land among the farmers was abandoned due to twin problems resulting in to low cropping intensity (48% to 103%). The cost of

cultivation was less by 30% to 58% in case of maize and 28% to 53% in wheat on problematic soils over normal farms. The drop in per hectare crop yields was found to be large in all the crops with negative net returns observed in both maize and wheat crops on problematic soils. The decomposition analysis indicated that, waterlogging and salinity depressed maize and wheat yield during *kharif* and *rabi* summer. The MVP and MFC ratios implied that, majority of the resources used in affected soils were constrained by degradation. The Timmer measure of technical efficiency in maize and wheat revealed that, high efficiency farms were more in normal soils where as, majority of them in degraded soils were operating with low efficiency levels. The aggregate annual monetary loss due to production losses for the farmers was estimated at Rs. 1.46 crores. The migration was more among marginal and small farmers due to reduced on-farm employment opportunities. The land resource degradation was more

in severe saline soils as a result the land and rental values were lowest in these degraded soils. Gini ratio analysis revealed that inequity in income

was found to be greater among farmers with degraded lands than in normal category. Farmers have strong perception about waterlogging and salinity.

An economic analysis of livelihood systems for rural community in Chitradurga district of Karnataka state

M.G. SAVITHA

2010

MAJOR ADVISOR : Dr. S. M. MUNIDINAMANI

The focus of the study was to analyse the economics of livelihood systems for rural community in Chitradurga district of Karnataka state. The purposive sampling technique was employed to select 160 respondents comprising equal number of landless, marginal, small and medium farmers across the study area. The primary data required for the study obtained through personal interview method using pre-tested schedule prepared for the purpose. The techniques of Tabular analysis, Gini-Coefficient and Garrett ranking test were employed. The data pertained to the year 2009-2010. The result of the study revealed that the average size of holding was 5.22 acres. The percentage of literacy was found to be only 65 per cent in the study area. Among various livelihood systems, the highest percent respondents (25.63%) had wage earning followed by crop production+livestock+wage earning (23.75%). More than one-third

(38.13%) of the respondents were preferred to work in mines as supervisors, truck drivers and labours as their alternative livelihood option. The percentage share of household income from wage earning was highest among landless households and showed a decreasing tendency with an increase in the size of land holdings. The overall value of Gini coefficient was 0.47. The head count ratio showed that the proportion of households below the poverty line was found to be higher (ranging from 56-58%) in Madakaripura and Kagalgere. The percentage of employment in wage earning to the total household was higher (199 mandays) compared to other counterparts. The annual expenditure incurred on consumption (Rs. 16,532.09) and the values of building inventory (Rs.1,14,230) were found to be highest in Madakaripura. The accessibility to basic necessities was the major problem expressed by most of the respondents in the study area.

Comparative economics of capsicum production under protected and open conditions in northern Karnataka

D. S. SREEDHARA

2010

MAJOR ADVISOR : Dr. M.G. KERUTAGI

Capsicum (*Capsicum annum* L. var. *grossum* sendt) production is concentrated in northern districts of the State. The study was conducted to analyse the comparative economics of capsicum production under open and protected conditions. Cost of establishment of shade net structure was Rs. 2, 51,110 per unit (0.25 acre). The cost of cultivation of capsicum under open and protected conditions was Rs. 38,884/acre and Rs. 55,080/unit, respectively. Variable cost accounted for higher proportion in open cultivation, whereas it was the fixed cost had higher proportion in the protected cultivation. Among the variable costs, the costs on plant protection chemicals and labourers were the highest under both the methods. Further, cost of production per quintal worked out to Rs. 1147 and Rs. 1001.50 in open and protected conditions, implying efficiency of the modern technology. Yield levels were 3.39 tonnes per acre in open and 5.50 tonnes per unit under protected conditions. Returns obtained were

Rs. 73,982 per acre in open and Rs. 1, 54,734 per unit in protected cultivation. Returns per quintal worked out at Rs. 2182.36 and Rs. 2813.35 under open and protected conditions, respectively. Similarly, B: C ratios were 1.90 and 3.92 in that order, indicating higher profitability in protected cultivation. Production problems of capsicum growers were lack of availability of high yielding and pest resistant varieties, non-availability of labourers on time and lack of technical guidance. Besides these, the specific problem of the farmers under open condition was instability in yield and that of protected condition was higher initial investment coupled by lack of owned capital. All the farmers used inorganic inputs resulting in polluting the ground water and soil. Three channels of marketing were identified, of which channel-I (farmers to consumers) was the most efficient, as farmers got 97.50 per cent share in a consumer's rupee.

Economics of production and value addition to vetiver in coastal Karnataka

H. R. SUNIL

2010

MAJOR ADVISOR : Dr. M.G. KERUTAGI

The present study was conducted to focus on economics of production and value addition to vetiver in Coastal Karnataka. Purposive random sampling technique was employed to select 60 sample farmers and 10 small scale and one medium scale processing units. Primary data was collected by personal interview method using well structured pre-tested schedule. Tabular, production function and financial analysis were employed to analyze the data. The results of the study revealed that farmers employed 159.70 mandays of human labour per acre. The total cost of cultivation of vetiver roots was Rs 51,556 per acre of which cost on human labour was the highest (46.46 per cent). The gross returns and net returns per acre were Rs. 1, 05,000 and Rs. 53,444, respectively and returns per rupee of expenditure was 2.03. Regression co-efficients for vetiver slips, labour, plant protection chemicals and irrigation charges

were positively significant and for manures and fertilizer was non-significant. The total cost of processing of vetiver roots and net returns per annum in medium scale unit were Rs.35, 26,451 and Rs.13, 85,549 respectively. Investment made on medium scale unit was found to be more profitable as compared to small scale units. High cost of production, high labour cost and low yield of vetiver roots were major production problems. Non-existence of local markets and lack of information on price were major marketing problems. Problems in getting subsidy and high sales tax were constraints encountered by medium scale processing unit. High cost of processing and non availability of quality raw material was the major problems expressed by both small and medium scale processors.

Economic analysis of cropping systems under tank irrigation in northern Karnataka

E. SURESH

2010

MAJOR ADVISOR : Dr. R. S. PODDAR

The study was conducted in two districts of northern Karnataka in selected tank commands with an objective of studying the economics of cropping pattern under tank irrigation system, cost and returns of crops, resource use efficiency in production of major crops, institutional arrangements for management of tank irrigation system and document problems in tank irrigation management. Purposive random sampling technique was employed to select 120 sample farmers from 12 selected tank commands. Primary data were collected through personnel interview method and secondary data on status of tanks were collected from minor irrigation department. Tabular and production function analysis were employed to analyze the data. The study identified major crops grown under tank irrigation systems in Bagalkot and Bijapur districts. Farmers in Bagalkot district cultivated crops in both *kharif* and *rabi* seasons, whereas in Bijapur district farmers cultivated crops in *kharif*, *rabi* and summer seasons also. The resources like labour, seeds, manures, chemical fertilizers

were under utilized in both the districts. Hence, there is scope for deployment of these resources. In both the districts returns were more in some crops due to reduced cost of cultivation and increased yield. The institutional arrangements of tank committee existed for tank management but participation was very meager in both the districts, no definite rules or guidelines were in place to regulate water management, farmers expressed their opinion that irrigation water was inadequate, often few farmers resorted to illegal and unauthorized water diversions. Constraints like, poor maintenance of tanks, siltation of tank bed, misutilization of allocated funds and improper cropping pattern were reported by the respondents. Organizational constraints included inadequate funds, staff, and lack of political will. Hence, there is a need to strengthen institutional support for provision of credit, infrastructure facility and formulate appropriate policies for safe guarding the interest of the farmers.

Economics of contract farming –A case study of chilli in Bagalkot district of Karnataka

J. SRIDHARA

2010

MAJOR ADVISOR : Dr. S. B. HOSAMANI

The study analyzed the costs, returns, income and employment, production efficiency and modus operandi of private firm in chilli producing under contract farming taluks viz., Bilagi and Mudhol in Bagalkot District of Karnataka. The primary data were collected (during 2008-09) from 127 chilli farmers. A multistage sampling procedure was adopted. In the first stage, Bilagi and Mudhol taluk were selected. In the second stage all 7 chilli growing villages under contract farming were selected and in the third stage, proportionately 20 per cent of the sample farmers in each village were chosen for the study. However, in Mudhol taluk due to a smaller sample size additional farmers were interviewed to make a sample size a minimum of 30 to enable for analysis of data using statistical packages. AVT-McCormick only one company dealing in procurement of dry chilli was interviewed for eliciting the information. The data subjected to Cobb-Douglas production function analysis besides tabular presentation.

The results revealed that per acre cost of chilli cultivation estimated to be Rs.38721.36, Rs. 41238.37 and Rs. 39882.74 in Bilagi, Mudhol and overall study area respectively. The per acre yield of chilli produce obtained were 1122.98, 1088.67 and 1096.49 Kgs in Bilagi, Mudhol and overall study area respectively by the chilli farmers. The marginal productivity analysis indicated that there is a scope for reorganizing the resources like seeds, bullock labour and plant protection chemicals. Climatic factor, improper identification of pest and disease, electricity problem, and non-existence of crop insurance were the problems confronting the chilli farmers.

The farmers were getting higher price than the market due to export tie-ups of the company. Hence, this system of contract farming may be replicated in similar area for the benefit of other farmers and need of crop insurance to cover the risks were the suggestion.

Comparative economics of vegetable production under organic and inorganic farming in Belgaum district

VINOD R. NAIK

2010

MAJOR ADVISOR : Dr. L. B. KUNNAL

The present study was conducted in Belgaum District of Karnataka. A sample of 30 farmers each practicing organic and inorganic cultivation of tomato and chilli were selected randomly for the study. Data were elicited for the year 2009-10 through survey method. The data collected was analysed using tabular presentation and output decomposition model. The estimated per acre cost of cultivation of tomato and chilli on organic farms was Rs. 17157.97 and Rs. 18336.62 respectively. On inorganic farms per acre cost of cultivation of these crops was Rs 17702.53 and Rs 19114.91. The per acre average yield of tomatoes and chilli on organic farms was 5.81 and 4.10 tonnes as compared to 6.95 tonnes and 4.86 tonnes on inorganic farms. The average per tonne market price of organic tomatoes was Rs 9550.00 where as it was Rs 6850.00 for inorganic tomatoes similarly for organic chilli it was Rs 9830.00 where as for inorganic chilli it was Rs 6300.00. The net return of tomato on organic

farms was Rs 32649.12 and was Rs 23074.52 on inorganic farms, the B:C ratio was also higher on organic farms (2.40) compared to inorganic farms (1.96). The net return of chilli on organic farms was Rs. 18226.94 and was Rs. 7983.77 on inorganic farms, the B:C ratio was also higher on organic farms (1.83) compared to inorganic farms (1.35). The results of decomposition analysis showed that the adopters of organic farming technology produced 14.88 per cent higher income from tomato production than inorganic farming adopters. Similarly 27.07 per cent higher income was realised from chilli production by organic farming adopters than inorganic farming adopters. As expressed by the sample farmers the major reasons for shifting to organic cultivation were higher returns and good quality of the vegetables. The major problems faced by the sample farmers were non-availability of labour and high commission charges.

AGRICULTURAL ENTOMOLOGY**Comparative efficacy of first and second generation Bt transgenic cottons**

ANAND HALLAD

2010

MAJOR ADVISOR : Dr. S. S. UDIKERI

The performance of first and second generation Bt transgenic cottons represented by different events was assessed through field experiment at Agricultural Research Station, Dharwad during 2009-10. Four and two rounds of protection were offered to non Bt and single gene Bt cottons respectively against bollworms. No protection was required for BG-II genotypes. Incidence of *Earias vittella* was >1.0 larvae/plant in all genotypes at 100 days after sowing except BG-II. *Helicoverpa armigera* larval incidence crossed economic threshold limits by 50 days in non-Bt, whereas by 100 DAS in events expressing Cry 1Ac, Cry 1C and Cry 1A. The incidence of all bollworms in Tulasi 4 BG-II and Chiranjeevi BG-II was negligible. Locule damage due to *Pectinophora gossypiella* was 23.2

per cent in DHH-11 non-Bt compared to the least (2.3%) in Chiranjeevi BG-II. Seed cotton yield harvested was 2210 kg/ha in Chiranjeevi BG-II. In protected BG-I genotypes the seed cotton yield ranged between 1640-1980 kg/ha. In DHH-11 the yield was 1581 kg/ha with complete protection which otherwise was limited to 1150 kg/ha. Characterization of resistance through bioassays indicated maximum mortality of *H. armigera* (98.4%), *E. vittella* (100%), *P. gossypiella* (92.9%) and *S. litura* (83.7%) at 50 DAS in Tulasi 4 BG-II. The mortality decreased to 75.9, 87.7, 80.3 and 57.3 per cent, respectively for both insect pests by 135 DAS. In *H. armigera* and *S. litura* the fourth instar larvae were less susceptible compared to third and second instars to all Bt events tested.

Effect of vegetable intercrops on mulberry, pest incidence and cocoon production

ANAND TONASHYAL

2010

MAJOR ADVISOR : Dr. G. M. PATIL

Field experiment was conducted under irrigated condition in paired row V-1 mulberry garden at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, to study the mulberry based vegetable intercropping system, its potential yield, pests incidence and cocoon production. French bean, field bean, cluster bean, cowpea, bhendi and raddish were grown as intercrops in mulberry during Rabi 2009-10. Sole mulberry produced significantly higher leaf yield of 14.50 t/ha/crop which was on par with mulberry intercropped with cluster bean (14.20 t/ha/crop) and mulberry intercropped with cowpea (13.09 t/ha/crop). However, significantly lowest leaf yield was recorded in mulberry intercropped with french bean (11.93 t/ha/crop). Land equivalent ratio was significantly maximum in mulberry intercropped with clusterbean (1.16), which was on par with mulberry intercropped with radish, and

lowest in mulberry intercropped with french bean (0.99). Higher gross returns of Rs 1,70,257/ha/ two crop and net returns (Rs 1,32,609/ha/two crop) were recorded in mulberry intercropped with cluster bean. All the intercrops in mulberry recorded minimum pest's incidence on mulberry than the sole mulberry. There was non significant influence of mulberry in reducing pest's incidence on vegetable intercrops. The matured silkworm larval weight (2.850g), cocoon yield (1.580 kg/1000worms), pupal weight (1.295g), shell percentage (19.37%), silk filament length (798.33m), denier (3.141) and ERR (93.50) were significantly superior in mulberry intercropped with cluster bean. Intercropping of cluster bean in paired row mulberry did not affect the mulberry leaf yield and return the silkworm growth and cocoon parameters were significantly higher and maximum income from intercropped mulberry garden.

Evaluation of indigenous bee attractants on Bt cotton

ANJAN KUMAR NAIK

2010 MAJOR ADVISOR : Dr. SHASHIDHAR VIRAKTAMATH

Studies on pollinator fauna, foraging activity of honey bees and effect of indigenous bee attractants on bee visitation and yield parameters of two genotypes of Bt cotton were made during Kharif season of 2009 at Oovanakoppa near Dharwad. Of the eight species of pollinators recorded on Bunny BG-I and Bunny BG-II Bt cotton hybrids, honey bees were predominant. *Apis cerana* F., *A. florea* F. and *A. dorsata* F. constituted 35.21, 31.22, and 24.53 per cent of total pollinators. Foraging activity of *A. dorsata* on both Bt cotton hybrids was uniform throughout the day and during the entire flowering period (7th to 42nd days after flowering). Activity of *A. cerana* and *A. florea* was also uniform but significantly higher numbers of *A. cerana* and *A. florea* bees (0.26 and 0.28, 0.26 and 0.27 bees/10m²/5min) were observed at 1330 h. In both BG-I and BG-II,

application of all the four indigenous bee attractants (Citral E, Citral Z, Fagara budrunga, Swertia densifolia) were equally effective in attracting significantly more number of bees (2.13 to 3.11 and 2.13 to 2.96 bees / 10m² / 5 min) which was as good as the Fruit boost, a commercial bee attractant. These indigenous bee attractants were able to enhance yield parameters viz, good opened bolls (6.83 to 16 per cent increase over control), seeds per boll (7.76 to 17.14 %), lint yield (6.56 to 12.96%), seed yield (5.80 to 13.33%) and kapas yield (10.02 to 13.51 %). At the same time there was a decline in the bad opened bolls to the extent of 19.77 to 32.93 per cent over control due to spraying of attractants. The enhancement of yield parameters is comparable to the efficacy of Fruit boost.

Efficacy of PEA (*Pisum sativum* L.) protein against *Callosobruchus chinensis* (L.), *C. maculatus* (F.), *Tribolium castaneum* (H.) and *Sitophilus oryzae* (L.)

K. S. ARPITHA

2010

MAJOR ADVISOR: Dr. J. S. AWAKNAVAR

Studies on the efficacy of Pea (*Pisum sativum* L.) protein against *Callosobruchus chinensis* (L.), *C. maculatus* (F.), *Tribolium castaneum* (H.) and *Sitophilus oryzae* (L.) was undertaken at College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka during 2009-10. Nine different pea cultivars were screened against *C. chinensis*, *C. maculatus*, *T. castaneum* and *S. oryzae*. Among them Prakash, local green and local yellow were least preferred for their survival, oviposition and development, while IPFD 6-5 and Pant P-5 were most preferred by bruchids. *T. castaneum* and *S. oryzae* did not prefer any of the pea cultivars for their survival and development. Based on the screening experiments yellow local variety was utilized for protein extraction and tested for the effect on bruchids, *T. castaneum* and *S. oryzae*. Whole pea-

flour at different concentrations of 0, 0.1, 0.5, 1, 5 and 10 per cent on w/w basis was also tested. Among the tested concentrations of 0, 0.001, 0.01, 0.1 and 1 percent (w/w basis), protein-enriched pea flour at 1 per cent caused maximum adult mortality and least progeny development of *T. castaneum* and *S. oryzae* whereas, least mortality of adults was observed at 0.001 per cent concentration, while whole pea flour gave moderate control at 10 per cent concentration. At 1 per cent protein-enriched pea flour was more toxic than whole pea flour. Protein-enriched pea flour and whole pea flour failed to exercise insecticidal activity on bruchids. Two and four months aged protein-enriched pea flour caused similar mortality effects as that of fresh pea-protein treatment. However, insecticidal activity was reduced after six months storage and failed to reduce progeny development.

Seasonal incidence and management of insect pests in maize

S. R. BIRADAR

2010

MAJOR ADVISOR : Dr. Y. K. KOTIKAL

The extensive roving survey revealed that eleven insect pests were found feeding on maize. Out of which three belonged to Lepidoptera, two each to Homoptera, Hemiptera and Coleoptera and one each to Diptera and Dermaptera. Among the three districts surveyed, shoot fly incidence was more in Belgaum district, while incidence of stem borer, armyworm, aphids and cob worm was highest in Bagalkot district with higher number of natural enemies. The higher number of shoot fly eggs per leaf was noticed during the month of September, March and April. The higher number of pin holes due to stem borer was noticed during the month of August and lower during the months of December and June. Similarly, maximum deadhearts by stem borer were noticed during the month of July (62%) and minimum during the month of June, December and January (32%). The peak population of aphids was observed during the month of April and peak activity of hairy caterpillar was noticed only

during the August irrespective of different dates of sowing. Maximum damage by cobworm was observed during March and minimum damage was observed during June. The hybrid EH-434042 showed resistance reaction to major insect pests followed by 900M-Gold and Super-900M. While, the maize hybrid KHHM-110 was highly susceptible for different insect pests as compared to other hybrids viz., KHHM-102, KHHM-101 and KHHM-200. Higher number of natural enemies were observed in KHHM-110. The Hybrid EH-434042 recorded higher fodder and grain yield, while KHHM-110 hybrid recorded lesser fodder and grain yield. Among four modules evaluated, the module M2 recorded lesser incidence of stem borer, armyworm, aphid and cobworm as compared to other modules. The module M4 recorded maximum pest incidence and as well more number of predators. Significantly higher fodder and grain yield was obtained from module M2 followed by modules M3, M1 and M4.

Comparative efficacy of interspecific cotton hybrids containing single and stacked Bt genes against pink boll worm, *Pectinophora gossypiella* (Saund.) and tobacco caterpillar, *Spodoptera litura* (Fab.)

HAREESHA K. BADIGER

2010

MAJOR ADVISOR : Dr. S. B. PATIL

The investigations were carried out at Agricultural Research Station, Dharwad Farm, University of Agricultural Sciences Dharwad, Karnataka during 2009-10 on comparative field efficacy of interspecific cotton hybrids containing single and stacked Bt genes against pink bollworm and tobacco caterpillar, spatio-temporal expression and bioefficacy of Cry1Ac and Cry2Ab, development and evaluation of IPM module integrating stacked Bt gene interspecific cotton hybrid. All the stacked Bt gene hybrids recorded significantly lower pink bollworm (0.10 to 0.24 larva/20 green bolls) and tobacco caterpillar population (0.11 to 0.35 larva/plant) compared to 1.18 to 3.76 PBW larva/20 green bolls and 1.12 to 1.66 Spodoptera larva/plant in single gene Bt and non Bt interspecific check hybrid. Decline in the expression of both Cry1Ac and Cry2Ab protein was evident through ELISA and bioassay. Higher expression of both the proteins was noticed in leaf canopy (0.42-3.66 µg) compared to

reproductive parts (0.14-1.83 µg). The concentration of Cry2Ab (9.52-61.66 µg) was many folds higher than Cry1Ac throughout the observation period. The mean pink bollworm mortality of 82.61 and 90.72 per cent on flowers and tender bolls respectively and 86.83 per cent mortality of Spodoptera was observed on leaves expressing stacked genes and was significantly more compared to the plant parts containing single gene (56.94%, 64.61 % and 17.17% respectively). No significant difference with respect to sucking pests and natural enemies population incidence was observed between BG-I and BG-II IPM modules. The IPM module with stacked Bt gene cotton hybrid was found to be more effective in suppressing the bollworms and foliage feeder which resulted in realization of higher seed cotton yield of 26.81q/ha with a net profit of Rs. 75408.00/ha compared to 25.02 q/ha yield with a net profit of Rs. 66153.00 in module integrated with single gene Bt hybrid.

Distribution, seasonal incidence and management of eucalyptus gall wasp *Leptocybe invasa* Fisher and La Salle (hymenoptera: eulophidae) with special reference to native parasitoids

HARISH KULKARNI

2010

MAJOR ADVISOR : Dr. A. S. VASTRAD

Investigations on "Distribution, seasonal incidence and management of eucalyptus gall wasp *Leptocybe invasa* Fisher and La Salle (Hymenoptera: Eulophidae) with special reference to native parasitoids" were carried out during 2009-10 at the Department of Agricultural Entomology, College of Agriculture, UAS, Dharwad. Seasonal incidence studies revealed that top portion of the sample harbored more of first and second stage galls. Middle portion of the sample contained more of second, third and fourth stage galls. Fourth and fifth stage galls were more in bottom portion of the sample. Roving survey conducted in 44 locations of 10 districts revealed that *L. invasa* has firmly established throughout Karnataka and highest number (35.23) of galls were recorded at Timmapur and lowest (5.04) at Nandi Hills per 30 cm shoot length. Infestation of gall wasp was seen throughout the year. *Megastigmus* sp. was recorded from 19 locations and the per cent parasitization was highest (61.14 %)

at Machagondanahalli (Bengaluru Rural Districts). *Aprostocetus gala* was recorded from nine locations and the per cent parasitization was highest (24.82 %) at Belgaum. Quarterly survey conducted at Vaddarahatti, Kulwalli, Prabhunagar and Kittur indicated that number of adult emergence was highest (553) in Vaddarahatti followed by Kittur (541). Parasitoids were recorded at all the locations and per cent parasitization ranged from 10.16 per cent to (Vaddarahatti) to 46.18 per cent (Vaddarahatti). Total life cycle of *L. invasa* from oviposition to adult emergence was 123.6±3.16 days. A total of 1470 and 343 *Megastigmus* sp. and *Aprostocetus gala* were recovered from two greenhouses where release and recovery studies were conducted. Neonicotinoids viz., acetamiprid, imidacloprid and thiacloprid were found effective as cutting dip up to 45 days. Seed treatment with thiacloprid, imidacloprid and acetamiprid was effective in reducing the infestation up to 30 days. Thiacloprid and imidacloprid were effective as foliar spray.

Survey and surveillance of green gram sphingid, *Agrius convolvuli* (Linnaeus) (Lepidoptera: Sphingidae) and its management

MALLAPPA CHANDARAGI

2010

MAJOR ADVISOR : Dr. R. R. PATIL

Fixed plot survey was carried out in Agriculture Research Station, Annigeri at weekly interval till the harvest of crop. The peak activity was noticed on 63 days (1.77 larvae/m row) old crop. Natural enemies, viz., *Trichogramma chilonis* Ishii, *Zygothrips ciliate* Wulp, *Zygothrips atropivora* Robineau-Desvoidy and bird predators, *Corvus splendens* L. and *Acridotheres tristis* L. were observed. The roving survey in different locations revealed the higher population in Gadag district (1.42 larvae/m.row) during second week of July followed by Dharwad (1.09 larvae per meter row) and Belgaum (0.68 larvae per meter row) districts during first and second week of August, respectively. Biology was studied in detail on green gram and black gram during July to August months under laboratory conditions. The development of egg, larva and pupal periods occupied 7.65±1.78, 24.85±2.33, and 17.35±3.44 days on green gram and 7.80±1.03, 26.25±2.43, 17.75±1.79 days on black gram, respectively.

Average fecundity on green gram and black gram was 138.80±8.09 and 104.0±16.53 eggs /female, respectively. Total life cycle was 49.85±7.55 and 51.80±5.06 days on green gram and black gram, respectively. In vitro studies indicated significant superiority of lambda cyhalothrin @1 and 2ml/l recording cent per cent mortality of *A. convolvuli* larvae 72 hours after spraying as compared to other chemicals. Whereas, under field conditions mechanical control and emamectin benzoate 5 SG were superior to rest of the chemicals recording least number of larvae per plot, followed by lambda cyhalothrin 5EC, spinosad 48SL. NSKE 5% was least effective. Maximum grain yield was recorded in emamectin benzoate (6.30 q/ha) followed by mechanical control (6.26 q/ha), spinosad 48 SC (5.90 q/ha) and lambda cyhalothrin 5EC (5.80 q/ha) as compared to control (3.15 q/ha). Higher BC ratio of 2.96 was obtained from lambda cyhalothrin (1.0 ml/l) followed by emamectin benzoate (0.25g/l) and indoxacarb (0.3ml/l) which recorded BC ratio of 2.49 and 2.40, respectively.

Survey and management of pests of capsicum under protected cultivation

NANDINI

2010

MAJOR ADVISOR : Dr. R. S. GIRADDI

Investigations were carried out at the Hi-Tech Horticulture project, MARS, Saidapur and farmer's field during 2009-10 on protected capsicum pests. Surveillance studies indicated that mite, *Polyphagotarsonemus latus* (Banks) and thrips, *Scirtothrips dorsalis* (Hood) incidence commenced on crop around 20-25 days after planting. It then gradually increased attaining peak during the period of September and November. *Spodoptera litura* (Fab) incidence was low initially but attained peak during August and then declined. Use of yellow sticky traps indicated that sucking pests viz whitefly, red mite, leafhopper and thrips occurred on capsicum crop during the cropping period (July to Sept) with varied densities. Studies on weather parameters indicated that there was positive correlation between mite and thrips population in relation to temperature. With reference to RH, negative correlation with mite population and positive correlation with thrips was noticed. There was non significant and negative correlation

between *S. litura* population and temperature where as positive and non-significant correlation was exhibited with RH. Among the newer molecules evaluated against mite, abamectin (1.3 mites/5 leaves & 30.6% leaf curl) was found to be effective followed by Econeem. For thrips, thiamethoxam (0.65 & 27.7%) and difenthiuron (0.7 & 32.7%) were found to be significantly superior compared to others. With respect to *S. litura*, acephate was found to be the best treatment followed by Clothianidin. Abamectin recorded significantly less number of snails and seedling damage (0.1 & 0.46pl/spot) followed by Econeem. The untreated capsicum crop recorded significantly highest pest densities and damage. Among IPM modules studied, chemical intensive module proved effective in reducing the pest population and crop damage with maximum net returns (Rs 19, 77,452 /ha), B:C ratio (4.8) and fruit yield (2304 g/pl) followed by IIHR module.

Comparative studies on the performance of yellow and black colour morphs of *Apis cerana indica* F. at Sirsi, Karnataka

NINGAPPA BANAKAR

2009

MAJOR ADVISOR : Dr. S. T. PRABHU

A. cerana population in Karnataka is composed of two distinct colour morphs: the yellow 'plain' morph and the black 'hill' morph. The two populations are called as 'hill morph' which are black in colour and restricted to higher elevations and seen in western ghats ecosystem, and the other as 'plain morph' which are yellow in colour and restricted to plain areas of lower elevation. A study was undertaken at Agricultural research station, Sirsi in Uttara Kannada district of Karnataka to know the comparative performance of these two colour morphs which are geographically separated. Performance of two populations was compared with respect to parameters like foraging behaviour, brood rearing activity.

There was also a study to identify foraging bee plants of both the colour morphs. The results of comparison study showed that the black hill morph and yellow plain morph performed on par with each other with respect to all parameters of foraging activities and brood rearing activities. There was no significant difference between both the colour morphs when statistically analysed for number of outgoing bees, number of pollen gatherers and number of nectar gatherers activity. The brood rearing activity of both the colour morphs was on par with each other. Brood rearing parameters like pollen area and nectar area exhibited no significant difference between two colourmorphs. The bee plants identified in Sirsi

include *Aporosa lindleyana*, *Ailanthus triphysa*, *Cocos nucifera*, *Careya arborea*, *Flacourtia Montana*, *Peltoforum ferrugineum*, *Sapindus emarginatus*, *Syzygium caryophyllaeum*, *Syzygium cumini*, *Tridax procumbens* and *Terminalia tomentosa* among 77 tree species, 10 shrubs and herbs. There were 19 species of plants which served as only pollen sources. The number of plants identified as only nectar source was 30 tree species and 27 number of plants was identified as both nectar and pollen

source. Majority of bee plants identified had the flowering period from January to May. Among the 10 shrubs and herbs 2 are nectar yielders and 8 species are both pollen and nectar yielders. On par performance of yellow colour morph with local black colour morph at Sirsi indicated that yellow 'plain' colour morph can be successfully introduced to 'hill' conditions in Western Ghat region of Uttara Kannada, where there are assured flora sources for pollen and nectar.

Studies on groundnut leaf miner, *Aproaerema modicella* Deventer. in northern dry zone of Karnataka

Y. V. PRAVEENA

2010

MAJOR ADVISOR : Dr. Y. K. KOTIKAL

Among 25 genotypes screened for their reaction against leaf miner, none was found to be immune or resistant, but five genotypes viz., Dh-4-3, ICGS-11, R-9227, R-8808, and R-9214 were found moderately resistant to leaf miner. Similarly six genotypes, Dh-101, Dh-107, Dh-112, GPBD-4, R-2001-2, TAG-24 and Dh-116 were moderately susceptible to leaf miner. Further, rest of the fourteen genotypes, Dh-108, GPBD-5, R-9271, TMV-2, Dh-109, Dh-2001-1, G-2-29, KRG-1, S-206, Dh-86, G-2-52, R-9251 and R-2001-3 were highly susceptible. Roving survey was conducted in and around Bagalkot area in farmers' fields. The incidence of GLM, foliage damage and leaflet damage were recorded during 2nd fortnight of April. During the course of study, the spiders were encountered as predators. Similarly, the parasitoids, *Goniozus* sp., *Chelonus* sp., *Sympiesis dolichogaster* Ashmead, *Bracon* sp., *Eurytoma* sp. and *Temelucha* sp.

were recorded. Among these all were larval parasitoids except *Chelonus* sp., which was egg-larval parasitoid. The efficacy of fifteen insecticides against leaf miner was assessed. The highest mean larval mortality was noticed in the case of monocrotophos, followed by dichlorvos and quinalphos in both first and second round of spray applications. Lowest mortality was noticed in the case of neem oil. Significantly higher yields were obtained in all the insecticidal treatments, except NSKE and neem oil. Maximum benefit, for every rupee spent on plant protection was obtained by spraying with monocrotophos 36 SL @ 1ml/l (5.43). However, quinalphos 25 EC @ 2ml/l (5.41), fenvalerate 20 EC @ 0.5 ml/l, thiodicarb 75 WP @ 0.6 g/l (4.77) and spinosad 48 SC @ 0.1 ml/l (4.71) were the next best treatments and may be recommended for the effective and economic management of leaf miner on groundnut.

Bioefficacy and persistence of insecticides against *Sitophilus oryzae* (L.), *Callosobruchus chinensis* (L.) and *C. maculatus* (F.) on wheat and cowpea

RAJANI B. RAJPUT

2010

MAJOR ADVISOR : Dr. R. H. PATIL

Investigations on bioefficacy and persistence of insecticides viz., malathion, fenvalerate, dichlorvos, spinosad deltamethrin and cypermethrin against *Sitophilus oryzae* (L.), *Callosobruchus chinensis* (L.) and *C. maculatus* (F.) on wheat and cowpea seeds stored for seed production were carried out in the Department of Agricultural Entomology, UAS, Dharwad during 2009-10. Among the insecticides tested for their efficacy as seed treatment spinosad 45 SC was found to be most toxic against *S.oryzae*, *C.chinensis* and *C.maculatus* with LC₅₀ values of 0.08 ppm, 0.24 ppm and 0.05 ppm respectively as compared to treated check Malathion (12.67 ppm, 23.13, 34.33). Fenvalerate 20 EC and dichlorvos 76 EC were least toxic against *S.oryzae*, *C.chinensis* and *C.maculatus* respectively. Cypermethrin 25 EC @ 25 ppm, deltamethrin 2.8 EC @ 3 ppm and dichlorvos 76 EC @ 80 and 100 ppm were found to be most

effective against *C.maculatus* recording no adult emergence. Cypermethrin 25 EC @ 25 ppm and deltamethrin 2.8 EC @ 3 ppm were found most effective against *C.chinensis* whereas spinosad 45 SC @ 2 ppm and deltamethrin 2.8EC @ 3 ppm were highly toxic to *S.oryzae*. The treated check malathion 50 EC @ 20 ppm was least effective. Among different insecticides tested for their persistence spinosad 45 SC and deltamethrin 2.8 EC were most toxic against *S.oryzae* and *C.chinensis* up to 6 months of storage period. However, malathion 50 EC and fenvalerate 20 EC treatments were least toxic. Spinosad 45 SC @ 2 ppm and deltamethrin 2.8 EC @ 2.5 ppm and excelled over all other insecticides by recording lowest adult emergence of *S. oryzae* and *C.chinensis* respectively followed by deltamethrin 2.8 EC @ 3 ppm. Malathion 50 EC @ 20 ppm recorded highest adult emergence of *S. oryzae* and *C.chinensis* followed by fenvalerate 20 EC @ 20 ppm.

Status of paddy insect pests and their natural enemies in rainfed ecosystem of Uttara Kannada district and management of rice leaf folder

B. S. RAJENDRA PRASAD

2010

MAJOR ADVISOR : Dr. S. T. PRABHU

The studies on the status of paddy insect pests and their natural enemies in rainfed ecosystem of Uttara Kannada district and management of rice leaf folder were undertaken during kharif 2009. Uttara Kannada district represented three distinct rice ecosystems, namely; upghat drill sown paddy, upghat transplanted paddy and coastal transplanted paddy. The roving survey revealed a total of 12 insect pests feeding on paddy crop. Among these White backed plant hopper (WBPH), Brown plant hopper (BPH), leaf folder and ear head bug were recorded as major pests. Whereas, others were considered as minor and negligible pests on this crop. The incidence of white backed plant hopper was seen from September till harvest of the crop. The maximum population of 865 nymphs and adults per hill was recorded, during first fortnight of November in Mundgod and zero population in Honnavar. The natural enemy complex revealed that 6 species of parasitoids, 27 species of predators, 6 species of spiders

and 3 species of pathogens were recorded. Spiders and mirids were most prominent natural enemies on BPH, WBPH and yellow stem borer. Correlation studies made between the major paddy insect pests with various biotic and abiotic factors revealed significant relationship with temperature and humidity and significant positive correlation with biotic factors like spiders, mirids and odonotans. Among the various ecofriendly approaches evaluated in the management of rice leaf folder, *Gnidea glauca* leaf extract @ 5% was found very effective in reducing larval population and leaf damage, which was found on par with chlorpyrifos 20 EC @ 2 ml/l and remaining all other botanicals were on par with each other but inferior to *G. glauca* and chlorpyrifos 20 EC. However, neem seed kernel extract (NSKE) and *Nomuraea releiy* were also found promising in reducing the larval population.

Screening elite genotypes and ipm of defoliators in groundnut

RASHMI YAMBHATANL

2010

MAJOR ADVISOR : Dr. R. K. PATIL

Screening elite genotypes and IPM of defoliators in groundnut were studied during Kharif 2009, at Main Agricultural Research Station, UAS, Dharwad. The seven groundnut genotypes were screened for *Spodoptera litura* (F.) resistance in the field. The genotypes viz., Mutant-III and ICGV-86699 Tan showed 11.5 and 12.0 per cent leaf damage compared to 44.0 per cent foliar damage in susceptible check, JL-24. The detailed investigation on biology of *S. litura* on these seven genotypes

further confirmed with the field screening studied by recording longest larval period (22.83 and 23.67 days), pupal period (11.67 and 11.33 days), lowest adult longevity (9.67 and 9.33 days) and fecundity (379.67 and 386.0 eggs/ female) in Mutant-III and ICGV-86699 Tan respectively. Whereas susceptible check, JL-24 has recorded shortest larval period (17.93 days), pupal period (9.83 days), higher adult longevity (11.83 days) and fecundity (592.0 eggs/ female). The resistant genotypes, Mutant-

III and ICGV-86699 Tan permitted *S. litura* to complete its life cycle in longest period (48.92 and 49.00 days respectively) compared to susceptible varieties, JL-24 and GPBD-4 (41.02 and 41.00 days respectively). The other genotypes GPBD-5, GPBD-6 and ICGV-86699 Red were intermediate. The effects of these resistant genotypes on the growth and development of *S. litura* could obviously be due to chemical factor i.e. antibiosis. Among different IPM modules, Module-II proved as effective

IPM module in reducing defoliator population, enhancing natural enemy population and recording higher yield (39.95 q/ha) with maximum net returns (Rs.89,850/ha) and highest C:B ratio (1:5.1) followed by Module-I. Module-II comprising of foxtail millet as intercrop (7:1) and insecticide Emamectin benzoate (0.2 ml/lit) and M-I was totally bio-intensive module and it comprising of sunflower as trap crop and *Nomuraea rileyi* spray and it was suitable for northern transitional belt.

Ecofriendly approaches for the management of pod borers in field bean, *Lablab purpureus* (L.) Sweet

REMYA KOLARATH

2010

MAJOR ADVISOR : Dr. SHEKHARAPPA

The studies on the effect of dates of sowing, efficacy of biorationals, biodynamic pesticides and safer insecticides for the management of pod borers in field bean were undertaken during *kharif* 2009 at the Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad. Results indicated that sowing during third week of July recorded least per cent pod (32.34) and seed damage (41.21) among the different dates of sowing. This was followed by sowing during second week of July. Among the four species of pod borers attacking the seed, *Maruca vitrata* was found to be the predominant one followed by *Cydia ptychra*. However, the population of *Helicoverpa armigera* and *Lampidius boeticus* were negligible. The important predators observed during study period were Robber fly, lady bird beetle grub, Stryphids,

Chrysoperla carnea Stephens and dragon fly. Efficacy of *Bacillus thuringiensis* @ 1 g/l and Endosulfan 35 EC @ 2 ml/l were more consistent in bringing down the incidence of pod borers irrespective of the two sprays and highest yield of 20.73 q/ha and 19.77 q/ha respectively. This was closely followed by NSKE @ 5% and Pongamia glabra SE 5% among the different biorationals. Among different biodynamics, Panchagavya (3%) + NSKE (5%), Panchagavya (3%) + GCK (0.5%) and Cow urine (10%) + GCK (0.5%) emerged as the best treatments with least per cent pod and seed damage and higher pod yield. All the newer insecticides except Rynaxiper 10 SC were effective in reducing the incidence of pod borers. However, Novaluron 10 EC (0.1 ml/l) proved to be superior followed by Emamectin benzoate 5 SG @ 0.2 g/l, Spinosad 45 SC @ 0.1 ml/l and Flubendiamide 20 SC @ 0.2 g/l.

Survey, crop loss estimation and management of mirid bug, *Creontiades biseratense* (Distant) (Miridae: Hemiptera) in Bt cotton

SHALINI

2010

MAJOR ADVISOR : Dr. C.P. MALLAPUR

Investigations were carried out at MARS, Dharwad and on farmers' fields on mirid bug, *Creontiades biseratense* (Distant) (Miridae: Hemiptera) in Bt cotton during 2009-10. Roving survey for the bug incidence was made in major Bt cotton growing belts of Karnataka. Among different places, the maximum incidence was noticed in Haveri district (13.29±3.00 bugs/5 squares) followed by Dharwad (9.40±3.20) while, least population was recorded in Uttar Kannada (2.38±0.09 bugs/5 squares). The maximum square and boll shedding was noticed in Haveri (11.27±3.64% and 4.81±1.18%, respectively). The results of fixed spot survey made at MARS, Dharwad indicated that the peak incidence of the pest was noticed during November third week (24.25 bugs/5 squares) coinciding with luxuriant vegetative growth stage of the crop. Studies on reaction of twelve selected Bt cotton hybrids against mirid bug incidence indicated that the bract size played an important role in imparting mirid susceptibility

whereas, number of hairs on leaf and bract imparted resistance to the pest. The Bt cotton hybrids viz., NCS-145 Bt, NCS-207, Bajarang and Chiranjeevi proved to be less susceptible to the pest. The economic injury level for *C. biseratense* on Bt cotton was worked out at 1.57 bugs/5 squares. Laboratory studies on the screening of various bioagents, botanicals and insecticides revealed that *Verticillium lecanii* @ 1x10⁸ conidia/ml, neem oil @ 5ml/l and acephate 75 WP @ 1.0g/l proved better against the mirid bug among bioagents, botanicals and insecticides, respectively. Among the different IPM modules evaluated, module-III (chemical intensive) proved quite effective in reducing the pest population with maximum net returns (Rs. 50,731/ha) and B: C ratio (21.82: 1.00) followed by module-II. Module-I with only ecofriendly approaches proved to be ineffective against the pest.

