

## ABSTRACTS OF THESES

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

## DOCTOR OF PHILOSOPHY

### AGRICULTURAL ECONOMICS

#### Production, marketing and export performance of turmeric in Karnataka: An economic analysis

VINOD R. NAIK

2013

MAJOR ADVISOR: Dr. S. B. HOSAMANI

The focus of the study was on the production, marketing and export performance of turmeric in Karnataka. Field level data were elicited for the agriculture year 2011-12 through personal interview method. The time series data on area, production, productivity, arrivals, prices, exports etc. were obtained from secondary sources. The growth in area, production and productivity were found to be higher during pre-WTO period in the case of India as a whole. Whereas, the instability indices for area, production and productivity of turmeric were lower during post-WTO period. The variation in average production of turmeric during the post-WTO period over the pre-WTO period was mainly due to change in mean area (122.95%) and change in mean yield (58.39%) in the case of Karnataka and India respectively. Per acre average cost of cultivation of turmeric was found to be high in the case of Belgaum district (₹ 83402) and B:C ratio (2.02) was found to be higher in the case of Chamarajanagar

district. The MVP: MFC ratio for chemical fertilizers and plant protection chemicals were found more than unity in the case of all four districts. In the case of all the selected districts majority of the farms achieved 90-95 per cent level of technical efficiency. The producer's share in consumer/processor rupee was more in channel-IV than channel-I and it was the highest in the case of Chamarajanagar district compared to others. The growth rate in export of turmeric in terms of quantity and value was high during overall period than that of pre and post-WTO periods. Results of Markov chain analysis revealed that the countries pooled under 'others category', UAE, UK and Iran would be the stable importers of the Indian turmeric in the future. The results of the co-integration analysis revealed that the Kochi, Erode and New York markets were well co-integrated. In all the four selected districts the major problems faced by the farmers were pest and disease attack and higher price fluctuations.

#### Performance of cotton crop in non-traditional areas of Karnataka – An economic analysis

B. S. PAVITHRA

2013

MAJOR ADVISOR: Dr. L. B. KUNNAL

There is a spectacular shift in cotton growing areas in Karnataka. From traditional areas, it has spread to many non-traditional districts like Mysore, Shivamogga, Chamarajanagar and Davanagere. Hence, the study has made an attempt to analyse growth in area, productivity and production of cotton, to identify the price and non-price factors influencing the production, profitability of cotton on different farm sizes, behaviour of arrivals and prices, marketing channels and their efficiency and problems in production and marketing of cotton crop in the non-traditional cotton producing areas of Karnataka. Both secondary and primary data were used for the study. Results revealed that growth in area was negative for all the three districts except Mysore district, which observed positive but non-significant growth rate (18.92%). The production growth rates of cotton crop were positive in Davanagere (4.16%) and Mysore district (10.67%). Cotton yield in Chamarajanagar (-4.62%) and Mysore (-6.94%) districts

experienced a negative growth rate, whereas Davanagere (7.57%) and Shivamogga (1.76%) districts showed positive growth rate. Principal component analysis was used to know the price and non-price factors influencing cotton production. One of the major factors responsible was lagged price of cotton. Net returns were high on large farms (₹ 76,550) compared to small farms (₹ 54,736) because of higher yield levels on large farms. Higher seasonal indices have been observed for market arrivals of cotton during peak period i.e., during the months immediately after the harvest. In markets, with wide area of operations, the transportation cost was found to be the component of the total marketing cost. Three marketing channels were identified for cotton, among which channel-III was the most efficient one. The major problem faced by the farmers in production of cotton was low yield and in case of marketing it was lack of deregulated markets.

### AGRICULTURAL ENTOMOLOGY

#### Studies on insecticide resistance in leafhopper. [*Amrasca biguttula biguttula* (Ishida)] in Bt cotton

D. SAGAR

2013

MAJOR ADVISOR: Dr. R. A. BALIKAI

Studies on insecticide usage, insecticide resistance and diversity in leafhopper. [*Amrasca biguttula biguttula* (Ishida)] across major cotton growing districts of Karnataka and nitrogen induced susceptibility on leafhopper population were under taken at the Department of Agricultural Entomology, College of Agriculture, Dharwad during 2011-2013. The insecticide usage pattern varied greatly between and within the locations indicating no definite insecticide usage pattern among the major cotton growing districts of Karnataka. In all the major cotton growing districts of Karnataka except Mysore, monocrotophos and imidacloprid formulations were the primary choices of insecticides for management of sucking pests in Bt cotton. Among the nine insecticides bioassayed, Monocrotophos registered higher LC<sub>50</sub> value during both the years followed by Imidacloprid, Thiamethoxam, Acephate and Acetamiprid while, the lower LC<sub>50</sub> value was registered by Fipronil followed by Clothianidin. The botanical, Azadirachtin 1500 ppm recorded higher LC<sub>50</sub> value as compared

to other nine insecticides. Leafhopper population of Raichur and Yadgir districts recorded higher LC<sub>50</sub> values to almost all insecticides under study, while Mysore district's leafhopper population recorded lower LC<sub>50</sub> values to all insecticides bioassayed. Higher mixed function oxidase enzyme activity was noticed in the leafhopper population of Raichur followed by Yadgir, while lower activity was noticed in Mysore district population. The six district's leafhopper cytochrome oxidase subunit I (COI) gene sequences were confirmed as *A. biguttula biguttula* COI gene. COI sequence analysis showed higher similarity among the leafhopper population of major cotton growing districts of Karnataka. The cotton leafhopper population of all the six districts was taxonomically identified as *A. biguttula biguttula*. The incidence of leafhopper and leaf nitrogen content increased with the increase in the nitrogen dosages. The toxicity results indicated that there was no such striking difference in LC<sub>50</sub> values among leafhopper population as influenced by dosages of nitrogen.

# Baseline susceptibility and compatibility of pesticides against *Spodoptera litura* (Fabricius) and *Plutella xylostella* (Linnaeus) in cabbage and their safety to beneficial insects

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2013

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Susceptible laboratory strains of *Spodoptera litura* and *Plutella xylostella* were used to establish baseline susceptibility for seven insecticides, median lethal concentration of the tested insecticides varied from 0.016 to 62.25 ppm for *S. litura*. Chlorantraniliprole (0.016 ppm) was highly toxic while Lambda-cyhalothrin (62.25 ppm) and Spinosad (62.15 ppm) were least toxic. Emamectin benzoate was highly toxic (0.009 ppm) and Lambda-cyhalothrin (10.22 ppm) was least toxic to susceptible strain of *P. xylostella*. Hirebagewadi population of *S. litura* exhibited greater levels of resistance to the tested insecticides followed by Garag and Madihal populations. Irrespective of insecticides, *P. xylostella* from Kolar population recorded higher level of resistance followed by Bengaluru and Dharwad population. Endosulfan proved to be safer to *Trichogramma chilonis*, followed by chlorantraniliprole. Spinosad recorded least mortality to the grubs of *Chrysoperla zastrowi sillemi*

(50.00%) in diet contamination method. Grub mortality of *C. z. sillemi* ranged from 0.00 to 93.33% at 48 h after treatment in contact residual toxicity method. Emamectin benzoate was highly safer with 13.33 % mortality to adults of *C. z. sillemi*. All the insecticides tested were toxic to adults of *Oomyzus sokolowskii*. Endosulfan (46.67%) was relatively safer to *Apis cerana* followed by Chlorfenapyr (60.74%). Chlorfenapyr was highly safer to *Bombyx mori* and *Samia cynthia ricini*. The combination of Emamectin benzoate+Hexaconazole was more effective in suppressing both lepidopteran pests and *Alternaria* leaf spot on cabbage. Pesticides at field recommended doses showed no phytotoxicity injury on cabbage crop. Indoxacarb and Flubendiamide persisted for longer time (21 days) against *S. litura* while flubendiamide and Chlorantraniliprole against *P. xylostella* persisted for a longer period of 28 days compared to all other tested insecticides.

## Effect of weather parameters on incidence of major insect pests and their natural enemies in few selected *kharif* and *rabi* crops

POORNIMA MATTI

2013

MAJOR ADVISOR: Dr. SHEKHARAPPA

Field studies were carried out to address the effect of weather change on the incidence of insect pests during *kharif* and *rabi* 2011-12 and 2012-13 at the Main Agricultural Research Station, Dharwad. Forecasting model for pod damage in greengram depicted minimum temperature and rainy days at four weeks lead time is consistently significant positively associated. Higher shoot fly eggs in *kharif* sorghum were noticed with increase in both minimum temperature and morning RH. At three week before, incidence of deadheart had positive relationship with evening RH and significant negative association with maximum temperature. Forecasting model for per cent defoliation in soybean at two weeks prior showed that morning RH is consistently significant negative association in normal sown crop. However, rainfall had significant positive relationship with foliage damage. Forecasting model for per cent pod damage due to *Helicoverpa armigera* in chickpea at four weeks before showed minimum temperature is consistently highly significant

and negatively associated. Forecasting models developed for deadheart due to shoot fly in M-35-1, at three week before in late sown crop and minimum temperature only had highly significant positive correlation, whereas, in DSV-4, evening RH had highly significant positive relationship. Forecasting model for aphids per 5cm central twig in safflower showed that solar radiation at four weeks prior is consistently significant and negatively associated. In intercrop, *Bt*, spinosad, emamectin benzoate and RPP spray efficacy on lepidopteran pests was higher with rise in evaporation, solar radiation and maximum temperature. Whereas, *Beauveria bassiana* showed higher efficacy with rise in morning RH and minimum temperature. Validation of forecasting model for per cent deadheart due to shoot fly infestation on *rabi* sorghum in late sown condition resulted lead week three model gave minimum error (3.66) and performed better in 2008 than 2009 and 2010 years with high R<sup>2</sup> value of 0.71.