Evaluation of first and second generation bt cotton genotypes for characterization of resistance to bollworms and tobacco caterpillar

R. SOMASHEKARA

2009

MAJOR ADVISOR :Dr. S. S. UDIKERI

Characterization of resistance to bollworms and tobacco caterpillar in first and second generation Bt cotton genotypes was assessed through field performance in protected and unprotected conditions at Agricultural Research Station, Dharwad during 2008-09. Protection against bollworms was not required for BG-II genotypes. Two and four rounds protection was warranted by BG-II and non-Bt genotypes for harvesting better yields. Incidence of *Earias vittella* was negligible. *Spodoptera litura* larval incidence was 0.92 and 0.85 larvae/plant in Bunny and RCH-2 non-Bt genotypes without any protection respectively. *Helicoverpa armigera* incidence crossed economic threshold limits by 50 days in non-Bt and 100 days in BG-I genotypes. Least incidence was noticed in RCH-2 BG-II and Bunny Bt-2. Locule damage due to *Pectinophora gossypiella* was 48.70 per cent in RCH-2 non-Bt compared to the least 2.30 per cent in RCH-2 BG-II and 10.61 per cent in RCH-2 BG-I without protection. Seed cotton yield was 22.83 q/ha in RCH-2 BG-II. Protected BG-I hybrids RCH-2 Bt and Bunny Bt could yield 19.83 and 16.0 per cent q/ha. In non-

Bt hybrid, yield range was 15-16 q/ha with full protection which other limited to 9.37-11.78 q/ha. Temporal variation in Cry protein expression was evidenced through insect bio-assay and ELISA. At 50 DAS, Cry1Ac concentration was more in bottom leaves (4.45-5.20 g/g) followed by middle and top leaves. Squares contained about 1.18-1.25 g/g Cry1Ac. At 100 DAS, in boll rind (0.68-0.78 g/g) and raw seed (0.13-0.18 g/g) of Cry1Ac was quantified. Similar trend was found at 75, 100 and 125 DAS. Similar trend is followed in Cry2Ab also with higher expression in leaves. The expression in squares, boll rind and raw seed was in the range of 58.69-59.82, 18.89-19.89 and 17.25-18.25µ g/g respectively. Bt cotton genotypes reduced food utilization efficiency of *H. armigera* (leaves) and *E. vittella* (squares) greatly compared to non-Bt genotypes. Second generation Bt cotton genotypes were found to be superior over BG-I hybrids in growth regulation action. Only second generation Bt cottons were found toxic to *S. litura* larvae, while there was non-significant difference between first generation Bt and non-Bt genotypes for rest of the pests targeted.

Management of *Sitophilus oryzae* (L.) and *Callosobruchus chinensis* (L.) in storage of sorghum and cowpea seeds

B. N. SRINATH

2010

MAJOR ADVISOR : Dr. J. S. AWAKNAVAR

Investigations on the effect of inert materials (Diatomaceous Earth, cow dung ash, rice husk ash, wood ash, sand and clay), neem products (neem leaf powder, neem seed kernal powder, neem cake, neem

oil, econeem and nimbidine) and insecticides (deltamethrin, emamectin benzoate, thiamethoxam, spinosad and malathion) admixed with the seeds on rice weevil, *Sitophilus oryzae* (L.) and pulse beetle, *Callosobruchus*

chinensis (L.) in sorghum and cowpea, respectively were carried out in the division of Agricultural Entomology, University of Agricultural Sciences, Dharwad during 2007-08. Among the inert materials, DE @ 0.3%, 0.2% and cow dung ash @ 30% recorded 100% mortality of *S. oryzae* and *C. chinensis* adults even up to 240 days after treatment (DAT). Clay @ 1% also recorded 100% mortality of *S. oryzae* in the fresh treatment but declined to 58.33% by 120 DAT and gradually to 53.33% but for *C. chinensis* 100% mortality was maintained through out 240 days. The above treatments recorded no seed damage, no weight loss, minimum seed moisture content and higher germination percentage. Among the neem products nimbecidine and neem oil both @ 5 ml per kg recorded mortality

ranging from about 48.00 to 26.00% in *S. oryzae*. Nimbecidine and neem oil showed higher mortality in *C. chinensis* ranging from 100% to about 51.00%. They recorded minimum seed damage, weight loss and higher germination percentage. Other neem products were less effective. Among the insecticides, emamectin benzoate, thiamethoxam and spinosad all at 2 ppm recorded 100% mortality of *S. oryzae* and *C. chinensis* over 240 DAT. Deltamethrin showed 95.00% mortality in *S. oryzae* which declined to 31.67% by 240 days but for *C. chinensis* 100% mortality was maintained for 240 days. They recorded minimum seed damage, minimum weight loss, minimum moisture content and higher germination percentage.

Seasonal incidence and management of okra mites, *Tetranychus* spp.

M. V. VARADARAJU

2010

MAJOR ADVISOR : Dr. B. S. NANDIHALLI

In *kharif* crop, the okra mites, *Tetranychus* spp. reached peak during the first fortnight of November 2008 while in *rabi* crop, the peak was noticed during the second fortnight of March 2009. However, in summer, the peak was recorded during second fortnight of May 2009 at Main agricultural Research Station, Dharwad. *Metarrhizium anisopliae* @ 2.5x10⁹ CFU/ml was significantly superior in controlling *Tetranychus urticae* Koch under laboratory condition. Under field condition, *M. anisopliae* @ 2.5x 10⁹ CFU Iml and *V. lecanii* @ 2.5x 10⁹ CFU Iml was superior in reducing the mite population and recorded higher yields of 13.73 and 12.71 tons per ha, respectively. The treated check i.e., dicofol recorded 14.92 tons fruit yield per ha. NSKE (5%) was significantly

superior to all other botanicals and possessed acaricidal and antifeedant properties under laboratory condition. Under field condition, NSKE (5%) was significantly superior in reducing tetranychid mite population and recorded highest fruit yield of 11.47 t/ha while the standard check, dicofol recorded 14.11 tons per ha. The newer acaricide molecules viz., abamectin 1.9 EC (0.2 ml) and diafenthiuron 50 WP (2 g/l) were significantly superior in reducing tetranychid mite population. The higher fruit yield of 17.59 t/ha was recorded in abamectin 1.9 EC with highest cost benefit ratio of 1: 4.80. The next best treatments were diafenthiuron 50 WP (17.15 t/ha) and fenazaquin 10 EC (16.15 t/ha). The standard check i.e., dicofol recorded 14.83 tons fruit yield per ha.

AGRICULTURAL EXTENSION EDUCATION

Livelihood activities of tibetan rehabilitants of mundgod-A socio-economic analysis

K. M. ERENEUS

2010

MAJOR ADVISOR : Dr. L. MANJUNATH

The research study was conducted during 2009-10 in Mundgod taluk of Karnataka. Tibetan settlement was purposively selected for the study with the total sample of 135 respondents from nine villages. The data was elicited through personal interview method. The socio-economic profile of the respondents revealed that, 47.40 percent of the Tibetan rehabilitants had primary school education, 92.60 percent were married, more number of them belong to medium level of family size (55.56%), considerable 39.25 percent belong to semi-medium level of annual income category and 68.89 per cent were categorized under medium level of annual expenditure (Rs 10557-37077). Majority of them belong to medium level of extension contact (66.67%), economic motivation (51.12%), risk orientation (54.07%) and majority of them do not possess livestock (62.96%) and have not undergone any training (55.56%). Majority (64.45%) of the respondents had high level of social participation,

75.56 percent of them participated in marriages regularly and 80.00 percent of them took part in festivals regularly. With regard to livelihood activities, considerable percent of 31.12 among the Tibetan rehabilitants had preferred agriculture + dairy as their livelihood practice, 52.38 percent of them had been in the agriculture + dairy for more than 20 years and majority of them (71.42%) are involved with agriculture + dairying activities throughout the year. Results also revealed that education, family size, annual income, risk orientation, economic motivation and social participation were found to be significantly associated with livelihood activities. Major problems expressed by the Tibetan rehabilitants in livelihood activities were lack of labour force (63.70%), followed by uncertainty of rainfall and lack of irrigation facilities (62.96%). Whereas, majority of the Tibetan rehabilitants suggested for creation of water facilities (59.25%), followed by organizing training programmes on skill development (45.00%) for their livelihood improvement.

Technological gap in turmeric production practices in Belgaum district

B. M. MADHU

2010

MAJOR ADVISOR : Dr. J. G. ANGADI

A study on technological gap in turmeric production practices in Belgaum district was carried out during 2009-10. Simple random sampling method was employed to select a sample of 140 turmeric growers. The information was elicited through personal interview method. The frequency curve of the diffusion followed almost 'bell-shape' when plotted over time. The cumulative curve of diffusion nearly approached 'S-shape'. Majority of the turmeric growers possessed medium level of knowledge (37.86%) about recommended practices of turmeric cultivation. Cent per cent of the turmeric growers had correct knowledge about recommended varieties, sowing time, time of application of FYM, intercrops and turmeric polishing. Only 13.58 per cent of the turmeric growers had knowledge about NPK application. Education, experience in turmeric cultivation, extension contact, mass media participation, deferred gratification, economic motivation, innovative proneness and risk orientation were

found to be significantly associated with knowledge of turmeric cultivation. Fourty four per cent of the respondents belonged to medium technological gap category. Regarding use of recommended varieties and sowing time, no technological gap was observed. As high as 85.00 per cent of technological gap was observed regarding use of recommended seed treatment practices. Education, experience in turmeric cultivation, extension contact, mass media participation, innovative proneness and risk orientation were found to be significantly associated with technological gap in turmeric cultivation. Majority of the turmeric growers (97.86%) marketed their produce in the regulated market. Majority of the respondents (97.86%) gathered information on market price by personally visiting the nearest market. The major problems perceived by the turmeric growers were irregular and insufficient supply of electricity for irrigation (88.57%) and non availability of labour in time (73.57%).

A study on knowledge and adoption of plant protection measures by paddy growers of raichur district

T. MANJUNATH

2010

MAJOR ADVISOR : Dr. L. MANJUNATH

The study was conducted in the randomly selected villages of taluks of Raichur district during 2009-2010. Manvi and Sindhanur taluks were purposively selected since these taluks are having more number of paddy growers and occupy more area under paddy cultivation as compared

to the other taluks in the district and also based on the criteria of high diseases and pest infestation level. The study revealed that cent per cent of farmers had knowledge about the stem borer. Majority of the farmers (88.57 % and 62.85%) had knowledge about brown plant hoppers and ear

head cutting caterpillar. Majority (77.14%) of the farmers knew about Phorate which is used for stem borer control, 73.14 per cent of them did know about dimethorate for control of brown plant hoppers. Whereas, only 51.42 and 45.71 per cent of them had knowledge about the symptoms of army worm and gundhi bug. About 47.00 (46.85) per cent of the farmers adopted furadan pesticide for control of stem borer. Only 17.14 and 21.71 per cent of them adopted proper concentration of Carbofuran and Dimethoate, whereas 58.28 per cent of them had adopted proper concentration of Endosulfan 35 EC. About 38.85 per cent of the respondents had annual income below Rs. 49,310.43, followed by 35.42

per cent of them between Rs. 49310 to Rs. 1,21,217 and rest of them (25.71%) had an income more than Rs. 1,21,217. Majority of the respondents (60.57%) belong to medium level of mass media utilization category. High majority (96%) of the respondents possessed television sets. Vehicles, sprayers and dusters were possessed by 90.85 and 89.71 per cent of the respondents, respectively. Lack of knowledge about chemicals, lack of knowledge about number of sprays and lack of knowledge with regard to technology application were the major constraints expressed by 43.42, 62.85 and 83.42 per cent of respondents, respectively.

An impact study on farmer's knowledge and adoption level of sunflower frontline demonstrations (FLDs¹) in Bijapur district of Karnataka

K. M. RAGHAVENDRA

2010

MAJOR ADVISOR : Dr. S. K. METI

The study was conducted in 2007 in Bijapur district of Karnataka state, where Frontline Demonstrations were conducted during 2002-03 to 2006-07 by Krishi Vigyan Kendra (KVK) of Bijapur, University of Agricultural Sciences (UAS), Dharwad. Among participant farmers, majority (55.00%) of them belong to high level knowledge category, 30.00 per cent belong to medium knowledge category and 15 per cent of farmers belong to low knowledge category. Majority of participant farmers belong to high and medium adoption category (48.33 and 45.00 % respectively). Only 6.67 per cent of farmers belong to low adoption category. Whereas, 21.66 per cent of farmers belongs to high adoption category. Among participant farmers, 91.66 per cent had knowledge about variety, whereas 66.66 per cent of non-participant farmers were not known about variety. About 98.33 percent of participant farmers & 43.33 percent of non-participant farmers had knowledge about seed treatment with *Azospirillum* in relation to FYM application. Majority (40.00%) of

participant farmers belongs to medium scientific orientation category, followed by low and high (31.67% and 28.33%) scientific orientation category, respectively. The study implies that, the findings, gain in knowledge and adoption by both participant and non-participant farmers have clearly shown the difference with respect to improved selected technologies. Frontline demonstrations influenced non-participant farmers to motivate and inculcate the technologies covered in the frontline demonstrations and their consultancy pattern clearly indicated that the majority of non-participant farmers consulted the participant farmers as their source of consultancy for many practices. Seeds in-time followed by high cost of seed, high cost of fertilizers, non-availability of fertilizers, high cost of plant protection chemicals, non-availability of *Azospirillum* culture, non-availability of plant protection chemicals, difficulty in plant protection operations and transportation facility as their major constraints.

A study on knowledge and adoption of post-harvest management practices among the mango growers of northern Karnataka

RAVIKUMAR D. MODI

2010

MAJOR ADVISOR : Dr. A. BHEEMAPPA

The present study on knowledge and adoption of post-harvest management practices among the mango growers of Dharwad and Belgaum districts was conducted during 2008-09. Based on random sampling the selected 120 mango growers were interviewed using the structured interview schedule. The results showed that one-third of respondents were noticed to possessed small holding (34.17%) and more 18 years of experience in mango cultivation (33.33%). More number of sample farmers were observed in medium level of achievement motivation (64.16%), followed by risk orientation (50.00%) and economic motivation (37.50%). The overall knowledge about post-harvest management practices revealed that 45.00 per cent possessed medium level of knowledge. The detailed analysis of individual management practices indicated that a high per cent of respondents had knowledge of duration taken for fruit maturity (95.83%), identifying maturity of fruits (93.33%), storage techniques (91.67%) and suitable varieties for processing (90.00%). Similarly,

majority of respondents possessed knowledge of ideal time for harvesting (87.50%), use of fruits pickers for harvesting (77.50%) and importance of grading and packing (72.50%). The analysis of the overall adoption of post-harvest management practices showed that more number of the respondents (45.00%) were noticed in low adoption. Further, adoption of individual practices revealed that a high per cent of respondents adopted recommended variety (95.00%), followed by method of harvesting (71.67%) and time of harvesting (52.50%). But, cent per cent of respondents did not used potassium permanganate while picking of fruits. The results of simple correlation showed that knowledge and adoption of post-harvest management practices were significantly determined by risk orientation, achievement motivation and economic motivation. A high percentage of respondents expressed the constraints of labour shortage and high wages (75.00%) and lack of technical knowledge and guidelines (71.00%).

Farmers perceptions, preferences and utilization of SRI and traditional paddy straw for livestock

H. S. SATHISH

2010

MAJOR ADVISOR : Dr. NAGARATNA BIRADAR

Present study was conducted to know the farmers' perceptions, preferences and utilization of SRI and traditional paddy straw for livestock in three (Haveri, Chikballapur and Uttar Kannada) paddy growing districts of Karnataka during 2009-10. Data was collected by personal interview method from 120 paddy growers using pre-tested standardized interview schedule. Majority of the respondents were middle aged having medium land holdings. Almost equal percent of them belonged to high and medium income categories. Majority had nuclear and big families, owned herds of medium size and followed direct method of feeding fodder. Extension contact and extension participation of the respondents was found to be medium. More than half of the respondents grew paddy alone in Kharif. High percent of them were practicing SRI method in an area of up to 0.51 acre. Majority of the respondents allotted a land holding of up to 2 acres for paddy cultivation. Almost half of the respondents possessed high

experience in paddy cultivation and majority of them were cultivating paddy for grains. Half of the respondents opined that grain yield is important in both SRI and traditional paddy. A high grain to straw ratio of 1:1.93 and 1:1.92 was obtained in Chikballapur in SRI and traditional paddy respectively. The performance of SRI paddy was found to be good over traditional method of paddy cultivation with respect to characteristics like seed rate, amount of water required, number of tillers, grain and straw yield etc as perceived by farmers. In case of performance of SRI and traditional paddy in characters related to straw quality and quantity, SRI paddy straw was perceived to be good with respect to number of tillers, height of crop, softness, leafiness, color, acceptability etc over traditional paddy straw. Nearly half of the respondents belonged to medium category of paddy straw utilization for livestock.

Impact of institution village linkage programme (IVLP) of UAS, Dharwad on participant farmers

UDAYKUMAR B. DODDAMAN

2010

MAJOR ADVISOR : Dr. K. A. JAHAGIRDAR

The study was conducted purposively in Dharwad district of Karnataka state to evaluate the impact of the TAR-IVLP of UAS, Dharwad. It was revealed from the study that improved variety (JS-335) was adopted by 53.12 and 75 per cent of participant farmers during 2005-06 and 2006-07, respectively. The adoption level was decreased over the years. With respect to soybean crop, 44.62 per cent of participant farmers and 39.32 per cent of non participant farmers belonged to high crop productivity group. Mean area under groundnut crop was found to be 2.00 acres with respect to IVLP participant farmers, whereas mean area of 1.52 acres in case of non-participant farmers with a mean difference of 0.48 and per cent change of 24 per cent. The mean area under cotton crop was found to be 2.71 acres with respect to IVLP participant farmers, whereas mean area of 1.98 acres in case of non-participant farmers with

a mean difference of 0.72 and per cent change of 26.84 per cent. The mean area under soybean crop was found to be 3.06 acres with respect to IVLP participant farmers, whereas mean area of 2.82 acres in case of non-participant farmers with a mean difference of 0.24 and per cent change of 7.77 per cent. Drought spell for 3 years, unsuitability of land and lower yields due to more pest and disease incidence are the major constraints experienced by 93.75, 37.5 and 78.12 per cent of participant farmers, respectively in adopting JS-335 variety of soybean. Labour intensive work, Heavy investment, less returns and unavailability of certain components of IPM like traps are the major constraints experienced by 82.14, 57.14, 67.85 and 35.71 per cent of the participant farmers, respectively in adopting components of IPM technology in cotton.

Adoption gap in groundnut production in northern transition zone of Karnataka

WONDANGBENI KIKON

2010

MAJOR ADVISOR : Dr. J. G. ANGADI

A study on adoption gap in groundnut production in Northern Transition Zone was carried out during the year 2009-2010. Thirty demonstrator farmers and sixty fellow farmers formed the sample for the study. The data was elicited through the personal interview method. The overall adoption gap for demonstrator farmers was to the tune of 41.55 per cent and for the fellow farmers it was 79.90 per cent. The yield gap on the demonstration fields was 23.96 per cent while it was 59.15 per cent between the demonstrator and fellow farmers' field. Both the adoption and yield gaps were found to be significantly different between the demonstrator and fellow farmers. Cent per cent of the demonstrator farmers had not adopted recommended Copper Sulphate application. All the fellow farmers had not adopted eight important recommended practices such as application of Rhizobium, Phosphorus Solubilizing Bacteria, Lime

Sulphate and Copper Sulphate, control of pest (Spodoptera) and diseases like Damping Off, Fungal Neck rot and Leaf Spot. Education, farming experience, extension contact, mass media utilization, cosmopolitaness, cropping intensity and innovative proneness were negatively and significantly related to adoption gap of demonstrator as well as fellow farmers while age was positively and significantly related to their adoption gaps. Landholding had significant relationship with the adoption gap of fellow farmers. All the independent variables explained 91.90 per cent and 79.20 per cent of variation in the adoption gaps for the demonstrator and fellow farmers respectively. High cost of chemicals and fertilizers (96.67%) and price fluctuation (86.67%) were the major constraints in adoption of recommended cultivation practices of groundnut.

AGRICULTURAL MICROBIOLOGY

Studies on dual inoculation of potassium solubilizing bacteria and phosphorus solubilizing bacteria on growth and yield of maize (*Zea mays* L.)

KUNOTO Y. CHISHI

2010

MAJOR ADVISOR : Dr. V. P. SAVALGI

A glasshouse experiment was conducted during *kharif* 2009 at Main Agricultural Research Station, Dharwad to study the effect of dual inoculation of potassium solubilizing bacteria (KSB) and phosphorus solubilizing bacteria (PSB) on growth and yield of maize. Bacterial isolates of potassium solubilizing bacteria (KSB) and phosphorus solubilizing bacteria (PSB) were collected from Department of Agriculture Microbiology, University of Agricultural Sciences, Dharwad. All the bacterial isolates were tested for K and P solubilization and characterized upto genus level based on morphological characters. In vitro K solubilization by bacteria ranged from 2.41 µg/ml to 44.64 µg/ml and in vitro Pi released by the PSB isolates from TCP ranged from 17.47 to 21.5 per cent. Three efficient K

solubilizing bacteria and P solubilizing bacteria were examined for their influence on growth, and yield of maize plant under glass house condition. All the treatment with dual inoculation of KSB and PSB were found to increase growth parameters, nutrient content and yield components compared to control and with single inoculation of KSB and PSB. Three strains of present study viz., KSB 11, KSB 16 and KSB 27 in combination with PSB 98(2) showed higher potential. Dehydrogenase, Urease and Phosphatase activities in rhizosphere soil of maize were significantly higher in the treatment inoculated with KSB + PSB as compared to control and single inoculation. Thus it can be inferred that combination of potassium solubilizing bacteria (KSB) and phosphorus solubilizing bacteria (PSB) have the potential to be used as bioinoculants.

Influence of liquid organic manures on microbial activity, growth, lycopene content and yield of tomato (*Lycopersicon esculentum* MILL.) in the sterilized soil

NILEEMA S. GORE

2010

MAJOR ADVISOR : Dr. M. N. SREENIVASA

An experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the influence of liquid organic manures viz., Panchagavya, Jeevamruth and Beejamruth on microbial activity, growth, lycopene content and yield of tomato in the sterilized soil during *kharif* 2009. The rhizosphere and phyllosphere population of fluorescent pseudomonads, phosphate solubilizing microorganisms and free-living nitrogen fixers were significantly highest when all the three organic liquid manures were given followed by RDF + Beejamruth + Jeevamruth + Panchagavya at 75 DAS (days after sowing) and 160 DAS. The enzymatic activities viz., dehydrogenase, urease and phosphatase were significantly highest when all the three organic liquid manures were given at both the stages of crop growth. The plant growth and root length recorded was significantly highest with the application of RDF + Beejamruth + Jeevamruth + Panchagavya and it was found to be

significantly superior over other treatments. The N, P and K concentration of plants was significantly highest in the treatment given with RDF + Beejamruth + Jeevamruth + Panchagavya. Among all the treatments, the application of Beejamruth + Jeevamruth + Panchagavya resulted in significantly highest lycopene content. The application of RDF + Beejamruth + Jeevamruth + Panchagavya resulted in significantly highest yield of tomato and it was found to be significantly superior over other treatments. The application of Beejamruth + Jeevamruth + Panchagavya was next best treatment and resulted in significantly highest tomato yield as compared to RDF alone. This study clearly brought out significant improvement in soil biological indicators such as microbial population and enzymatic activity due to combined application of liquid organic manures. There was significant improvement in the yield of tomato with the combined application of liquid organic manures with RDF.

Potential of rhizobacteria to control bhendi yellow vein mosaic virus in bhendi

NISHA M. PATIL

2010

MAJOR ADVISOR : Dr. K. S. JAGADEESH

As many as fifty rhizobacterial isolates from the culture collection of Departments of Agricultural Microbiology and Biotechnology were screened against Bhendi Yellow Vein Mosaic Virus (BYVMV) disease in bhendi. Based on the disease control, five isolates were selected for further studies. Four of them (B-40, 212(1), 212(4), 205(4)) belonged to non-fluorescent *Pseudomonas* and one 218(1) belonged to fluorescent *Pseudomonas*. The above selected rhizobacterial isolates were evaluated for their ability to control BYVMV and promote growth in bhendi. These isolates controlled the disease ranging from 60 to 86.67 percent. The green house experiment revealed that *Pseudomonas* 218(1) was the most promising isolate which controlled BYVMV by 86.67 per cent. The mechanism of virus control was elucidated. All the isolates induced systemic

resistance in bhendi plants. Plants inoculated with the lignite based formulation of fluorescent *Pseudomonas* 218(1) recorded the highest phenol content, peroxidase activity and PALase activity (20.83 %, 79.35 % and 47.05 % respectively higher than the diseased control). The plants treated with fluorescent *Pseudomonas* 218(1) also showed the highest reduction in the insect population (83.33 per cent less than that of the diseased control). Semi quantitative PCR analysis revealed lower viral load accumulation in plants inoculated with these isolates. The fluorescent *Pseudomonas* 218(1) recorded maximum plant height, total biomass, chlorophyll content and fruit yield. Which were increased by 46, 56, 62 and 132 per cent, respectively over the diseased control.

Studies on microalgae for biodiesel production

H. VARSHA RANI

2010

MAJOR ADVISOR : Dr. GEETAG SHIRNALLI

The increase in air pollution, depletion in the fossil fuels and ever increase in their price have led to search for alternate fuels. Among the renewable sources, microalgae could be one of the best alternates. Microalgae have higher potential to produce biodiesel. Hence, the present study was conducted. Seventeen isolates of microalgae were isolated from various water samples from lakes and tested for lipid production under fluorescent microscope using Nile red stain. The reference strains used in the study were *Botryococcus braunii* and *Neochloris oleoabundans*. Among the isolates *Botryococcus* sp. (B6) and *Scenedesmus dimorphus* (SD7) showed maximum fluorescence indicating potential strains for lipid production. The highest biomass was produced by *Botryococcus braunii* (7.90 mg ml⁻¹) followed by *Scenedesmus dimorphus* (SD7) (4.53 mg ml⁻¹), *Botryococcus* sp. (B6) (3.56 mg ml⁻¹) and *Neochloris oleoabundans* (3.46

mg ml⁻¹). The lipid production was 5.33 mg ml⁻¹, 2.53 mg ml⁻¹, 2.26 mg ml⁻¹ and 1.42 mg ml⁻¹ respectively. These strains were grown in the different concentrations of Ferric ammonium citrate (FAC) and Sodium nitrate to study their effect on biomass and lipid production. Different FAC levels tested were 10.7 μM, 21.4 μM and 42.8 μM. Sodium nitrate used in the study were 8.5 mM L⁻¹, 17 mM L⁻¹ and 34 mM L⁻¹. FAC level of 42.8 μM and Sodium nitrate level of 8.5 mM L⁻¹ were optimum for biomass and lipid production. The combined effect of the FAC at 42.8 μM and Sodium nitrate at 8.5 mM L⁻¹ showed maximum biomass and lipid production by the microalgal strains as compared to that of standard medium. From this study, B6 and SD7 isolate of microalgae were potential and can be further used for large scale production and lipid extraction for converting to biodiesel.

AGRICULTURAL STATISTICS**Evaluation of statistical models in price forecasting – A case of timber trade**

H. S. ANIL KUMAR

2010

MAJOR ADVISOR : Dr. R. B. NAIK

Timber price was considered as the important variable affecting the optimality of forest management. On the other hand, forecasting of timber price is very uncertain. The present study was conducted to study the behavior of different forecasting models in timber price forecasting from Dandeli and Kiruvatti depot. The information on price was collected from the respective depots for the study period from 1980 to 2009. In the present investigation different forecasting models like trend analysis, ANN model, Box-Jenkins model and Exponential smoothing models are considered to produce forecast and to measure the forecast accuracy among selected different models. The pattern of two different timbers (Teak and Indian Kino) prices from two different depots are analyzed for price movement, including the existence of trend and seasonality component and also the Stationarity property. Price forecasts based on various time series forecasting methods are produced and compared with

the published forecasts. The forecast errors obtained from different models are following normal distribution from both timber depots, there by satisfying one of the assumptions of forecasting models. In case of teak price forecasting Box-Jenkins (ARIMA) model was best validated for both the timber depots with the higher correlation coefficient and the lesser coefficient of variation. In case of Indian Kino price forecasting, Box-Jenkins (ARIMA) model for Dandeli depot and Single exponential smoothing model for Kiruvatti depot was best validated. Finally Box-Jenkins (ARIMA) model was found to be best forecasting model by producing minimum value of MAPE and RMSE for Dandeli depot. Where as for Kiruvatti depot Box-Jenkins (ARIMA) model was found to be best in Teak price forecasting and Single exponential smoothing model was found best in forecasting Indian Kino price with a minimum value of MAPE and RMSE.

A statistical investigation on association between weather parameters and crop yield in selected districts of Karnataka

K. M. CHIKKESH KUMAR

2010

MAJOR ADVISOR : Dr. A. R. S. BHATI

A statistical investigation on association between weather parameters and crop yield in selected districts of analyzed for the period of 1980-2006. The statistical tools namely correlation analysis, regression analysis, cluster analysis and different non linear models were employed. The results revealed that there is a association between weather parameters and crop yield. All long selected weather variables rainfall is positively and maximum temperature is negatively correlated with crop yield. The models were built in order to predict yield with help of individual weather parameter and all combined together, best models were selected based on the significance of the model and R², which explains the variation in

dependent variable due to independent variables. Different non linear models were used for predicting yield using each weather parameter, among that power, compound, cubic, - curve, logarithmic and quadratic models were found significant. The results revealed from cluster analysis, rainfall was classified in to three clusters based on the departure of aridity index from the mean value. The first cluster included those years which are considered as slight drought prone year, second cluster consists of years which are moderate drought years. Similarly the third cluster consists of years which are severe drought prone years respectively. Among selected years maximum years were classified under slight drought year and only few were classified under severe drought year.

Statistical modelling technique on export of fruit crops in India

S. HARI PRASAD

2010

MAJOR ADVISOR : Dr. K. V. ASHALATHA

The Export of fruits in India have recorded increase during certain years and also decrease during some other years. India has a large range of varieties of fruit in its basket and accounts for 10% of world's total fruit production. India is the largest producer of Mango, Banana, Sapota and Lime. About 39% of world's Mango and 23% of world's Banana is produced in the country. The secondary data on Export of fruit crops was collected based on the availability. Annual Fruit crops Export data from the CMIE, Foreign Exchange Reviews (1994 to 2009 in 1000\$US), Annual Mango Export data from the APEDA DATABASE from (1985 to 2009, in crores). Annual Banana Export data from FAO STAT DATABASE (1985 to 2008 in 1000\$US). The research aim was to develop a suitable statistical model for describing the trend by employing different statistical modeling. At last the best one is recommended for the further study. The polynomial function fitting was carried out with different degrees and the selection of the best model was based on R-square value. Different degrees were tried to fit among all the degrees carried out 5th degree polynomial showed best fit to the Annual fruit Export, 6th degree polynomial showed best to the Mango Export, 6th degree polynomial showed best to the Banana export and Quadratic polynomial (2nd degree) showed the best to the Monthly Export of fruit crops. Nine Non-linear models were tried among all the models the best model was selected based on the highest R-square value and least MSE value. All models were found to be significant (at 1% and 5%). These models were fitted to Annual fruit Export, Mango and Banana Export. In the process it showed that the Compound, Growth and Exponential models were best fit with highest R-square and least MSE values. But only in case of Mango Export it showed Linear model was best

fit and the next best was found to be the same models. So these three models are best to find the growth in Export or to find trends for Exports. The Box-Jenkins procedure is concerned with fitting a mixed Auto Regressive Integrated Moving Average (ARIMA) model to a given set of data. The objectives in fitting this ARIMA model are to identify the stochastic process of the time series and predict the future values accurately. These methods have also been useful in many types of situation which involves the building of models for discrete time series and dynamic systems. Keeping in view of the specific objective of the present study, the data on the export of monthly fruit crops of India was collected. The Box-Jenkins ARIMA model is fitted to the monthly fruit exports. Seasonality was found in the data so seasonal ARIMA model is used.. So, the differencing was done to remove non-stationarity and made stationary. Making use of differenced series (which is stationary), the ACF and PACF are computed because it helps in tentatively identify the model. Then the parameters of all tentatively identified model was estimated by iterative process. The AIC and SBC values of least were considered to identify the model. The model (1,1,1 : 1,1,1) was identified and subjected to diagnosis checking in order to determine the adequacy of model. The residues of estimated model is examined for testing the randomness of series and for its significance. Both Ex-ante and Ex-post forecast is done for the identified model. In selecting the best model to forecast the trend for monthly fruit export, the accuracy measures MAPE and MSE are considered. Among all the models tried, the Box-Jenkins ARIMA model (1,1,1 : 1,1,1) was best fit with least MAPE (15.198 percent) and MSE (3.36) values. And the forecasted values from the ARIMA model were much nearer to the Actual values.

A statistical investigation on export of cashewnut from India

K. PADMANABAN

2010

MAJOR ADVISOR : Dr. Y. N. HAVALDAR

A statistical investigation on export of cashew nut from India were analysed for the period of 1980-2008, for trend analysis of export of cashew kernel and cashew nut shell liquid. For import of raw cashew nut, the period taken was between 1995-2008. The study period taken for probability transition analysis was 1999-2008 and the period of 1997-2008 was taken for instability analysis. The statistical tools namely polynomial regression analysis, Markov chain analysis and co-efficient variation were employed. The results revealed that trend in export of cashew kernel behaved almost constant in the initial study period. After 1988 it started increasing till the end of the period. The export of cashew nut shell liquid showed decreasing rate at initial study period and it almost fluctuates throughout the study period, but after 2006 it was showing increasing trend and import of raw cashew nut to India showed increasing at increasing rate till 2006, after 2006, it decreases gradually. The transitional probability matrix showed USA was one of the most stable importer of Indian cashew kernel and cashew nut shell liquid. The Tanzania was the major exporter of raw cashew nut to India. The countries like UK

and Japan had the retention of zero percent. So these countries are unstable importers of Indian cashew kernels. The 'other countries' showed stable importers both cashew kernel and also cashew nut shell liquid. The projection to the year of 2015, showed decreased rate in case of USA, Netherland, UK, Japan and France. UAE showed increased rate of import of cashew kernel from India. In case of cashew nut shell liquid, countries like USA, Japan and 'other countries showed increased rate and the Korea Rep. showed the decreased rate of import. The raw cashew nut import from Tanzania and Mozambique showed decreased rate compared to the year 2008. Ivory Coast, Guinea Bissau and Indonesia, Benin and other countries showed increased rate of import. The results revealed from instability analysis, the USA, Netherland are stable importers and the UAE was the most unstable importer of Indian cashew kernel. The cashew nut shell liquid export showed unstable to all importing countries. In case of raw cashew nut import, the Tanzania showed the stable, compared to all other exporting countries.

Statistical investigation and interpretation of replacement series intercropping experiments with mixtures methodology

B. N. RAJESHWARI

2010

MAJOR ADVISOR : Dr. A. R. S. BHAT

Intercropping has been traditional practice in our country. In recent years research into intercropping has attracted attention of the agricultural scientists. Therefore this study has been undertaken to demonstrate the applicability of the mixture experiment in agricultural research. The object of the mixtures methodology is to obtain individual parameters with an interpretation closer to that of parameters in ordinary polynomial response functions. In the methodology used, a relationship is built between crop response and the proportions of crops. Statistical techniques used to analyze data from Mixture Experiments involve fitting Multiple Regression models with the intercept set to zero. One purpose of statistical modeling in a Mixture Experiment is to model the mixing components such that predictions of the response for any mixture component, singly or in combination, can be made empirically. A chickpea based mustard intercropping experiment conducted in Agricultural Research

Station (ARS), Gulbarga during the year 2007 and 2008 laid out in RCBD was considered for the study. It is a replacement series intercropping experiment with 3 replications comprising 5 different row proportion treatments along with 2 sole crop treatments and satisfies all the criteria to apply mixtures methodology. About 11 different price combinations were worked out keeping in mind the small and large variations of prices in the market. The results of multiple regressions for all the price ratios showed 6:2 row proportion of chickpea + mustard to be more stable with fluctuations in market prices and proved to be optimum with existing market price when compared with results of usual ANOVA. Mixtures methodology is proved to be advantageous over results of ANOVA in aspects like change in optimum area to be recommended with change in market price, narrow range of confidence interval, prediction of the optimum response of the row ratio not included in the experiment.

Study on optimum plot size and optimum plot shape of soybean crop

B. KAVITHA

2010

MAJOR ADVISOR : Dr. K. V. ASHALATHA

The total area used to conduct uniformity trial was 1898 sq m. Rows are along E-W direction columns are N-S direction. Observation on plot yields were recorded plot wise at the time of threshing. The basic unit being of size 1.2 sq.m (4 column plants at 30 cm *10 cm spacing). The total area divided into 1470 units each unit have size of (1.2 *1.0) sq m. The coefficient of variation decreased as the plot size increase but not proportionally in case of both characteristics, viz., yield per unit plot and number of pods per unit plots. The sum of squares worked out for rows and columns separately showed relatively higher fertility gradient along the columns. The presence of rough fertility along the rows also can be seen in the contour map. The observed relation between plot size and variance was in conformity with the Fairfield Smith variance law. At the larger plot

sizes, the regression line showed a tendency to curve down although Fairfield Smith method and maximum curvature showed some difference in case of both the characters, viz., yield per unit plot and number of pods per unit plot taken separately. And trend in decrease of coefficient of variation is found almost similar for both the characters. From all these above considerations, a plot size of 3.6 Sq. m (3.6 m *1.0 m) is found advisable for conducting field experiments in soybean. The optimum plot size based on number of pods did not differ significantly from that determined by yield. Although number of pods is economically best in determining the optimum plot size and shape, yield factor is considered to be the best for the purpose of identifying fertility contours and optimum plot size and shape.

Evaluation of statistical models for agroforestry systems

R. VEENA

2010

MAJOR ADVISOR : Dr. S. N. MEGERI

The study was conducted based on secondary data. The main objective of the study was to predict the yield of different tree species and agriculture crop. Here we have considered seven tree species namely *Azadirachta indica*, *Dalbergia latifolia*, *Prosopis cineraria*, *Ceiba pentandra*, *Terminalia bellarica*, *Mangifera indica*, *Tamarindus indica* and soybean as field crop in tree interspace. The required data was collected from AICRP (All India Co-ordinated Research Project) on agroforestry, UAS Dharwad. The different models were tried and the best two models were selected based on R^2 and Standard error value. The result indicated that Polynomial model, Sinusoidal model, MMF model, and Sinusoidal model were found better for the height of tree species in general. The best fitted model for Diameter of the above mentioned tree species were Gaussian model followed by Richards model, Gaussian model followed by

and Richards model, MMF model followed by Gompertz model, Gompertz model followed by Weibull model, MMF model followed by Gompertz model, Rational model followed by Gompertz model and MMF model followed by Gompertz model respectively. The yield of field crop (soybean, at 1m and 5m distance) was increased in the beginning i.e. up to five years and then declining trend was noticed. The best fitted model for soybean yield was Rational and Hoerl model for both 1m and 5m distance. The negative correlation between the yield and diameter, yield and height and positive correlation between height and diameter was noticed. Multiple regression also tried to find out the yield of field crop in relation to height, dbh and weather parameters. The step down procedure indicates the rain fall and temperature contributes more for the field crop.

Statistical investigation of price behaviour in chilli

VEERANAGOUDA GOUDRA

2010

MAJOR ADVISOR : Mr. Y. N. HAVALDAR

The present study was conducted to know the statistical investigation of price behaviour of chilli (*Capsicum annum* L.) in North . Chilli is one of the most important commercial spice crops of India. The information on price and arrival of chilli in Byadagi and Hubli market was collected for the period 1993-94 to 2008-09. The highest arrivals of seasonal indices in Hubli market were observed in February (287.4) and the lowest, in August (6.6). With regard to price indices of chilli, the highest price was recorded in January (110.23). In case Byadagi market, the highest arrivals of seasonal indices were observed in February (211.7) and the least arrivals in August and September (18.9). Whereas, the highest price indices were noticed in January (121.6) and lowest price indices in August (84.1). The critical analysis showed a gradual increasing trend in arrivals in both markets but the price of chilli in both markets exhibited mild up and down trend equation. The CGR in North showed a positive

growth rate with respect to area (13.70), production (13.88) and productivity (12.20) but, these values were non- significant at five percent level of significance. Districts wise analysis of area showed that the highest CGR was noticed in Belgaum (4.85) at ten percent level of significance and Haveri (0.65) at five percent level of significance. In case of production, the highest CGR was noticed in Belgaum (5.41). In case of productivity, the highest compound growth rate was noticed in Bidar (1.74) and Raichur (0.21) districts. The accuracy measures like MAPE and MSE are considered as the best models to forecast monthly arrivals and prices. Among all the models, ARIMA model was best with least MAPE and MSE values (for Hubli, arrivals 843.33, 671.22 respectively, for prices 233.42, 150.23 respectively and for Byadagi, arrivals 1023.5, 756.23 respectively, for prices 466.33, 256.33). The forecasted values from the ARIMA model were much nearer to the Actual values.

AGRONOMY**Response of hybrid pigeonpea [*Cajanus cajan* (L.) mill sp.] to planting geometry and fertility levels**

BHANU KUMAR MEENA

2010

MAJOR ADVISOR : Dr. U. K. HULIHALLI

A field experiment was conducted during *Kharif* season 2009 at Main Agricultural Research Station. University of Agricultural Sciences, Dharwad to study the response of hybrid pigeonpea to planting geometry and fertility levels. The experiment was laid out in factorial RBD design with three replications. The experiment consisted of nine treatment combinations of hybrid pigeonpea ICPH- 2671 with two factors, three planting geometry S_1 -60 cm x 30 cm, S_2 90 cm x 30 cm, S_3 90 cm x 45 cm, and three fertility levels F_1 25: 50 N, P Kg ha⁻¹ F_2 37.5: 75 N, P Kg ha⁻¹ F_3 50: 100 N, P kg ha⁻¹ respectively and pigeonpea variety Maruti (ICP-8863) with recommended packages of practices in control plot. The results revealed that the hybrid pigeonpea ICPH-2671 recorded significantly higher grain yield (24.04 q ha⁻¹) and the magnitude of yield increase was 41.7 percent higher as compared to variety Maruti (16.79 q

ha⁻¹). The yield parameters like grain weight per plant, number of pods per plant, grain yield q ha⁻¹ and growth parameters like number of primary and secondary branches per plant, leaf area index and dry matter accumulation were higher with hybrid pigeonpea ICPH-2671 compared to variety Maruti significant difference among the plant geometry and fertility levels treatment combinations with respect to growth and yield parameters were observed. The treatment combination S_3F_3 (90 cm x 45 cm + 50: 100 N, P kg ha⁻¹) recorded significantly higher grain yield (25.65 q ha⁻¹) and it was 42.8 percent higher than the control (16.79 q ha⁻¹). The growth and yield parameters were higher with S_3F_3 treatment combination compared to other treatment combinations. The study indicated that hybrid pigeonpea ICPH-2671 has better response to wider geometry and higher dosage of fertilizer help in getting better yields of pigeonpea.

Response of baby corn (*Zea mays* L.) to plant density and fertilizer levels

GULABRAO S. KOLE

2010

MAJOR ADVISOR : Dr. C. P. MANSUR

A field experiment was conducted at University of Agricultural Sciences, Dharwad, Karnataka to study the response of baby corn (*Zea mays* L.) genotypes to plant density and fertilizer levels under rainfed condition during *kharif* 2009. The experiment was laid out in randomized complete block design with three replications, constituting 12 treatment combinations involving three factors viz., two genotypes, (PEHM-2 and PC-4), two spacings (45 cm x 10 cm and 45 cm x 20 cm) and three fertilizer levels (150:75:40, 200:100:50, 250:125:60 kg N,P₂O₅ and K₂O ha⁻¹). Crop was harvested for green cob three days after silking. The baby corn genotypes Pusa Early Hybrid Maize-2 (PEHM-2) recorded higher cob yield with husk (1794 kg ha⁻¹) and cob yield (572 kg ha⁻¹) compared to Pusa Composite-4 (PC-4). Genotype PC-4 recorded significantly higher content of protein (12.33%), total carbohydrate (48.73%), non reducing sugar (0.309%) and total sugar (0.396%). Among the spacing, 45 cm x 10

cm recorded significantly higher cob yield (674 kg/ha), growth and yield attributes compared to 45 cm x 20 cm spacing. Whereas, the 45 cm x 20 cm spacing recorded significantly higher content of protein (12.24%), non reducing sugar (0.306 %), reducing sugar (0.071 %) and total sugar (0.394%). 250:125:60 N: P₂O₅:K₂O kg/ha recorded significantly higher cob yield with husk (1937 kg ha⁻¹), contents of quality, growth and organoleptic parameters viz., protein (12.68%), total carbohydrate (52.01 %), non reducing sugar (0.324 %), reducing sugar (0.075%) and total sugar (0.416%) compared to 200:100:50 N: P₂O₅:K₂O kg/ha. The significantly higher interaction for cob yield with husk (2291 kg ha⁻¹), cob yield (859 kg ha⁻¹), net returns (Rs. 42080 ha⁻¹) and benefit cost ratio (3.84) was obtained with baby corn genotype Pusa Composite-4 (PC-4) with 45 cm x 10 cm spacing along with 150:75:40 N: P₂O₅:K₂O kg/ha.

Studies on flooding duration on growth, yield and quality of sugarcane genotypes under simulated condition

K. JAGADISHA

2010

MAJOR ADVISOR : Dr. N. S. KAMBAR

A field experiment was conducted at Agricultural Research Station, Sankeshwar, University of Agricultural Sciences, Dharwad on medium black soil to study the effect of sugarcane genotypes and different flooding duration on growth and yield of sugarcane under simulated condition during *kharif* 2007. There were 8 treatment combinations consisting of two sugarcane genotypes viz., Co 94102 and Co 86032 and four flooding durations at 7, 14 and 21 days with one control (non-flooded) treatments were laid out in RCBD in three replications. There was no significant difference in cane yield and quality parameters of sugarcane genotypes due to various flooding durations. Both the genotypes

are found to be susceptible to the flood. This was indicated by reduced number of millable canes. Significantly higher cane yield and better quality parameters are recorded in control treatment and were on par with 7 days flood treatment. The cane yield and quality parameters are found to decrease, as the flood duration increase from 7 to 21 days. Physico-chemical properties were significantly deteriorated in all flooding duration compared to control. Nutrient status of the soil viz., nitrogen, phosphorus, potassium and calcium carbonate also significantly reduced in all flooding durations. Bacterial, fungal, actinomycetes population significantly reduced in 21 days flooding duration compared to 7 and 14 days flooding duration

Effect of spentwash and tillage on growth, yield and juice quality of sweet sorghum [*Sorghum bicolor* (L.) Moench]

MALLIKARJUN T. MALAGI

2010

MAJOR ADVISOR : Dr. S. S. ANGADI

A field experiment was conducted during *kharif* 2005 at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the effect of spentwash and tillage on sweet sorghum under rainfed condition. Results revealed that deep tillage recorded significantly higher grain yield (18.0 q/ha), green biomass yield (35.5 t/ha) and ethanol yield (769.6 l/ha) as compared to shallow tillage. The grain yield components, growth and juice quality parameters followed similar trend as that of yield. Among the different spentwash levels, application of 150 kg N per ha through spentwash recorded significantly higher grain yield (18.0 q/ha), green biomass yield (34.7 t/ha) and ethanol yield (750.2 l/ha) as compared to 75 kg N per ha through spentwash and control. The yield components, growth and juice quality parameters followed similar trend as that of yield. Similarly, soil properties with deep tillage recorded significantly higher soil moisture content (12.99%) and available N, P, K

and organic carbon content (0.638%) as compared to shallow tillage. Among spentwash levels control recorded significantly higher soil moisture content (12.95%). Similarly, significantly higher available soil nitrogen was recorded with 150 kg N per ha through spentwash (243.10 kg N/ha) compared to 75 kg N per ha through spentwash and control. Significantly highest available soil phosphorus was recorded with 75 kg N per ha through spentwash (49.57 kg P₂O₅/ha). The highest available soil potassium (1155.00 kg K₂O/ha) and electrical conductivity (0.595 dS/m) were recorded with 150 kg N per ha through spentwash. Similarly, higher organic carbon and microbial population was recorded with 150 kg N per ha through spentwash. The study indicated that deep tillage with 100 kg N per ha through spentwash was found to be suitable with respect to soil properties, yield, juice quality and higher net returns (Rs.21644.9/ha).

Efficacy of glyphosate and propaquizafop for control of *Cynodon dactylon* in cotton

PATIL PRNAVSINGH RAJU

2010

MAJOR ADVISOR : Dr. S. M. HIREMATH

A field experiment was conducted to study the efficacy of glyphosate and propaquizafop for control of *Cynodon dactylon* in cotton in vertisols at College of Agriculture, Dharwad during *kharif* 2009. The experiment was laid out in a split plot design with three replications. Treatment consisted of two main plots (cropped and fallow) and six herbicide treatments as subplots (glyphosate 4.5 kg/ha fb by glyphosate 4.5 kg/ha at 45 days intervals - H₁, glyphosate 4.5 kg/ha tank mix with propaquizafop 200g/ha fb glyphosate 4.5 kg/ha tank mix with propaquizafop 200 g/ha at 45 days interval - H₂, glyphosate 4.5 kg/ha pre-plant fb IC at 45,60, 90 days after sowing - H₃, glyphosate 4.5 kg/ha tank mix with propaquizafop 200g/ha pre-plant fb IC at 45,60,90 days after sowing - H₄, weed free check - H₅ and weedy check - H₆). Weedy check recorded the higher dry weight of *Cynodon*, other weeds and total

weeds in both cropped as well as fallow area whereas; lowest in weed-free check. Herbicide treatments H₁ and H₂ recorded lower dry weight in both cropped and fallow than H₃ and H₄. Density of weeds, weed control index, regeneration percentage of weeds and rhizome control efficacy followed the trend of weed dry weight. The higher seed cotton yield was obtained with H₅ (2055 kg/ha.) whereas, significantly lower seed cotton yield (201 kg/ha) was observed in H₆. The different herbicidal treatments viz., H₁, H₂, H₃ and H₄ were next in order in seed cotton yield to H₅. The economics of weed management practices indicated that application of glyphosate at 4.5 kg per ha alone (Rs. 21,062 /ha) or in combination with propaquizafop 200g per ha (Rs. 21,122/ha) followed by intercultivations at 45, 60 and 90 days after sowing resulted in higher net returns and B:C ratio (1.60).

Nitrogen management in hybrid maize (*Zea mays* L.) through leaf colour chart

PRASHANT H. SARNAIK

2010

MAJOR ADVISOR : Dr. G. B. SHASHIDHARA

A field study was conducted during *kharif* 2009 at Main Agricultural Research Station, Dharwad, to study the nitrogen management

in hybrid maize (*Zea mays* L.) through leaf colour chart. The experiment was laid out in split plot design with three replications. The treatments

comprised of leaf colour threshold values (LCC 3, 4 and 5) and N levels (0, 20 and 30 kg ha⁻¹) with two controls. The result revealed that, LCC-5 recorded significantly higher (77.49 q ha⁻¹) grain yield over LCC-4 (72.36 q ha⁻¹) and LCC-3 (60.19 q ha⁻¹). The magnitude of increase in LCC-5 yield over LCC-4 and LCC-3 were 7.09 and 28.74 % respectively. Among the N levels, 30 kg N ha⁻¹ recorded significantly higher (73.34 q ha⁻¹) grain yield over 20 and 10 kg N ha⁻¹ (70.42 and 66.28 q ha⁻¹, respectively). Application of 30 kg N ha⁻¹ per dressing by maintaining the leaf greenness

Evaluation of pre-plant and post emergent herbicides in chilli + onion + cotton intercropping system

RAJESH S. KALASARE

2010

MAJOR ADVISOR : Dr. RAMESH BABU

A field study was conducted during *kharif* 2009 at Main Agricultural Research Station, Dharwad, to study the evaluation of pre-plant and post emergent herbicides in chilli + onion + cotton intercropping system under rainfed conditions in black soils. The experiment was laid out in randomized block design with three replications. Among the weed control treatments, pre-plant application (PPA) of oxyfluorfen @ 0.15 kg ha⁻¹ + post-emergent application (POE) of oxyfluorfen @ 0.15 kg ha⁻¹ (POE) and hand weedings (HW) at 30 and 60 days after transplanting of chilli (DAT) and PPA of pendimethalin CS @ 650 g ha⁻¹ + POE of oxyfluorfen @ 0.15 kg ha⁻¹ and HW at 30 and 60 DAT recorded significantly higher chilli equivalent yield (74.3 q/ha and 65.8 q/ha, respectively) and also recorded higher weed control efficiency (91.17% and 89.36%,

up to 5 recorded significantly higher grain yield (81.97 q ha⁻¹) with a saving of 45 kg N over 150% RDN (76.27 q ha⁻¹) with an additional income of Rs. 8028 and Rs. 4260 per ha over 100 and 150% RDN. The growth and yield components and nitrogen uptake at 50% flowering and at harvest increased significantly by application of 30 kg N ha⁻¹ at LCC-5 as compared to all other treatment combinations. The gross returns (Rs. 74,795), net returns (Rs. 58,257) and B: C ratio (4.52) was significantly higher with LCC-5 with application of N @ 30 kg ha⁻¹ per dressing.

Fodder productivity and quality of amaranth genotypes under different row spacing and seed rate

P. A. SMITHA PATEL

2010

MAJOR ADVISOR : Dr. S. C. ALAGUNDAGI

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad in Northern Transition Zone (Zone 8) of Karnataka on clay soil to study the fodder productivity and quality of amaranth genotypes under different row spacing and seed rate under rainfed condition during *kharif* 2009. The experiment was laid out in split split plot design in three replications, with 18 treatment combinations involving two row spacing in main plot (30 & 45 cm), three genotypes in sub plot (Suvarna, GA-1 & SKNA-504) and three seed rates in sub-sub plot (2.0, 2.5 and 3.0 kg ha⁻¹). Fertilizer dose of 100:50:50 kg N, P₂O₅ and K₂O per ha was applied and crop was harvested for green forage at flower initiation stage. The forage quality parameters were analysed on whole plant dry matter basis by following the standard

procedure. The row spacing of 45 cm recorded significantly higher green forage yield (36.77 t ha⁻¹), higher dry matter yield (2.33 t ha⁻¹) and yields of all the quality parameters compared to 30 cm row spacing. Among the genotypes, Gujarat Amaranth-1 (GA-1) produced significantly higher green forage (37.64 t ha⁻¹), dry matter yield (2.59 t ha⁻¹) and contents and yield of quality parameters compared to Suvarna and SKNA-504 genotypes. Seed rate of 2.5 kg ha⁻¹ produced significantly higher green forage (36.30 t ha⁻¹), dry matter (2.33 t ha⁻¹) and higher yields of quality parameters compared to 3.0 kg ha⁻¹ seed rate. Significantly higher green forage yield (43.53 t ha⁻¹), dry matter yield (3.01 t ha⁻¹) and yield of quality components, net returns (Rs. 23410 ha⁻¹) and benefit cost ratio (3.53) can be obtained with genotype Gujarat Amaranth-1 (GA-1) in 45 cm row spacing at 2.5 kg per ha seed rate.

Response of sweet corn (*Zea mays* L. *saccharata*) to different sources of organics

B. R. WAGHMODE

2010

MAJOR ADVISOR : Dr. H. B. BABALAD

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2009-10 on clay loam soils to evaluate the response of sweet corn to different sources of organic manures and liquid organic manures. The experiment was laid out in a Split-plot design with three replications. The experiment comprised of six manurial treatments M₁, M₂, M₃, M₄, M₅, and M₆ as main plots and three liquid organic manures (S1- Bio-digester liquid @ 10%, S2- Panchagavya @ 3% spray, S3-Cow urine @ 10% and a control (S4) as sub-plots. The results indicated that both organic manures and liquid organic manures had significant effect on growth, yield parameters, quality parameters and nutrient uptake as well as nutrient status of the soil. Significantly higher sweet corn fresh cob yield (6254 and 6222 kg/ha) and stover yield (7.36 and 7.04 t/ha) was recorded with RDF and RPP treatments, respectively. Among the liquid organic manures *viz.*, bio-

digester liquid @ 10% spray, panchagavya @ 3% spray and cow urine @ 10% spray recorded significantly higher growth and yield parameters like number of leaves, total dry matter production, cob length, cob girth, number of cobs per plant, fresh and dry grain weight and fresh cob yield over control. Significantly higher fresh cob yield (5594 and 5262 kg/ha) and stover yield (5.41 and 5.67 t/ha) were recorded in the treatment receiving bio-digester liquid @ 10% spray and panchagavya @ 3% spray respectively over rest of the treatments. Significantly higher net returns (Rs. 21,990) was recorded in bio-digester liquid @ 10% spray over rest of the treatments. The interactions effects, RPP with bio-digester liquid @ 10% spray resulted significantly higher fresh cob yield (7067 kg/ha) and net returns (35,250 Rs./ha) and GLM + EC + VC (top dressing at GGS) with cow urine @ 10% spray which was found on par.

AGRICULTURAL BIOCHEMISTRY

Biochemical efficacy of homa organic farming in soybean crop

KUMARI NAMRATA

2010

MAJOR ADVISOR : Dr. P. W. BASARKAR

A field experiment laid out in completely randomly block design with eight treatments exposed to Homa atmosphere replicated thrice was conducted during *kharif* 2009 to study the Biochemical efficacy of Homa Organic Farming in soybean crop (JS 335) by creating Homa atmosphere. The conventional control (CC) and control without Homa (CWH) were maintained 1 km away. Basal treatment to all the Homa treatment (HT) seeds was fresh cow dung and cow urine. Agnihotra Homa (AH) at sunrise and sunset and Om Tryambakam Homa (OTH) performed for 3-4 h daily yielded smoke and ash. Homa ash was used for seed treatment and for furrow application. A special bio-digester, Biosol prepared contained AH

ash and was used for soil and foliar application. The OTH ash as seed treatment and foliar application of Biosol was superior in parameters like maximum plant height, dry matter accumulation (DMA) in leaves, grain and straw yield and 100 seed weight. Homa treatment increased grain yield (5-6 % over CC and 20-26 % over CWH). The AH ash as seed treatment with Biosol as soil application was significantly superior over control in case of DMA in stem, total biomass per plant, number of pods per plant, nodule count and nodule dry weight wherein Homa ashes and Biosol as furrow application increased nodule count by 55-105 per cent over CC and 106-180 per cent over CWH. The macro and micro nutrients

increased in soil with furrow application of both the Homa ashes and Biosol. Soil Zn content and dehydrogenase activity increased (151% and 233%, respectively) over control with soil application of AH ash and Biosol. Rust incidence and insect attack was significantly low (10-30 %) with foliar application of Biosol which was superior over furrow application

of Homa ashes and Biosol. Total protein and oil content increased on HT and activities of α -amylase and invertase in soy seeds on soil application of Biosol were superior. Homa smoke, ashes and Biosol thus show promise to the farming community to produce disease free healthy crops with good returns.

CROP PHYSIOLOGY

Seed hardening techniques to improve drought tolerance in rainfed wheat (*Triticum aestivum* L.)

CHIKKAPPAIAH

2010

MAJOR ADVISOR : Dr. C. M. NAWALAGATTI

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during rabi 2008 to study the influence of seed hardening techniques to improve drought tolerance in rainfed wheat (*Triticum aestivum* L.) on various morpho-physiological, biochemical, biophysical traits, yield and yield components in wheat var. Bijaga yellow. The experiment was laid out in randomized block design with three replications. The experiment consisted of nine treatments viz., water soaking, CaCl_2 , cycocel and two nutrients KCl, KNO_3 . Significant differences were observed for various morpho-physiological, biochemical and yield and yield attributes due to seed hardening techniques, use of growth retardant and chemicals. Significant increase in plant height, dry matter in leaf, stem and reproductive parts and total dry matter content was noticed due to treatments as compared

to control, whereas plant height was decreased with the application of CCC (500 and 1000 ppm). The growth parameters viz., LAI, AGR, CGR, RGR, NAR, SLW, LAD and BMD increased significantly due to seed hardening with CCC (500 and 1000 ppm) and KNO_3 (1 and 2%). The biochemical parameters viz., total chlorophyll content, nitrate reductase activity and proline content increased significantly due to seed hardening with cycocel (500 and 1000 ppm) and KNO_3 (1 and 2%). Seed hardening with cycocel (500 and 1000 ppm) also recorded significantly higher seed yield followed by KNO_3 (1 and 2%) and the increased yield was due to higher number of spikes per plant, grain yield per plant and test weight. From the point of economics, seed hardening with cycocel (1000 ppm) was more effective and economical in increasing the yield and also the net returns.

Influence of plant growth regulators on growth, physiology and yield in cucumber (*Cucumis sativus* L.)

MERENTOSHI MOLLIER

2010

MAJOR ADVISOR : Dr. M.B CHETTI

A field study was conducted during rabi 2009-10 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the influence of plant growth regulators on growth, physiology and yield in cucumber (*Cucumis sativus* L.). The experiment was laid out in randomized block design with nine treatments and three replications. The treatments consisted of two growth promoters viz., gibberellic acid (50 and 100 ppm), naphthalene acetic acid (50 and 100 ppm), a retardant CCC (250 and 500 ppm), salicylic acid (500 and 1000 ppm) and a control. Results revealed that the application of plant growth regulators significantly increased morpho-physiological traits viz., vine length, number of leaves and number of female flowers per plant as compared to control. Growth parameters viz., leaf area, LAI, AGR, RGR, CGR, NAR, LAD, SLW and BMD were also influenced by the application of plant growth regulators.

The biochemical parameters viz., chlorophyll content (Ch a, Ch b and total chlorophyll), Nitrate Reductase Activity (NRA) and sugar content (reducing, non-reducing and total sugars) increased significantly due to the application of plant growth regulators. Application of growth regulators increased leaf dry weight and reproductive dry weight and total dry weight significantly and total dry weight showed a positive correlation with yield. All the yield contributing characters viz., fruit length, fruit diameter, percent fruit set, number of fruits per plant and fruit yield increased significantly due to plant growth regulators. The fruit yield was significantly higher with the foliar application of GA₃ (50 ppm) followed by CCC (500 ppm) compared to control. The economics of using different growth regulators revealed that the B : C ratio was maximum with NAA (100 ppm) followed by GA₃ (50 ppm).

Influence of plant growth regulators on growth, physiology, yield and quality of soybean (*Glycine max* (L.) Merrill)

RAKSHA SHINDE

2010

MAJOR ADVISOR : Dr. C. M. NAWALGATTI

A field experiment was conducted during kharif, 2009 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the growth, physiology, yield and quality of soybean (*Glycine max* (L.) Merrill) as influenced by plant growth regulators (PGRs). The experiment was laid out in factorial randomized block design replicated thrice with different plant growth regulators viz., Prodigb (20, 40 and 60 ppm), CCC (500 and 1000 ppm) and TIBA (100 and 200 ppm) as foliar spray, with two varieties (KHSb-2 and JS-335). The PGRs viz., cycocel and TIBA decreased the plant height whereas, Prodigb increased it significantly. The number of branches increased significantly with PGRs. The application of PGRs hastened the days for flower initiation. The growth regulator treatments significantly increased leaf dry weight, dry weight of stem, reproductive parts and total dry weight. The growth

parameters viz., leaf area, LAI, LAD, SLW, BMD, CGR, AGR, RGR and NAR increased significantly due to PGRs. The cycocel was effective in increasing CGR, SLW and BMD whereas, Prodigb was very effective in increasing in leaf area, LAI and LAD. Biochemical parameters viz., chlorophyll 'a', chlorophyll 'b', total chlorophyll content and NRA were significantly higher with the application of CCC (500 ppm). Seed oil content was found to be superior with the application of PGRs. The seed yield plant⁻¹, number of seeds plant⁻¹, number of pods plant⁻¹ and 100 seed weight increased significantly due to growth regulators. The application of CCC (500 ppm) recorded significantly highest seed yield in both the genotypes followed by Prodigb (60 ppm) and TIBA (100 ppm). From the economic point of view, CCC (500 ppm) was more profitable in terms of net returns.

Physiological studies on weed control efficiency in brinjal (*Solanum melongena* L.)

SANKET S. MANE

2010

MAJOR ADVISOR : Dr. B. B. CHANNAPPAGAUDAR

A field experiment was conducted during summer season of 2009 to study the physiological aspects on weed control efficiency (WCE) in brinjal (*Solanum melongena* L.) at University of Agricultural Sciences, Dharwad. The experiment was laid out in randomized block design with ten treatments consisted of four herbicide treatments at two different concentrations with weed free check and unweeded control and replicated at three times. Results revealed that the application of butachlor and pretilachlor @ 1.5 kg a.i. ha⁻¹ were found to be phytotoxic while pendimethalin @ 1.0 and 1.5 kg a.i. ha⁻¹ was found not phytotoxic. The number of monocots, dicots, total number and total dry weight of weeds were found to be maximum in unweeded control and pendimethalin @ 1.5

kg a.i. ha⁻¹ decreased these parameters. WCE was highest with the pendimethalin @ 1.5 kg a.i. ha⁻¹. The morpho-physiological characters and total dry matter accumulation were found to be lowest in unweeded control and application of pendimethalin @ 1.5 kg a.i. ha⁻¹ increased all these parameters. The growth parameters viz., leaf area, LAI, AGR, CGR, NAR, LAD, SLW and BMD were significantly lower in unweeded control while the application of herbicides increased these parameters, pendimethalin @ 1.5 kg a.i. ha⁻¹ recorded highest. The biochemical parameters viz., chlorophyll content, NRA decreased significantly due to crop weed competition in unweeded control. The yield parameters viz., fruit length, fruit diameter, number of fruits and fruit yield decreased

significantly in unweeded control while weed index was higher. The fruity yield was significantly higher with application of pendimethalin @ 1.5 kg

a.i. ha⁻¹. The economics of experiment revealed that the B:C ratio was maximum with pendimethalin @ 1.5 kg a.i. ha⁻¹.

Studies on improvement of shelf life of onion (*Allium cepa* L.) var. Arka Kalyan

SANTOSH RATHOD

2010

MAJOR ADVISOR : Dr. B. S. JANAGOUDAR

The field experiment was conducted at MARS, UAS, Dharwad during kharif 2009 to study the effect of different sources of organics, fertilizers and chemical spray on growth and storage life of onion (*Allium cepa* L.) var. Arka Kalyani. The experiment consisted of main plot treatments - chemical spray, sub plot treatments – organics and sub-sub plot design with three replications. The plant morphophysical characters were recorded at various stages of growth. Significant influence on all growth parameters like plant height, number of leaves, root length, neck diameter, leaf dry matter and bulbs were observed with application of Vermicompost, ammonium sulphate and SOP. Among organics, vermicompost found superior over FYM. Among the sources of nitrogen, ammonium sulphate was found superior to urea. Among the potassium sources, SOP was superior with respect to the yield and yield attributing

characters like fresh bulb weight, bulb diameter, bulb yield and including TSS, rotting bulbs. Similar results were observed due to application of vermicompost and ammonium sulphate as a nitrogen source. Different sources of organics, potassium and nitrogen influenced the shelf life of onion during storage. Potassium sources were non-significant with respect to storage loss, however, TSS was higher in SOP than MOP. Among different nitrogen sources, urea showed highest storage losses due to rotting and sprouting as compared to ammonium sulphate. Whereas, TSS were highest in ammonium sulphate as compared to urea. The morphological characters like plant height, number of leaves, neck diameter, root length, leaf dry matter and bulbs were higher in treatments with application of vermicompost, SOP and ammonium sulphate. Similarly, shelf life of onion was enhanced in these treatments. Chemical spray did not influence growth parameters significantly.

FOOD SCIENCE AND NUTRITION

Impact of shift work on nutritional status, lifestyle and health status of shift workers

CHITROTPALA DEVADARSHINI

2010

MAJOR ADVISOR : Dr. (Mrs.) B. KASTURIBA

A study entitled "The Impact of Shift Work on Nutritional Status, Lifestyle and Health Status of Shift workers" was carried out during 2009-2010 at various software industries in Bhubaneswar, Orissa. The objectives of the study were to assess the nutritional status and life style in shift workers to document their health problems. A total of 70 subjects in the age group of 22-33 years, belonging to software profession were considered for the study, with 34 shift workers and 36 permanent day workers. Information on nutritional status, food habits, lifestyle, health status were collected by a structured and pre-tested questionnaire. Results showed that, majority of the day workers (41.7%) were having ideal BMI, whereas, 55.9 per cent shift workers were in obese grade I group. Analysis of diet survey revealed no significant difference in the intake of food as well as nutrients between the day and shift workers. Tobacco consumption and

alcohol consumption was significantly higher in shift workers. Higher consumption of sweet drinks, sweets, baked products, fried items, fast foods and higher frequency of missing meals were found in shift workers than day workers. Gastrointestinal complaints including loss of appetite, indigestion, abdominal bloating was two to three times more frequent in shift workers than day workers. A significant difference was observed with regard to fasting blood sugar in day (91.84 mg/dl) and shift workers (97.10 mg/dl). Higher levels of serum total cholesterol (195.33 mg/dl), triglycerides (159.65 mg/dl), LDL cholesterol (125.48 mg/dl) were observed in shift workers than day workers (total cholesterol 173.43 mg/dl, triglycerides 150.08 mg/dl and LDL-cholesterol 114.17 mg/dl). Low HDL cholesterol was observed among shift workers (39.62 mg/dl) than day workers (44.96 mg/dl).

Optimization of process and development of premix of traditional sweet snack *Anaras*

GANGAMMA S. NINGANAGOUDAR

2010

MAJOR ADVISOR : Dr. (Mrs.) NIRMALA B. YENAGI

India has a versatile cultural heritage of traditional food. All most all traditional foods are regional specific. The documentation of traditional food system is urgent because the knowledge of harvesting and food preparation is fast disappearing. The present study was undertaken to standardize the ready-to-eat fried snack *Anaras* for method of preparation, its quality evaluation and to develop instant mix as a convenient premix to meet the market demand of the product. *Anaras* is a deep-fat fried sweet prepared from partially fermented rice flour with jaggery. A survey was done to document marketing of traditional homemade convenient ready-to-eat grain based snacks (cereals and pulses) and instant mixes from women enterprenures. General information of traditional method of preparation, raw ingredients used, and processing methods was collected

from households who were knowing the method of preparation. *Anaras* was optimized for methods of processing of flour, proportion of jaggery addition and frying temperature. The ideal traditional method of preparation of ready-to-eat *Anaras* was use of bold rice flour (three days soaked) with addition of jaggery in the proportion of 1:1.50 and frying the product at 180-185°C. The optimized ready-to-eat *Anaras* was prepared by different types of rice (Bold and Fine) and little millet (White and Black) flour and evaluated for product quality. Mean organoleptic scores of *Anaras* prepared with bold rice was higher and lower for both millet varieties. The instant mix stored in polythene covers showed the decreased moisture content (30.25% to 24.73%) and increased free fatty acids (0.393% to 0.439%) and the shelf life of developed instant mix was for seven days.

Standardization and characterization of value added ash gourd (*Benincasa hispida*) ready-to-serve beverage

GEETA KPALESHWAR

2010

MAJOR ADVISOR : Dr. (Mrs.) UMA KULKARNI

Considering the therapeutic values of ash gourd (*Benincasa hispida*), the present investigation was carried out with the objectives to document the availability and utility of ash gourd and its products, as well as to develop the acceptable ash gourd Ready-to-Serve (RTS) beverage. Matured green fruits were available in varied size, length, breadth and circumference. *Sandige* was the only product available in the retail outlets of Dharwad city, which was packed and procured from the local cottage industries and self help groups. Ash gourd juice was provided in the Ayurvedic Health Care Centres for obesity, nausea, acidity and epilepsy. At household level, the fruit was utilized for the preparation of dehydrated product *Sandige*, both in urban and rural sectors of Dharwad. The fruit composed high moisture and low protein, fat, carbohydrates, total minerals and

crude fibre. The ash gourd residue had high moisture, crude fibre and low mineral matter. The ash gourd juice was unstable beyond two hours at ambient temperature (28±2°C). The developed RTS beverage with salt and pepper was bottled, refrigerated (5±2°C), studied for changes in the quality during storage of three months. The stored RTS beverage was organoleptically acceptable and microbiologically safe up to 60 days. As storage period continued, RTS beverage turned sour with decline in sensory scores. The total soluble solids, acidity and reducing sugars increased, while ascorbic acid and total sugars decreased at the end of storage. Thus availability and utility of the ash gourd fruit can be enhanced by standardization and characterization of value added RTS beverage which can be effectively stored at refrigerated conditions.

Minimal processing of green leafy vegetables

JYOTHI B. REDDY

2010

MAJOR ADVISOR : Dr. (Mrs.) PUSHPA BHARATI

An investigation was carried out on minimal processing of green leafy vegetables. Effect of packaging materials, pretreatments, storage conditions in extending shelf life and its effect on ascorbic acid of rajagira, kiraksali, fenugreek and shepu was ascertained. Polypropylene pouches of 150 gauge with vents for rajagira was LDPE pouches for fenugreek leaves with tender stem extended shelf life upto six and four days respectively with 84.36, 85.46 per cent moisture; 21.01, 1.12 per cent PLW; 9.01, 9.42 per cent decayed amount respectively. LDPE and polypropylene 100 gauge extended shelf life of kiraksali with tender stem upto four days with 84.01, 82.72 per cent moisture; 2.06, 2.09 per cent PLW and 1.03, 13.1 per cent decayed amount respectively. Shelf life of shepu with tender stem was three days when packed in polypropylene 150 and 100 gauge with 86.61, 88.58 per cent moisture, 1.29, 1.53 per cent PLW and 5.89, 7.02 per cent decayed amount respectively. Dipping

solutions were inefficient in extending shelf life of GLVs. Under refrigerated conditions, the shelf life of rajagira was 26 and 17 days when packed in polypropylene of 100 gauge and 150 gauge with vents respectively with 69.05, 72.08 per cent moisture; 8.89, 15.78 per cent PLW; 11.16, 8.05 per cent decaying; 6.91 per cent ascorbic acid retention. Shelf life of fenugreek and kiraksali in LDPE pouches was six and eight days with 84.41, 82.82 per cent moisture; 1.35, 0.74 per cent PLW; 3.06, 13.55 per cent decayed amounts 11.52 and 8.64 per cent retention of ascorbic acid respectively. Kiraksali packed in 100 gauge PP, shepu in 100 and 150 gauge PP and stored in refrigeration had shelf life of seven days with 80.09, 80.32, 84.06 per cent moisture; 2.5, 2.84, 2.89 per cent PLW; 11.25, 17.56, 12.04 per cent decaying and 11.52, 8.64, 8.64 per cent ascorbic acid retention respectively.

Bioaccessibility of iron and zinc from green leafy vegetable based products

MADHU V. PATTED

2010

MAJOR ADVISOR : Dr. (Mrs.) PUSHPA BHARATI

A study was conducted on bioaccessibility of iron and zinc from Green Leafy Vegetable (GLV) based products in the year 2008-2009 with the objective to analyze the bioaccessible iron and zinc in selected products and to study the effect of acidulants and cooking utensils on the bioaccessibility. Bioaccessibility was estimated using modified protocol of Luten *et.al.*, (1996). Moisture, ash and pH of selected products varied significantly. Total iron and zinc contents ranged from 12.20-19.30 and 1.50- 2.60 mg/100g in soaked and cooked *bhajis*, 7.60-14.05 and 2.00mg/100g each in baked chapathis, 6.88-10.90 and 2.00-2.10mg/100g in deep fried products, 7.51-11.30 and 1.90mg/100g each in cooked and seasoned products respectively. Spinach dhal contained 9.75 and 2.7 mg/100g of total iron and zinc respectively. Whereas, per cent bioaccessible iron and zinc ranged from 5.53-9.83; 46.66-78.42 per cent respectively. Acidulants commonly employed in Indian culinary viz lime juice, tomato, raw mango

powder, tamarind were used to enhance acidity of selected products. Moisture, ash and pH varied significantly on addition of acidulants. Addition of lime juice to fenugreek *bhaji* augmented bioaccessibility of iron significantly from 5.53 to 16.17 per cent. Incorporation of tomato puree in shepu dalvada resulted in highest per cent increase (5.87 to 7.49). Utensils viz hindalium, teflon coated and iron ware were used for cooking to know the effect on bioaccessibility of minerals. Products when cooked in different metallic utensils varied significantly with respect to moisture, ash and pH. Total and bioaccessible iron increased significantly when cooked in iron utensil. Hence, it can be concluded that processing methods like soaking and boiling will help in partial elimination of anti-nutrients and help to increase the bioaccessible mineral contents of the products, addition of acidulants enhances the bioaccessibility of minerals. Use of traditional iron utensils for cooking augments quantitative and qualitative iron in the products.

Development and quality evaluation of barnyard millet (*Echinochloa frumentacea* Link) flakes

RAJESHWARI LENKANNAVAR

2010

MAJOR ADVISOR : Dr. (Mrs.) BHARATI V. CHIMMAD

Barnyard millet is important underutilized minor millet. An investigation was undertaken to explore barnyard millet for development of breakfast cereals, evaluate physico-chemical, sensory and storage quality in the Department of Food Science and Nutrition, University of Agricultural Sciences, Dharwad. The colour, size, weight, volume, bulk density, expansion ratio, texture, water absorption and solubility index were measured by standard methods. The millet grain was lighter than corn with 'L', 'a' 'b' values of 76.33 to 78.31, 1.90 to 7.48 and 15.96 to 19.24, respectively. Thousand grain volume was 1.90 ml and 162.5 ml and weight was 2.50 g and 206.7 g with a bulk density of 1.32 g/ml and 1.27 g/ml for millet and corn grain. Moisture, protein fat, total mineral, carbohydrate, dietary fiber content ranged between 8.66 to 10.18, 10.52 to 5.77, 3.25 to 0.75, 2.02 to 0.53, 68.76 to 72.90 and 12.66 to 10.40 per cent. Iron

and copper content were high 11.60 and 0.23 mg/100g and 8.00 and 1.50 mg/100g, respectively. The hot process extruded flakes were exhibited chromatic components of 79.49, 2.94 and 14.67 and texture was 4095.52 g force. Water absorption index was 4.41 and solubility index 8.44 per cent. Millet flakes recorded moisture 1.47, protein 5.10 and carbohydrate 78.16, dietary fiber 13.40. The millet flakes were highly acceptable even after storage period of two months. The rolled flakes were small 3.91g and 7.00 ml per thousand flakes and exhibited color values of 75.56, 2.16 and 15.33. The flakes recorded moisture 9.59, protein 6.44, fat 1.67 and carbohydrate 70.06 per cent. Various traditional and novel products such as *avalakki/poha*, *payasam*, *kheer*, *halwa*, pudding and drink from rolled millet flakes were highly acceptable. Ready to use mix of carrot millet kheer exhibited shelf life more than four months.

Dehydration of green leafy vegetables and its effect on quality

R. RAJESHWARI

2010

MAJOR ADVISOR : Dr. (Mrs.) PUSHPA BHARATI

Green leafy vegetables (GLVs) are highly perishable but can be preserved by various methods including dehydration which is eco-friendly and easily adoptable. An investigation was undertaken to study the dehydration of GLVs (amaranthus, fenugreek, shepu and gpgu) and its effect on quality. Cabinet drier and microwave oven (900 MHz) were used for dehydration of. Blanching (2min), sulphitation (3% sodium bisulphate for 1min), blanching + sulphitation were the pretreatments employed before dehydration. Untreated GLVs served as control. Among the GLVs highest edible portion was registered by gogu (127.6g). The GLVs required less time (2-3h) to dry completely at 60°C compared to 40 and 50°C. Drying rate was faster in cabinet dried gogu and microwave dried shepu. Untreated shepu leaves required less time of 1.24h to dry and registered higher yield, lower moisture and physiological loss in weight (14.03, 3.67

& 85.97% respectively) and rehydration ratio of 4.89 compared to all pretreated leaves. Blanched fenugreek dried in cabinet possessed higher protein (33.22%), microwave dried blanched fenugreek had 23.34 per cent of ash. Cabinet dried untreated amaranthus, fenugreek and shepu possessed significantly higher calcium (296.14, 264.97 & 277.22mg/100g respectively). Blanched, cabinet dried amaranthus and microwave dried fenugreek showed to contain higher iron (56.21 & 54.13mg/100g respectively). Unblanched gogu had higher dietary fiber content (Total-48.8; Soluble-8.0; & Insoluble-40.8mg/100g respectively). Chlorophyll content was found to be higher in cabinet dried shepu (58.23%) and microwave dried amaranthus (92.81%). Cabinet and microwave oven dried unblanched and blanched GLVs stored under ambient condition (27°C,

52%RH) showed that the moisture content doubled at the end of storage and rehydration ratio decreased. Unblanched, dried amaranthus was accepted

by 98 per cent of the consumers, of which 92 per cent were willing to purchase if made available in the market.

Documentation of pickles and development of dehydrated mango pickle mix

RASHMIS. BULLA

2010

MAJOR ADVISOR : Dr. (Mrs.) USHA MALAGI

Pickle is one of the oldest, and most successful method of food preservation known to human. The study was undertaken to document the pickles from seven states (n=70) and develop dehydrated mango pickle mix using three pickling varieties of mangoes grown in UAS Dharwad. About 93 types of pickles, three types of convenience spice mixes were documented from seven states. Dry forms of pickles viz., mango and lime were documented from Karnataka, Gujarat, Punjab and Kerala. An experiment was performed to standardize a process for the development of ready to use dehydrated sweet and spicy mango pickles using three varieties of mangoes. The organoleptic evaluation revealed that the dehydrated sweet pickle made from Dharwad local 2 variety was found to be most acceptable. The standard procedure for development of dehydrated

sweet and spicy pickle were curing in salt (10%), dehydration at 60°C for 2h, mixing of spices and drying for half an hour, mixing with oil and packing in 300 gauge LDPE pouches. The developed dehydrated sweet mango pickle did not show significant change in any of the sensory parameters after six months of storage except for the color which changed from bright to dark. The TSS of dehydrated sweet pickle remained constant (8°Brix). Increase in pH (2.68 to 3.06), moisture (22.49 to 24.16%) and microbial count (yeast and bacteria) was observed whereas, ascorbic acid, titrable acidity and ash content decreased (82.10 to 11.70 mg/100g, 2.93 to 1.79 mg/100g and 4.85 to 4.53 % respectively) at the end of six months storage. The developed sweet pickle was found to be acceptable by the consumers.

Documentation of traditional convenience foods of north Karnataka

SAVITA ISHWARAPPAGOL

2009

MAJOR ADVISOR : Dr. BHARATI V. CHIMMAD

Documentation of traditional convenience foods of North was conducted across hilly, transitional, coastal and dry zones (urban and rural) during 2008-09, methods, modification, seasonality and factors influencing of traditional convenience foods preparations were collected through personnel interview and participatory rural appraisal techniques from middle income families (240). Market survey of food shops of Dharwad was carried out to document the traditional convenience foods, purchase preference among different populations. Nutrient composition of selected traditional convenience foods available in Dharwad market was undertaken using Annapurna software. The study revealed that 162 traditional convenience foods (106 ready-to-eat and 56 ready-to-use) documented across the regions more among urbanites (134) compared to rural group (81). Cereal based foods dominated (60) the category (ready-to-eat 32, ready-to-use 28). It was observed that the traditional convenience foods actually prepared (rural 81 and urban 64) were less

than the documented (rural 131, urban 134). It was evident that high school attended respondents, housewives not employed generally prepared more convenience foods. Family size, type and number of generations living together negatively influenced the preparation of traditional convenience foods. There were 70 traditional convenience foods in the market. Nutrient computation revealed that Shenga laddu provided highest calories (189 Kcal) roasted groundnut highest protein and fat (6.87 g and 13.35 g) ragi laddu highest calcium (89.35 mg) and rice flakes chivda highest iron contents (10.15 mg) per serving. Modifications in terms of ingredients, methods of preparation were observed for sensory quality, convenience, economy and variety. Thus the study documented a vast range of traditional convenience foods across the different zone of North. Some of which are available in the market. There is a scope for introducing various traditional convenience foods into the market for various reasons.

Development and evaluation of popped sorghum breakfast cereal for nutrient adequacy

SHAHEEN JANVEKAR

2010

MAJOR ADVISOR : Dr. NIRMALA B. YENAGI

Popping of cereals is a well known traditional method of processing. It is a simple and least expensive method to obtain ready-to-eat products. Popped sorghum being pre-cooked, ready-to-eat material can be used in snack food or specialty foods. In the present investigation popped sorghum based ready-to-eat breakfast cereal was developed and evaluated for its nutrient adequacy. A market survey was conducted to document the availability of different types of breakfast cereals in Dharwad. A popular sorghum grain cultivar "Mugad local" was used for the entire study. Ready-to-eat popped sorghum was enriched for aesthetic and protein quality by addition of food ingredients such as jaggery, popped amaranth, nuts mixture and raisins and evaluated for, nutrient adequacy, storage quality and consumer acceptability. The survey results revealed Ready-to-use (RTU), Ready-to-eat (RTE) and Ready-to-cook (RTC) were the three

types of breakfast cereals available in the market. *Maida* and *avalakki* were the most commonly available RTU breakfast cereals followed by puffed rice, *idli* rava, Bombay rava, *kesari* rava. Kellogg's was the most popular brand among RTE breakfast cereal with many varieties. *Rava*, *idli*, *upma*, *dosa*, *uttappam* and oats were the RTC breakfast cereals available in different brands. The nutrient adequacy of RTE and RTC breakfast cereal was better than RTU. The popped sorghum breakfast cereal was highly acceptable by the consumers and organoleptically acceptable during the one month storage. The developed breakfast cereal was on par with the market breakfast cereals with respect to proximate composition and organoleptic acceptability. It provided 10.30 per cent dietary fiber hence it can definitely enter the market as a whole grain ready-to-eat breakfast cereal.

Formulation of little millet (*Panicum miliare*) based composite mix and its quality evaluation

SHAILA KURAHATTI

2010

MAJOR ADVISOR : Dr. (Mrs.) PUSHPA BHARATI

The present investigation was undertaken in the Department of Food Science and Nutrition, University of Agricultural Sciences, Dharwad. Composite mixes were developed using little millet or cereals (wheat, rice and sorghum), pulses (green gram dhal and bengal gram dhal), oilseed (peanut) and green leafy vegetables (amaranthus or chakramuni) by employing roasting and dehydration techniques. Out of six formulations tried four mixes had amaranthus or chakramuni leaves and two contained garden cress seeds. The formulated mixes were tested for physical characteristics, nutrient composition, *In vitro* Protein Digestibility (IVPD), *In Vitro* Starch Digestibility (IVSD) acceptability and shelf life mix in aluminium laminated pouches for a period of six months at ambient temperature. Higher proportion of particles (59.89-72.82) in all six formulations were of 180-250µ. Little millet mixes had significantly

higher swelling power (4.77-5.44g/g) and dispersability (78.15-79.25%). Multigrain mixes possessed higher moisture (5.67%), protein (14.85%) and ash (2.14%) compared to little millet based mixes (5.58, 13.79 and 2.03%). Crude fat (7.60%), carbohydrates (70.12%) and energy (404 Kcal) content were higher in little millet based mixes. Amaranthus incorporated mixes had higher iron content (6.61-8.76mg/100g). Multigrain mix with amaranthus had better IVPD (70.4%) and IVSD (115.56mg glucose/g). Little millet based mix possessed higher total (16.55%) and insoluble (11.25%) fiber, while multigrain mix had higher soluble fiber (6.45%) Little millet mix had excellent shelf life to 60 days, while multigrain mix had storage life of 105 days with better sensory scores. Though there was increase in moisture and peroxide value during storage, the increase was within the permissible limits of BIS (10% and

10meq/kg fat respectively). Little millet mix with amaranthus leaf powder was highly appreciated in the form of *thalipattu* and laddu by a panel of

judges. It can be concluded that little millet can be utilized in the form of composite mix similar to multigrain mix.

Nutrition educational intervention regarding consumption of whole grains in the management of diabetes

SOUMYA BERANJE

2010

MAJOR ADVISOR : Dr. (Mrs.)NIRMALA B. YENAGI

The study on nutrition educational intervention regarding consumption of whole grains in the management of diabetes was conducted in Dharwad city in 2009-2010. The knowledge and practice of use of whole grains in the management of diabetes was assessed in 109 type 2 diabetics of different economic status including both genders. An educational material (booklet) on whole grains in the management of diabetes was developed in both English and Kannada having different lesson plans related to structure of whole grains, distribution of nutrients, processing of grains, important cereals and pulses for the effective management of diabetes, advantage of consumption of whole grains and whole grain recipes. The nutrition educational intervention was conducted on 35 sub-samples for a period of three months. The per cent knowledge score of selected diabetic subjects ranged from 3.70 to 56.00. More than 88.00 per cent of the subjects had their knowledge score less than 50.00 per cent. Majority of diabetic subjects had moderate knowledge level

(36.70%) followed by low (32.10%) and high knowledge level (31.20%). The practice regarding consumption of whole grains was satisfactory in majority of subjects (41.3%). Knowledge and practice of the diabetic subjects were associated with age, education, income and duration of disease. A significant improvement in knowledge score of diabetic subject between 70-90 category was increased from 5.70 to 28.60 per cent. A significant improvement in knowledge scores was in the high knowledge level after the intervention was from 22.90% to 43.00%. Thus showing the effectiveness of nutrition educational intervention. The mean practice score before intervention was 38.77 and after the intervention was 47.57 hence, the improvement in practice was by 8.80 units which was significant and after intervention good practices were adopted. Thus study concludes that nutrition educational intervention can be effective measure for bringing about favorable and significant changes in knowledge and practice of diabetic subjects.

Development and value addition to barnyard millet (*Echinochloa frumentacea* Link) cookies

UMA BALLOLLI

2010

MAJOR ADVISOR : Dr. (Mrs.) BHARATI V. CHIMMAD

Barnyard millet (*Echinochloa frumentacea* Link) is a nutritious minor millet. An investigation was undertaken to develop value added barnyard millet cookies. Barnyard millet flour recorded higher proportion of coarser particles and high water holding capacity (2.69 g/g) than refined flour. Standardization trials indicated that incorporation of barnyard millet flour could be incorporated at 60 per cent in the standard recipe, to yield acceptable cookies with low trans-fats (0.13%). Highly acceptable value added cookies were developed with nutraceutical ingredients such as linseed, soy, cocoa, chocolate, dry fruits nuts and garden cress seeds. Value added barnyard millet cookies were nutritionally superior than control cookies. Chrome values of the cookies differed significantly. Wide variations in physical characteristics of the cookies were noted. Average weight, thickness, diameter, volume and spread ratio of cookies ranged from

14.75 to 16.16 g, 0.72 to 0.88 cm, 5.95 to 6.66 cm, 14.33 to 21.00 ml and 6.82 to 9.25, respectively. Among the value added cookies garden cress seeds incorporated for iron enriched recorded higher iron (21.21%), dietary fibre (9.34%), energy (483 Kcal) and manganese (145.45 mg/100 g) content, besides exhibiting high sensory quality and excellent texture (3393.00 g force). It exhibited shelf-life of more than 120 days without apparent increase in moisture and peroxide values. Control cookies could be stored for 75 days whereas plain millet cookies were storable only for 45 days. Consumer acceptability tests of iron enriched barnyard millet cookies revealed acceptability by more than 90 per cent. Thus, value added barnyard millet cookies with potential health benefits containing traces of trans-fats could be developed by incorporating barnyard millet flour at 60 per cent level, replacing refined flour.

FORESTRY

Assessment of carbon sequestration of different tree species planted under shelterbelt of northern transitional zone of Karnataka

AMITKUMAR CHAVVAN

2009

MAJOR ADVISOR : Dr. H. SHIVANNA

A major problem being faced by human society is the global warming and is believed to be rising due to human activity. Carbon emission is one of the strongest causal factors for global warming. Northern transitional zone of Karnataka is a plain and dry area where multipurpose trees are grown around the farm land by the farmers as bund planting, boundary planting, wind breaks and shelter belts for providing shelter to the crops grown in the farms. Such trees absorb carbon, stores as a biomass and help to reduce carbon concentration in the atmosphere. Keeping these points in view the present study was carried out in Ranebennur Taluk of Haveri district to assess growth performance and Carbon sequestration by the five different tree species planted during 2003 under

shelterbelt. Among five different tree species planted under shelterbelt the growth performance of *Acacia auriculiformis*, *Dalbergia sissoo* and *Azadirachta indica* showed superior growth performance. At Devaragudda the highest amount of Carbon sequestration was recorded in *Dalbergia sissoo* (12.84 ton/ha) in 48 months and 21.78 ton/ha in 60 months followed by *Azadirachta indica* and *Acacia auriculiformis*. At Agricultural Research Station Hanumanamatti, the maximum amount of Carbon sequestration was observed in *Acacia auriculiformis* (14.72 ton/ha) in 48 months and 21.31 ton/ha in 60 months followed by *Azadirachta indica* and *Dalbergia sissoo*. Shelterbelt at ARS Hanumanamatti showed significant difference among different tree species planted.

Effect of management of contour hedge rows of *Gliricidia* on biomass productivity and tree-crop competition in vertisols of Northern Karnataka

MAKRAND P. GUJAR

2010

MAJOR ADVISOR : Dr. S. L. MADIWALAR

Establishing hedges of fast growing N₂ fixing tree species on contour bunds has been found to be feasible technology in northern transitional zone of Karnataka (zone-8). But, the competition between hedgerows and crop for resources hinders the widespread adoption of this technology. The present study was undertaken to devise suitable methods for managing the hedgerows to reduce tree crop competition and to quantify biomass production from hedgerows. Except plant height and number of branches per plant all the growth and yield parameters of soybean viz. number of leaves per plant, dry weight per plant, number of pods per plant, number of seeds per pod, number of seeds per plant, seed weight per plant and seed yield differed significantly due to hedgerow

management techniques. All the treatments involving pruning (T₁ to T₈) recorded significantly higher seed yield per ha than no pruning control. Highest seed yield per ha was obtained in treatment 5 i.e. pruning once and application of pruned material + trenching (3020 kg/ha). Pruning once + prunings applied (7105 kg) recorded highest total dry biomass production per ha. Total dry biomass production per ha did not differ significantly in treatments with pruning once and pruning twice. Similarly, pruning application had no beneficial effect over pruning removal with respect to dry biomass production per ha. But, higher total dry biomass per ha was obtained in no trenching (6904 kg) than trenching (6586 kg).

Prunings obtained from hedge row had on an average 2.11 % N, 0.24 % P and 1.27 % K. Pruning showed 64.40 per cent increase in net returns per ha over no pruning. Pruning once and application of pruned material (T₁)

(46233 Rs/ha) had highest net returns per ha. Pruning application resulted in higher net returns per ha (43586 Rs/ha) compared to prunings removed (36211 Rs/ha).

Studies on foliar diseases and their management in *Pongamia pinnata* (L.) pierre

NATALYA KRISHNAMBIKA

2009

MAJOR ADVISOR : Dr. V.SURYANARAYANA

The documentation of diseases of *Pongamia* raised in high rainfall (Therakanahalli forest nursery, Sirsi) and low rainfall (Haveri forest nursery, Haveri) receiving nurseries showed five diseases. Associated pathogens were characterized as *Fusicladium pongamiae* tar leaf spot and blight, *Collectrichum gloeosporioides* for leaf blight *Rhyisma pongamiae* for tar spot, *Dothiorella pongamiae* for leaf spot and blight and *Cephaleuros virescens* for red rust Highest combined foliar diseases (68.10%) and Per cent disease Index (66.22%) were recorded in high rainfall receiving nursery. Progression in combined diseases occurred in Four phases viz., log phase (August to December), stationery phase (December to February) and declining phase (February to June). Exceptionally, *Fusicladium* leaf Spot occurred through the year and found positively and significantly correlated with relative humidity ($r=0.564$). The mean annual disease induced defoliation was high in heavy rainfall receiving forest nursery (30.38%) over low rainfall receiving nursery (14.78%). Annual averages of height,

collar diameter and sturdiness quotient were lesser (12.32 cm, 3.98 mm and 0.3 respectively) in forest nursery of the high rainfall region tahn low rain fall receiving nursery [16.74 cm, 6.22 mm and 0.38 respectively]. Similarly, disease induced seedling mortality study also reveale maximum value in high rainfall receiving nursery (30.03%) over low rainfall rec:iving nurseiy (8.1 %). Accordingly, heavy rainfall receiving nursery suffered from high monitory loss (Rs.4500/3000 seedling stock raised) than low rainfall receiving nursery (Rs. 1215/3000 seedling stock). In *in vitro* efficacy tests with 34 fungi-toxicants, Propiconazole, Tridemorph, *Trichodma harzianum* showed equal efficiency (100% inhibition) followed by Neem seed karnal extract (68.2%) against *Rhytisma pongamiae*. Among these, Propiconazole and Tridemorph proved efficient in field evaluation under nursery condition. Among 48 CPT's evaluated, the progenies of CPT 11, 14 and 17 were found moderately resistant to *Fusicladium* leaf spot. The present investigation finds first of kind in the literature.

Biochemical characterization of clones of acacia hybrid and eucalypts for pink disease resistance

P. NAVEEN KUMAR

2010

MAJOR ADVISOR : Dr. S.T.NAIK

Eucalypts and Acacia are the promising among fast growing tree species introduced into India. Monocropping of clones invites large scale pests and diseases. Managing with chemical alone is uneconomical. So identifying resistant source is best viable solution. Field performance of different clones of Acacia hybrid and Eucalypts showed different reaction with regard to Disease Resistance Index. (G-84 (2.95), G-15 (1.00), K-47 (2.72) and K- 31 (0.97). To understand variation among isolates of *Corticium salmonicolor* disease samples from eight different hosts from three states were collected. Results revealed variation in growth rate, colony colour, shape, sclerotial initiation, These were fast and prominent in isolate CS-RE-ET (90 mm, dull white, radial spread with wavy margin and 12 days, respectively). Vegetative compatibility indicated groups G1-G2 and G3-G1 were compatible for growth and sclerotial body production.

To understand the factors responsible for pink disease resistance in Acacia hybrid and Eucalypts, chemical analyses results revealed that resistant sources in Acacia hybrid, G-84 contained higher quantity of phenol (9.72mg/g), od phenol (16.49 mg/g), sugars (1.98 mg/g), amino acid (0.82 mg/g). The enzyme activities of peroxidase (1296.90 g⁻¹ tissue/min), polyphenol oxidase (14.96 g⁻¹ tissue/min) and phenylalanine ammonia lyase (1.29) than in susceptible ones. Similarly in Eucalypts, clone MG 55 and HP 79 contained and expressed higher quantity and activity than susceptible SR. Effect of phytoalexin on growth of mycelium showed higher rate of inhibition in resistant clones 47 K (46.33 %) and G 22 (48.67 %). Correlation and regression analyses between DRI and biochemicals in both Acacia hybrid and Eucalypts revealed a positive and significant relation in all resistant clones $r = 0.866$ and $Y = 1.958x + 11.00$.

Loss estimation and management of anthracnose and white mold in *Jatropha curcas* L.

PRADEEP RATHOD

2009

MAJOR ADVISOR : Dr. V. SURYNARAYANA

Among the diseases of *Jatropha curcas*, *Cylindrocladium* white mold and anthracnose caused by *Colletotrichum gloeosporioides* found highly destructive. Microscopic and grow out tests in ascertaining seed borne nature of the above diseases revealed negative. However, poor growth performance of seedlings from diseased seed sources was recorded. In loss estimate studies, severe disease class (> 50% DSI) recorded highest reduction in height (72.18% and 57.69%), collar diameter (70.07% and 73.68%), number of branches (98.85% and 80.14%), leaf area (49.34% and 46.54%), fruit set (37.10% and 34.70%) and seed yield (374.88kg/ha and 413.66kg/ha) over control in white mold and anthracnose, respectively. Severe class had highest oil yield loss (142.78kg/ha accounting to Rs.4711.66 in white mold and 167.07kg/ha accounts to Rs.5513.34 in anthracnose). Under *in vitro* assays of fungitoxicants, Carbendazim, Chlorothalonil, Propiconazole and Mancozeb resulted cent per cent mycelial growth inhibition of *Colletotrichum gloeosporioides* at both

500 and 1000ppm. Next best were 5 and 10% fresh leaf extracts of *Prosopis juliflora* and *Azadirachta indica*. Field disease management trial at nursery level against anthracnose proved 0.2% Mancozeb and 0.1% Carbendazim were efficient in reducing DSI and rate of disease development (r) of anthracnose, with least per cent defoliation at 60 days of second spray. In field management trials with five integrated treatments, sequential schedule of 0.2% Mancozeb, 10% *Prosopis* leaf extract followed by 0.2% Mancozeb proved efficient in reducing DSI of both diseases with maximum per cent increment in height, collar diameter, number of branches and leaf area. Even though the C: B ratio in above treatment was lower the net return (Rs. 11,701.40 in white mold and Rs. 8,933.90 in anthracnose) was higher than other treatments. Hence, it is for recommendation to improve yield and income to the farmer. All the seed sources evaluated against *Cylindrocladium* white mold found susceptible after 90 days.

Studies on collection, quantification and seed quality of *Terminalia alata*

D. SHIVAPRASAD

2010

MAJOR ADVISOR : Dr. K . S.CHANNABASAPPA

Success of afforestation and reforestation programmes mainly depends on availability of good quality seeds. Seeds from healthy trees provide greater assurance that resulting stock will have good survival and resistance against stress conditions. Apart from other factors, quality seed production is influenced by age of tree and diameter classes. The study was conducted to evaluate the seed production potentiality of *Terminalia alata* as influenced by forest types (Moist deciduous, Dry deciduous and Semi evergreen) and diameter classes (10 - 40 cm, 40 - 80 cm and > 80 cm). Among morphometric characters, maximum height. (29 m), clear bole (21.09 m) and crown height. (7.97 m) was noticed in semi evergreen forest of > 80 cm dbh. Maximum crown diameter (13.32 m) was observed

in moist deciduous forest of > 80 cm dbh. Maximum number of fruits per tree (16131.12) and fruit. yield per tree (29.32 kg) found in moist deciduous forest having more than 80 cm dbh. Among the seed parameters, significantly maximum seed weight (177.17 g) was recorded in moist. deciduous forest. of 40 - 80 cm dbh. Maximum germination per cent (59.34 %), Mean daily germination (1.64), Peak value (4.25), Germination rate (2.79), Germination value (7.00) was recorded in Haliyal region of moist deciduous forest of 40 - 80 cm dbh. Among the seedling parameters seedling height (26.90 cm), shoot length (27.24 cm), root length. (13.95 cm), shoot and root fresh weight (2.83 g and 2.63 g) were found maximum in 40 - 80 cm dbh of moist deciduous forest of Haliyal location. The

present. study indicated that moist deciduous forest type of Haliyal and Tattihalla are the best locations and 40 - 80 cm dbh is the best diameter

class for collection of quantity and quality seeds of *Terminalia alata* from Uttara kannada district.

Carbon sequestration studies in shelterbelt tree species

K. R. SWAMY

2010

MAJOR ADVISOR : Dr. H. SHIVANNA

The study was conducted to assess the performance of different Agroforestry tree species with respect to their growth, biomass and carbon stock at Agricultural Research Station, Hanumanamatti of Haveri district in Karnataka. Among six different tree species planted under shelterbelt the growth performance with respect to gbh, height, clear bole height and basal area was highest in *Acacia auriculiformis*, whereas, *Azadirachta indica* performed well in crown diameter and number of branches. while, standing biomass and carbon was highest in *Acacia auriculiformis* followed by *Azadirachta indica*. Maximum above ground biomass was observed in *Acacia auriculiformis* (57.65 t ha-1) followed by *Tectona grandis* (55.57 t ha-1) while, below ground biomass was highest in *Tectona grandis* (20.25t ha-1) followed by *Acacia auriculiformis*. Above ground carbon sequestration

was highest in *Acacia auriculiformis* (13.30 t ha-1) followed by *Tectona grandis* (12.20 t ha-1) while, below ground carbon sequestration was more in *Tectona grandis* (4.35 t ha-1) followed by *Acacia auriculiformis*. The form factor was observed maximum in *Pongamia pinnata* (0.30) followed by *Dalbergia sissoo* (0.44) and *Acacia auriculiformis* (0.49) and the least was in *Azadirachta indica* (0.69). Total volume found highest in *Acacia auriculiformis* followed by *Azadirachta indica*. The soil under shelterbelt species exhibited better chemical properties. Higher soil pH (4.70 and 6.40) and electrical conductivity (0.80 and 0.55 dsm-1) was recorded under *Azadirachta indica* at both 0-15 cm and 15-30 cm depths. While, high soil organic carbon was in *Tectona grandis* (1.34 % and 0.99 %).

GENETICS AND PLANT BREEDING

Effect of gamete selection for wilt resistance on segregation of markers linked to wilt resistance and productive traits in chickpea (*Cicer arietinum* L.)

ANILKUMAR CHOOUKIMATH

2010

MAJOR ADVISOR : Dr. R. L. RAVIKUMAR

Chickpea is one of the major pulse crops of India, ranking third in production globally and accounts. But production is not adequate to meet domestic demand. The yield levels are restricted by several biotic and abiotic factors among which *Fusarium* wilt caused by *Fusarium oxyspomm* is serious .disease. The pollen selection for wilt resistance has increased the frequency of resistant plants in the segregating generations. However its effect on sporophytic fitness is not clear. Hence present study aims to study effect of gamete selection for wilt resistance on quantitative traits. Gamete selection for wilt resistance was applied using fusaric acid in F₁ produced ITom cross Karikadle x WR-315 and BG-256 x WR-315. Two sets of F₂ were generated ITom each cross, one is treated F₂ produced ITom selfing F₁ plants sprayed with fusaric acid and other is control F₂ produced ITom selfing F₁ sprayed with water. DNA extracted from control and treated F₂ populations of both the crosses were screened for wilt resistance using molecular markers. The chi-square analysis revealed a significant deviation in the segregation of these markers in the treated F₂ population whereas in the control F₂, the segregation of the markers followed -mendelian ratios. The marker analysis revealed that there was

more frequency of wilt resistant plants in the treated F₂ population than expected. The effect of gamete selection for wilt resistance on segregation of quantitative traits was evaluated by estimating mean, range, variance, frequency distribution for each trait in both the crosses. Gamete selection did not had effect on mean and range of traits but there was reduction in the variance for majority of the traits. Frequency distribution for traits also did not show major shifts in both the crosses. However KS-test was significant between control and treated F₂ populations for many quantitative traits of cross BG-256 x WR-315. Correlation and path analysis revealed no major shifts in the character association between seed yield and yield components in control an treated F₂ populations of both the crosses. The number of pods has highest positive direct effect on seed yield in control and treated F₂ populations of both the crosses. The number of pods showed the highest positive direct effect on seed yield in control and treated F₂ populations of both the crosses. The same trend was observed in path analysis also. Gamete selection for wilt resistance at F₂ increased the frequency of resistant genotypes in F₂ but it did not show any major effects on segregation of other nontargeted quantitative traits.

Genetic variability studies in field bean (*Lablab purpureus* L. Sweet)

AVINALAPPA H. HOTTI

2009

MAJOR ADVISOR : Dr. V. RUDRANAIAK

Field investigation with fifteen genotypes was carried out to study the genetic variability during 2008-09. The second experiment was conducted to estimate the heterosis, combining ability of parents and hybrids. The hybrids were obtained by crossing six lines with three testers in line x tester fashion. Eighteen F₁s, six lines, three testers and two checks viz., HA₃ and local avaré were evaluated during 2009-10. The genetic parameters viz., PCV, GCV, heritability and genetic advance were found to be highly significant for inflorescence length, number of inflorescence per plant, number of pods per plant and seed yield per plant indicating the existence of wide range of genetic variability in the material evaluated. The correlation studies revealed strong positive association of yield with number of inflorescence per plant and number of pods per

plant. Path coefficient analysis revealed that number of secondary branches per plant had highest positive direct effect on seed yield. The higher magnitude of SCA variance was observed for all the characters compared to GCA variance. Hence, the ratio of GCA variance to SCA variance was lesser than unity for all the traits except number of pods per plant. DA-12 was the best general combiner for number of pods per plant, protein content and seed yield per plant. The cross combinations DA-8 x DA-14, DA-11 x DA-15, DA-12 x DA-14 and DA-12 x DA-15 were found to be promising for seed yield as they had high positive standard heterosis. Genotypes were also screened for pest and disease. Two genotypes viz., DA-6 and DA-14 showed resistant reaction to pod borer. While, DA-1 and DA-9 and crosses viz., DA-11 x DA-13, DA-11 x DA-14 and DA-12 x DA-14 showed resistant reaction to Anthracnose disease.

Fertility restoration, heterosis and combining ability involving diverse CMS sources in sunflower (*Helianthus annuus* L.)

CHANNAMMA B. KAMATI

2009

MAJOR ADVISOR : Dr. K. G. PARAMESHWARAPPA

This study was undertaken to assess the fertility restoration magnitude of heterosis and combining ability involving 26 lines of sunflower to explore the diversification of cytoplasm. The lines comprised of four male sterile lines and 22 diverse restorer lines which were crossed in all possible combination. The experiment was laid out in L x T design at the Oilseeds Scheme, MARS, University of Agricultural Sciences, Dharwad during *kharif* 2008. The restorer lines used behaved differently on different CMS sources and only three lines ARM 244, DRSI 378, DRSI 635 restored fertility on all MS lines except CMS 300 2A and all the lines restored fertility on PET2-7-1A. DRM 6-1 behaved as restorer on CMS

300 2A. Only 40 F₁ hybrids along with their parents were studied for the extent of heterosis and combining ability during *kharif* 2008 for 10 characters by adopting L x T analysis considerable average heterosis was observed for all characters studied. Highest magnitude of average heterosis was observed for seed yield per plant (57.58%), test weight (27.12%), head diameter (23.47) and plant height (11.35%). For the character days to 50 per cent flowering, days to maturity, hull content, the hybrids recorded negative average heterosis. None of the crosses had high SCA effect for all the studied. In majority of the crosses high SCA effects was

due to high x high or low x high general combining ability of parents. The best crosses for seed yield and for oil content PET 2-7-1A x 6D-1, PET 2-7-1A x ARM 244 (Br), PET 2-7-1A x ARM 240 (Br) with high SCA

effect have been identified ARM 240 (Br) and DRSI 635 among the males and PET 2-7-1A and CMS 17A among the females were identified parents for exploitation of heterosis based on GCA effects.

Genetic analysis of diverse sources of CMS on fertility restoration, heterosis and combining ability in sunflower (*Helianthus annuus* L.)

DIVYA AMBATI

2010 MAJOR ADVISOR : Dr. K.G . PARAMESHWARAPPA

The experiment was conducted to establish the fertility restoration behavior, heterosis and combining ability of different pollen parents over diverse CMS sources in the sunflower. The 120 crosses were obtained from crossing five male sterile lines and 24 pollen parents in L x T fashion during summer 2009. The crosses along with parents and checks were evaluated in *kharif* 2009 for the fertility restoration behavior, heterosis and combining ability in RCBD. The differential restoration behavior of the pollen parents established the diversity among the five CMS lines. The known six R lines among 24 pollen parents tested found to be common restorers for both PET-1 and PET-2-7-1A cytoplasm, with no restorers and maintainers identified for CMS-300-2A and PET-2-7-1A, respectively, in the material used. For the heterosis and combining ability studies, 60

hybrids selected based on fertility restoration and mean seed yield were used. Among them PET-2-7-1A x ARM-250, DSF-15-A x RHA-95-C-1 and PET-2-7-1A x DRM-29-4 found to show significant and positive standard heterosis for seed yield, oil content along with some other economically important traits in sunflower. The new CMS source PET-2-7-1A and conventional CMS-17-A among the female lines, ARM-250 and DRM-29-4 among the males found to be the good general combiners and offered scope for improvement of inbred lines for seed yield and its attributing traits. Most of the hybrids showing high sca effects observed as a result of low x low or high x low combination indicating good complementation of favorable alleles between the parents.

Genetic studies involving derived lines of B x B, B x R and R x R crosses for productivity traits in *rabi* sorghum (*Sorghum bicolor* (L.) Moench)

DEEPAK KUMAR

2010

MAJOR ADVISOR : Dr. B. D. BIRADAR

An experiment was carried out at RARS, Bijapur and MARS, Dharwad during *rabi* 2007-08, using a total of 120 F₆ generation lines derived from B x B, B x R and R x R crosses along with parents and checks in RCBD with 2 replications. The study aimed to assess the genetic variability, diversity, and nature of association between yield and its component traits. Genetic variability studies, at both locations revealed higher PCV and GCV among the derivatives of B x B and B x R for number of grains per panicle and grain yield per plant, while R x R derivatives showed high for number of primaries per plant, number of grains per panicle and grain yield per plant. Derivatives of B x B and B x R exhibited high heritability coupled with genetic advance for all the characters under study except number of leaves and number of internodes at both locations. While, R x R derivatives recorded high heritability coupled with genetic advance for all the characters under study at both the locations. Hence,

selection made through these characters would be effective. Character association studies indicated that grain yield per plant had strong and positive association with panicle breadth, number of primaries per panicle, test weight, number of grains per panicle and fodder yield per plant. The characters viz., number of primaries per panicle and number of grains per panicle had the highest direct positive effect on grain yield. Diversity analysis indicated that the traits viz., number of primaries per panicle contributed maximum towards diversity while, plant height and number of primaries were next in order. For all the characters studied, cluster V at Bijapur and X at Dharwad ranked first and the genotypes belonging to these clusters appear to be most potential one and can be extensively used for further breeding programme. A total of eight promising 'B' lines and thirteen promising 'R' lines were found superior over the checks 104B and R-354 respectively at both the locations.

F₂ Bulk segregant analysis for alternaria disease resistance using RAPD marker in sesame (*Sesamum indicum* L.)

V. ESWARAPPA

2010

MAJOR ADVISOR : Dr. R. LOKESHA

The present investigation was undertaken to identify the *Alternaria blight* resistance in sesame (*Sesamum indicum* L.) by using RAPD marker. The F₂ bulk segregant population generated from both straight and reciprocal crosses of RT-273 x Gulbarga Local Black. For the standardization DNA extraction protocol, totally 300 F₂ bulked segregants of sesame genotypes, among 91 genotypes were straight cross and 209 genotypes were reciprocal crosses, out of 91 straight crosses, 20 sesame genotypes (selected based on phenotypic scoring) used to genetic analysis from straight cross and out of 209 reciprocal crosses, 22 sesame genotypes were selected for DNA isolation. A total of ten bands, which were consistent, unambiguous and repeatable, produced from the primer OP A-6 were used for analyzing the sesame genotypes of both straight and reciprocal crosses

for resistant to *Alternaria blight*. In case of straight crosses, out of ten bands four bands were monomorphic and six bands were polymorphic compared with parents GLB and RT-273 using 10Kb ladder, in reciprocal crosses, out of ten bands four bands were monomorphic and six bands were polymorphic. The RAPD marker of 10 kb band was found association between resistance and OPA-6 primer. F₂ bulked segregant analysis clearly indicated that the resistance was in control of a single dominant gene because the susceptible v/s resistant could segregate as 3:1 based on banding pattern. The field observation further confirmed the dominance nature of the resistant gene, so the primer OP A-6 can distinguish resistant and susceptible genotypes. Thus resistant loci can be marked using DNA markers.

Genetics of yield and its attributes in *Gossypium hirsutum* L.

HANAMARADDI KENCHARADDI

2010

MAJOR ADVISOR : Dr. RAJESH S. PATIL

The investigation was undertaken in *Gossypium hirsutum* L. to elicit information on nature of gene action, correlation coefficients, path analysis, path of productivity, identification of transgressive segregants, studying the heterosis in F₁ and inbreeding depression in F₂ and F₃ generations. The material included non-segregating (P₁, P₂ and F₁) and segregating (F₂ and F₃) populations of the cross LH-2076 X RACH-11. The present analysis indicated the importance of both additive and dominance components when all fourteen the characters were considered. Among them, dominance effect was noticed in all the characters except seed index. Among the interaction components, dominance x dominance (I) effect was important for all the characters except ginning out-turn where additive x additive effect was important. Correlation studies indicated strong positive association between seed cotton yield and boll number whereas number of monopodia and interboll distance were negatively

associated with seed cotton yield at both genotypic and phenotypic levels. The path analysis indicated that the number of bolls per plant had the highest direct effect on seed cotton yield at both genotypic and phenotypic level. The path of productivity analysis among the top six F₃ progenies revealed that the number of bolls per plant, boll weight, plant height and halo length contributed positively while, number of monopodia per plant and interboll distance contributed negatively towards the path of productivity. The highest number of transgressive segregants was observed in number of bolls per plant followed by seed cotton yield per plant in both F₂ and F₃ generations. Mid-parent heterosis and heterobeltiosis was highly significant for most of the characters except ginning out-turn and magnitude of inbreeding depression in F₂ generation was higher than in F₃ generation indicating the overdominant nature of gene action.

Assessment of genetic variation for root traits in relation to phosphorus nutrition in groundnut (*Arachis hypogaea* L.)

S. JADHAV SACHIN

2009

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

Groundnut is important oilseed and food crop, presently cultivated throughout tropical, sub-tropical and warm temperate zones of the world. Phosphorus is one of the most deficient nutrients owing to its high fixation and less mobility. As an adaptation strategy roots undergo morphological modifications trying to acquire more P. Hence experiment was carried out to assess to genetic variability for root traits in relation P nutrition in groundnut (*Arachis hypogaea* L.) in population developed from cultivars JL 24 and ICGV 86590, contrasting for response to P nutrition. Population was evaluated in field for yield related traits, most of which displayed significant variations across the seasons with low to medium heritability. Randomly selected 100 RILs were screened in P sufficient (100 %) and P insufficient (25 %) conditions in sand culture for 45 days, which displayed significant variations for primary root length, shoot length, root volume, root dry weight, shoot dry weight and total

dry weight and significant interaction with P concentrations. Mean performance of genotypes was increased in P insufficient condition. RILs excelled both parents for per cent responsiveness in all root traits. Further most contrasting 20 RILs were selected based on per se performance and per cent responsiveness and evaluated for P uptake traits root P, shoot P, total P and internal P efficiency. Selected RILs displayed significant variations with high heritability for all P uptake traits. Most P uptake traits except IPE exhibited higher PCV, GCV values. Association analysis depicted significant positive correlation of root traits with P content and RV and negative correlation with IPE. Depending on per se performance and per cent responsiveness 1-23 and 1-18 were selected as most responsive across traits. 7-13 was selected as least responsive. Lines superior for root and P uptake traits were also superior for yield related traits.

Assessment of genetic potential of exotic tomato [*(Solanum lycopersicum* Mill.) Wetted] breeding lines for yield and disease resistance

KATKAR GAJANAN DATTATRAY

2010

MAJOR ADVISOR : Dr. O. SRIDEVI

Tomato [*(Solanum lycopersicum* Mill.) Wetted] is one of the most important vegetable crops grown in India. However, modern cultivars of tomato have a limited genetic diversity and demand for high yielding disease resistant hybrids is alarming. With this outlook an effort was made to increase genetic variability and breeding for ToLCV resistant hybrids by utilizing more diverse exotic tomato breeding lines. Diversity analysis among 19 exotic tomato breeding lines and cultivars viz., Pusa-Ruby, Vaibhav and Arka-Vikas was made through the D² analysis, PCA, RAPD markers and SRAP markers, which revealed that almost all exotic breeding lines are generally diverse from cultivated varieties. Hence, utilization of exotic breeding lines could be worthy to increase new gene and breeding for hybrid vigour. Nineteen exotic tomato breeding lines and cultivars viz., Pusa-Ruby, Vaibhav and Arka-Vikas were crossed in line x tester design to assess the combining ability and heterosis. A perusal of the results indicated that the tomato lines PT4722A, CLN2777C, CLN2460E,

CLN2498D, CLN2123C and Vaibhav showed highest GCA effects for most of the characters and lines viz., CLN2545A, CLN2777A, CLN2123C, CLN2123D, PT4722A and tester Vaibhav found to be resistant for ToLCV. The hybrid, Arka-Vikas x CLN2123E showed maximum SCA effect for yield and its contributing characters as well as fruit quality characters, followed by Vaibhav x PT4722A. While, hybrids Pusa-Ruby x CLN2545A, Vaibhav x CLN2498E, Vaibhav x CLN2768A and Vaibhav x CLN2460E showed resistance to ToLCV. The hybrids Vaibhav x PT4722A, Arka-Vikas x CLN2123E, Vaibhav x CLN2768A, Vaibhav x CLN2777F, Vaibhav x CLN2400B, Arka-Vikas x CLN2460E, Arka-Vikas x CLN2777B, Pusa-Ruby x CLN2498E and Pusa-Ruby x CLN2777F showed significant heterosis over the best check hybrids. The identified superior breeding lines and hybrids may be cultivated further for confirmation of their superiority across seasons and locations as well as utilized in future breeding programme.

Heterosis and combining ability for yield and yield component traits in sunflower (*Helianthus annuus* L.)

C. M. KEERTHI

2010

MAJOR ADVISOR : Dr. H. L. NADAF

A study was undertaken to assess the magnitude of heterosis and combining ability for yield and component characters. The material consisted of six cytoplasmic male sterile (CMS) and ten restorer lines crossed in all possible combinations during summer 2009. Total of 16 parents and 60 hybrids along with six check hybrids were evaluated in randomized block design with three replications at MARS, Dharwad during kharif 2009. Highest magnitude of average heterosis was observed for oil yield per hectare (57.24%) followed by seed yield per hectare (47.42%). Maximum value of standard heterosis for seed yield per plant was recorded by CMS 17A x 6-D-1P#2 (79.12%). Majority of the hybrids exhibited negative heterosis for days to 50 per cent flowering and days to maturity. Among hybrids CMS 607A x RHA-857 recorded higher better parent

heterosis for oil content. CMS 17A and CMS 234A among the females and 6-D-1P#2 and VI-66 among the males were identified as good general combiners for more than one trait based on gca effect, which could be utilized further in heterosis breeding. The magnitude of SCA variances was larger for all characters studied indicating non-additive gene action prevailing for traits. None of the crosses had high SCA effect for all the traits studied. The best cross combinations for seed yield (kg/ha) (CMS 234A x 6-D-1P#2) and oil content [CMS 234A x R-298(Br)] with high SCA effect have been identified which were resulted from H x L, L x L or L x H gca combinations. None of the parents showed tolerant to Alternaria leaf spot reaction while only one hybrid CMS 17A x RHA-857 recorded some degree of tolerant reaction.

Evaluation of different germplasm lines for alternative uses; Disease and pest reaction in bidi tobacco

KENCHAPPA BHUMARANNAVAR

2009

MAJOR ADVISOR : Dr. P. V. KENCHANGOUDAR

A study was undertaken in bidi tobacco germplasm lines to assess the alternative uses like nicotine, solanesol and seed oil, pest and diseases, yield and yield attributing traits at ARS Nipani during Kharif-2007 with two replications in RBD. Genotypes differed significantly for all the traits except for number of leaves in set-III. Nicotine and solanesol showed high variability parameters (GCV, PCV, heritability and GAM) coupled with positive correlation within and also with leaf width and chlorides pointing at simple selection with additive gene action and simultaneous improvement of different traits. While negative association of nicotine and solanesol with plant height and reducing sugars can be objected while selection. Seed oil content had very low variability parameters but showed positive association with seed yield, number of capsules, number of branches and leaf width would reveal importance in further improvement. Other yield contributing traits also needed

concurrent attention as the amount of phytochemicals produced per unit area are directly related with total biomass. Direct positive effect of plant height, number of leaves, leaf length and width, internodal length, nicotine, reducing sugar on leaf yield; number of capsules per plant and seed oil content on seed yield would lay stress on selection programme in improving the biomass. Genetic divergence studies in forty nine high yielding genotypes yielded seven clusters wherein high inter cluster distance indicating wide diversity among genotypes which would yield superior segregants within short period. Scoring across mean values of traits among the clusters, cluster III, VI, II and IV showed good combination of desired phytochemicals. Solitary cluster III ranked first can be utilized for selection towards high leaf yield. In cluster-II genotypes 20-49-36-36 (A2 x olor), 169-119 (medium internode) and 108-15 1/2 (K20 x Sokha) showed multiple disease resistance with high yielding desired phytochemical can be considered in enhancing the target traits.

Molecular mapping and tagging of quantitative trait loci (QTLs) for morphological, physiological and yield traits in rice (*Oryza sativa* L.)

LAXUMAN

2010

MAJOR ADVISOR : Dr. P. M. SALIMATH

The present investigation was carried out to map QTLs for morphological, physiological and productivity traits, for yield and related traits in mapping population consisting of 188 backcross inbred lines (BILs) derived from Swarna and NERICA-L-20. Considerably high variability was observed for all the morphological, physiological and productive traits. This was evidenced by high range and mean performance for different traits in BILs. High yielding BILs were superior for productivity traits like, number of tillers per plant, number of productive tillers per plant, panicle weight, number of grains per panicle and plant height at maturity. The BILs SN20-L41, SN20-L18, SN20-L17 and SN20-L183 were superior to best check Rasi under irrigated condition for yield and yield related traits. In all 106 QTLs were identified for 14 yield and its related traits using interval mapping. Forty six (43.39%) QTLs were

derived from NERICA-L-20 and had a beneficial effect on the trait. Phenotypic variance explained by QTLs ranged from 7.90 to 84.00 per cent in BILs. The co-localized traits are known to be highly correlated. In the present study 16 co-localized chromosomal regions with QTLs for three or more traits were identified. The traits like days to heading and days to 50% flowering were co-localized on many chromosomal regions and also were highly correlated (> 0.90). Segregation distortion was observed to the extent of 67.8 per cent of the mapped SSR marker loci in BILs. Yield per plant was strongly influenced by eight QTL alleles. Of these six were derived from NERICA-L-20 with each contributed more than 10 per cent to the phenotypic variance with high additive effect on this trait (> 4 g). QTLs which detected at a LOD of more than 3.0 and contributing more to the phenotypic variance with large additive effect on the trait are reliable for further validation and MAS.

Evaluation of RILs for nutritional traits in groundnut (*Arachis hypogaea* L.)

T. P. MUHAMMED AZHARUDHEEN

2010

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

Two recombinant inbred line (RIL) populations derived from TG 19 x OPBD 4 and TG 49 x OPBD 4 crosses were phenotyped for quality (protein content, oil content and fatty acid profile), disease resistance (rust and late leaf spot) and productivity traits (pod yield, 100-seed weight and shelling%) in two seasons (Summer and kharif 2009). In both the populations, the ANOVA indicated significant variation for all the traits. Phenotypic data analysis for genetic variability components revealed higher magnitude of variation with high heritability for diseases, moderate to high variability with high heritability for nutritional quality and higher magnitude of variation but lower heritable variation for productivity traits. Distribution of RILs was bimodal to normal for rust and normal for LLS but within the range of parents, indicating simple inheritance for rust but complex for LLS. The distribution for nutritional quality and productivity traits was mostly normal revealing complex inheritance.

Transgressive segregants in both the directions indicated contribution of favourable alleles from both the parents. A higher percentage of the superior segregants for rust were observed in the cross involving a Virginia parent (TO 19). Whereas, the cross involving a Spanish bunch parent (TO 49) revealed high percentage of superior segregants for late leaf spot, productivity and quality traits. Correlation between rust and LLS was negative revealing antagonistic nature of the diseases. Highly significant and positive correlation was observed between protein and oil content; 100-seed weight and pod yield in both the populations. Negative correlation existed between oleic and linoleic acid, palmitic and oleic acid, O/L ratio and linoleic acid. Several RILs superior to best parent were identified for different traits which could be utilized in future breeding programmes. The study indicated scope for combining high yield and disease resistance with desirable confectionery traits.

Characterization of mutants derived through induced mutagenesis in tetraploid wheat (*Triticum* sp.)

G. RAMYA

2010

MAJOR ADVISOR : Dr. K. MADHUSUDAN

Dicoccum wheat (*Triticum dicoccum* (Schrank.) Schulb) is tetraploid wheat which is a good source of protein and dietary fibre and also suitable cereal for diabetes and cardiovascular disease. Dehulling in emmer wheat is a laborious process and involves additional expenses. Dicoccum wheat grain is red in colour which affects the acceptability of consumer and it is susceptible to spot blotch (*Helminthosporium sativum*). The extent of variation realized by hybridization in case of dicoccum wheat has been often reported to be inadequate. It is suggested that the application of mutagenic treatment to hybrids may be a means of adding the variability inherent in the cross. The material used in this study comprised of M3 and M4 generation of tetraploid wheat with four parents (2 dicoccum and 2 durum) and their crosses in all combination which are mutated by different doses of EMS and gamma rays. 101 free threshable mutants obtained from M3 generation were evaluated to elicit information to identify promising free threshable mutants. Direct mutagenesis

contributed more free threshable lines and EMS treatment was more effective in giving free threshable lines compared to gamma rays as it induces point mutations but gamma irradiation has given more mutants which are resistant to spot blotch. Genetic and molecular diversity in the material representing different mutagenic treatments revealed no relation between mutagenic treatment and genetic diversity. Mutant no. 963 (150Gy-DDK1025XDWR 1006) and 1519 (200Gy-DDK 1025XDWR 1006) vs. check DDK 1025 had high test weight, protein content and high yield. Mutants 873 (150Gy-DDK1025X HD 4502), 1349 (200Gy-DDK 1001X HD 4502), 1184 (200Gy-DDK 1001), 1759 (250Gy-DDK 1025X HD 4502), 2320 (0.2%EMS-DDK 1025X HD 4502), 2524 (0.3%EMS-DDK 1001), 2516 (0.3%EMS-DDK 1001) and 2537 (0.3%EMS-DDK 1001) were found to be productive, free threshable mutants which have amber grain color and showed resistance to spot blotch.

Genetic variability for resistance to *Sclerotium rolfsii* in groundnut (*Arachis hypogaea* L.)

SANTOSHKUMAR B. PUJER

2009

MAJOR ADVISOR : Dr. P. V. KENCHANAGOUDAR

Stem and pod rot caused by *Sclerotium rolfsii* is the major constraint in groundnut production system in all groundnut growing regions and it poses a serious threat to kharif and summer season in both light sandy and vertisols. In the present investigation, an attempt has been made to understand the variability present in advanced generation using statistical parameters like GCV, PCV, heritability, genetic advance over mean and assess the interrelationships among the component traits of pod yield through correlation studies. Analysis of variance revealed significant difference among the genotypes (g) for eleven characters studied over two seasons. Pooled analysis of variance revealed significant seasonal variation and also exhibited significant G E interaction for all characters studied. Disease incidence was relatively higher during summer season at harvesting stage of crop that recorded low GCV (6.36%), high

PCV (22.38%), high heritability (81.0%) and low genetic advance (3.71%). The average shelling percentage (69.10%) and oil content (43.14%) was found with low for GCV, PCV, heritability and genetic advance. The disease incidence showed variable interaction with the plant at different stages of plant growth. Strong negative association between disease incidence and yield per plant revealed the importance of disease incidence in determination of yield per plant under disease epiphytotic conditions. Out of 165 lines derived from the cross between TAG 24 (42.17%) and R 9227(26.88%), six recombinant inbred lines (21, 25, 26, 36, 109, 165) had better disease resistance recording low disease incidence (19.79%-25.92%). High frequency of desirable segregants for oil content and pod yield per plant compared to parents were recorded. These lines could be exploited in breeding programme for improving the existing cultivars.

Heterosis and combining ability for fruit yield and its component traits in double cross derived lines of okra (*Abelmoschus esculentus* (L.) Moench)

SATEESH ADIGER

2010

MAJOR ADVISOR : Dr. G. SHANTHKUMAR

A study was under taken to assess the magnitude of heterosis and combining ability for fruit yield and component characters also to know the cooking quality and acceptability of the genotypes. The material consisted of forty double cross derived lines and three testers viz., Arka Anamika, Pusa Sawani and Parbhani Kranthi. A total of 43 parents and 120 hybrids along with checks viz., Syngenta, Sinnova, Mahyco 10, Ankur, US agro and Mahyco were evaluated in Simple Lattice Design with two replication during *Kharif* 2009. Considerable average heterosis was observed for all the characters studied. Highest magnitude of heterosis was observed for the fruit yield per hectare (17.32%) followed by number of fruits per plant (9.72). In majority of the crosses high SCA effect was due to low x low, low x high or high x low GCA of the parents. The best cross

combination for fruit yield per plant in 38 x 3 with high SCA effects have been identified. Lines 13, 5, 25 and 38 among the females and Parbhani Kranthi and Pusa Sawani among males were identified based on the GCA effect which could be utilized for further heterosis breeding. The cooking quality and acceptability of the genotypes viz., lies 4, 6 and 27 and the tester Parbhani Kranthi and Arka Anamika and hybrids 38 x 3, 13 x 3, 3 x 1 and checks Ankur and Mahyco 10 were evaluated in one way analysis of variance and found that there was no significant difference among the genotypes for frying time and oil absorption. Based on the acceptability results concluded that the check Ankur (7.83) ranked first in acceptability. The Arka Anamika (7.50), 27 (7.33) and hybrid 3 x 1 (7.33) scored second, third and fourth ranks, respectively.

Studies on genetic male sterility system in diploid cotton

SEKHAR BABU GEDDAM

2010

MAJOR ADVISOR : Dr. B. M. KHADI

An investigation was taken up at Main Agricultural Research Station, Dharwad during *kharif* 2009-10 to estimate the heterosis in GMS based diploid hybrids for yield, yield contributing and fibre quality traits, to study the genetics of male sterility and to identify the male sterile and fertile plants of GMS genotypes through the RAPD markers. Study was also made to investigate the morphological differences between the male sterile and respective fertile plants of GMS genotypes. Heterosis study revealed that the interspecific crosses MSD 7 nor RAHS-14 and MSD 7 nor Jayadhar were found to be highly heterotic for yield and fibre quality traits and these crosses may be used for exploitation of hybrid vigour. Study on genetics of male sterility indicated that the GMS system in diploid cotton is under the control of single recessive gene. The plant morphological characters of GMS genotypes were found similar to their

normal fertile counterparts. But significant reduction was observed in sterile genotypes for flower morphological traits like flower pedicel length, staminal column length, style length, filament length, anther number and anther colour compared to their fertile genotypes. Out of the 60 random decamer primers screened, 34 primers produced polymorphism between sterile and fertile plants of GMS genotypes. Primers like OPAB 19, OPH 20, OPI 2, OPI 3 and OPI 7 could show the consistent polymorphic bands. Hence they can be considered as putative markers for linkage studies and for identification of male sterile and fertile plants in the GMS based Hybrid seed production plots at the early stages of the crop growth. Of the polymorphic primers OPI 3 produced a male sterile specific fragment of 486 bp size and it is sequenced and converted into a trait specific SCAR (Sequence Characterized Amplified Regions) marker.

Evaluation of blackgram germplasm for quantitative traits with particular reference to resistance to powdery mildew and MYMV diseases

SHRIDEVI B. MASTAMARADI

2010

MAJOR ADVISOR : Dr. P. M. SALIMATH

An experiment was conducted using 95 diverse blackgram germplasm lines collected from different parts of the country to study their disease reaction, assess genetic variability, genetic diversity and stability. Two separate experiments were conducted to find the disease reaction to powdery mildew and MYMV under field conditions. In the first experiment genotypes were screened against powdery mildew during *kharif* 2009. at Dharwad. Genotypes KU7-605, 523 and IC-436508 were found to be resistant. Second experiment was conducted during summer 20 I 0 at Dharwad for screening the genotypes against MYMV. The genotypes KU5-573 and BDU-3-5 were found to be immune and Tu-94-2 resistant. Following augmented randomized block design the third experiment was conducted during 2009 at Dharwad to assess variability and diversity. Significant variation was observed for all the traits except number of branches/plant. Based on mean performance the genotypes K U-98-40-2 (13.20 g/plant), G-I (13.14 g/plant) and IC-436536 (12.9 g/

plant) were found to be significantly superior for seed yield over the check variety TAU-I (10.41 g/plant). Diversity analysis revealed that number of pods per plant and plant height contributed considerably towards divergence. Genetic diversity at molecular level was estimated by using 20 RAPD primers. Molecular profiling of genotypes revealed homology between the genotypes therefore, the grouping of genotypes based on morphological diversity and DNA fingerprinting was not concurrent. For the fourth experiment 38 genotypes were selected based on mean performance and genetic diversity. These genotypes were evaluated to assess their stability using Eberhart and Russell model at Dharwad. Mundgod and Mugad in summer 20 I O. Based on stability parameters genotypes viz., 488-15-6, Manikya and LBG-685 were found to be stable for majority of characters with higher mean performance, whereas the genotype IC-436722 was found to be specifically adapted to unfavourable environment.

Heterosis combining ability and gene action studies for productivity related traits in green gram (*Vigna radiata* (L) Wilczek)

K. SUJATHA

2009

MAJOR ADVISOR : Dr. S. T. KAJJIDONI

An study on line x tester analysis in green gram (*Vigna radiata* (L) Wilczek) was conducted during *kharif* 2009 with an objective to study the extent of heterosis, to assess the combining ability of the parents and to know the nature of gene action in respect of seed yield and its eleven component traits involving two varieties as lines and ten varieties as testers and their 20 hybrid combinations. Twelve parents were screened for powdery mildew under natural epiphytotic condition in which resistant reaction was exhibited by only one genotype i.e. T ARM18 and moderate resistant reaction was shown by four genotypes, TARM-1, TARM-2, YC-1 (VC-6468-11-1 A) and BPMR-145. Susceptible reaction was exhibited by Yaibhav, DMG-1030, KGS-83, BPMR-1 and Pusabaisaki. Relatively high degree of better parent heterosis was observed in the present study, especially for the traits namely, seed yield per plot (26.43 to 113.17%), seed yield per plant (18.73 to 136.43%), total dry matter at harvest (19.12 to 84.44%) and number of pods per plant (25.75 to 58.90%). Chinamung x YC1, Chinamung x TARM-18, Chinamung x BPIVIR-1,

Pusabaisaki x YC-I and Pusabaisaki x BPMR-1 were the top performing crosses across the traits. Among the male parents YC-1, TARM-18 and TARM-1 were good general combiners for most of the traits. Among female parents Chinamung was relatively good general combiner for most of the traits than Pusabaisaki. The per se performance of testers reflected that TARM-2 recorded highest seed yield of 5.57 (g/plant) and followed by T ARM-I and YC-I recording same seed yield of 4. 67(glplant) and 4.63(glplant) with hundred seed weight of 3.17 (glplant) and 3.33 (g/plant) and all three top performing parents showed moderate resistance reaction to powdery mildew. Three hybrids viz., Chinamung x YC-1, Chinamung x T ARM-I 8 and Chinamung x BPMR-1 exhibited significant sca effects with good per se performance for seed yield per plant and seed yield per plot. The genetic analysis revealed that the most of the traits were under control of additive genetic and also by epistatic variation. Heterotic cross combinations involving exoitic line VC-1 and indigenous line BPMR-1 can be advanced further for isolation of superior segregants.

Breeding investigations in vegetable soybean (*Glycine max* (L.) Merrill)

P. SWATHI

2009

MAJOR ADVISOR : Dr. G. T. BASAVARAJA

An investigation was carried out at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2008 to access the genetic variability, quality traits and stability among vegetable soybean genotypes. The experimental material for the study comprised of twelve vegetable soybean genotypes developed/ maintained at All India Co-ordinated Research Project on Soybean, University of Agricultural Sciences, Dharwad along with two checks *viz.*, Himso 1563 and JS 335. Among the genotypes, strain 2000-02 recorded highest green pod yield (9408 kg/ha) and significant superiority with respect to traits *viz.*, pod length, pod width and 100 seed weight and sugar content (91.5 mg/g) compared to checks. Check Himso 1563 recorded highest protein content (41.94 %) followed by 2000-02 (41.54%). The study revealed wide range of variability for all traits indicating the presence of sufficient variation among the genotypes. High heritability coupled with high genetic advance was observed for traits *viz.*, plant height, days to maturity, days to 50 per

cent flowering, pod length, pod width, 100 seed weight, sugar content, protein content and oil content. The association analysis revealed that green pod yield had significant positive association with 100 seed weight and sugar content at genotypic level. The organoleptic evaluation indicated that strain 2000-02 exhibited highest scores for over all acceptability compared to checks Himso 1563 and JS 335. In stability analysis, pooled ANOVA revealed significant differences among genotypes and environment for all the traits except for number of pods per plant indicating diverse nature of genotypes and environment. The G x E interaction was significant for all the traits except for number of branches per plant and green pod yield indicating differential response of the genotypes in different environments. However, on the basis of stability parameters 2000-05 was identified as stable genotype for all the characters studied except plant height across environments.

Breeding investigations on improving combining ability for exploitation of heterosis in okra (*Abelmoschus esculentus* (L.) Moench)

TIMMANNA P. ONTAGODI

2009

MAJOR ADVISOR : Dr. P. M. SALIMATH

An investigation was carried out during *rabi* (2007), summer and *kharif* seasons of 2008 and 2009 at Botany Garden, College of Agriculture, UAS, Dharwad to study the variability generated and component of variance, among first cycle of BIP progenies (BIPC₁) generated from F₂ populations, second cycle of BIP progenies (BIPC₂) generated from random mated F₃ populations and four F₄ populations developed from four commercial hybrids *viz.*, BH-1, BH-2, B.H-3 and BH-4. Biparental populations developed were P₁ (BH-1x BH-2), P₂ (BH-2x BH-1), P₃ (BH-3x BH-4) and P₄ (BH-4x BH-3). The mean fruit yield per plant was higher in case of BIPC₂ populations (P₁=370.91 g, P₂=318.00 g, P₃= 334.39 and P₄=354.52) compared to that of BIP₁ populations (P₁=346.48 g, P₂=328.74, P₃=331.03) except P₂ population. All the BIP populations showed higher populations (P₁=346.48 g, P₂=328.74, P₃=305.90 and P₄=331.03) except P₂ population. All the BIP populations showed higher mean yield/plant than the F₄ populations (BH-1 =324.21, BH-2=304.21, BH-3=312.67 and B H-4=318.82). Range values showed similar pattern

as that of mean values. Biparental population P₁ exhibited higher GCV (37.66 and 39.76) values in both BIPC₁, and BIPC₂ cycles, respectively for the character fruit yield/plant compared to other BIP populations, whereas BH-2 (28.39) showed higher GCV in case of F₄ populations. Genetic advance and GAM values followed the similar pattern as that of GCV values. Of the two cycles of biparental mating, BIPC₂ populations resulted in higher within and between family variances as compared to BIPC₁ populations. Cross combination P₁ showed higher within family (41552.73 and 49552.73), whereas P₄ exhibited higher between family variance (1053.93 and 814.87) in both BIPC₁ and BIPC₂, respectively as compared to other two cross combinations for fruit yield/plant. Low narrow sense heritability (9% and 6%) was observed for P₁ population in both the cycles of BIP populations for fruit yield/plant followed by P₄ population. Per cent distribution of superior segregants observed was more in P₁ (44%) and P₄ (24.80%) populations of BIPC₂, while BH-1 (27%) in case of F₄ populations for the character fruits yield/plant.

Genetic investigations involving biparental mating and selection schemes in tomato [*Solanum lycopersicum* (Mill.) Wettst.]

R. VENKATARAMAN

2010

MAJOR ADVISOR : Dr. (Mrs.) O. SRIDEVI

The present investigation was conducted at Botany Garden of Agriculture College, Dharwad to compare the relative efficiency of different selection methods *viz.*, individual plant selection (IPS) and bulk (BP) in biparental progenies (derived from inter and intra-population mating) for release of genetic variability, nature of association of component traits with fruit yield in tomato. Assessment of variability and percent of superior segregants released in single cross F₃ populations of tomato was also done as part of another experiment. The results of BIP F₃ populations revealed that, the mean values were high in inter-population mating (M/S and S/M) for the characters average fruit weight (43.55 and 50.03) and yield (598.33 and 665.96) in IPS method compared to intra-population mating. Estimates of genetic parameters were high in populations of bulk method compared to IPS. Population S/M of bulk method recorded highest values for GCV and PCV for number of fruits per

plant (107.43 and 111.77), average fruit weight (49.68 and 51.36) and fruit yield (49.30 and 63.37). Population 4 of single cross F₃ populations showed highest GCV and PCV for number of fruits per plant (47.54 and 52.60) and average fruit weight (35.84 and 38.20). Correlation studies revealed that fruit yield per plant was associated with fruits per truss, number of fruits per plant and average fruit weight in both the experiments. But population S/M of IPS method showed positive correlation of number of fruits per plant with average fruit weight. This type of change in association pattern in desirable direction indicated that biparental mating had resulted in breaking of undesirable associations. Inter mating populations (M/S and S/M) showed higher percentage of superior segregants for yield contributing traits. Single cross F₃ populations, 1 and 4 showed high number of superior segregants for yield related and quality traits. This would be effect of the common parent S-22 used in generation of these populations.

Study of segregating material derived from crosses of red x red and red x white grain for yield and grain mold resistance in sorghum [*Sorghum bicolor* (L.) Moench]

VINAY S. PATTED

2010

MAJOR ADVISOR : Dr. M. Y. KAMATAR

The present investigation was intended to estimate the nature and magnitude of genetic variability, genetic diversity and character association for yield and grain mold resistance in 99 sorghum F₃ progenies of Red x Red and Red x White grain crosses including parents and checks. Variation for grain mold associated traits were analyzed and characterized with respect to grain hardness, panicle compactness, grain colour, glume length and colour. Among 99 progenies 30 progenies had partly hard grains and 19 progenies had hard grains and with incidence of grain mold. In case of panicle compactness 6 progenies were very loose, 9 progenies

were loose and 26 progenies were semi-loose and exhibited low incidence of grain mold. Twenty one progenies and seven progenies had long glume coverage and very long glume coverage respectively and were resistant to grain mold. All red grained progenies showed low incidence of grain mold and progenies which had red and black coloured glumes were moderately resistant to grain mold. First and eleventh progenies of IS 24995 x IS 23585, first and ninth progenies of IS 24996 x IS 23585 and 8th progeny of IS 25022 x IS 23585 were high yielding and resistant to grain mold.

Using D2 statistics 99 genotypes were grouped in to ten clusters. Cluster I was largest with 42 genotypes followed by cluster-II with 30 genotypes. Cluster-III secured first rank across seven traits followed by cluster-I indicating the presence of most promising genotypes in them for yield and mold resistance. Correlation studies indicate that grain yield had

positive and highly significant association with 1000 grain weight and fodder yield, whereas days to maturity and days to flowering had negative and highly significant correlation with grain yield. Path co-efficient analysis revealed that 1000 grain weight had the highest positive direct effect on grain yield.

HOME SCIENCE EXTENSION AND COMMUNICATIONS

A study on government educational programmes in rural area

MADHU BYATAPPANAVAR

2010

MAJOR ADVISOR : Dr. UMA S. HIREMATH

The present investigation was intended to estimate the nature and magnitude of genetic variability, genetic diversity and character association for yield and grain mold resistance in 99 sorghum F3 progenies of Red x Red and Red x White grain crosses including parents and checks. Variation for grain mold associated traits were analyzed and characterized with respect to grain hardness, panicle compactness, grain colour, glume length and colour. Among 99 progenies 30 progenies had partly hard grains and 19 progenies had hard grains and with incidence of grain mold. In case of panicle compactness 6 progenies were very loose, 9 progenies were loose and 26 progenies were semi-loose and exhibited low incidence of grain mold. Twenty one progenies and seven progenies had long glume coverage and very long glume coverage respectively and were resistant to grain mold. All red grained progenies showed low incidence of grain mold and progenies which had red and black coloured glumes were moderately

resistant to grain mold. First and eleventh progenies of IS 24995 x IS 23585, first and ninth progenies of IS 24996 x IS 23585 and 8th progeny of IS 25022 x IS 23585 were high yielding and resistant to grain mold. Using D2 statistics 99 genotypes were grouped in to ten clusters. Cluster I was largest with 42 genotypes followed by cluster-II with 30 genotypes. Cluster-III secured first rank across seven traits followed by cluster-I indicating the presence of most promising genotypes in them for yield and mold resistance. Correlation studies indicate that grain yield had positive and highly significant association with 1000 grain weight and fodder yield, whereas days to maturity and days to flowering had negative and highly significant correlation with grain yield. Path co-efficient analysis revealed that 1000 grain weight had the highest positive direct effect on grain yield.

Devadasi women - An exploratory study

MAMATA DALAVI

2010

MAJOR ADVISOR : Dr.(Mrs.) CHHAYA BADIGER

Research study was conducted on Devadasi Women in the year 2009-2010 in Hubli, Navalgund of Dharwad district and Nargund of Gadag District of Karnataka with a sample size of 80 Devadasi women. The data was collected on personal characteristics, awareness, opinion, knowledge and suggestions for improvement of Government programmes. This information was collected through pre tested structured interview schedule. Devadasi women revealed that major reasons for dedication were poverty, social customs and religious beliefs. Majority of Devadasis belonged to middle age (72.50%) most of them were illiterates (86.50%) and belonged to scheduled caste (70.00%). Half of the respondents were agricultural labourers. Most of the respondents were aware about subsidiary income generating activities like dairy (68.75%), poultry (65.00%) and sheep rearing (61.50%). Fourty per cent of Devadasi women had expressed favourable opinion towards the income generating activities. More than

90 per cent of the respondents expressed the training need on phenyle preparation followed by candle making (71.25%), vessel cleaning powder preparation (66.20%), washing powder preparation (63.80%) and agarbatti making (57.50%). After the training programme, in the high knowledge category of candle making there were 43.80 per cent of Devadasi women while in vessel cleaning powder preparation 31.20 per cent, in washing powder preparation 27.50 per cent, in phenyle preparation 48.80 per cent and in agarbatti making 40 per cent of Devadasi women were found. Most (45%) of the respondents had received Below Poverty Line (ration) cards followed by state Government masashana (26.20%) and janata houses (25.20%). Most (87.50%) of the respondents suggested to provide pension for all Devadasis, janata houses (86.25%) and employment reservation for their children (83.75%). There was association between the education, size of the family and annual income with the awareness level of income generating activities.

Awareness and listening behaviour of the listeners of krishi community radio station

MADHU PATTANASHETTI

2010

MAJOR ADVISOR : D. A. NITHYASHREE

The study was conducted during 2009-10 in Dharwad district of state to investigate the awareness and listening behaviour of Krishi Community Radio Station listeners. The data was collected from 76 women and 76 men respondents, selected based on random sampling from four villages in Dharwad taluk through personal interview schedule. The results showed that majority of the respondents were of young age (81.58%), married (69.74%) and 44.08 per cent were literates. Most of the respondents possessed radio sets (60.53%) and were listening to the radio at home (93.42%). Higher number of respondents were aware of Krishi Chintana programme (85.53%) followed by Pakshika Salahegalu (81.58%) and Vigyanigala Sandarshana (53.29%). Fifty two per cent of the respondents preferred Krishi Chintana programme followed by Pakshika Salahegalu (46.71%) and Avishkaragalu (32.89%). Sixty eight per cent of the listeners had medium level of listening behaviour and more than half

of the respondents (57.24%) listened to the programmes only for half an hour. Seventy five per cent of the listeners said that duration of the programmes were not adequate. Most (61.84%) of the listeners faced lack of signals as a major problem followed by power cut (54.61%) and burden of household/field work (32.89%). Higher number (59.87%) of listeners suggested that programmes must be broadcasted in the morning (9am-12pm) and evening (6pm-9pm) time followed by improvement in the network coverage (54.61%). Twenty eight per cent of the listeners preferred news as an additional programme. The question and answer format of presentation was most (66.45%) preferred by listeners followed by interview with farmers (51.32%) and dialogue (41.45%). The awareness level of programmes was associated with education, family size and land holding of the respondents. Listening behaviour was associated with education and family size of the men listeners.

Utilization of information and communication technology (ICT) tools by staff and students in Universities

SMARANIKA PARIDA

2010

MAJOR ADVISOR : Dr. (Mrs.) UMAS. HIREMATH

A study on "Utilization of information and communication technology (ICT) tools by staff and students in Universities" was undertaken in the year 2009-2010 with a sample size of 184 staff (92) and students (92) of Karnatak University and University of Agricultural Sciences in Dharwad district of Karnataka. The data was collected on awareness, knowledge, extent of utilization, problems faced and suggestions about selected ICT tools with the help of pre-structured interview schedule. Majority of students were having more awareness (98.91%) than that of staff (92.39%). Friends and relatives played major source of awareness

(52.71%) about ICT tools for most of the respondents. Most of the respondents were having awareness regarding Internet (93.47%) followed by MS Word (92.39%) and MS Excel (89.13%). Staff were leading with knowledge level (50.00%) whereas students were leading with utilization level (40.21%) of ICT tools. Maximum number of respondents paid money on usage of Internet (66.84%). Internet and MS power point were highly used for gaining knowledge (67.39%) and making presentation (64.67%) respectively. Staff and students preferred Internet more due to clarity and need based. Both staff and students were facing the general

problems like read only content, articles giving only abstracts, lack of proper training, low or poor connection of Internet and difficulties to download full article. During usage of ICT tools, staff were facing the specific problems like less conversation with parents, eye pain, back ache and head ache whereas, students faced less meeting of friends and siblings,

head ache and eye pain regularly. Respondents suggested for proper Internet connection for each PC followed by training. There was association between type of family, size of family, occupation of parents/ husband / wife and accessibility to computer with the knowledge and utilization level of respondents of ICT tools.

HORTICULTURE

Integrated nutrient management studies on growth, yield and quality of garland chrysanthemum (*Chrysanthemum coronarium* L.)

AIRADEVI P. ANGADI

2010

MAJOR ADVISOR : Dr. J. C. MATHAD

A field experiment was conducted on red sandy loam soil at Floriculture unit of Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad, during *kharif* 2009-2010 to study the effect of integrated nutrient management on growth, yield and quality of garland chrysanthemum. The experiment was laid out in randomized block design with 3 replications and 9 treatment combinations comprising of inorganic fertilizers, organic manures and biofertilizers. The treatment receiving *Azospirillum* + PSB + 50% vermicompost equivalent to RDN + 50% recommended NPK recorded the highest plant height, number of branches, plant spread, leaf area index, dry matter accumulation and yield attributes such as number of flowers per plant, number of flowers per plot, flower yield/plot, flower yield/plot and flower yield/ha. The early flower bud initiation, 50 per cent flowering and more

flowering duration was achieved in the treatment receiving *Azospirillum* + PSB + 50% vermicompost equivalent to RDN + 50% recommended NPK. Significantly higher available nutrients (nitrogen, phosphorus and potassium) and their uptake by plants was recorded in treatment receiving *Azospirillum* + PSB + 50% vermicompost equivalent to RDN + 50% recommended NPK. Application of *Azospirillum* + PSB + 50% vermicompost equivalent to RDN + 50% recommended NPK registered significantly higher quality parameters such as flower diameter, shelf life of loose flowers and vase life of cut flowers. The economic analysis clearly indicated that net returns/ha and B:C ratio was highest in the plots treated with *Azospirillum* + PSB + 50% vermicompost equivalent to RDN + 50% recommended NPK (Rs. 1,95,135 and 4.23 respectively) and this finding can be used in making garland chrysanthemum production more profitable.

Stability analysis of lemongrass genotypes

T. ANUMOL

2010

MAJOR ADVISOR : Dr. C. K. VENUGOPAL

An experiment was conducted during June, 2008-09 to May, 2009-10 at three different environments viz. Medicinal and Aromatic Plants Unit, Saidapur Farm, Dharwad; Agricultural Research Station (ARS) Paddy, Sirsi and Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka to find out the stable genotypes of lemongrass (*Cymbopogon flexuosus*) over locations and to characterize the genotypes based on morphological characters. The treatments included seven genotypes of lemongrass OD-440, Cauvery, Krishna, Pragati, Praman, OD-19 and CKP-25. Genotype environment interactions were significant for most of the characters indicating differential response of the genotypes in different environments. On the basis of stability parameters it was revealed that genotypes Krishna, OD-19, Praman, CKP-25 and Cauvery were more stable for majority of characters over all three locations. On the basis of stability analysis of individual characters, genotype Krishna was found to

be stable for as many as five characters followed by genotypes OD-19, Praman, CKP-25 and Cauvery (four characters) and Pragati (three characters). Among all the genotypes, OD-440 was found to be stable for only two characters. The genotypes Cauvery, Praman showed stability for herbage yield per plant and total herbage yield, while genotypes Cauvery and CKP-25 were more stable for oil yield per plant. With respect to citral content OD-19, CKP-25 and Krishna were more stable. For characterization based on colour of leaf, genotypes were grouped into pale green and green; based on colour of leaf sheath as red, light red, greenish red and ashy green. The tillers have divergent growth for only one genotype whereas six genotypes have compact growth. Among the tested genotypes all possessed hairs on leaf blade. There was no difference among genotypes for leaf arrangement and all the genotypes were grouped under alternate category.

Studies on planting dates and storage of seed rhizome in ginger (*Zingiber officinale* Rosc.)

ARWANKIE SHADAP

2010

MAJOR ADVISOR : Dr. N. K. HEGDE

Studies on planting dates and storage of seed rhizome in ginger were carried out during 2009-10 at Kittur Rani Channamma College of Horticulture, Arabhavi, Gokak (Tq), Karnataka. Field trial on planting dates was laid out in randomized block design with six treatments, replicated four times. Among the six planting dates, higher fresh rhizome yield was obtained by May planting (17.09 t/ha) followed by June planting (16.49 t/ha) and the yield was decreased with delayed planting. Incidence of *Helminthosporium* leaf spot was minimum in May (22.87%) and June (28.26%) planting compared to March planting (68.96%). Storage study was laid out as factorial RBD with two factors (Storage methods and seed rhizome treatment) replicated three times. The rhizome stored in 250 gauge polyethylene bag with 0.5 per cent vents and kept in ZECC after treating with *Trichoderma harzianum* recorded minimum physiological

loss in weight (14.37%) and maximum recovery of seed rhizome (77.51%). Stored seed rhizome was evaluated for field performance and in the field M3S3 (rhizome stored under ZECC after treating with *Trichoderma harzianum*) recorded maximum germination (98.89%) at 45 days of planting with favourable growth attributes. The crop raised from seed rhizome stored under ZECC after treating with *Trichoderma harzianum* produced vigorous growth with higher fresh rhizome yield (22.35 t/ha) closely followed by the crop raised from rhizome stored under 250 gauge polyethylene bag with 0.5 per cent vents after treating with *Trichoderma harzianum* (20.48 t/ha) and the crop raised from rhizome stored under ZECC treated with 0.3 per cent Ridomil MZ (20.07 t/ha). The lowest fresh rhizome yield was recorded in the conventional practice of storing in sand layer with no seed treatment (11.84 t/ha).

Micropropagation studies in dracaena and cordyline

CHINNU JOSEPH KATTOOR

2010

MAJOR ADVISOR : Dr. A. N. MOKASHI

An investigation on micropropagation in Dracaena and Cordyline was conducted during 2009-2010 in the tissue culture lab of the Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad. The study on surface sterilization of explants pretreated with a fungicide (bavistin) and a bactericide (streptomycin) revealed that 0.1% HgCl₂ for 5 minutes showed minimum contamination without any toxicity to both the plants. As regards suitability of explants, shoot tip and nodal cuttings were the best for culture establishment in case of Cordyline. Shoot tips gave the quickest response for initial growth and nodal cuttings

took more time for growth. In case of multiple shoot production, there was no significant difference between nodal cuttings and shoot tips. The explants of dracaena did not show any response. *In vitro* proliferated explants were sub cultured on MS medium with BAP at different concentrations. Increase in the concentration of BAP in the media led to an increase in the multiplication rate. However there was a decrease in shoot length which resulted in formation of clumps. Media with 4 mg/l BAP showed better response in terms of shoot production. The combination of BAP and NAA improved shoot multiplication as against

BAP alone resulting in more number of multiple shoots (4 mg/l BAP + 0.5 mg/l NAA). As the shoots formed were relatively shorter, GA₃ was added to improve shoot length. Media fortified with 4 mg/l BAP + 0.5 mg/l NAA + 5 mg/l GA₃ produced more number of shoots of more length. Shoots obtained in the present study were transferred to rooting media but

the multiplied shoots did not respond to *in vitro* rooting rather callus tissues were formed instead of roots, so *ex vitro* rooting was undertaken. Treating the microshoots with 25 ppm IBA and hardening the shoots in peat media found to be effective with respect to percent rooting, number of roots and root length.

Effect of substrates pre-treatments and drying methods on quality of dehydrated oyster mushroom (*pleurotus florida*) products

DADASAHEB DESAYI

2010

MAJOR ADVISOR : Dr. LAXMAN KUKNOOR

An investigation on effect of substrates, pre-treatments and drying methods on quality of dehydrated oyster mushroom (*Pleurotus florida*) products was carried out at the Department of Post Harvest Technology, K.R.C.C.H, Arabhavi during 2009-2010. Higher yield per bag (840 g/kg), yield per kg substrate (480 g/kg), bio-efficiency (84.13 %), shelf life (6 days), colour and appearance (4.67), flavour (4.71), overall acceptability (4.75) and B:C ratio (4.66) were recorded in wheat straw + dolichous bean husk + tur powder + bagasse treatment combination. The least time taken for dehydration (9.35 hrs), dehydration ratio (8.60), non-enzymatic browning (0.55 %), microbial count and higher recovery (1 1.63 %), rehydration ratio (2.76), higher scores for colour and appearance (4.8-3.4), texture (4.2-3.2), taste (4.6-3.4) and overall acceptability (4.4-3.2) were recorded in mushrooms pretreated with 1 per cent KMS+ 0.5 per cent citric acid for 5 minutes under electric drier from

initial to 6 months of storage. In the organoleptic evaluation of mushroom fortified biscuits at 15 and 30 DAS, higher score for colour and appearance (4.5-3.3), flavour (4.6-3.9), crispiness (4.54-3.10), taste (4.55-3.20) and overall acceptability (4.53-3.30) and also the least count for bacteria, fungi, yeast were noticed in bakery recipe + 10 per cent mushroom powder + 0.2 per cent strawberry flavour. Higher score for colour and appearance (4.50), texture (4.10), taste (4.30) and overall acceptability (4.15) was observed in the mushroom fortified noodles prepared by 15 per cent mushroom powder+ noodle flour. Less oil uptake (32 ml/400g), higher recovery (21. 77%), colour and appearance (4.50), flavour (4.30), crispiness (4.30), taste (4.34) and overall acceptability (4.4) were recorded in fresh mushroom chips prepared by soaking in 1 per cent salt + 1 per cent KMS + 0.5 per cent citric acid for 5 minutes along with partial dehydration for 2 minutes.

Studies on organic production techniques in knolkhol (*Brassica oleracea* var. *gongylodes* L.)

C. V. DIVYA

2010

MAJOR ADVISOR : Dr. J. C. MATHAD

An experiment was conducted during *kharif* and *rabi* 2009 at Olericulture section of the Division of Horticulture, University of Agricultural Sciences, Dharwad to find out the influence of organic manures on growth, yield, quality and economics of knolkhol. The treatments included were combinations of organic manures (FYM, Poultry manure, Sheep manure, Vermicompost) with or without biofertilizers (*Azospirillum* + Phosphorus solubilizing bacteria). Integrated application of organic manures with biofertilizers had a beneficial effect on growth and yield attributes of knolkhol and recorded results next best to RDF+FYM and RDF alone. In both the seasons all the growth parameters (plant height, number of leaves, leaf area, diameter of knob and dry matter content) and yield found to be significantly higher when RDF was supplied together with FYM and the lowest was observed when only organic manures were supplied without biofertilizer treatment to the plant. The net returns and B:C ratio was found to be higher in the same treatment. Among organic

manures combination, T₅ which received poultry manure (4t/ha), vermicompost (5t/ha) along with biofertilizer (*Azospirillum* and phosphorus solubilizing bacteria) and T₆ which received sheep manure (4t/ha), vermicompost (5t/ha) along with biofertilizer (*Azospirillum* and phosphorus solubilizing bacteria) have shown significantly higher growth, yield and B:C ratio close to control (RDF alone). *Rabi* found to be more suitable season for growing knolkhol compared to *kharif*. Quality parameters like protein content, ascorbic acid, TSS and shelf life of knolkhol were increased by the application of organic manures with biofertilizers, while crude fibre content decreased significantly. Protein content was highest in RDF+FYM received knobs but ascorbic acid and TSS found to be higher in treatments which received organic manures together with biofertilizers. Crude fibre found to be the least in organic manure alone treated knobs and the same treatment increased shelf life of the knob.

Evaluation of bottle gourd genotypes (*Lagenaria siceraria* (Mol.) Standl.)

M. HARIKA

2010

MAJOR ADVISOR : Mr. VILAS D. GASTI

Field investigation with twenty five genotypes of bottle gourd was undertaken to elicit information on evaluation for growth, earliness, yield, quality, seed parameters and pest and disease incidence at Department of Vegetable Science, Kittur Rani Channamma College of Horticulture, Arabhavi during *kharif*, 2009-10. Analysis of variance revealed significant ($p=0.05$) differences among treatments for 24 growth, earliness, yield, quality and seed parameters. The genotype Sarika was found to possess maximum number of primary branches. While, Anand Bottlegourd-1 recorded maximum vine length and Thar Samridhi was noted for highest number of leaves and thicker flesh. The genotype NBBL-12 was noted for earliness to flowering and fruiting, while, the genotype Gaja was found to be promising for lower sex ratio (male to female), more number of fruits per vine, fruit yield per hectare and seed yield per

hectare. Performance studies revealed that the genotypes Gaja, NS-421, NBBL-12, Sharada, INDAM-204, NS-443, Super Dhana, Arka Bahar and Krushi Sampada were found promising for fruit yield and Anand, Gaja, Gutkha and NS-443 for seed yield. The genotypes Gutkha, Sarika and Kaveri were found to show resistant reaction against downy mildew. Elina was found to be resistant to fruit fly while US-15, Sharada, Arka Bahar, Champion and NBBL-52 were found to show least incidence. Correlation studies revealed significant and positive association of fruit yield with vine length, number of fruits per vine, fruit yield per hectare, seed yield per fruit, seed yield per vine and seed yield per hectare. Whereas, seed yield was significantly and positively correlated with vine length, T.S.S., number of fruits per vine, average fruit weight, fruit yield per vine, fruit yield per hectare, 100 seed weight and seed yield per hectare, suggesting that possibility of simultaneous selection for these traits.

Stability analysis in marigold

KAPIL V. PATIL

2010

MAJOR ADVISOR : Dr. BALAJI S. KULKARNI

An investigation was undertaken to assess stability of twenty promising marigold genotypes under three different environments viz., *Rabi*, Summer, and *Kharif* during 2008-2009. The observations in all the environments were assessed for different growth, flowering, yield and quality characters following the stability model of Eberhart and Russell (1966). The genotypic variance was highly significant for all the characters except for stem girth at 60 days after transplanting. Genotype X

environmental interactions were significant for plant height at 60 and 90 days after transplanting, plant spread at 30,60 and 90 DAT, number of primary branches at 90 DAT, days taken for 50 percent flowering, leaf area at 30, 60 and 90 DAT, flower yield per plot, seed yield per plant, flower diameter, shelf life and xanthophyll content. The genotype AMC-19 was stable with relatively better yield and quality as indicated by its high mean value with stable and predictable performance followed by

AMC-8 and AMC-20 across the different environments. The genotype AMC-6 was found suitable for favourable environmental conditions. Correlation studies over environment revealed positive and significant

association of yield per hectare with number of flowers per plant, duration of flowering, plant height, plant spread, chlorophyll 'a' content and leaf area.

Studies on effect of different sources of nitrogen and potassium on productivity and shelf life of onion (*Allium cepa* L.) var.

Arka Kalyan

LAXMAN KALE

2010

MAJOR ADVISOR : Dr. T. B. ALLOLLI

The investigation was conducted at MARS, UAS, Dharwad during kharif 2009 to study the effect of different sources of nitrogen and potassium on productivity and storage of onion (*Allium cepa* L.) var. Arb Kalyan. The superiority of morphological characters like plant height, number of leaves, neck thickness, leaf area, chlorophyll content dry matter and nutrient uptake were due to sulphate of potash as a source of potassium and ammonium sulphate as a source of nitrogen. Among various interaction effect, highest uptake of nitrogen and potassium were due to interaction of sulphate of potash and ammonium sulphate. Similarly, yield and yield attributing characters viz, polar and equatorial diameter, fresh bulb weight, rings per bulb, TSS, bulb yield were significantly maximum due to application of sulphate of potash and ammonium sulphate than sources of potassium and nitrogen. Economics of crop worked out. Among

potassium sources, the higher net return was obtained with sulphate of potash. But muriate of potash exhibited higher B:C ratio than sulphate of potash due to its lower cost. Among nitrogen sources, the highest net return was realized due to application of ammonium sulphate. But the highest B:C ratio was noticed due to application of urea which is mainly attributed to lower cost of urea. Interaction with respect to B:C ratio found significant. The highest B:C ratio recorded due to interaction effect of muriate of potash and urea, which may be further attributed to lower prices of both urea and muriate of potash. During storage studies, there was no significant difference on any of the post harvest parameter of onion due to different source of Potassium. Among different nitrogen sources, significantly lowest loss in PLW, rotting, sprouting and total loss due to application of sheep manure followed by FYM.

Studies on storage of mango varieties/hybrid under evaporative cool chamber

MAHANTESH

2009

MAJOR ADVISOR : Mr. SYED ABBAS HUSSAIN

An experiment was conducted in new orchard, Main Agriculture Research Station, Raichur during May and June, 2006-07 to find out the effect of packages under evaporative cool chamber and ambient condition in mango varieties and hybrid. The experiments were laid out in factorial RBD with eight treatments and 4+ 1 replications. The lesser physiological loss in weight and increase in total soluble solids, titrable acidity and ascorbic acid were noticed in Zero energy cool chamber than ambient conditions when fruits were packed in perforated plastic crates. In the studies, total soluble solids in per cent of mango fruits slowly increased when the fruits were kept in zero energy cool chamber than ambient condition. The data revealed that there was decrease in organic acid content during storage period. The higher values of ascorbic acid content

on 15th day of storage under zero energy cool chamber condition was maintained in perforated plastic crates (29.29 mg/100g). The data obtained from the different experiments on Khadar and Beneshan varieties and Neleshan hybrid of mango fruits indicate that chlorophyll content in fruit peel under different storage condition decreased. The decline was slow in zero energy cool chamber as against ambient conditions because of low temperature and high humidity. The result on reducing sugar up to 9th day and later slightly reduced under zero energy cool chamber as well as ambient condition. Among packages, perforated plastic crates were found superior in terms of low decay loss (17.5 %), however the decay percent was more in zero energy cool chamber.

Micropropagation studies in jamun (*Syzygium cumini* L.)

NEYAZ AHMED CHOUDHRI

2010

MAJOR ADVISOR : Dr. V. C. KANAMADI

Jamun (*Syzygium cumini* L.) competently can be propagated *in vitro* by using single nodal segments taken from the seedlings. The nodal segments with single node taken from the seedlings produced multiple shoots when cultured on MS (Murashige and Skoog, 1962) medium along with 3 per cent sucrose + 2 mg/l BAP and 100 mg/l ascorbic acid. An average of 6 shoots per explant was produced with following transfer to the medium after 15 days. The shoots were excised and the residual explants were transferred to fresh medium, where they again developed shoots. Up to six such passages of 2 weeks resulted in the production of shoots from the repeatedly sub cultured explants. The results were also noticed that over a passage of 6 subcultures reduced the phenolic browning and at the end with following repeated harvesting of the shoots and

subculture of the residual explants an average of 32 shoots per explant was obtained. Among anti oxidants activated charcoal (0.5 %), and a surface sterilants mercuric chloride (0.5%, 11 min), and media strength i.e. MS at half strength was proved to be more effective in producing multiple shoots when a single nodal segment in vertical position from seedlings was cultured. The *in vitro* developed shoots produced roots when transferred to ¼ strength MS medium along with 3 per cent sucrose and 3 per cent activated charcoal with cent per cent rooting on addition of 2.5 mg/l IBA and produced more number of roots (5.5). The developed shootlets were hardened on vermiculite with 32.5 per cent of survival after 6 weeks. The shootlets were then transferred to the polybags and then to the field.

Effect of organic manures and inorganic fertilizers on growth, root yield and quality of ashwagandha

(*Withania somnifera* Dunal.)

NICHAPUR VIJAYA

2010

MAJOR ADVISOR : Dr. K.N. KATTIMANI

Field investigation with different combinations of organic manures and inorganic fertilizers was undertaken to elicit information on nutrient management in ashwagandha in the experimental field of the department of Medicinal and Aromatic Plants, Kittur Rani Channamma College of Horticulture, Arabhavi during 2007-08. The experiment was laid out in factorial randomized block design with 27 treatments involving different combination of organic manures and inorganic fertilizers with three replications. Among different levels of farmyardmanure (FYM), vermicompost and inorganic fertilizers, application of 5.0 t FYM per hectare, 1.0 t vermicompost and 30:40:30 kg NPK per hectare had beneficial effect on vegetative growth and yield parameters. Significantly highest plant height (76.68 cm), number of leaves per plant (47.84), number of branches per plant (10.48), plant spread (61.24 cm and 58.98

cm East west and North south respectively), LAI (3.498), CGR (0.860 g/m²/day), RGR (0.0460 g/g/week), NAR (0.221 g/m²/day), dry matter accumulation (17.40 g/plant), fresh root yield (12.30 q/ha), dry root yield (9.33 q/ha), seed yield (192.47 kg/ha) and root diameter (15.82 mm) were recorded with the combined application of 5.0 t FYM + 1.0 t vermicompost + 30:40:30 kg NPK per hectare. Highest root length (14.68 cm) was recorded with 5.0 t FYM + 1.0 t vermicompost + no NPK per hectare. The highest net returns of Rs. 37,945 per hectare and cost benefit ratio of (3.07) was obtained by the combined application of 2.5 t FYM + 1.0 t vermicompost + 15:20:15 kg NPK per hectare under agro-climatic conditions of Arabhavi. Significantly highest total alkaloid content was recorded with the application of 5.0 t FYM + 1.0 t vermicompost followed by 5.0 t FYM+ 0.5 t vermicompost and 5.0 t FYM per hectare alone (0.21% each).

Influence of pretreatments of bulbs and split application of fertilizers on growth and yield of tuberose (*Polianthes tuberosa* L.) Cv. single

GAIKWAD VIJAYKUMAR HARIDAS

2009

MAJOR ADVISOR : Dr. ASHOK HUGAR

A filed experiment was conducted in new orchard, Main Agriculture Research Station, Raichur during 2008-09 to know the influence of pretreatment of bulbs and split application of fertilizers on growth and yield of tuberose. The experiment was laid out in split plot design having nine treatments (3 main and 3 sub treatments)¹ and three replications. Among the pretreatments of bulbs, water soaking treatment was found significantly superior for vegetative parameters, viz., days required to sprouting, plant height, number of tillers, number of leaves and leaf area and yield parameters, viz., number of spikes per clump, individual flower weight, flower yield per clump, flower yield per plot, flower yield per hectare (7.89 tonnes) and shelf life of flowers (2.81 days) than control. The same treatment was found on par with GA3 treatment in respect to

both vegetative and yield parameters. Among the different split doses of NPK, four splits of NPK was found significantly superior for vegetative parameters, viz., plant height, number of tillers, number of leaves and leaf area and yield parameters, viz., number of spikes per clump, spike length, number of flowers per spike, individual flower weight, length of flower, flower yield per clump, flower yield per plot, flower yield per hectare (7.72 tonnes) and shelf life of flowers (2.94 days) as compared to two split doses of NPK. The same treatment was found on par with three split doses of NPK. Among the treatment combinations, the water soaking of bulbs and four splits of NPK significantly recorded higher values in respect to vegetative and yield parameters including flower yield (8.59 tonnes), gross returns (Rs. 3,00, 650/ha), net returns (Rs. 1,59,267/ha) and B : C ratio (2.12) as compared to other treatment combinations.

Evaluation of pink pulped navalur guava selections

PATIL SHANMUKH PRABHU

2010

MAJOR ADVISOR : Dr. A. N. MOKASHI

A field experiment was carried out at the Silver Jubilee Orchard, MARS, UAS, Dharwad, during the year 2009 to study the performance of pink pulped Navalur guava selections in relation to growth, yield and quality parameters and to identify the genotype which is rich in lycopene content having dark pink coloured pulp with soft and less seeds. Among seven pink pulped Navalur guava selections, Selection-5 was found vigorous exhibiting higher plant height and spread. It also produced the highest number of fruits (809), yield per plant (101 kg) as well as yield per ha (280 q) but took maximum days to attain fruit maturity from flowering. Fruits were round shaped in Selection-3, Selection-7 and Selection-9, necked in Selection-1 and Selection-5. The highest pulp weight was recorded in Selection-7 (58.27 g). Selection-3 recorded the

highest number of seeds per fruit but seeds were soft as they were light in weight. The highest total soluble solids (12.87°B) was significantly recorded in Selection-3. Significantly minimum titrable acidity (0.22%) was recorded in Selection-1. Selection-7 recorded maximum content of ascorbic acid (232.02 mg/100 g of pulp). Selection-3 was found superior in total (9.37%), reducing (4.76%) and non-reducing (4.61%) sugars content. Sugar-acid ratio a criteria for taste was found to be highest (32.96) in Selection-1. Maximum lycopene content (5.10 mg/100 g pulp) was recorded in Selection-3 which recorded strawberry coloured pulp. It is inferred from the present study that Selection-3 had good growth and found to be the best in terms of physical and biochemical quality parameters, though Selection-5 was best with respect to yield.

Effect of media and organic extracts on success and survival of softwood grafting in mango (*Mangifera indica* L.)

PRAKASH P. DAWALE

2010

MAJOR ADVISOR : Dr. G. S. K. SWAMY

An investigation was carried out on 'Effect of media and organic extracts on success and survival of softwood grafting in mango (*Mangifera indica* L.)' during 2009 to 2010 at Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi in Gokak taluk of Belgaum district, Karnataka. Among the different media, mango stones sowed in red soil + FYM + sand + *Trichoderma harzianum* + vermicompost recorded maximum germination percentage (82.50%) and germination vigour index (2.60). Significantly minimum germination percentage (57.50%) and germination vigour index (1.76) was recorded in control. Maximum rootstock diameter (6.59 mm), rootstock height (39.23 cm) and number of leaves (14.67), graft success (89.57%), graft survival percentage (86.66%), graft height (20.83 cm), graft diameter (7.16 mm), number of sprouts (2.90) and number of leaves (16.87) were also recorded in red soil + FYM + sand + *Trichoderma harzianum* + vermicompost compare to other treatments. Among the different organics, stones pre-

treated with panchagavya 3 per cent recorded significantly less number of days for initiation of germination (10.67 days), maximum germination percentage (70.83%), rootstock height (27.20 cm), rootstock diameter (6.40 mm), number of leaves (14.37), graft success (92.33%), graft survival (90.05%), graft height (22.07 cm), graft diameter (7.49 mm), number of sprouts (3.27) and number of leaves on graft (16.60) compare to other treatments. However, beejamruth at three per cent had showed highest germination vigour index (1.74). The grafts under red coloured shade net recorded highest graft success of (78.00%) and graft survival per cent (72.00%) respectively. Lowest graft success and graft survival (55.00% and 66.00% respectively) were recorded in blue coloured shade net. Maximum graft height (18.83 cm), graft diameter (7.16 mm), number of sprouts (3.82) and number of leaves per graft (18.96) were also recorded in red coloured shade net.

Performance of dutch roses under polyhouse

PRASHANT PARAMAGOUDAR

2010

MAJOR ADVISOR : Dr. S. S. PATIL

An experiment was conducted at Hi-tech Horticulture Unit, Main Agricultural Research Station, Saidapur Farm, University of Agricultural Sciences, Dharwad, during 2009-2010 to study the performance of Dutch rose cultivars under naturally ventilated polyhouse (NVPH), viz., Red Burlin, First Red, Passion, Tropical Amezan, Naranga, Grand Gala, Upper Class, African Dawn, Shakira and Gold Strike. The results indicated that cultivars differed significantly with respect to various characters like number of flowers per plant, stalk length, stalk girth, bud length, bud diameter, number of petals per flower and vase life. Grand Gala found to be very vigorous and recorded the maximum stalk length. Cultivar Naranga recorded the maximum number of cut flowers per plant (14.13) followed by First Red (13.47) and Grand Gala (13.00). However they were on par with each other. Cultivar Grand Gala produced maximum bud length and

bud diameter, while Gold Strike showed maximum stalk girth. Grand Gala and First Red were found to be early for flower initiation. The cultivars Naranga, First Red and Grand Gala had given highest benefit to cost (B:C) ratio of 2.28, 2.12 and 2.01 respectively. The longevity of cut flowers held in tap water was maximum in Grand Gala followed by First Red. Vase life study with four preservatives at two concentrations indicated that aluminum sulphate at 300ppm was the best in maintaining the freshness of cut flowers with extended vase life of 12.89 days compared to 7.77 days in control. The present study revealed that the cultivars viz., Naranga, First Red and Grand Gala emerged as promising cultivars for commercial cultivation under naturally ventilated polyhouse situations under Dharwad conditions.

Studies on organic farming practices in onion (*Allium cepa* var. *cepa*)

PRAVEENKUMAR D. AGASIMANI

2010

MAJOR ADVISOR : Dr. T. B. ALLOLLI

An experiment was conducted during *kharif* 2009 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to find out the influence of different sources of organic manure and biofertilizers on growth, yield, quality and economics of onion. The treatments consisted of combinations of organic manures (FYM, Poultry manure, Panchagavya, Beejamrut and Jeevamrut) with or without biofertilizers (*Azospirillum* + *Phosphorus solubilizing bacteria*). Application of various sources of organic manure with biofertilizers imparted beneficial effect on growth and yield attributes of onion. All the growth parameters (plant height, leaf length, number of leaves, days to maturity, neck thickness and dry matter content) and yield attributes were positively influenced by RDF (125:50:125 kg NPK/ha) + FYM (30

t/ha) application. The performance of onion was poor when it was nourished with Beejamrut + Jeevamrut (T_{10}), as reflected in poor growth and lower yields. Among different sources of organic manures, treatment consisting of FYM + Panchagavya (T_3) and FYM + Biofertilizers (T_8) proved beneficial, as manifested in vigorous growth and higher yields. On the contrary, the cost of cultivation and net returns were highest in onion which was raised with RDF + FYM. Supplementation of organic sources of manures resulted in bulbs with higher TSS, longer shelf life, less per cent of rotting, sprouting and disease infestation. Onion bulbs which were produced with RDF + FYM tend to exhibit the highest rotting and sprouting of bulbs. Storage loss (%) was reduced due to supplementation of organic manures consisting of 'Beejamrut and Jeevamrut'.

Processing of aonla fruits for value addition

G. P. REKHA

2009

MAJOR ADVISOR : Dr. A. K. ROKHADE

An investigation on processing of aonla fruits for value addition was carried out in the Department of Post-harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi during 2006-07. Aonla juice can be preserved by addition of 800 ppm potassium metabisulphite or 600 ppm sodium benzoate for six months at ambient conditions of storage. The organoleptic scores of 3.92 and 3.83, 4.26 and 4.24, 4.09 and 4.03 and 4.22 and 4.17 (out of 5.0) were recorded for colour and appearance, taste, flavour and overall acceptability, respectively. Good quality aonla burfi can be prepared with the recipe of one kg aonla pieces + 1.5 kg sugar. However, even a better quality burfi can be prepared using one kg aonla shreds + 2.5 kg sugar. The organoleptic scores of 4.37 and 4.34, 4.39 and 4.14, 4.40 and 4.14, 4.33 and 3.81 and 4.38 and 4.11 (out of 5.0) were recorded for colour and appearance, texture, taste, flavour

and overall acceptability, respectively. Good quality aonla supari can be prepared by steeping the aonla slices in six per cent common salt solution for two hours followed by sprinkling spice mixture (15 g cumin powder + 5 g pepper powder + 2 g asafoetida/kg slices) and drying in an electric drier. The organoleptic scores of 4.55, 4.33, 4.63, 3.64 and 4.26 (out of 5.0) were recorded for colour and appearance, texture, taste, flavour and overall acceptability, respectively. Organoleptically acceptable jam can be prepared from aonla fruits with a recipe of one kg fresh aonla pulp + 1.5 kg sugar + 0.5 per cent pectin. However, a good quality mixed jam can also be prepared using aonla + guava pulp having recipe of 0.75 kg aonla pulp + 0.25 kg guava pulp + one kg sugar. The organoleptic scores of 4.50 and 4.00, 4.50 and 3.50, 4.25 and 4.00, 4.25 and 4.00, and 4.25 and 3.95 (out of 5.0) were recorded for colour and appearance, texture, taste, flavour and overall acceptability, respectively.

Processing of banana into crisps and papad

RAVI POLICE PATIL

2010

MAJOR ADVISOR : Dr. S. L. JAGADEESH

An investigation was carried out to standardise the methodology and suitability of banana varieties for preparation of crisps and papads at the Department of Post-harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi during the year 2009-2010. Banana crisps recovery was maximum (51.33%) in T_3 (0.5% KMS+60°B syrup+2% citric acid). Maximum total (60.35%) and non reducing sugars (29.38%) were found in T_2 (2g/kg S+70°B syrup+2% citric acid), while reducing sugar (31.71%) in T_4 (0.5% KMS+70°B syrup+2% citric acid). The organoleptic scores regarding colour and appearance, texture, taste and flavour and overall acceptability were maximum in T_3 (4.19, 3.79, 3.82 and 3.96, respectively). With respect to stage of ripeness, bananas used four days after harvest for making crisp resulted in maximum recovery (51.79%) and significantly higher organoleptic scores. Among seven varieties tried, Yalakkibale (T_9) recorded maximum crisps recovery (57.49%). Crisps of Grand Naine variety (T_1) recorded maximum total

(64.79%), reducing (33.54%) and non reducing sugars (31.25%). However, higher organoleptic scores were recorded in Yalakkibale (T_{10}) for Colour and appearance (4.20), texture (4.09), taste and flavor (3.95) and overall acceptability (4.01). Banana papads prepared from steamed banana (T_1) recorded minimum oil uptake (16.09%) and maximum expansion (29.19%). The maximum organoleptic scores for colour and appearance of papads were recorded in T_7 (Black gram papads) (4.18), for texture and taste and flavour in T_1 (3.85 and 3.85 respectively), for overall acceptability T_7 (3.92) and it was at par with T_1 (3.86). Among seven varieties studied for papad, Yalakkibale recorded maximum recovery (39.60%) and dry matter (30.85%). However maximum expansion (29.19%) and minimum oil uptake (16.09%) was noticed in Grand Naine. Organoleptic scores for colour and appearance and overall acceptability were high in Yalakkibale (4.26 and 4.10 respectively). But the variety Grand Naine scored high for texture (4.28) and taste and flavour (4.10).

Processing of jamun fruits

ROHINI P. SHINGALAPUR

2009

MAJOR ADVISOR : Dr. V. C. KANAMADI

An investigation on processing of jamun fruits using different genotypes was carried out at the Department of Post-harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi during 2006-07. Jamun juice can be preserved by addition of 600 ppm sodium benzoate upto eight months at an ambient storage condition. The organoleptic scores of 4.18, 4.51, 3.85 and 4.28 (out of 5.0) were recorded for colour and appearance, taste, flavour and overall acceptability, respectively. Good quality jam can be prepared from jamun fruits with the recipe having one kg pulp + 675 g sugar + 2 g citric acid + 25 mg pectin. The mean organoleptic scores of 4.25, 4.14, 3.93, 4.16 and 4.28 (out of 5.0)

were recorded for colour and appearance, texture, taste, flavour and overall acceptability, respectively. Good quality jelly can be prepared from jamun fruits with the recipe consisting of 500 ml water + 3 g pectin + 1 kg pectin extract + sugar at 1 : 0.75 ratio (pectin extract : sugar). The mean organoleptic scores of 3.83, 3.53, 3.46, 3.13 and 3.43 (out of 5.0) were recorded for colour and appearance, taste, texture, flavour and overall acceptability, respectively. Good quality jamun leather can be prepared using the recipe consisting of fresh pomace + 30 per cent sugar + one per cent citric acid and drying in an electric tray drier. The highest scores (out of 5.0) for taste (3.77) and overall acceptability (3.70) were recorded. The leather could be stored well upto five months.

Integrated nutrient management in ashwagandha (*Withania somnifera* Dunal.)

SADASHIV R. PATIL

2010

MAJOR ADVISOR : Dr. K. N. KATTIMANI

A field investigation on integrated nutrient management in ashwagandha (*Withania somnifera* Dunal.) was carried out at the

Department of Medicinal and Aromatic Plants, Kittur Rani Channamma College of Horticulture, Arabhavi-591310, University of Agricultural

Sciences, Dharwad during July, 2009 to December, 2009. The experiment was laid out in factorial randomized block design with 27 treatments involving different combination of organic manures and inorganic fertilizers with three replications. Among different levels of farm yard manure (FYM), vermicompost and inorganic fertilizers, application of 2 tonnes FYM, 0.5 tonne of vermicompost and fertilizer combination of 20:30:20 kg NPK per hectare had beneficial effect on growth, yield and quality parameters. Significantly maximum plant height (70.81cm), number of leaves (45.09), number of branches (8.89), plant spread East-West (41.40 cm) and North-South (37.21 cm), leaf area index (0.948), cumulative growth rate (0.549g/m²/day), relative growth rate (0.0463 g/g/day), net assimilation rate (0.067 g/m²/day), photosynthetic rate (6.35 $\mu\text{mole m}^{-2}\text{s}^{-1}$), sub stomatal CO₂ (278.17), dry matter accumulation

(18.39 g/plant), root length (19.28 cm), fresh root yield (13.68 q/ha), dry root yield (11.09 q/ha) and seed yield (118.56 kg/ha) were recorded with the application of 2 tonnes FYM, 0.5 tonne of vermicompost along with 20:30:20 kg NPK per hectare. Whereas maximum root diameter (8.98 mm) was recorded with combined application of 2 tonnes FYM, 0.5 tonne of vermicompost and 10:15:10 kg NPK per hectare. The maximum alkaloid content (0.27%) was recorded with the application of organic manures viz., 2 tonnes of FYM along with 0.5 tonne of vermicompost. The highest net return of Rs. 57,461.99 per hectare and benefit cost ratio of (4.83) was obtained by the combined application of 2 tonnes FYM, 0.5 tonne of vermicompost and 20:30:20 kg NPK per hectare under rainfed situation in northern dry zone of Karnataka.

Studies on genetic variability in gladiolus

K. SAHANA

2010

MAJOR ADVISOR : Dr. BALAJI S. KULKARNI

The investigation to find out the amount of variability present in the accessions of gladiolus (*Gladiolus hybridus* Hort.) was carried out at the Department of Floriculture and Landscaping, Kittur Rani Channamma College of Horticulture, (University of Agricultural Science, Dharwad), Arabhavi, Gokak, Belgaum, Karnataka during the period of September 2008 to April 2009. The estimate of phenotypic variance (PV) was higher compared to genotypic variance (GV) for all growth and flower characters, indicating the role of environment. The GCV and PCV revealed that the low differences were observed for plant height, stem girth, number of leaves per plant, leaf length, days taken for spike initiation, spike yield per plant, spike length and number of florets per plant, suggesting the major contribution of genetic variability towards the total variance indicating ample scope for improvement. Estimates of high heritability

with high genetic advance (GA) were observed for plant height, leaf length, spike length, rachis length, number of cormels per plant and average weight of daughter corms, indicating the possible role of additive gene action. Spike yield per plant had positive and highly significant correlation with number of daughter corms per plant and number of shoots per plant, suggesting the possibility of simultaneous selection for these characters. Path analysis revealed that days taken for corms sprouting, number of leaves per plant, leaf length, spike length, girth of spike and number of florets per spike, had high direct effects on spike yield, indicated the possibility of increasing spike yield by selecting the genotypes based on these characters directly. The genotype Sylvia was high yielding. Whereas, the genotypes Eighth Wonder, Pacific and White Prosperity performed better with respect to quality parameters, which could be used in breeding programme.

Genetic variability studies in clusterbean [*Cyamopsis tetragonoloba* (L.) Taub] genotypes

SHABARISH P. RAI

2010

MAJOR ADVISOR : Dr. P. R. DHARMATTI

Clusterbean genotypes collected from different regions of Karnataka were evaluated in Randomized Complete Block Design, with two replications to study the genetic variability, correlation, path analysis and genetic divergence at Olericulture unit, Main Agricultural Research station, University of Agricultural Sciences, Dharwad, during kharif 2009. Analysis of variance revealed high significant (at P=0.01) difference among genotypes for all eleven characters taken for study. Broad genetic base was evident as the value of genotypic and phenotypic coefficient of variance was high for plant height, number of branches, pods per plant, clusters per plant, pods per cluster, pod length, yield per plant and yield per hectare. High heritability coupled with genetic advance over mean was observed for plant height, number of branches, days to 50% flowering, pods per plant, yield per plant and yield per hectare which indicated

predominance of additive gene actions for these traits. Correlation studies revealed significant and positive association of vegetable pod yield per hectare with plant height, pods per cluster, pods per plant and pod yield per plant. Path analysis for vegetable pod yield per hectare revealed that pods per cluster, pod length, number of seeds per pod and yield per plant are being chief contributing characters at genotypic level. The genetic divergence studies using Mahalanobis D² statistics grouped thirty one genotypes of clusterbean into three groups. Cluster I showed maximum intra cluster distance and maximum inter cluster distance was between clusters I and III. Among the ten characters included in D² analysis, yield per hectare contributed maximum towards genetic divergence followed by pod length and plant height. A few of the most promising genotypes evolved from present study for vegetable pod yield were line 22, line 25, line16, RB-1, JKD-1 and Pusa Navbahar.

Standardization of softwood grafting in guava

SHASHIKUMAR

2010

MAJOR ADVISOR : Dr. G. S. K. SWAMY

Studies on 'Standardization of softwood grafting in guava' was carried out during January 2009 to April 2010 at Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi Dist. Belgaum, Karnataka. Studies to know the effect of chemicals, growth regulator and bioformulations on germination, growth and grafting success of guava revealed that significantly minimum number of days for initiation of germination was recorded with water soaked seeds for 24 hrs (14.32 days), while maximum number of days for completion of germination was observed with control seeds (44.14 days). Seeds treated with GA3 @ 500 ppm recorded significantly highest germination percentage (78.66%). Water soaked seeds for 24hrs had shown significantly highest germination index (3.48) compared to other treatments. Maximum rootstock height (13.55cm) and number of leaves (24.24) were recorded in GA3 @ 500 ppm treated seeds while rootstock girth was found maximum

in water soaked seeds for 24hrs (5.54mm). GA3@ 250ppm resulted significantly highest percentage of graft success (60.00%) and lowest in control (40.00%). The highest graft survival percentage was recorded in Panchagavya (93.75%) and lowest in control (83.33%). Studies on effect of season on grafting success resulted significantly maximum graft success and graft survival during February month (78.33% and 93.61% respectively), while minimum were recorded during December month (45.00% and 66.66% respectively). Growth parameters like graft height was maximum in October (21.68 cm), graft girth in September (6.85 mm) number of leaves (15.33) and sprouts in March months (3.51). Studies on precuring of scions on grafting success revealed that the scions cured for nine days recorded highest graft success (84.00%) and graft survival (88.09%) along with growth parameters like graft height (21.96cm), number of leaves (15.10) and number of sprouts (3.37) while graft girth did not vary significantly among the treatments.

Evaluation of daisy (*Aster amellus* L.) genotypes for growth and yield parameters

K. H. SHEKHARA

2010

MAJOR ADVISOR : Mr. A. M. SHIROL

An investigation was carried out to know the performance of daisy genotypes with respect to growth and yield parameters at Floriculture

and Landscaping unit of Kittur Rani Channamma College of Horticulture, Arabhavi, UAS, Dharwad during June 2009 to October 2009. The results

indicated that the genotypes Light Blue Tall, Sky Blue, Purple Multipetal, White Tall and White Daisy performed better for growth (plant height, plant spread, number of leaves, number of suckers and dry matter production). The genotype Dwarf Pink was dwarfest, while Purple Light was least spreading with minimum dry matter production. The genotype Dwarf Pink was earlier for first flowering and 50 per cent flowering. The late flowering was noticed in Star White Daisy. Spike length and rachis length were maximum in the genotypes Light Blue Tall, White Daisy and Sky Blue. The flower size was maximum in Sky Blue. The number of

spikes per plant and spike yield per hectare was maximum in the genotypes Light Blue Tall, White Tall and Purple Multipetal. The spikes of the same genotypes were found to have more vase life. This is due to accumulation of more carbohydrates. The genotypes Light Blue Tall, Sky Blue, Star White Daisy were scored more in terms of spike length. Flower colour was attractive in the genotypes Dwarf Pink and Dark Purple. Flower size was more in Sky Blue and Light Blue Tall genotypes, whereas it was less in Star White Daisy. Appearance and overall acceptability was excellent in the genotypes Star White Daisy and Purple Multipetal based on consumer's acceptance.

Standardization of production practices of bell pepper under shade net condition

SHIVKUMAR

2009

MAJOR ADVISOR : Mr. S. ABBAS HUSSAIN

An experiment was conducted in shade net at Horticulture garden, MARS, Raichur during *kharif* 2008 to study the effect of different spacings and different levels of fertilizer. The experiment was laid out in split plot design (SPD) with three replications. There were eighteen treatment combinations. Among various treatment in spacings number of fruits per plant (19.44), average fruit weight (75.93 g) and fruit yield per plant (1.07 kg), were significantly higher in wider spacing S₁ (45 x 45 cm) but fruit yield per meter square (6.40 kg), fruit yield per plot (9.78 kg) and fruit yield per hectare (63.96 t/ha) were higher in closer spacing S₃ (30 x 30 cm). Wider spacing S₁ recorded higher number of branches, maximum stem thickness, higher leaf area index, maximum plant spread and chlorophyll content of leaves compare to other treatments. Among various

fertilizer tried, RDF + FYM (F₆) recorded maximum number of fruits per plant (19.96), Average fruit weight (72.27g), Fruit yield per plant (1.15 kg), was significantly higher in fertilizer combination of F₆ (RDF + FYM). Different fertilizer levels differed significantly with respect to growth parameters and higher number of branches, maximum stem thickness, higher leaf area index, maximum plant spread and chlorophyll content of leaves compare to other treatments. Among interaction treatment combination of S₃ at F₆ recorded maximum yield compare to other treatment combinations. Fertilizer level F₆ at S₃ recorded significantly higher gross return (Rs.10,03,500/ha⁻¹), cost of cultivation was maximum in S₃ at F₂ (Rs.2,88,060 ha⁻¹) while net return was high in S₃ at F₆ (Rs.7,40,136 ha⁻¹) with higher B:C ratio (2.81).

Studies on effect of pre-harvest treatments on quality and shelf-life of seedless grapes cv. Sonaka

SHIVAKUMAR B. BIRADARPATIL

2010

MAJOR ADVISOR : Dr. LAXMAN KUKANOOR

An investigation on effect of pre-harvest sprays of growth regulators, calcium compounds and fungicides and their combination effects on the storage behaviour of seedless grapes cv. Sonaka was carried out during the year 2008-09 in the Department of Post-harvest Technology, K.R.C College of Horticulture, Arabhavi. Pre harvest spray of 2 per cent calcium nitrate on grapes 10 days before harvest helped in increasing the storage period up to 35 days in cold storage with better quality parameters Viz., higher TSS (25.07%), ascorbic acid retention (3.28 mg/ 100 g pulp), total, reducing and non reducing sugars (24.42%, 23.00 % 1.41 % respectively) with minimum acidity (0.355 %) and better physical parameters like minimum physiological loss in weigh (15.02 %) and least physical damage (0.47 %) with higher organoleptic scores (general

appearance 2.69; firmness 2.8 and overall acceptability 3.01 out of 5.0). However in combination treatment, calcium nitrate (2%) with carbendazim (0.1 %) was more effective in maintaining quality parameters like maximum TSS (25.34 %), ascorbic acid retention (3.49 mg/100g of pulp) higher total, reducing and non reducing sugars (24.62 %, 23.20 % and 1.42% respectively) with minimum titratable acidity (0.365 %), physical damage (0.43 %) with better organoleptic parameters. Grape bunches sprayed with 200 ppm NAA recorded minimum per cent of berry drop (9.53 %). Further the combination treatment 200 ppm NAA with 5g/lit *Trichoderma harzianum* (8.06 %) also reduced the berry drop in storage. The treatments of Thiophanate methyl (0.2 %) and the combination of carbendazim + CaCl₂ registered minimum berry rot (12.93 % and 8.37 %) respectively during storage.

Genetic variability and divergence studies in pumpkin (*Cucurbita spp.*)

SHIVANAND M. MALASHETTY

2010

MAJOR ADVISOR : Dr. M. B. MADALAGERI

The investigation on "Genetic variability and divergence studies in pumpkin (*Cucurbita spp.*)" was undertaken during the year 2009-2010 at Department of Vegetable Science, K.R.C.C.H., Arabhavi, Kamataka. All 57 Genotypes showed significant differences for all the 19 characters studied. GCV and PCV were low to moderate for all 19 characters. High heritability with high GAM was recorded for cavity size, average fruit weight and yield per vine indicated the presence of additive gene effects for these traits. Hence, improvement could be done through phenotypic selection. High heritability with low to moderate GAM was observed for vine length, primary branches per vine, leaves per vine, days to first female flowering, nodes upto first female flowering, days to first harvest, fruit length and fruits per vine, fruit circumference, flesh thickness, seeds per fruit, hundred seed weight, TSS and carotene content indicated the role of non-additive gene effects. Hence, improvement in these traits would be more effective by selecting specific combinations followed by

inter se mating of lines. The character association studies revealed that fruit yield per vine had significant positive association with average fruit weight, vine length, leaves per vine, number of seeds per fruit, fruit length, cavity size, leaf size, hundred seed weight, flesh thickness, primary branches per vine, TSS, fruits per vine and fruit circumference. Path analysis studies revealed that only fruits per vine and average fruit weight had true association with high direct effect. Genetic divergence studies categorised the 57 genotypes into 15 distinct clusters. The cluster XIV showed maximum intra cluster diversity. Inter cluster distance revealed the maximum divergence between clusters X and XIV. Yield per vine contributed maximum to overall genetic diversity followed by leaf size and cavity size. Arka Suryamukhi, Arka Chandan, Belgaum Local, KP-2, KP-19, KP-23, KP-24, KP-25, KP-27 and KP-32 were identified as Promising genotypes.

Integrated nutrient management studies in chrysanthemum (*Chrysanthemum morifolium* Ramat.) Cv. Raja

SHIVARAI KUMAR VERMA

2010

MAJOR ADVISOR : Dr. S. G. ANGADI

Chrysanthemum commonly known as Guldaudi or Autumn or Queen of the East is one of the most important flowers extensively grown for cut flower and loose flower for garland making, general decoration and hair adornments. There are several agro-techniques which influences the flower production of chrysanthemum. Application of fertilizers is the most important which directly influence the growth and yield of flower

crops. Therefore, the present study was aimed to find out the influence of integrated nutrient management (INM) on growth, yield and quality of chrysanthemum at new orchard, floriculture unit, Department of Horticulture, College of Agriculture, University of agriculture Sciences, Dharwad, during *Kharif* season of 2008-2009. The experiment was laid out in randomized complete block design with three replications and

eight treatment combinations. The treatment composing Azo+ PSB + VC equivalent 50% RD'N' + 50% RDF + 50% FYM (T_8) recorded the highest plant height, number of branches, plant spread, dry matter accumulation and yield attributes such as number of flowers per plant and flower yield. Significantly higher available nutrients (N, P_2O_5 and K_2O) and their uptake by plants were recorded in this treatment. The same treatment (T_8)

registered significantly superior quality parameters such as stalk length, flower diameter, shelf life of garland flowers. The economics analysis clearly indicated that net returns per hectare and B:C ratio was the highest in the plots treated with Azo+ PSB + VC equivalent 50% RD'N' + 50% RDF + 50% FYM (T_8) (Rs. 328504.00 and 6.04 respectively) and this findings can be used in making chrysanthemum production more profitable.

Genetic variability studies in chilli (*Capsicum annum L.*)

SHRINIVAS KISHANRAO KULKARNI

2010

MAJOR ADVISOR : Mr. VILAS D. GASTI

Field investigation with eighty chilli accessions was undertaken to elicit information on genetic variability, character association and path analysis at Department of Vegetable Science, Kittur Rani Channamma College of Horticulture, Arabhavi during kharif 2008-09. Analysis of variance revealed significant ($p=0.05$) differences among treatments for 25 out of 27 growth, yield, quality and red chilli parameters. The values of genotypic and phenotypic coefficient of variation were high for the characters like fruits per plant, early, late and total fruit yield, fruit length, fruit density, chlorophyll 'a', chlorophyll 'b', ascorbic acid and fresh and dry red chilli yield, indicating the existence of little variability in the germplasm evaluated. High heritability coupled with high genetic advance over mean were observed for plant height, plant spread, fruits per plant, late and total fruit yield, fruit length, fruit breadth, seeds per fruit, fresh

and dry red chilli yield, indicating additive gene action for these traits. Therefore, selection of these traits would be gainful. Correlation studies revealed significant and positive association of yield with secondary branches, plant spread, fruits per plant, ten fruit weight, fruit length, fruit breadth, seeds per fruit, suggesting that possibility of simultaneous selection for these traits. Path analysis revealed that the number of fruits per plant showed more positive significant correlation with dry chilli yield followed by ten fruit weight would be gainful as they had direct effect. Per se performance revealed that DCA-6, DCA-14, DCA-17, DCA-20, DCA-32 and Byadagi Kaddi were found promising for green chilli yield and DCA-3, DCA-14, DCA-21, DCA-27 and Arka Lohit for dry chilli yield, JC 324894, Pant C-1, DCA-7, DCA-11 and Arka Lohit were found resistant against thrips, mites, aphids and fruit borer.

Response of heliconia (*Heliconia* sp.) CV. golden torch for organic and inorganic nutrition under protected cultivation

H. E. SUSHMA

2010 MAJOR ADVISOR : Dr. B. SATHYANARAYANA REDDY

An investigation was undertaken to know the response of heliconia (*Heliconia* sp.) cv. Golden Torch for organic and inorganic nutrition under protected cultivation during 2008-2009 in the experimental field of Department of Floriculture and Landscaping, K.R.C. College of Horticulture, Arabhavi, Belgaum. The experiment consisted of nine organic and 14 inorganic treatments. Among these the treatment with *Glomus fasciculatum* and *Trichoderma harzianum* showed maximum sprouting percentage (94.45 %). Whereas the organic treatment with *Glomus fasciculatum*, *Trichoderma harzianum* and other bioformulations viz., Panchagavya, Amrit pani, Agnihothra ash, dry mulch and 2 kg FYM/ m^2 (T_3) showed significantly early sprouting (60.67 days) and flowering (208 days). It was on par with inorganic treatment plants T_{12} spaced at 40x40 cm and nourished with 25:10:20 g NPK + 2 kg FYM/ m^2 for other

parameters viz., plant height (156.95 cm), stem girth (3.38 cm), number of tillers (19.10), leaf area (6333.36 cm^2), more number of flowers per plant (3.07), stalk length (55.07 cm), rachis length (25.43 cm) and vase life (14.47 days). The treatment T_{13} (40 x 40 cm spacing and 25:20:20 g NPK+ 2 kg FYM/ m^2) showed high leaf chlorophyll content viz., chlorophyll 'a', chlorophyll 'b' and total chlorophyll, nitrogen, phosphorus and potassium. The maximum cost benefit ratio of 1: 2.35 was recorded in treatment with 25:20:20 g NPK + 2 kg FYM/ m^2 and 30x30 cm, followed by treatment with 25:10:20 g NPK + 2 kg FYM/ m^2 and 30x30 cm. From the investigation, it was concluded that plants spaced at 40x40 cm and nourished with 25:10:20 g NPK + 2 kg FYM/ m^2 showed good result which was on par with organic treatment having *Glomus fasciculatum*, *Trichoderma harzianum* and other bioformulations viz., Panchagavya, Amrit pani, Agnihothra ash, dry mulch and 2 kg FYM/ m^2 .

Effect of dates of planting and nitrogen levels on growth and yield of kalmegh (*Andrographis paniculata* L.)

J. N. SUNIL

2010

MAJOR ADVISOR : Dr. P. M. GANGADHARAPPA

An investigation was carried out to study the effect of dates of planting and nitrogen levels on growth and yield of kalmegh (*Andrographis paniculata* L.) at the Department of Medicinal and Aromatic Plants, Kittur Rani Channamma College of Horticulture, Arabhavi-591 310, University of Agricultural Science, Dharwad during May-November 2009. The experiment was laid out with 4 dates of planting as main plot treatment and 6 levels of nitrogen as sub plot treatment in split plot design with three replications. Among dates of planting at harvest (120 DAP), 30th May planting (D_1) recorded maximum plant height, number of branches, number of leaves, plant spread in E-W and N-S direction, leaf area index, absolute growth rate, relative growth rate, net assimilation rate, specific leaf area, specific leaf weight, fresh and dry herbage yield per plant, per plot and per hectare, available nitrogen in soil and uptake of

nitrogen (%) in plant and minimum number of days to 50 per cent flowering. Among nitrogen levels at harvest (120 DAP), application of 100 kg N/ha (N_4) recorded maximum plant height, number of branches, number of leaves, plant spread in E-W and N-S direction, leaf area index, absolute growth rate, relative growth rate, net assimilation rate, specific leaf area, specific leaf weight, fresh and dry herbage yield per plant, per plot and per hectare. The minimum number of days to 50 per cent flowering was noticed in control (N_0). Whereas, the highest available nitrogen in soil and uptake of nitrogen (%) in plant were recorded with the application of 125 kg N/ha (N_5). The treatment combination of 30th May planting (D_1) and application of 100 kg N/ha (N_4) is beneficial for obtaining the maximum profit and cost benefit ratio (1:3.37) under northern dry zone of Karnataka.

Evaluation of betelvine (*Piper betle* L.) genotypes, studies on suitability of live standards and organic nutrient solutions for cv.

Ambadi

THAVAI PRANAV VISHWANATH

2010

MAJOR ADVISOR : Dr. N.K. HEGDE

Field experiments were carried out separately to evaluate betelvine genotypes for growth, yield and quality attributes, to assess suitability of different live standards for betelvine cultivation under northern dry zone of Karnataka and to study the response of betelvine cv. Ambadi to foliar spray of various organic solutions, at Kittur Rani Channamma College of Horticulture, Arabhavi, Tq. Gokak, Dist. Belgaum during 2008-2009. Among fifteen genotypes evaluated Ghane Gatte recorded the highest values for the characters viz., plant height (3.62m), number of laterals per

vine (9.23) at 330 days after lowering (DAL) and laterals per meter height (3.56) at 210 DAL. The genotypes Ghane Gatte, Nava Bangla and Kari Yele were promising with favourable growth attributes leading to higher leaf yield (71.28, 54.86 and 50.71 lakh leaves/ha respectively). Betelvine genotype Ambadi had good market demand with a productivity of 32.32 lakh leaves per ha. The genotype Nava Bangla recorded an essential oil content of 0.55 per cent followed by Ghane Gatte (0.54 %). Higher organoleptic scores (>3.00/5.00) were recorded by Bili Yele, Kari

Balli and Nava Bangla. The live standards viz., *Sesbania grandiflora* Pers., *Ceiba pentandra* L., *Gliricidia sepium* Jacq., *Millingtonia hortensis* L. and *Moringa oleifera* Lam. were vigorous in growth as indicated by higher growth attributes, viz., basal girth, DBH, crown size and compactness of canopy. Growth of betelvine cv. Ambadi was better on the stem of *Sesbania grandiflora*, *Gliricidia sepium* and *Moringa oleifera* due to roughness of bark and availability of adequate filtered light resulting in higher yield of 467.24, 414.37 and 310.84 leaves per vine per year.

Effect of nitrogen, phosphorus and potassium on growth, yield and quality of bird of paradise (*Strelitzia reginae* Ait.)

R.VASANTHA KUMAR

2010 MAJOR ADVISOR : Dr. B. SATHYANARAYANA REDDY

A field experiment was carried out at the Agricultural Research Station, Kanabargi, Belagavi during the year 2007-08 to study the effect of nitrogen, phosphorus and potassium on growth, yield and quality of bird of paradise (*Strelitzia reginae* Ait.). All the growth, yield and quality components were influenced by nitrogen, phosphorus and potassium. The time taken for flowering increased with the increasing doses of nitrogen, while phosphorus decreased the time taken for flowering. The flower yield was maximum with the application of 50: 20: 50 g nitrogen, phosphorus and potassium per meter square. However, it did not differ significantly with the application of 50 : 20 : 37.5 g nitrogen, phosphorus and potassium per meter square. Nitrogen and phosphorus enhanced the flower quality with respect to stalk length, bract length and stalk girth,

whereas potassium influenced the flower quality with respect to stalk length. The net returns and benefit cost ratio were the highest (Rs. 816007.25/ha and 3.55, respectively) at 50: 20: 50 g nitrogen, phosphorus and potassium per meter square followed by 50 : 20 : 37.5 g nitrogen, phosphorus and potassium per meter square (Rs. 799473.93/ha and 3.51, respectively). The benefit cost ratio at 50: 20: 37.5 g (3.51) was comparable with that of 50: 20: 50 g NPK per meter square. From the aforesaid findings of the present study, it can be finally concluded that the nutrient combination comprising of 50 g nitrogen, 20 g phosphorus and 37.5 g potassium per meter square and a common dose of FYM (2.5 kg/plant) would be economically the best to achieve better vegetative growth, higher yield of superior quality flowers in bird of paradise.

Stability analysis in watermelon (*Citrullus lanatus* Thunb.)

VASANTHKUMAR

2010

MAJOR ADVISOR : Mr. A. M. SHIROL

Sixteen genotypes of watermelon were assessed for stability parameters (mean, regression coefficient and deviation from regression) for thirty characters under three environments during 2009-2010 at Kittur Rani Channamma College of Horticulture, Arabhavi. The genotype x environmental interaction were significant for number of leaves at 60 DAS, vine length at 60 DAS, number of primary branches at 60 DAS, days to first female flower, node bearing first female flower, days to first harvest, average fruit weight, fruit yield per vine, fruit yield per plot, fruit yield per hectare, fruit equatorial diameter, rind thickness, flesh thickness, total soluble solids, total sugar, reducing sugar, number of seeds per fruit and seeds weight. The genotypes NS-246, NS-295, NS-200, Seven Samurai and NS-1004 with higher mean values found stable for fruit yield per vine, fruit yield per plot and fruit yield per hectare. The genotypes NS-246, NS-295, NS-200, Seven Samurai and NS-1004 were found stable for

average fruit weight. The genotypes SPW-10, NS-246, Apoorva, MHW-6 and Seven Samurai were found stable for vine length at 60 DAS. The genotypes NS-246, Sugar Baby, Patanegra, NS-1004 and NS-295 were found stable for days to first female flower. The genotypes Sugar Baby, NS-246, Crimson Sweet, JK Lekha and Seven Samurai were found stable for total soluble solids. The outstanding hybrids identified for yield stability were NS-246, NS-295, NS-200, Seven Samurai and NS-1004, which can be exploited commercially. Correlation studies over all the three environments revealed positive and significant association of fruit yield per vine with fruit yield per plot, fruit yield per hectare, average fruit weight, number of fruits per vine, vine length at 45 DAS, number of leaves at 60 DAS, flesh thickness, fruit equatorial diameter, total soluble solids, total sugar, vine length at 60 DAS and days to first female flower.

Stability analysis of F₁ hybrids and parents in brinjal (*Solanum melongena*. L)

N. VASU

2010

MAJOR ADVISOR : Dr. RAVINDRA MULGE

Fifty two genotypes of brinjal were assessed for stability parameters (mean, regression coefficient and deviation from regression) for 18 characters under three environments during 2008-09 at Kittur Rani Channamma College of Horticulture, Arabhavi. The genotype x environment interactions were significant for plant height at 60 and 90 days after transplanting (DAT), plant spread from North to South and East to West at 60 and 90 DAT, days to first flowering, days to 50 per cent flowering, average fruit weight, number of fruits per plant and yield per plant. For yield per plant the genotypes B-8 x KB-04 and B-7 x KB-04 were found stable, while genotypes B-9 x SW, B-4, B-7 x SW and Kalpataru were found unstable and suited to favorable environments. For number of fruits per plant the genotypes B-8 x SW, B-3 x SW and B-12 x SW, for average fruit weight B-6 x KB-15, B-3 x SW and B-8 x SW and

for days to 50 per cent flowering B-9 x SW, B-11 x SW, B-10 x SW, B-12 x SW and B-3 were found stable. The genotypes B-3 x SW, B-11 x SW, B-5 x SW, B-10 x SW, B-8 x SW and B-12 x SW were found stable for more number of traits and can form a common gene pool for future breeding. Heterosis studies carried out over environments revealed the higher magnitude of standard heterosis for number of fruits per plant (48.60%), yield per plant (27.78%) and average fruit weight (26.58%). Maximum standard heterosis for yield per plant was observed in the hybrid B-8 x KB-04 (27.78%) followed by B-7 x KB-04 (24.35%) and B-2 x KB-04 (24.31) and these hybrids were identified as poor specific combiners for yield per plant. For yield per plant and fruit length, both additive and non-additive gene actions and for average fruit weight and number of fruits per plant only non-additive gene actions were predominant.

Influence of cane regulation on the productivity and quality of wine grapes (*Vitis vinifera* L.)

VINAYAK S. PATIL

2010

MAJOR ADVISOR : Dr. D. R. PATIL

A field experiment on 'Influence of cane regulation on the productivity and quality of wine grapes (*Vitis vinifera* L.)' was carried out during May 2009 to April 2010 in the vineyard of a progressive farmer in Bijapur district. The experiment consisted of two varieties (Shiraz and Cabernet Sauvignon) and seven cane regulation levels (Control, 40, 36, 32, 28, 24, 20 canes/vine) and was laid out in split plot design. Among the varieties, Cabernet Sauvignon vines recorded significantly higher internodal length (4.74 cm) and girth (5.52 mm) of the fruiting shoot, maximum

panicles per vine (62.25), bunches per vine (52.19) and took less days for panicle initiation (16.25). Whereas, maximum bunch weight (113.34 g), berry weight (1.27 g), berry volume (1.21 cm³) and early maturity (139.48 days) were recorded in Shiraz vines. Among the cane regulation levels, vines regulated at 20 canes per vine were recorded maximum internodal length (5.32 cm) and girth (5.71 mm) of the fruiting shoot, maximum panicles per cane (2.73), bunches per cane (2.54), bunch weight (127.56 g), bunch length (13.78 cm) and breadth (6.07 cm), berries per bunch

(119.39), berry weight (1.38 g), length (13.96 mm) and breadth (12.83 mm) of berry, berry volume (1.32 cm³), TSS (23.73 °Brix), TSS to acid ratio (38.42), total sugars (22.49%), reducing sugar (20.80%) and early panicle initiation (15.18 days) and matured early (134.90 days). However, maximum number of panicles per vine (71.42), bunches per vine (63.59), yield (5.74 kg/vine, 19.31 t/ha), acidity (0.92%) and juice content

(78.30%) were recorded in no cane regulation treatment. Significantly maximum panicles per vine (81.78) and bunches per vine (69.23) were recorded in Cabernet Sauvignon vines with no cane regulation treatment. The incidence of pests and diseases were not significantly influenced by varieties and cane regulation levels under North dry zone of Karnataka.

Generation mean analysis in muskmelon (*Cucumis melo* L.)

H. VINAYKUMAR SHETTY

2010

MAJOR ADVISOR : Dr. RAVINDRA MULGE

Generation mean analysis in muskmelon was carried out using P1, P2, F1, F2, BC1, BC2 generations developed from Cross-I (Karnool-1x Hara Madhu), Cross-II (Haryana Local x Hara Madhu) and Cross-III (IC 203079 x Punjab Sunheri) at Kittur Rani Channamma College of Horticulture, Arabhavi during 2009-10 to study the gene action for growth, yield and quality parameters. Desirable heterobeltiosis was observed for rind thickness in all the three crosses and for flesh thickness in Cross-I. Significant Inbreeding depression was observed in Cross-I and Cross-II for flesh thickness and in cross-III for total soluble solids. High estimates of heritability was recorded for days to first harvest in Cross-II and Cross-III and rind thickness in Cross-I. Magnitude of genetic advance as per cent over mean was high in Cross-I and Cross- II for yield per vine and in Cross-I for rind thickness. Scaling test revealed the presence of epistasis for most of the traits in majority of the crosses. Additive (*d*) gene effect was significant for days to first harvest, rind thickness and flesh thickness

in Cross-I and Cross-II and average fruit weight and yield per vine in Cross-II and Cross-III. Dominance effect (*h*) was significant for total soluble solids in Cross-I and Cross-III, average fruit weight and yield per vine in Cross-I and flesh thickness in Cross-III. Estimates of additive x additive (*i*) interactions were significant for days to first harvest and total soluble solids in Cross-III. Additive x dominance (*j*) interactions were significant for days to first harvest, average fruit weight and total soluble solids in all the three crosses and for flesh thickness in Cross-I and Cross-II and for yield per vine in Cross-II. Dominance x dominance (*l*) interactions were significant for flesh thickness and total soluble solids in all the three crosses and for days to first harvest in Cross-II and Cross-III and for average fruit weight in Cross-I. Duplicate epistasis was found operating for flesh thickness and total soluble solids in all the three crosses and for average fruit weight and yield per vine in Cross-I and Cross-II. Complementary epistasis was found operating for days to first harvest in Cross-I.

Characterization of jamun genotypes based on morphological, biochemical parameters and studies on propagation

YUMNAM SOMI SINGH

2010

MAJOR ADVISOR : Dr. G . S . K . SWAMY

Studies on 'Characterization of jamun genotypes based on morphological, biochemical parameters and studies on propagation' was carried out during 2008 to 2010 at Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi Dist. Belgaum, Karnataka. Among 23 genotypes studied, maximum fruit weight (15.67 g) and pulp weight (11.83 g) were recorded in the genotype KJS-300. The genotype KJS-18 recorded significantly longest fruit (3.90 cm), while the shortest (2.05 cm) was recorded in genotype KJS-43. The highest pulp content (80.64%) was recorded in genotype KJS-25. The maximum pulp to seed ratio (6.17) was recorded in KJS-02 and lowest seed weight (1.17 g) was recorded in genotype KJS-24. Highest TSS (21.23%) and acidity (0.66%) was recorded in genotype KJS-03 and KJS-25 respectively. Highest anthocyanin (1.36 00) and ascorbic acid (28.17 mg/100 g) was recorded in KJS-18 and KJS-02 respectively. Highest total sugar (16.37%) and non-reducing sugar (16.36%) were registered in the genotype KJS-09.

Maximum sugar to acid ratio (53.24) and reducing sugar (0.030%) was recorded in the genotype KJS-26 and KJS-43 respectively. Propagation studies revealed that cultivated and wild type jamun seeds inoculated with *Glomus fasciculatum* recorded highest germination percentage (96.00% and 96.66% respectively) compared with untreated seeds. The rootstocks of cultivated and wild type inoculated with *Glomus fasciculatum* exhibited significantly maximum spore population in the rhizosphere and also higher root colonisation at one month (83.25% and 80.00%) and at grafting stage (86.00% and 82.00%) respectively. Highest graft success (63.33% and 60.00%) and graft survival (94.74% and 94.44%) was registered in inoculated rootstocks of cultivated and wild type respectively compare to control (30.00% and 10.00% respectively). Maximum graft success was recorded in softwood grafting (38.00%) which was on par with wedge grafting (34.00%), while minimum was recorded in chip-budding (8.00%).

HUMAN DEVELOPMENT

Physical growth, puberty and associated problems among school girls

KRUSHNAPRIYA SAHOO

2010

MAJOR ADVISOR : Dr. SARASWATI HUNSHAL

A study on "Physical Growth, Puberty and Associated Problems among School Girls" was under taken in year 2009-2010. Multistage method was used in selecting sample; constituted 384 school girls in the age of 9-15 years, from two urban and two rural schools of Dharwad and Khurda Districts of Karnataka and Orissa. The data on physical growth, puberty, factors affecting physical growth & menstruation and information about menses was collected with the help of schedule. Height and weight of girls of both districts was less than NCHS (50th percentile) and ICMR standards. The quantum of increase in height and weight was more between 11 to 12 years (4.86 cm) and 12to 13 years (4.95 kg) respectively, compared to other ages indicating the growth spurt of girls. More number (68.0%) of girls from both regions was malnourished. Among different categories of malnutrition, more number (29.43%) of girls were in short duration malnutrition category closely followed by long duration (26.82%)

malnutrition. Age, nutritional status, food habit, participation of sports activities and parental factors such as education, occupation and income had significantly related with physical growth. Regarding pubertal changes, the mean age of breast, pubic hair, auxiliary hair and menarche was found 10.51, 11.83, 12.62 and 12.45 years respectively. Girls with normal nutritional status, non-vegetarian food habit, medium income, other backward caste and small size family attained menarche significantly at earlier age. High level of participation in sports activities significantly delayed the attainment of menarche. More number of girls reported problems such as abdominal pain, back ache, feeling tired, irritation, depression and drowsiness during menstruation. Majority of girls reported that they were scared followed by discomfort and indifferent feelings towards their first menstruation.

Parenting stress of normal and mentally challenged children

NARMADA HIDANGMAYUM

2010

MAJOR ADVISOR : Dr. PUSHPA B. KHADI

A differential research design to compare the level of parenting stress of normal and mentally challenged children and to know the influence of child's, parental and familial characteristics on parenting stress and general stress was undertaken. Mentally challenged children

studying in special school and normal children studying in normal school of age group 5 -10 years in local area formed the population. A sample of 30 mentally challenged children was drawn from two special schools and a proportionate sample of 60 normal children was drawn from four

normal schools. Parenting stress index-short form developed by Abidin (1995), General stress inventory developed by Ivancevich and Matteson (1980) was used to assess parenting stress and general stress respectively. Kuppaswamy socio-economic status scale modified by Mahajan and Gupta (1995) was used to assess socio-economic status of the family. Maternal temperament was measured by a self structured questionnaire. The results revealed that 73.3 per cent of parents of mentally challenged children and 21.7 per cent of parents of normal children were in clinically significant level of parenting stress. Parents with low and high educational and occupational level had more parenting stress. Parents of mentally challenged children experienced significantly more general stress than

parents of normal children. Parents of the first born had higher general stress than later borns. Fathers of higher educational status had significantly higher general stress among both groups while mothers of higher educational status had higher general stress only among normal group. Parenting stress and its components were positively and significantly correlated with general stress among normal children but non significant in case of mentally challenged children indicating that almost all parents of mentally challenged children experienced parenting stress and not general stress. This implies the need for parental educational program for reduction of parenting stress.

PLANT BIOTECHNOLOGY

Development and characterization of iAc and Ds starter lines for gene tagging in sorghum

AMIT KUMAR VERMA

2010

MAJOR ADVISOR : Dr. RAMESH S. BHAT

Transposon-mediated mutagenesis in *Sorghum bicolor* L. (Moench) was attempted with the development and characterization of Ds starter lines carrying pUR224NA and pUbiDs were generated for insertional inactivation and activation tagging, respectively, and iAc lines with pKU352NA. *In vitro* regenerated plants that rooted in liquid medium (MS +0.5 ppm NAA +0.5 ppm IBA, 6% sucrose) recorded significantly high survivability and establishment. In total, 6, 7 and 33 PCR confirmed plants were established for pUR224NA, pUbiDs and pKU352NA, respectively. Six Ds lines previously developed with pNU435 were also included in this study. T₁ progenies of pNU435 plants showed 3:1 segregation ratio with Basta application, indicating single copy T-DNA/Ds integration. PCR confirmed T₁ progenies of pKU352NA, pUR224NA and pUbiDs also showed 3:1 segregation. Southern hybridization for EcoRI digested DNA of pNU435-T₀(1)-T₁(27) showed a single band of expected 2567 bp with CamV 35S probe. A 202 bp right border flanking sequence

showed homology to a hypothetical mRNA (XM_002459886) of sorghum. Nine regenerants were obtained by co-infecting the calli derived from pNU435 [pNU435-T₀(1)] with iAc construct (pKU435NA) for transient expression of transposase (TET). Out of nine, four had intact Ds; while five plants had transposed Ds. Of the four plants with intact Ds, one plant carried iAc, indicating its mutagenic nature. Of the five plants with intact Ds, four plants contained iAc indicating that are not stable mutants. One plant IDs-T₀(8) showed Ds transposition, but did not show the presence of iAc, so it was regarded as a putative stable Ds insertion line. Crosses were made for pNU435 and pUR224NA launch pad lines with iAc lines. Seed set was seen in both the crosses involving pNU435 and in one cross involving pUR224NA. The starter lines generated in this study can be employed to generate mutagenic population, while Ds tagged mutant can be studied for mutant phenotype.

Effect of random mutagenesis of native cry1Ac and cry2 on the toxicity against *Plutella xylostella*

ATULKUMAR UPADHYAY

2009

MAJOR ADVISOR : Dr. P. U. KRISHNARAJ

Random mutations in full length native cry1Ac and cry2 was created by using GeneMorph II Random Mutagenesis Kit by taking the plasmid DNA of expressed genes as target for mutation. The mutants were cloned in prokaryotic expression vector pET-32C(+) and expressed in *E. coli*. BL21 (DE3) PlysS. Mutated and native cry1Ac were also cloned into pYES2C/T and expressed in *Saccharomyces cerevisiae* INVSc1. The expression was confirmed through SDS-PAGE. The confirmed mutant clones of cry1Ac and cry2 were induced with IPTG and active protein was isolated. The isolated proteins from different clones were subjected for bioassay against *Plutella xylostella* and the insect mortality was recorded at an interval of 24, 48 and 72 hrs. On the basis of per cent mortality at

given intervals, it was found that 40% of the clones showed 65 to 75 % mortality indicating no effect of mutation in these clones. Forty one percent clones showed little decrease in toxicity (40 to 60 % mortality) to the chosen insect. Only 5% clones showed mortality in the range of 70 to 80% which is slightly more than reference i.e., native cry1Ac. Approximately 9% clones showed mortality less than 40% mortality. One mutant clone (M25), compare with the reference strain showed enhanced mortality of 80% which is 10% more than native cry1Ac. In case of cry2 mutants, it was found that majority of mutants i.e., 56% had mortality rate ranging from 51% to 65%. Fourteen clones had a mortality of less than 50% while only 10 clones showed mortality in the range of 70 to 75%. No increased mortality was observed in the mutant clones.

Production and characterization of scFv monoclonal antibody against Cry2B and scFv polyclonal antibody against Cry1Ac through phage display technology

CHIDANAND A. RABINAL

2010

MAJOR ADVISOR : Dr. NARAYAN MOGER

Cry2B and Cry1Ac protein were used to produce single chain fragment variable (scFv) monoclonal antibody for Cry2B and scFv polyclonal antibody for Cry1Ac. The Tomlinson I library was amplified and the scFv phages were made displayed on their surface. They were incubated with immobilized antigen in immunotube for further amplification. Such four rounds of biopanning process were carried out for selection of scFv polyclonal antibody against both the proteins. The ELISA test results indicated that the fourth biopanning phage particles had higher binding affinity to the target antigens. In case of Cry2B, forty-five clones were selected from fourth biopanning and the same were subsequently used to produce monoclones. In case of Cry1Ac, because of their poor affinity with antigen during affinity selection process only polyclonal antibody was produced. The two clones viz., pscFvCry2B 19 and

pscFvCry2B43 of Cry2B were selected based on monoclonal phage ELISA and further confirmed by the cross specificity test with random mutant Cry2B proteins. The selected clones were sequenced with LMB3 forward and pHEN reverse primer and characterized. The scFv fragment of pscFvCry2B19 and pscFvCry2B43 is 746 bp and 747 bp long and they shared homology to each other at DNA and amino acid level, except at C' terminal end. According to the sequence analysis the clone pscFvCry2B19 consist of 55.09% G+C and 44.91% A+T. Similarly pscFvCry2B43 has 54.89% of G+C and 45.91% of A+T. Both the clones have similar conserved domains in Ig super family between 47 to 119 positions. The homology search with BLASTn algorithm indicated 96% identity to Homo sapiens partial scFv genes. These observations indicated that both the scFv antibodies bind to a single epitope.

Validation of tomato leaf curl virus regions for promoter activity

GUNJAN BHARTI

2010

MAJOR ADVISOR : Dr. P. U. KRISHNARAJ

The present study was conducted to clone and analyze the activity of various regions of promoters from tomato leaf curl virus in *E. coli* and yeast (*S. cerevisiae*) and develop a plant transformation vector using the

promoters of ToLCV. In order to define the minimal region of PRKT17 and PTOLP promoter necessary for activity, deletions were carried out from 5' end of both PRKT17 and PTOLP promoter based on the basic

characteristics of promoters. Taking this as a reference A3, A2, B3, B2 were designed. The promoter fragments A3, A2, B2 were cloned into prokaryotic promoters vector, pKKLUX (*Bam*HI) having *cat* (chloramphenicol acetyl transferase) as reporter gene and transformed into *E. coli* DH5 α . The clone pGBK111 containing A3 region could grow on the plate upto 250 g per ml but pGBK110, pGBK112 containing A2 and B2 region respectively could grow on the plate having very low concentration of chloramphenicol (5 - 10 g/ml). A3 (578 bp), A2 (74 bp), B3 (174 bp), B2 (122 bp) were cloned into pYESSR + Zeo and

transformed into yeast. Zeocin plate assay for the clones pGBK250, pGBK251, pGBK252, pGBK253 was done by streaking the clones on the plates having zeocin concentration ranging from 25 to 100 g per ml. The pGBK251 and pGBK253 containing A3 and B3 region respectively could grow on the plate upto 50 g per ml concentration of zeocin. A1 (611 bp), A2 (74 bp), A3 (578 bp), B1 (286 bp), B2 (112 bp), B3 (174 bp) were cloned into promoter probe vector pVR37 and pVR44 and transformed to *Agrobacterium tumefaciens*.

Functional modulation of selected microRNAs under heat shock regimes in *Arabidopsis thaliana*

M. MAHALE BARKU

2010

MAJOR ADVISOR : Dr. B. FAKRUDIN

Involvement of microRNAs in gene regulation has opened new vistas in understanding complex biological mechanisms of stress tolerance in plants. In this study, *Arabidopsis thaliana* plants were used to test miR171, miR161, miR168, miR399, miR399e, miR397a and miR395b for their expression under ambient control, 35, 40 and 45 °C, each for 1, 2 and 3 hr of exposure using Locked Nucleic Acids mediated *in situ* hybridization in leaf and root tissues. Using a novel heat shock module, effect of shoot heat shock on expression pattern of microRNAs and promoter activity in ambient root tissues was unrevealed. Among tested microRNAs, miR161, miR168, miR171 and miR397a expression in leaf, while miR171 and miR397a expression in root tissues was recorded in control plants. Four microRNAs viz., miR399e, miR399, miR395b and miR171 expressed in leaf tissues upon heat shock treatments. With an increase in level of heat shock and exposure duration, a concomitant

higher expression of all four responding microRNAs was noticed in leaf tissues. Expression of heat shock responding microRNAs was more prominent in mesophyll tissues, cuticular layer and vascular tissues. Upon imposing heat shock of 35, 40 and 45 °C for 1, 2 and 3 hr duration to shoot portion lead to expression of miR399e, miR399, miR395b and miR171 in ambient root tissues. Induction of promoters of these microRNAs in ambient root tissues as a function of shoot heat shock was clear and obvious. Like in leaf tissues, higher levels of expression of responding microRNAs with increase in level of heat shock and exposure time in compensation manner was recorded. The study unambiguously points at possible communication of shoot heat shock signals to root tissues; physical movement of microRNA cannot be neglected. The target genes of these microRNAs form candidates to develop heat tolerant plants through their down regulation. [Indian patent filed: 3894/CHE/2010]

Cloning of endochitinase genes from *Trichoderma* species

RADHESHYAM SHARMA

2010

MAJOR ADVISOR : Dr. SUMANGALA BHAT

The present study was conducted to clone endochitinase genes from *Trichoderma* spp. During the study, eighty *Trichoderma* isolates were used to screen for the presence of three endochitinase (*ech33*, *ech36* and *ech42*) genes. Full length sequence of *Trichoderma harzianum ech33*, *ech36* and *ech42* were downloaded from NCBI database and gene specific primers were designed using Primer-3 software and synthesized at Sigma Aldrich Chemical Pvt. Ltd., Bangalore. The total genomic DNA was isolated from fungal mycelium and screening was done with gene specific primer using PCR. Seventy three *Trichoderma* isolates showed the presence of *ech33* and presence of *ech36* was observed in 76 *Trichoderma* isolates belonging to three species of *Trichoderma* viz., *T. harzianum*, *T. virens* and *T. viride*. The *ech42* gene was found to be absent in two isolates each belonging to *T. harzianum* and *T. virens*. Restriction analysis of the PCR

products corresponding to these three endochitinase gene with selected enzymes failed to identify the novel pattern. Further, the two endochitinase genes viz., *ech33*, *ech36* were ligated to pTZ57R/T and transformed into *E. coli* DH5. The cloned genes were confirmed through PCR and restriction analysis. The recombinants were sequenced at Bangalore Genei Pvt. Ltd., Bangalore. Analysis of the cloned sequence confirmed the presence of *ech33* and *ech36* in the recombinant clones. The cloned *ech33* gene showed 98 per cent a homology with reported sequence (Accession No. FJ358733) at nucleotide and 95 per cent homology at protein level. *ech36* gene showed 99 and 100 per cent homology with reported sequences (Accession No. AF406791) at nucleotide and protein level, respectively.

Cloning of endochitinase genes from *Trichoderma* spp and expression study in *Saccharomyces cerevisiae* INVSc1

RAMESH METHRE

2010

MAJOR ADVISOR : Dr. SUMANGALA BHAT

The present study was conducted to clone different endochitinase genes (*chit18-10*, *chit18-13*, *chit18-14*) from *Trichoderma* spp using specific primers and analyze their expression in *Saccharomyces cerevisiae*. Isolates belonging to three different species viz., *T. virens*, *T. harzianum* and *T. reesei* were used for this purpose. Using specific primers, amplification corresponding to only endochitinase *chit18-13* (1.3 kb) from *T. reesei* and *chit18-14* (1.87 kb) from *T. harzianum* were observed. Corresponding bands were eluted and cloned into pTZ57R/T cloning vector. The clones were confirmed through PCR amplification and restriction analysis. The clones were sequenced and analyzed for homology at nucleotide and protein level. The *chit18-13* gene showed 99% homology at nucleotide level with reported sequence in database (Acc.No.BK006086.1) and 98% at protein level (Acc.No. DAA05861.1).

Sequencing of the other gene (*chit18-14*) did not confirm the presence of the gene. Phylogenetic analysis of cloned gene *chit18-13* with previously cloned genes in our laboratory indicated that *chit18-13* fall into different cluster and not closely related to previously cloned genes. The *chit18-13* was further cloned into yeast expression vector pYES2/CT and transferred to *Saccharomyces cerevisiae* INVSc1. Expression of *chit18-13* gene was confirmed by SDS-PAGE, substrate conversion assay and bioassay against *Sclerotium rolfisii* and *Rhizoctonia solani*. The crude protein from YRSR13 showed 3.87 times more chitinolytic activity compared to yeast host carrying plain (pYES2/CT) vector. Clear inhibition (54.2%) of the pathogen growth was observed when high concentration of crude protein (1000 g/25ml of PDA) from YRSR13 was added in the PDA.

Detection of *in vitro* antipathogenic activity and molecular diversity in *Trichoderma* isolates using SRAP markers

ROBINI R. BANSODE

2010

MAJOR ADVISOR : Dr. SUMANGALA BHAT

The present investigation was carried out to screen eighty *Trichoderma* isolates belonging to eight species against two fungal plant pathogens viz., *Sclerotium rolfisii* and *Rhizoctonia rolfisii* using dual culture assay and to study molecular diversity among eighty three *Trichoderma* isolates belonging to four species using SRAP primers. Per cent inhibition of mycelial growth and time taken by *Trichoderma* isolates to overgrow the pathogen were recorded. *Trichoderma* isolates showed variation in their antagonistic property against *S. rolfisii* and *R. solani*. Further, these

eighty isolates were grouped into four classes viz., most efficient, efficient, moderately efficient and poor based on per cent inhibition according to Bell *et al.*, (1982). Of the eighty *Trichoderma* isolates tested, five isolates (IABT -1002, IABT -1041, IABT -1042, IABT -1044 and IABT-1046) showed high antagonistic activity against both *S. rolfisii* and *R. solani*. Also, eight *Trichoderma* isolates (IABT-1005, IABT-1012, IABT-1014, IABT-1023, IABT-1025, IABT-1030, IABT-1038 and IABT-1057) were

found to have poor antagonistic activity against both *S. rolfii* and *R. solani*. The time taken by *Trichoderma* isolates to overgrow *R. solani* was less (5 days) and it was 8 days for *S. rolfii*. Forty three pairs of SRAP primers produced 97.98 per cent polymorphism. All the isolates were grouped into twelve clusters, among which cluster IV, VII, X, XI were solitary. The isolates from the solitary clusters viz., IABT -1088, IABT -1151, IABT -1093 and IABT -1044 showed high divergence from other

isolates. Isolates from the same region showed some similarities in SRAP clustering in UPGMA analysis. Also, the *Trichoderma* isolates within the same sub cluster showed difference in their antagonistic property. However, in few cases, the correlation was observed between the cluster formed based on SRAP and the antagonistic property of *Trichoderma* isolates. For instance, IABT-1041 and IABT-1042 which were grouped together were found to be most efficient against *S. rolfii* and *R. solani*.

Development of a scar marker for the detection of *Ralstonia solanacearum* (Smith) Yabuuchi

SARITA V. GUND

2010

MAJOR ADVISOR : Dr. NARAYAN MOGER

Bacterial wilt disease caused by *Ralstonia solanacearum* is one of the most important constraint in the production of solanaceous vegetable crops. It has been divided into five races based on their host range, geographical distribution and ability to survive under different environmental conditions. One hundred fourteen strains of *R. solanacearum* were isolated from wilt affected plants of brinjal, chilli and tomato were collected from Karnataka and Goa. The identification and confirmation of collected isolates were done by cultural characteristics, pathogenicity test and PCR amplification of 16S rDNA region. Leaf infiltration test on tobacco leaves was performed for race identification of bacteria. It was found that among 114 isolates, forty two were belonged to Race 2 and seventy two were belonged to Race 3. Ten isolates from each group were screened with seventy five RAPD primers as an initial

step to develop SCAR markers. It was found that OPAB-08 RAPD primer gave amplicon of size 600 bp only in Race 2 isolates. The species specific amplicon of size 950 bp and 900 bp was observed with OPA-09 and OPG-07 primers respectively. These specific amplicon with respective RAPD primers were sequenced to develop SCAR marker. Race 2 specific SCAR marker, RS-R2 and two species specific SCAR markers RS-1 and RS-2 were developed. Further confirmation of designed primer was done with all collected isolates (114 isolates). It was found that RS-R2 showed an amplicon of size 600 bp in Race 2 isolates. This indicated that the RS-R2 can be used for unbiased identification of Race-2. Similarly, RS-1 and RS-2 primers gave an amplicon of size 920 bp and 900 bp respectively in all collected isolates. So, these two SCAR markers will help in the diagnosis of *R. solanacearum*.

Development and characterization of transgenic tomato with native and codon optimized *chiA* from *Serratia marcescens* Sm141

K. SAKTHIVEL

2010

MAJOR ADVISOR : Dr. P. U. KRISHNARAJ

In view of the absence of chitin in plant cells it is possible to engineer chitinase gene expression in these cells without negative effects on plant growth and development. Moreover, the chitinase enzyme will not only hydrolyse infecting fungal cell walls, but also release the oligosaccharides by hydrolysis and elicit both direct and indirect host defense mechanisms. *Agrobacterium* mediated transformation is a routine approach for introducing genes into plant genotypes. Despite the success in tomato transformation, problems still arise with obtaining large number of positive plants from viable callus. We have attempted to generate putative transgenic tomato plants for broad spectrum resistance to devastating fungal diseases in tomato by introducing the *chiA* gene into one of the tomato cultivars, Pusa Ruby. In this transformation method, no feeder layers were used. T0-plants were obtained and confirmed at structural level for the transgene presence by PCR and southern hybridization. The desired 1692 bp and 1666 bp amplicons were detected

for native and codon optimized *chiA* respectively, in T0-plants DNA samples by PCR. One to three copies of transgene were integrated into the genome. PCR positive plants FM3, N1, N2, and N3 did not give hybridization signals. Transgene expression at transcriptional level was quantified by qRT-PCR. Transgenic tomato line FM2 with an estimated 3 copies of the codon optimized *chiA* maintained high transcript levels which in turn conferred maximal antifungal activity. Results of antifungal activity of the two enzymes, native and codon optimized chitinaseA on *Sclerotium rolfii* fungi showed that, transgenic tomato plants which constitutively express the codon optimized *chiA* are more capable of inhibiting *Sclerotium rolfii* in-vitro than native *chiA*. Taken together, our study developed a simple, repeatable and efficient transformation protocol and demonstrated that transformation of tomato with *chiA* is an effective means of imparting genetic disease resistance and *chiA* could be used as persistent biocontrol agent.

Cloning and expression of *chiA* from native *serratia marcescens* AUDS227

SMITA R. BABAR

2010

MAJOR ADVISOR : Dr. P.U. KRISHNARAJ

Serratia marcescens, a chitinolytic bacterium, produces chitinases capable of degrading fungal cell wall. Chitinases are the enzymes which hydrolyze the p-1, 4 linkages in the chitin micro fibril are known to be involved in the resistance to fungal diseases in plants. In the present study, an attempt was made to isolate the genes for these enzymes from the bacterium. Sixty native isolates of *S. marcescens* obtained from the culture collection of the Department of Biotechnology, UAS, Dharwad were screened to check their chitinolytic activity on colloidal chitin media in comparison with the reference strain *Sm141*. The total DNA isolated from the native isolates of *S. marcescens* was used to identify *chiA*, *chiB* and *chiC* with diagnostic primers. In order to find out variability amongst *chiA*, RFLP analysis of *chiA* positive isolates of *S. marcescens* was done along with the reference strain *Sm141*. The *SmAUDS227chiA*, *SmAUDS274c!ziA* and *SmAUDS365c!ziA* revealed different restriction fragments compared to the reference *Sm141 chiA*. Based on the chitin

resolution and difference in banding pattern of *SmAUDS227chiA* with the reference *Sm141chiA* with *PstI*, the *SmAUDS227c!ziA* was selected further for cloning and expression studies. The novel *chiA* from *S. marcescens* AUDS227 was cloned in pTZ57R/T transformed and maintained in *E. coli* DH5a and these constructs were named as pSBKIOIA, pSBKIOIB, pSBKIOIC and pSBKIOID. In order to assess the expression of cloned *chiA*, it was sub cloned into prokaryotic expression vector pET32C+ and the constructs were named as pSBK201A, pSBK201 B, pSBK201C and pSBK201 D and the SDS-PAGE analysis showed that *chiA* has expressed 79.86 kDa protein. In order to find out the functionality, the confirmed clones were induced with IPTG and the induced protein from different clones was subjected for bioassay against fungal pathogens viz., *S. rolfii* and *R. solani* and it showed crescent shaped growth inhibition of fungal pathogens compared to the control.

Monitoring the expression of selected drought responsive transcription factor genes in sorghum

SUPRIYA AGLAWE

2010

MAJOR ADVISOR : Dr. B. FAKRUDIN

Five transcription factor (TF) families, the HAP2, MADS, ARF, HB and MBF comprising 20 members were tested for their up-and down regulation in well watered and water stressed shoot and root tissues of sorghum cv. M35-1. Selected genes were *in situ* hybridized in both tissue

types as a function of moisture stress regimes. The PTSb00029.1 and PTSb00033.1 of ARF family and PTSb00174.1 and PTSb00175.1 of HB family recorded 2 to 5, PTSb00221.1 and PTSb00208.1 of MADS family and PTSb00128.1 of HAP2 family recorded 5 to 10 fold up-regulation

under moisture stress regimes. The PTSb00128.1, a HAP2 family member, recorded 15 fold up regulation in mild stressed root tissues. TF genes such as PTSb00218.1, PTSb00220.1, PTSb00031.1, PTSb00032.1, PTSb00034.1 and PTSb00223.1 were found down regulating in both tissues types under stress condition. However, the PTSb00128.1, PTSb00221.1, PTSb00029.1, PTSb00033.1 and PTSb00174.1 TFs were found up regulating to varied levels in mild and serve stressed root tissues only. Taken together, moisture stress triggered up regulation of more genes in root tissue compared to shoot tissue in sorghum. Three TF genes, PTSb00220.1 (MADS), PTSb00223.1 (MBF) and PTSb00328.1 (WRKY)

Expression of *rvl1* and *sr11* in transgenic tomato lines and their toxicity against *Meloidogyne incognita* and *Bemisia tabaci*

YOGESH S. BHAGAT

2010

MAJOR ADVISOR : Dr. RAMESH BHAT

Transgenic tomato lines were developed by Agrobacterium-mediated transformation with *rvl1* (*Remusatia vivipara* lectin) and *sr11* (*Sclerotium rolfsii* lectin) genes, and they were analysed for the expression and toxicity of RVL1 and SRL1 to common root knot nematode (*Meloidogyne incognita*) and white fly (*Bemisia tabaci*). Ten and six independent transgenic T₀ plants and their T₁ progenies amplified 771 bp and 429 bp products with *rvl1*- and *sr11*-specific PCR. Left border TAIL-PCR showed T-DNA integration at 28279 bp and 94855 bp on chromosome number 8 for a representative *rvl1* [*rvl1* T₀(2)] and *sr11* [*sr11* T₀(3)] plant, respectively. Partially purified RVL1 and SRL1 could agglutinate rabbit erythrocytes. For RVL1, the total activity was 7.8×10^2 and the specific activity was 4.3×10^2 . Likewise, for SRL1, the total activity was 3.3×10^2 and the specific activity was 2×10^2 units. Among various sugars tested,

were selected based on their expression levels in qRT-PCR data and the DIG-labeled riboprobes along with *18S rRNA* were prepared through *in-vitro* transcription for in-situ hybridization. Critical factors such as probe and buffer concentration and post hybridization washing time were optimized using 18S rRNA probe in root and shoot tissues. The *in-situ* expression pattern of these genes was studied at cellular level in well watered and drought stressed shoot and root tissues. The expression could be localized to specific tissue types and overall expression pattern all the three genes was comparable to pattern revealed in qRT-PCR method. The expression of *18S rRNA* was found to be constitutive in both tissue types and stress regimes.

only mucin could inhibit the agglutination activity of RVL1 and SRL1. RVL1 showed a 26.2 kDa band on SDS-PAGE. Bioassay with 100 J2 of *M. incognita* showed that 39 and 52 J2s infected T₁ *rvl1*- and *sr11*-transgenic plants, respectively, against 100% infection in control plants after 3rd day of inoculation. All these J2s were in vermiform. On 6th day, 57% and 59% of the infected J2s turned to sausage-shape in *rvl1* and *sr11* plants, respectively compared to 73% in the control. On 90th day, control plants had 67.71 galls/plant compared to 26.00 and 30.14 galls/plant in *rvl1*- and *sr11*-plants, respectively. Control plants showed a gall index of 7 (highly susceptible), whereas *rvl1* and *sr11* transgenics showed an index of 3 (moderately resistant). Bioassay with whitefly revealed that *rvl1* plants could check the growth of the insect with 30.0% mortality, which was significantly higher than that found in *sr11* plants (11.4%) or control plants (8.5%).

PLANT PATHOLOGY

Studies on anthracnose of pomegranate caused by *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc.

K. JAYALAKSHMI

2010

MAJOR ADVISOR : Dr. V. B. NARGUND

Pomegranate anthracnose is an important disease which affects leaves and fruits. The severity of pomegranate anthracnose was more in Bagalkot district followed by Koppal, Bijapur Gadag and Raichur districts. The identity of the fungus was confirmed as *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. The fungus showed maximum growth on Potato dextrose broth on 12 th day after incubation at $27 \pm 1^\circ\text{C}$. Culture of *C. gloeosporioides* which exhibited diversity with respect to cultural characters like type of the growth, mycelial colour, pigmentation and sporulation with maximum growth on Potato dextrose agar. The highest radial growth and sporulation of the fungus was recorded at 30°C , and light condition having 12 hours light alternated with 12 hours dark. The different days of incubation of culture filtrates of *C. gloeosporioides* differed

in their action to inhibit the seed germination, root and shoot elongation of sorghum seeds and induction of phytotoxic symptoms on tomato seedlings. Among the fungicides, bioagents and botanicals tested against the *C. gloeosporioides*, carbendazim + mancozeb, propiconazole, *T. viride*, and datura leaf extract, were superior, in inhibiting the mycelial growth of the fungus under in vitro condition. The bioefficacy of fungicides and bioagent which performed well in vitro condition were tested in vivo condition as well. Among them, carbendazim + mancozeb at 0.3 per cent and propiconazole at 0.1 per cent concentration were effective in reducing the per cent disease index of anthracnose disease. Ganesh, Araktha and Kesar showed susceptible reaction while other 16 genotypes showed moderately susceptible reaction under detached leaf technique.

Morphological and molecular variability of *Xanthomonas axonopodis* pv. *punicae* (Hingorani and Singh) Vauterin et al. causing bacterial blight of pomegranate

MADHU S. GIRI

2009

MAJOR ADVISOR : Dr. S. K. PRASHANTHI

Pomegranate (*Punica granatum* L.) is an important fruit crop of India and other subtropical countries. Bacterial blight caused by *Xanthomonas axonopodis* pv. *punicae* (Hingorani and Singh, 1959) Vauterin et al. is a major threat to pomegranate production. Morphological, physiological, biochemical and molecular diversity of the 16 isolates of *Xanthomonas axonopodis* pv. *punicae* collected from various parts of Karnataka was studied. Lokapur and Ramatala isolates produced highly mucoid colonies on YDCA and GYCA medium. The maximum colony size was found in case of Lokapur, Ramatala, Gulaganjikoppa and Kothabala isolates, while the least colony diameter was recorded in Uthnal isolate. YDCA, GYCA and YNA media supported good growth of all the isolates. Many isolates failed to grow on the XPS medium. The temperature 20°C supported the maximum growth of 11 isolates, while 30°C was found optimum for the remaining five isolates. All the isolates showed maximum growth at pH 5.0. However, Ramatala and Mudhol isolates showed good

growth even at pH 8.0. Among sixteen isolates, only five isolates could hydrolyse starch and they showed variation in their ability to hydrolyse starch. Almost all the isolates produced strong to weak acids from sucrose, maltose and dextrose, where as Hagaribommanahally isolate failed to produce acid from sucrose and maltose. Bardol isolate failed to produce acid from sucrose. Uthnal, Bardol and Bandi isolates failed to produce hydrogen sulphide gas where as remaining isolates produced heavy to weak H₂S gas. RAPD analysis distinguished the 16 isolates in to 2 major clusters; cluster A was represented by a single isolate i.e., Hagaribommanahally isolate of Bellary district and cluster B encompassed all other isolates. The maximum genetic similarity of 91% was observed between Gulaganjikoppa and Kurubararamanahally isolate; least similarity was found between Thavargere and Shravanagere isolates. Molecular diversity study indicated the fact that, the variation is independent of geographical location.

Studies on *Cercospora beticola* Sacc. causing leaf spot of palak (*Beta vulgaris* var. *bengalensis* Hort.)

POORNIMA

2010

MAJOR ADVISOR : Dr. YASHODA R. HEGDE

The major constraint for cultivation of palak is leaf spot caused by *Cercospora beticola* Sacc. Leaf spot was noticed in all the locations

surveyed with the range of 17.3 to 57.3%. The maximum disease severity was noticed in Dharwad district (45.38) and least in Belgaum district

(33.7). Symptoms were observed on both leaf and petiole as dark brown coloured spots with circular or irregular margin. Closely situated spots coalesced and formed large necrotic patches. Sporulation was observed in Potato dextrose agar with 6% and 4% dextrose, sugarbeet leaf extract medium and mycelial bits kept on host leaf surface. The maximum sporulation and long sized conidia were observed when mycelial bits were kept on host leaf surface. The minimum sporulation and short sized conidia were observed in sugarbeet leaf extract medium. Potato dextrose agar and soypeptone agar supported maximum radial growth and dry mycelial weight on 16th day of incubation. The temperature of 25°C and pH 7.0 were found to be the best for fungal growth. Host range studies

indicated that *C. beticola* can infect hosts like *Amaranthus sp* and *Beta vulgaris* which can be considered as collateral hosts. The plants were more susceptible to infection at 28 days old stage indicating the most vulnerable stage of the host. Under *in vitro* condition, among botanicals *Tridax procumbense* at 20% and among bioagents *Trichoderma harzianum* were able to reduce the growth of pathogen to a remarkable extent. Under *in vivo* conditions botanicals like *Allium sativum*, *Azadirachta indica* at 20% recorded minimum disease. Among biorationals, *Pseudomonas fluorescens* @ 0.2% has given good result with least per cent disease index.

Studies on biological management of collar rot of sesame caused by *Sclerotium rolfsii* Sacc.

N. PRAVEEN KUMAR

2009

MAJOR ADVISOR : Dr. M. G. PALAKSHAPPA

Sesame is one of the important oilseed crops of Karnataka. Sesame suffers from several diseases. Among them collar rot caused by *Sclerotium rolfsii* is the most destructive one causing 10-15 per cent loss. Hence, detailed studies on this pathogen including isolation, pathogenesis test, standardization of inoculum level, survey of the disease in sesame growing areas of northern Karnataka, *in vitro* evaluation of botanicals, bioagents, biorationals, organic amendments and integrated disease management had been carried out. Rhizosphere population of microorganisms was estimated in different intervals in the treatments of integrated management of collar rot of sesame. A pure culture of *S. rolfsii* was obtained from sesame plants showing typical collar rot symptoms and its pathogenicity to sesame was proved. Maximum incidence (5.9%) was recorded in MARS, UAS, Dharwad and minimum incidence (1.0%) in MARS, UAS, Raichur

and Kanyadoddi village in Raichur taluka. Nimbicidin at 5 and 10 per cent, *T. harzianum* and cow urine + vermiwash at 2 and 6 per cent and cow urine + butter milk at 4 and 6 per cent were found effective in inhibiting mycelial growth and sclerotial formation of *S. rolfsii*. Vermicompost recorded least disease incidence (30.30%) followed by neem cake (33.33%). Rhizosphere microbial population increased in all integrated treatments tested. At 30 DAS the maximum population of fungi, bacteria and actinomycetes were noticed in T₁ (FYM + seed treatment with *T. harzianum*), T₂ (FYM + seed treatment with *P. fluorescens*) and T₅ (FYM + drenching with *jeevamrutha*), respectively. The same trend was also noticed at 45 DAS. In the integrated management of sesame collar rot, the treatment T₇ (FYM + seed treatment with carboxin) was found to be the most effective in reducing the disease and it recorded the least per cent disease incidence (33.33%).

Biochemical and molecular characterization of mutants of tetraploid wheat against spot blotch caused by *Bipolaris sorokiniana* Sacc. (Shoem.)

P. E. PRADEEP

2010

MAJOR ADVISOR : Dr. I. K. KALAPPANAVAR

A nematode random survey of the Bt cotton crop rhizospheres from the important Bt cotton growing areas of north Karnataka revealed the presence of plant parasitic nematodes like *Aphelenchus sp.*, *Hoplolaimus sp.*, *Helicotylenchus sp.*, *Pratylenchus sp.*, *Rotylenchulus reniformis*, *Tylenchorynchus sp.*, Dorylamids - like plant pathogenic nematodes and *Tylenchus* - like plant pathogenic nematodes. *Rotylenchulus reniformis* was found to be the most predominant nematode associated with cotton as revealed by the community analysis of plant parasitic nematodes. Pathogenicity tests conducted on Bt cotton cultivar MRC-7918 showed that initial inoculum densities of 100 and above infective juveniles were pathogenic to the cultivar reducing plant growth parameters. This nematode was found to complete its life cycle in 27 to 29 days in Bt cotton cultivar MRC- 7918 under Dharwad conditions. Among 25 Bt

cultivars of *Gossypium sp.*, three cultivars showed a disease index of 1, i.e. Chiranjeevi and Tulsi-4 (BG-I) and RCH-2 (BG-II). Twenty of the cultivars showed a disease index of 2 (resistant) and two of the cultivars, MRC-7918 and Tulsi-117, of BG-II were moderately resistant to the infection caused by reniform nematode. Bt genes whether Cry 1 AC or Cry 2 AB or both in combination did not show any adverse effect on the spectrum of nematode associated with cotton. Management studies were conducted with chemicals, botanical, organic amendments and two PGPR strains belonging to *Pseudomonas sp.* Neem seed powder at 5 g per 100 g of seeds for seed treatment effectively increased the plant growth parameters and reduced the nematode population in soil and in root. This treatment was followed by *Calotropis latex* (@ 5 per cent), Carbosulphan (@ 6 per cent) and PGPR-50 (*Pseudomonas sp.* @ 10 per cent) seed treatment.

Plant parasitic nematodes associated with Bt cotton (*Gossypium spp.*)

PRITISHIVAJI SONAVANE

2010

MAJOR ADVISOR : Dr. S. LINGARAJU

A nematode random survey of the Bt cotton crop rhizospheres from the important Bt cotton growing areas of north Karnataka revealed the presence of plant parasitic nematodes like *Aphelenchus sp.*, *Hoplolaimus sp.*, *Helicotylenchus sp.*, *Pratylenchus sp.*, *Rotylenchulus reniformis*, *Tylenchorynchus sp.*, Dorylamids - like plant pathogenic nematodes and *Tylenchus* - like plant pathogenic nematodes. *Rotylenchulus reniformis* was found to be the most predominant nematode associated with cotton as revealed by the community analysis of plant parasitic nematodes. Pathogenicity tests conducted on Bt cotton cultivar MRC-7918 showed that initial inoculum densities of 100 and above infective juveniles were pathogenic to the cultivar reducing plant growth parameters. This nematode was found to complete its life cycle in 27 to 29 days in Bt cotton cultivar MRC- 7918 under Dharwad conditions. Among 25 Bt

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Management of bacterial blight of pomegranate caused by *Xanthomonas axonopodis* pv. *punicae* (Hingorani and Singh) Vauterin *et al.*

J. RAJU

2010

MAJOR ADVISOR : Dr. V. I. BENAGI

Considering the magnitude of the disease and its resultant losses, the investigation was undertaken to study the disease and pathogen thoroughly and to bring out an appropriate management aspects to mitigate

the problem effectively. Survey conducted during 2009-10 revealed the highest disease incidence (70%) and severity (35%) on fruits in the villages of Bagalkot district followed by Koppal and Gadag districts. Lowest disease

incidence (48.57 %) and severity (24.28%) was observed in the villages of Raichur district. It was severe in mrigbahar cropping season compared to hastabahar and ambiabahar. The causal organism was isolated from the infected leaf, fruit and stem parts by following the serial dilution plating technique using nutrient agar medium. Pathogenic test revealed that the *Xanthomonas axonopodis* pv. *punicae* was pathogenic to pomegranate and produced typical symptoms on pomegranate leaves after four days of inoculation as small water soaked lesions. *In vitro* evaluation of chemicals indicated that, Streptocycline (0.05%) + COC (0.2%) exhibited superior efficacy followed by Streptocycline (0.05%) + Copper hydroxide (0.2%) than COC and Streptocycline alone. Among bioagents *Pseudomonas*

fluorescens was superior in inhibiting growth of bacteria followed by *Bacillus subtilis*. Whereas, *Trichoderma* sp. were found ineffective. Among plant extracts tulsi leaves and neem seed oil at higher concentrations (30 and 40 %) were found inhibitory. *In vivo* studies indicated that Streptocycline (0.05%) + COC (0.2%) and Streptocycline (0.05%) + Copper hydroxide (0.2%) found effective in reducing the disease severity of 73.7 and 71.2 per cent respectively. 0.2 per cent copper hydroxide (68.59 %) and copper oxy chloride (67.45 %) also reduced the disease. At 1 per cent *Bacillus subtilis* (51.67 %) and *Pseudomonas fluorescens* (50.11%) also found moderate effective.

Studies on phytoplasma disease of periwinkle [*Catharanthus roseus* (L.) G. Don.]

SANJEEV KUMAR

2010

MAJOR ADVISOR : Dr. A. S. BYADGI

Periwinkle, an evergreen shrub is cultivated for its medicinal uses as well as an ornamental plant and used in plant pathology as an experimental host for phytoplasmas. Phytoplasmas are cell wall-less, non-helical prokaryotes that colonize plant phloem and insects gut wall and are known to cause devastating losses in crops and natural ecosystems worldwide. The average disease incidence varied from 1.53 per cent to 12.75 per cent in Northern Karnataka. Most typical symptoms were witches broom, virescence, phyllody and little leaf. The phytoplasma disease of periwinkle was neither mechanically transmissible nor through seeds. The phytoplasma successfully transmitted through wedge grafting to healthy periwinkle plants producing typical phyllody, virescence and witches broom symptoms. Phytoplasma was also transmitted to sunflower, safflower, brinjal, tomato and sesamum but failed to express any symptom even up to 120 days of inoculation. Dodder transmission to healthy

periwinkle, *Solanum lycopersicum* and *Sesamum indicum* was also successful but concentration of phytoplasma was too less for symptom expression as evidenced by positive nested PCR result after 120 days of inoculation. Both leafhopper and aphids failed to transmit phytoplasma from the infected periwinkle to healthy one. Ultra thin section of infected leaf midrib showed typical oval to round pleomorphic bodies of phytoplasma under transmission electron microscope. The partial 16S rRNA gene of periwinkle phytoplasma was cloned into a cloning vector (PTZ57R/T) and sequence was found to be of 1246 bp long. Evolutionarily closeness to subgroup 16SrI-B (*Candidatus* Phytoplasma asteris) and virtual RFLP Pattern similarity to 16SrI-B predict that the periwinkle phytoplasma from Dharwad belongs to 16SrI-B phytoplasma group and hence forth present isolate can be designated as *Catharanthus roseus* phytoplasma Dharwad isolate.

Studies on pomegranate wilt complex

SHREESHAIL SONYAL

2010

MAJOR ADVISOR : Dr. ARUN SATARADDI

Pomegranate wilt complex is an important disease which results in complete wilting of plant. The severity of pomegranate wilt complex was more in Bellary district followed by Koppal, Gadag, Bijapur, Bagalkot and Raichur districts. During the period of survey new plant parasitic nematodes were found in Karnataka viz., *Meloidogyne incognita*, *Helicotylenus dhystera*, *Xiphinema* sp. Dorylamid PPN and *rotylechulus reniformis*. The identity of the fungus was confirmed as *Ceratocystis fimbriata* Ell. and Halst. The fungus showed maximum growth on Potato Dextrose broth on 16th day after incubation at 25±1°C. Culture of *C. fimbriata* which exhibited diversity with respect to cultural characters like type of the growth, mycelia colour, pigmentation and peritheium production with maximum growth on Oat meal agar. The highest growth of the fungus was recorded at 30°C, and fungus was grown maximum at pH

7.5. The different days of incubation of culture filtrates of *C. fimbriata* differed in their action to inhibit the seed germination of sorghum seeds. Among the fungicides, bioagents and botanicals tested against the *C. fimbriata*, propiconazole, vitavax power, hexaconazole and tricyazole, *T. harzianum*, *T. viride*, and Zinger rhizome extract, were superior, in inhibiting the mycelia growth of the fungus under *in vitro* condition. However in the interaction study, the *C. fimbriata* + *M. incognita* showed less shoot and root length and shoot and root weight followed by fungal giant culture (*C. fimbriata*) compared to all other treatments. The bioefficacy of fungicides and bioagents which performed well *in vitro* were tested *in vivo* condition as well. Among them, propiconazole at 0.2 per cent and difenconazole at 0.2 per cent concentration and *T. harzianum* + *P. flourescens* and neem cake were effective in reducing the per cent disease incidence of wilt complex.

Serodiagnosis and molecular characterization of tomato mosaic virus (ToMV)

SHWETA AMBAGER

2010

MAJOR ADVISOR : Dr. A.S.BYADGI

The tomato (*Solanum lycopersicum* L) is a member of solanaceae family. Among the viral diseases, tomato leaf curl and tomato mosaic are destructive diseases of tomato in India. Tomato mosaic disease causes up to 59 percent reduction in the weight of tomato fruit. The mean incidence of tomato mosaic tobamovirus was 55.98 percent. Till nineteenth century tomato mosaic disease was considered to be caused by Tobacco Mosaic Virus (TMV). But in recent years it is called as Tomato Mosaic Virus (ToMV). Hence for confirmation study was carried out on different aspects viz. Symptomatology, molecular characterization, electron microscopy, purification of virus, production of antiserum and serodiagnosis. The inoculated tomato plants developed typical mosaic symptom 10-15 days after inoculation. The electron microscopic study showed presence of long, rigid rod shape tobamovirus particles. The PCR successfully amplified

the CP-gene from infected tomato leaf samples with specific ToMV primers. The amplicon of ToMV- CP gene was confirmed by electrophoresis and PCR product was sent for sequencing. The coat protein had 485 bp and codes for 161 amino acids. Nucleotide blast results showed that CP gene sequence under study shared highest similarity with Indian ToMV isolate (97 %) and 95 percent with TMV Indian isolate. With this highest similarity with TMV isolate, ToMV can be conclude as a strain of TMV, but not a different virus itself. Polyclonal antiserum against the virus was produced by immunization of rabbit with partially purified virus preparation. This antiserum had a titer of 1:1024. Double antibody sandwich enzyme linked immunosorbent assay (DAS-ELISA) was standardized by utilizing γ globulins and purified homologous conjugate developed during the study and was successfully used to detect ToMV in different samples.

SEED SCIENCE AND TECHNOLOGY

Effect of fungicidal seed treatment on control of grain smut incidence, seed yield and quality and storability of *rabi* sorghum [*Sorghum bicolor* (L.) Moench.]

BAPURAYAGOURA B. PATIL

2010

MAJOR ADVISOR : Dr. ASHOK S. SAJJAN

An investigation was carried out with two experiments at Department of Seed Science and Technology and MARS, University of

Agricultural Sciences, Dharwad during 2009-2010. The storage experiment was laid out in CRD to study the effect of fungicidal seed treatment on

seed quality during storage. The experiment consisted nine seed treatments with fungicides viz., T₁ (Carboxin + Thiram @ 3 g kg⁻¹ seeds i.e. Vitavax Power), T₂ (Sulphur @ 3 g kg⁻¹), T₃ (Thiram @ 3 g kg⁻¹), T₄ (Carbendazim + Iprodione @ 3 g kg⁻¹ i.e. Quintal), T₅ (Carbendazim @ 3g kg⁻¹ i.e. Bavistin), T₆ (Captan + Hexaconazole @ 3 ml kg⁻¹ i.e. Takat), T₇ (Sulphur + Thiram @ 1.5 g + 1.5 g kg⁻¹) and T₈ (Control). The seeds treated with carboxin + thiram (vitavax power) @ 3 g kg⁻¹ seeds recorded significantly higher germination (73.75 %), root length (16.75 cm), shoot length (16.73 cm), vigour index (2469), seedling dry weight (163.0 mg⁻⁵ seedlings), lower electrical conductivity (0.866 dSm⁻¹) and moisture content (12.18%) at the end of nine months of storage over the control. The field experiment

Studies on synchronisation in NHH-44 Bt cotton hybrid seed production

BASAVARAJ LAKKUNDI

2010

MAJOR ADVISOR : Mr. M. R. ESHANNA

An investigation was carried out to study the synchronization in NH-44 St cotton hybrid seed production at Agricultural "Research Station, Dharwad during *kharif* season, 2009. Among the staggered sowing of male parent, 50 per cent first male sowing + 100 per cent female sowing, remaining 50 per cent male seeds were sown seven days after the first male sowing recorded higher number of female flower buds crossed per plant (90.58), crossed bolls per plant (34.75), crossed seed cotton yield (1019 kg/ha) and crossed seed yield (664 kg/ha) compared to other two staggered sowing treatments and also simultaneous sowing of both the parents recorded higher crossed boll weight (3.72 g), crossed seed weight per boll (2.10 g), crossed seed index (8.82 g), germination (80.93%), seedling vigour index (2674) compared to other two staggered sowing treatments. Among the chemical spray, the boom [Nitro benzene (20% w/w), Aromatic nitrogen minimum (2.20%), urea and zinc sulphate in liquid form] spray recorded higher number of female flower buds crossed per

was laid out in RCBD to study the effect of fungicidal seed treatment on seed yield, quality and control of smut incidence in *rabi* sorghum. The experiment consisted 11 seed treatments. The seeds treated with carboxin + thiram (vitavax power) just before sowing @ 3 g/kg seeds were recorded significantly maximum ear head length, breadth, weight (18.9 cm, 13.4 cm, 42.2 g respectively), number of primaries per ear head (33.7), seed weight per plant (36.1 g), seed yield per plot (1.079 kg), seed yield per hectare (1521.9 kg) and lesser smut incidence (1.10%). The higher gross, net returns and B:C ratio (34,037, 26,217 Rs/ha, 4.35 respectively) and seed quality parameters were significantly higher in the same treatment over the control.

Phenotypic characterization, assessment of genetic diversity, screening for protein content and bruchid infestation in cowpea [*Vigna unguiculata* (L.) Walp.] genotypes

BASAVARAJ MAKANUR

2010

MAJOR ADVISOR : Dr. V. K. DESHPANDE

A field and laboratory experiments were conducted at Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad during *kharif* 2009 for phenotypic characterization, assessment of genetic diversity, screening for seed protein content and genotypic relative response to bruchid infestation. Thirty five cowpea genotypes were grouped based on the seed and seedling morphological characters such as seed coat colour, hilum colour, seed shape, seed coat lusture, hundred seed weight, seed size and hypocotyl pigmentation. Further based on the plant morphological characters such as pigmentation on stem, growth pattern, 50 per cent flowering, flower colour, growth habit, pubescence on stem, leaf colour, immature pod pigmentation, raceme position, pod attachment, plant height, primary branches per plant, clusters per plant, pods per peduncle, pods per plant, mature pod constriction, days to maturity, pod length, seeds per pod, pod colour at

maturity, seed yield per plant and hectare of genotypes were classified into different groups. Among 13 characters studied ten characters contributed to diversity, in which the highest contribution was recorded by the seed size followed by pod length. Significant difference was recorded for seed protein content. The highest percentage of protein content (24.06%) was noticed in IC97787 and lowest (13.88%) was in IC259159-2 genotype. Significant difference was also observed among genotypes to their relative susceptibility to bruchid to immune. Correlation analysis indicated that seed size, weight and protein content of cowpea genotypes have no influence on the relative susceptibility to *Callosobruchus maculatus*. Comparatively least susceptible genotypes were IC202784, IC212872, IC4506 and IC198701 while highly susceptible genotypes were IC214757, IC198361 and Mumbai local and rest of all were moderate to highly susceptible to bruchid infestation.

Characterization of soybean [*Glycine max* (L.) Merrill.] varieties through morphological, chemical, molecular markers and image analyzer

CHAVAN NIVRATI GOVINDRAO

2010

MAJOR ADVISOR : Dr. RAVI HUNJE

An experiment was conducted at the Main Agricultural Research Station, during *kharif*, 2009 for identification of soybean varieties through morphological characters, chemical, molecular markers and image analyzer were carried out at Seed Quality and Research Laboratory at National Seed Project, UAS, Dharwad. Twenty four soybean varieties were grouped into different groups based on the seed morphological characters such as seed coat colour, hilum colour of the seed, seed shape, seed coat luster and 100-seed weight and the seedling morphological characters viz., shoot length, root length, seedling length and seedling hypocotyl pigmentation. Based on plant morphological characters such as growth habit, plant height, presence of pubescence on stem and number of branches per plant. Leaf morphological characters such as leaf shape, leaf size, leaf colour, leaf length, leaf width, leaf area, leaf perimeter and petiole length. The flower characters such as 50% flowering, flower colour and pod characters viz.,

presence of pubescence on pod, pod pubescence colour, pod intensity of brown colour, pod colour and pod shattering characters and also days to harvest and seed yield of varieties were classified into different groups. Seed morphometric characters like seed length, seed width, seed area, seed perimeter and leaf morphometric characters like leaf length, leaf width, leaf area and leaf perimeter were measured by using Image Analyzer. The seed were subjected to NaOH, KOH and peroxidase test for differentiating the varieties. Based on the seedling growth response to GA₃, varieties were grouped as low, moderate and high response and based on 2, 4-D and malathion varieties were grouped as least, moderate and highly affected. RAPD profile for all 24 varieties was generated with 12 random decamer primers. The highest molecular diversity was observed between the varieties Type-49 and VLS-59 and lowest between Punjab-1 and NRC-37.

Influence of seed treatments and containers on storage potential of Bt and non Bt cotton varieties

K. H. HEMASHREE

2010

MAJOR ADVISOR : Dr. M. B. KURDIKERI

The storage potential of Bt cotton cv. Bikaneri Nerma and non Bt cotton cv. Sahana was undertaken with four seed treatments viz. thiram 75 per cent WDP @ 2g per kg seeds, imidachloprid @ 3 g per kg seeds, CaOCl₂ @ 3 g per kg seeds, sweet flag rhizome @ 10 g per kg seeds and were packed in cloth bag, polythene bag (700 gauge), alluminium pouches and stored under ambient conditions. The Bt cotton variety recorded higher germination and seedling vigour parameters compared to non Bt cotton at the end of 12 months of storage. Among the seed treatments, seed treated with CaOCl₂ recorded higher germination (66.95%) and other seed quality parameters at the end of storage period. Seeds packed in alluminium foil pouches recorded higher germination (68.03%), vigour parameters with lower electrical conductivity and seed infection compared to seeds stored in other containers at the end of storage period. In the

interaction effect of varieties and treatments (VxT), Bt and non Bt seeds treated with CaOCl₂ recorded higher germination (69.00 and 65.91%, respectively) and other vigour parameters throughout the storage period. In the interactions between varieties and packaging materials (VxC), Bt seeds packed in alluminium pouches found superior in all the seed quality parameters followed by polythene bag and were lowest in cloth bag. In the interactions of seed treatments and containers (TxC), seed treated with CaOCl₂ and stored in alluminium foil pouches and polythene bag recorded higher germination (70.87 and 69.87%) with higher vigour parameters at the end of storage period. Among interactions of varieties, seed treatments and containers (VxTxC) Bt cotton seeds treated with CaOCl₂ and packed in alluminium pouches recorded higher germination (71.25%) and other seed quality parameters at the end of storage period.

Characterization of wheat (*Triticum* spp.) genotypes through morphological, chemical and molecular markers

JAGADALE SHIVSAGAR MANSING

2010

MAJOR ADVISOR : Dr. N. K. BIRADARPATIL

An experiment was carried out at national Seed Project, University of Agricultural Sciences, Dharwad during *khari*f 2009 for characterization wheat genotypes through morphological, chemical and molecular markers. Twenty two wheat genotypes were grouped into different groups based on 38 morphological characters, out of that seven distinct characters were found to be effective to identify each genotypes from others. Based on the seed shape genotypes were grouped into ovate (7), oblong (9) and elliptical (6). Brush hair length is also distinct characters led to classify into lacking (8), medium (6) and long (8). Based on flag leaf waxiness on sheath, genotypes were grouped into medium (7), strong (7) and very strong (8). Flag leaf waxiness on blade was a most distinct character and genotypes were classified as very weak (11), weak (1), medium (6), strong (1) and very strong (3). Ear density was also most distinct character which led to classify genotype as dense (6), medium (7), and very dense

(5). Based on the awn attitude, genotypes were grouped as medium (6), spreading (9) and oppressed (7). While, peduncle attitude was used to differentiate the genotypes as, straight (13), bent (6) and crooked (3). The seed were subjected to phenol, NaOH, KOH and peroxidase test for differentiating the genotypes. The phenol and NaOH tests were more useful in differentiating the genotypes. Phenol test led to classify genotypes as absent (9), light brown (4) and dark brown (8). Under the NaOH test 18 genotypes showed straw colour, while four genotypes showed dark orange colour. The seedling growth response of 22 wheat genotypes varied with GA₃ and 2,4-D treatment. SRAP profile for ten genotypes were generated with 17 forward and reverse primer combinations. The highest molecular diversity was observed between the genotypes UAS-304 and DWR-2006 and lowest between DWR-162, DWR-195 and DWR-225.

Effect of sowing seasons and seed dropping heights on mechanical seed damage and seed quality traits in soybean [*Glycine max* (L.) Merrill.] genotypes

MOHANA RANGANATHA DANDAGI

2010

MAJOR ADVISOR : Dr. M. N. MEHRAWADE

Totally three experiments were conducted to investigate the effect of sowing seasons and seed dropping heights on mechanical damage and seed quality attributes in soybean genotypes. In first experiment, the *khari*f season (S₁) recorded higher hundred seed weight (14.09g), seed density (1.19g/cc), dehusked seed weight (11.1 9g), seed mechanical damage (87.2%), oil content (14.47%), seed germination (64.82%), seedling vigour index (1951) over summer season and genotypes. Among genotypes, significantly maximum hundred seed weight (15.95g), seed density (1.36g/cc) was recorded in MACS-13 and dehusked seed weight (12.38 g) in MA US-I and seed mechanical damage (90.00%) in JS 79-81, in VL Soya I. oil content (17.05%) in VL Soya21 (G₈₉), seed germination (89.00%) in Birsasoy I (G₄), seedling vigour index (3222) in Birsasoyl (G₄) over sowing seasons. In second experiment, *khari*f season recorded more hundred seed weight (16.14g), seed density, dehusk seed. weight (12.83g), seed mechanical damage (91.25%), seed germination (76.00%) and seedling vigour index (2732) compared to summer season over

genotypes. The JS-335 (V₂) recorded more hundred seed weight-seed density (1.16g/cc) compared to JS-9305 (V) variety. Whereas, more dehusk seed weight (11.87g), seed mechanical damage (91.5%), seed germination (69.67%) and seedling vigour index (2374) were seen in JS-9305 (V₁) variety over JS-335 variety over sowing seasons. Among four dropping heights, the undropped seeds (D₀) recorded consistently more hundred seed weight (14.94g), seed germination (77.37%) and seedling vigour index (2774) as against nine feet dropping height (D₃). In third experiment, the variety NRC-7 recorded significantly highest hundred seed weight (15.03g) and dehusk seed weight (11.24g). Whereas, it was the highest seed density (1.37g/cc) in JS9560; seed mechanical damage (93.50%), seed germination (76.33%) and seedling vigour index (2804) in JS-335 variety. The significantly maximum hundred seed weight (13.90g), seed germination (68.00%) and seedling vigour index (2215) were recorded in the seeds without dropping against those dropped from nine feet height which recorded minimum values

Studies on seed dormancy and invigouration in ashwagandha (*Withania somnifera* Daunal)

RAJASAHAB F. JANGLEPPANAVAR

2010

MAJOR ADVISOR : Dr. A. KRISHNA

Laboratory experiments were conducted to study the seed dormancy and invigouration techniques in Ashwagandha in the Department of Seed Science and technology, Agriculture College, University of Agricultural Sciences, Dharwad during 2009-10. Experimental results recorded that seed treatment with KNO₃ (1%) for 6 hrs has recorded significantly higher germination (79%), speed of germination (0.407), seedling dry weight (13.46 mg), root length, shoot length and seedling vigour index (5.43 cm, 12.82 cm and 1441, respectively) over untreated control. The seed germination differed significantly due to seed size, which increased significantly with increased seed size. The maximum and minimum seed germination values were recorded in big (80.00%) and small (64.84%) seeds. The difference in seed germination as influenced by seed invigouration treatments was found significant and maximum seed germination was noticed in seed treated with KNO₃ (1%) solution

followed by GA₃. KNO₃ seed treatment method of invigouration showed significantly superior seedling dry weight (13.17 mg), higher root length (5.04 cm), shoot length (13.58 cm) and vigour index (1449). The higher vigour seeds recorded maximum seedling dry weight (12.78 mg), root length (4.75 cm), shoot length (12.98 cm) and vigour index (1343) over the lower vigour seeds (11.93 mg, 4.11 cm, 11.69 cm and 1063, respectively). The seed quality parameters differed significantly due to application of bio-extract as seed treatment. Sweet flag rhizome extract (1:5) recorded significantly higher germination (71%), speed of germination (0.407), seedling dry weight (12.64 mg), higher root length (4.52 cm), shoot length (12.92 cm) and vigour index (1236). The effect on seed quality due to simulated environment through accelerated ageing (AA) at 40°C + 100% RH has recorded maximum germination (60%),

speed of germination (0.99), seedling dry weight (12.59 mg), root length (4.07 cm), shoot length (12.27 cm) and vigour index (996) as compared to another simulated environment (50°C + 100% RH). Seed subjected to

two days AA recorded higher germination (68.66%), speed of germination (0.313), shoot length (12.98 cm) and vigour index (1159) as compared to remaining ageing periods.

Influence of spacing, fertilizer and growth regulators on growth, seed yield and quality in annual chrysanthemum (*Chrysanthemum coronarium* L.)

SAINATH

2009

MAJOR ADVISOR : Dr. D. S. UPPAR

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2008 to study the influence of spacing, fertilizer levels and growth regulators on growth, seed yield and quality in annual chrysanthemum (*Chrysanthemum coronarium* L.). The experiment consisted of three spacing (S_1 -30x30, S_2 -30x45, S_3 -30x60) and fertilizer levels (F_1 -75:112.5:75, F_2 -100:150:100, F_3 -125:187.5:125 NPK kg/ha). It was laidout in Randomized Block Design (RBD) with factorial concept having three replications. The results indicated significantly higher plant height, number of branches, leaf area/plant, flower diameter and dry weight, number of seeds/flower and seed yield/plant at S_3 with F_3 . The seed quality parameters like thousand seed weight, germination percentage, seedling length, vigour index and dry weight were also higher. However, seed yield ha^{-1} , cost of cultivation, gross and net returns ha^{-1} and cost benefit ratio were higher with S_1 with F_3 . The other experiment consisted of nine

treatments viz., control, GA_3 @ 100 ppm, GA_3 @ 200 ppm, Tricontanol @ 500 ppm, Tricontanol @ 1000 ppm, Cycocel @ 1000 ppm, Cycocel @ 2000 ppm, Mepiquat chloride @ 1000 ppm and Mepiquat chloride @ 2000 ppm and was laidout in RBD with three replications. Foliar application of GA_3 @ 200 ppm spray recorded significantly higher plant height, number of branches, leaf area/plant, flower diameter and dry weight, number of seeds/flower, seed yield/plant and ha^{-1} . Among seed quality parameters, thousand seed weight, germination percentage, seedling length, vigour index and dry weight were also higher, it also recorded higher cost of cultivation, gross and net returns ha^{-1} , but the cost benefit ratio was highest in Tricontanol 1000 ppm. Based on the results it can be concluded that the combination of 30x60 cm with 125:187.5:125 NPK kg and GA_3 200 ppm is optimum for getting higher seed yield and quality in annual chrysanthemum.

Studies on integrated nutrient management on seed yield, quality and storability in greengram (*Vigna radiata* (L.) Wilczek).

SHRIKANT M. VADGAVE

2010

MAJOR ADVISOR : Dr. D. S. UPPAR

Field and laboratory experiment were conducted at Main Agricultural Research Station, UAS, Dharwad during *kharif* 2009 to study the influence of integrated nutrient management on seed yield, quality and storability in greengram (*Vigna radiata* L.). The field experiment consisted of nine treatments with different organic and inorganic manures and laid out in randomised block design with three replications. Results indicated that the application of 100% RDF + vermicompost @ 1.25 tha^{-1} + Rhizobium @ 375 g ha^{-1} recorded significantly higher number of pods per plant (24.20), number of seeds per pod (14.20), seed yield per plant (14.23 g), seed yield per ha (1138.89 kg), thousand seed weight (41.95 g), germination (98.33 %), seedling length (32.87 cm), seedling vigour index (3233), seedling dry weight (61.06 mg), seed protein content (23.55 %) and lower electrical conductivity of seed leachate (0.737 dSm^{-1}) compared

to other treatments. Laboratory experiment was conducted to know the effect of seed treatment with insecticide and fungicide on storability of three varieties viz., Chinamung, Pusa Baisaki and Selection-4 of greengram. Studies indicated that the seed treated with malathion @ 3 g/kg of seed + bavistin @ 2 g/kg of seed recorded higher germination (81.92%), seedling length (22.60 cm), seedling vigour index (1853) and seedling dry weight (47.19 mg) and lower electrical conductivity of seed leachate (1.452 dSm^{-1}) at the end of eight months of storage period. Among three varieties, Pusa Baisaki recorded higher germination (80.00%), seedling length (21.11 cm), seedling vigour index (1693), seedling dry weight (45.44 mg) and lower electrical conductivity of seed leachate (1.528 dSm^{-1}) at the end of eight months of storage period.

Influence of nipping and hormonal spray on seed yield and quality in field bean [*Lablab purpureus* (L.) Sweet] genotypes

E. SUDEEP KUMAR

2010

MAJOR ADVISOR : Dr. CHANNAVEERSWAMI

The experiments were conducted at the Main Agricultural Research Station, Dharwad and in the laboratory of Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad during *kharif* 2009. Between the genotypes though DA-8 genotype recorded higher plant height, the other growth parameters like days to flower initiation, days to fifty percent flowering were less with HA-3 genotype, which also recorded higher number of branches, pods per plant, pod weight, dry matter production, seeds per pod, seed yield per plant and per hectare (1966 kg). Similarly higher values for seed quality parameters like hundred seed weight, germination (90.73%), root length, shoot length, seedling dry weight, vigour index and seed protein content with lower seed leachate values were recorded by HA-3 genotype. Nipping of plants at 55 DAS lead to decrease in plant height but increased the number of branches, pods per plant (125.72), seeds per pod (4.87), seed yield per hectare (2166 kg).

Similarly, seed quality parameters such as hundred seed weight (28.61g), germination percentage (92.45%) and vigour index (3979) were significantly higher with nipped plants (N_2) compared to no nipped plants (N_1). Among hormonal sprays plants sprayed with GA_3 recorded higher plant height while, the other growth parameters recorded were higher with MH sprayed plants and also registered higher seed yield per hectare (1953 kg). The seed quality parameters like hundred seed weight, germination (90.20%), vigour index (3675) were maximum with MH spray. The interaction effect between $G \times N$, $G \times S$, $N \times S$ and $G \times N \times S$ were non significant for majority of the characters studied. However, in both the genotypes nipped plants sprayed with MH recorded higher growth, yield and quality parameters compared to either GA_3 or water sprays and also with no nipping.

Studies on pre-sowing treatments on field performance and seed quality in sesame

A. N. WAGHAMORE

2009

MAJOR ADVISOR : Dr. R. GURUMURTHY

The field and laboratory experiments were conducted to study the hydropriming with chemicals on field performance and seed quality and pre storage seed treatment on viability of high and low vigour seeds of sesame cv.DS-I. During *Kharif* 2009 at the Department of Seed Science and Technology, Agricultural College, Dharwad. The field experiment consisted of two factors viz., the main factor high and low vigour seeds., the sub factor consisted of seven treatments viz., Hydro priming, Hydro priming with KCl(2%), Hydropriming with KH₂P0₄ (2 %) Hydropriming with GA_3 (500 ppm), Hydropriming with CaCb (0.5%), Priming with cow urine (50 %) and Untreated control. The results showed significant difference due to seed Vigour level, hydro priming with chemicals and

their interaction effect. Among treatments hydro priming with GA_3 (500ppm) was significantly superior with respect to growth, yield and seed quality parameters followed by hydro ring with CaCb (0.5%) as compared to control irrespective of the seed vigour. Hydro priming with GA_3 (500ppm) recorded the highest values with respect to plant stand (90.67plants/plots) plant height at 30days (50.17cm), 60days (91.33cm) and at harvest (115.00cm), days to 50 per cent nowering (43.67 days), thousand seed weight (3.21 g), number of capsules (60.53 per plant), seed yield per plant (8.58g), seed yield per plot (577.67g) and seed yield per hectare (5.32q ha^{-1}) as compared to untreated control irrespective of the seed vigour. Pre storage seed treatment study results indicated that seed

treatment with Thiram (3 g kg⁻¹ seed), significantly superior with respect to seed quality parameters at the end of the six months of the storage

period followed by Chlorax (3 g kg⁻¹ seed), as compared to untreated control in both high and low vigour seeds of Sesame cv.DS-1.

SOILSCIENCE AND AGRICULTURAL CHEMISTRY

Characterisation and classification of soil resources of mantagani village in haveri district

H. B. PARAMESHWARA PULAKESHI

2010

MAJOR ADVISOR : Dr. P. L. PATIL

A study was undertaken to characterize, classify and map the soil resources of a village derived from chlorite schist in northern transitional zone (zone-8) of Karnataka in order to assess their land capability, irrigability and suitability for crops and also to assess soil fertility constraints. Mantagani village in zone-8 of Karnataka was selected as the study area. Soil survey was carried out to know the type and extent to soils prevailing in the area and to map the soils. Fourteen profiles were studied for the morphological, physical and chemical properties and classified up to family level and identified 7 series. The identified series are mapped into 16 mapping units. Land capability classification was carried out for the study area. The land capability classes namely III_{tsf}, III_{tsf}, III_{wsf}, and IV_t have been differentiated and mapped. Soil suitability evaluation for irrigation showed that soils were moderately suitable (S2) and marginally suitable (S3) for surface irrigation. The mapped soils from

the study area were assessed for the suitability of crops like cotton, wheat, maize, chilli, jowar, sunflower, pearl millet, groundnut and pigeonpea. Mantagani soil series were moderately (S2) and marginally suitable (S3) for crops like cotton, wheat, maize, chilli, jowar, sunflower, groundnut and pearl millet. Soils are currently not suitable for pigeonpea (N1) with limitations of pH and ESP. One hundred fifteen samples (0-30 cm) drawn from the farmers' fields were analysed for their fertility status and mapped by GIS technique. The pH of soil samples was slightly acidic to alkaline. Soil organic matter content was low. Available nitrogen, phosphorus was generally low to medium and available potassium and sulphur were low to high. Regarding available micronutrients, zinc and iron were deficient where as, copper and manganese were deficient to sufficient in these soils.

Nitrogen release pattern and its availability to maize (*zea mays* L.) in relation to soil fertility ratings in a vertisol of transitional zone of northern Karnataka

G. VILASITHA

2009

MAJOR ADVISOR : Dr. B. BASAVARAJ

A field experiment was carried out on a Vertisol to evaluate the release pattern of nitrogen in relation to soil fertility ratings, nutrient uptake and its effect on yield of maize crop at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2008-09. The design adopted was RBD with nine treatments replicated thrice. The experimental study revealed that the treatment 8 (T₈) receiving 30% more nitrogen than RDN (recommended dose of nitrogen) with RDK recorded the highest content of ammonical, nitrate and available nitrogen content in the soil at 30, 60 and 90 DAS of crop growth. It was followed by the treatment T6 which received 20% more nitrogen than RDN. NPK content of the index leaf differed significantly among the treatments at different stages of crop growth. At knee high and tasselling stages treatment 8 (T₈) which received 30 per cent more

nitrogen than RDN recorded the higher N and K content while treatment 9 (T₉) which received higher nitrogen and less potassium than RDN recorded the higher P content in the index leaf. The highest grain yield of 10.78 t/ha was observed in the treatment 8 (T₈) which received 30 per cent more nitrogen than RDN and it was closely followed by the treatment 9 (T₉) which received higher nitrogen and less potassium than RDN recorded a yield of 10.76 t/ha. The net returns and B: C ratio were higher with application of 30 per cent more nitrogen than RDN. (T₈ and T₉). The treatment 8 (T₈) which received 30 per cent more nitrogen than RDN with RDK recorded the higher N and K content in the grain, stalk and soil after harvest. Treatment 9 (T₉) which received higher nitrogen and less potassium than RDN recorded the higher P in grain, stalk and soil.