## Crop habitat diversification, planting time and plant geometry for management of chilli pests

SUJAY HURALI

2013

MAJOR ADVISOR: Dr. R. S. GIRADDI

Investigations on effect of different cropping systems, planting time and planting geometry; influence of different genotypes on chilli pests and evaluation of new molecules and their effect on natural enemies were carried out during 2008-09 and 2009-10 at the Main Agricultural Research Station, UAS, Dharwad. Lowest incidence of sucking pests, leaf curl index, larval population of *Helicoverpa armigera* (Hub.) fruit damage with higher yield and net returns were obtained from different cropping systems when compared to sole chilli. The coccinellids and chrysopids were found in large numbers in different cropping systems (intercropping, trap cropping and border/ barrier cropping). Significantly lower level of sucking pest, leaf curl index, larval population of *H. armigera* and fruit damage was observed in the crop with July 15<sup>th</sup> planting and 90x60 cm spacing. The interaction effect among date of planting and different spacing was significant. Dry chilli yield was significantly highest with July 15<sup>th</sup> planting

and 90x60 cm spacing (4.21 q/ha) followed by July 30<sup>th</sup> and 90x60 cm (4.09 q/ha) and July 15<sup>th</sup> and 75x45 cm (3.81 q/ha). Similar pattern of treatment significance was observed in case of predator population also. The cultivars viz., Sarpan hybrid, Tejashwini and Sankeshwar recorded relatively lower sucking pest population, leaf curl index, larval population of *H. armigera* and fruit damage when compared to popular varieties viz., Byadagi kaddi and Byadagi dabbi which exhibited these phonological characters at lower levels. Thiamethoxam 25WG @ 1 g/l, Abamectin 1.8EC @ 0.5 ml/l, Diafenthiuron 50 WP @ 0.75 g/l were found highly effective against sucking pests. Against *H. armigera*, Novaluron 10 EC @ 0.75 ml/l, Emamectin benzoate 5SG @ 0.4 g/l and Spinosad 45SC @ 0.3 ml/l were found quite promising. Significantly highest yield (4.65 q/ha) recorded in Diafenthiuron 50 WP @ 0.75 g/l with higher net returns (₹ 22,661/ ha).

## Studies on defoliators and stemfly pests of soybean and their management

PRABHU NAYAKA

2013

MAJOR ADVISOR: Dr. R. H. PATIL

Investigations were carried out on different insect pests of soybean at ARS, Bailhongal and MARS, UAS, Dharwad, Karnataka during *kharif*, 2010-11 and 2011-12. Survey was under taken in four districts of northern Karnataka viz., Dharwad, Belgaum, Haveri and Bagalkot during *kharif* 2010 and 2011. Among districts surveyed, Belgaum and Bagalkot were identified as hot spots for stem fly while Dharwad and Belgaum were identified as hot spots for defoliators by recording higher incidence. The

surveillance in fixed plot study indicated the highest incidence of *Melanagromyza sojae* during 36<sup>th</sup> and 37<sup>th</sup> Meteorological Standard Week (10.10 and 15.00%, respectively). The population of *Spodoptera litura* ranged from 2.50-3.45 larvae/meter row length, *Thysanopplusia orchalcea* from 1.05-1.82 l/mrl and *Spilarctia oblique* from 1.30-2.15 l/mrl and activity of natural enemies observed on 15 days after sowing. Correlation studies between insect pests and weather parameters revealed that, rainfall

had negative correlation ( $r = 0.55$ ) and maximum temperature ( $r = 0.71$ ) had positive correlation with *S. litura* and *M. sojae*. Seed dressing with Thiamethoxam 70 WS @ 3.0 g/kg seed + foliar spray of Thiamethoxam 25 WG @ 0.5 g/l at 20 days after sowing proved its superiority over other treatments in managing stem fly by recording high seed yield of 25.64 and 24.42 q/ha during 2010 and 2011, respectively. Among the insecticide, Flubendiamide 480 SC 0.2 ml/l was found to be the most effective in

managing leaf eating caterpillars by recording highest seed yield of 23.95 q/ha. The simulation studies revealed that 25 per cent defoliation at 20 DAG did not significantly affect the seed yield while at 60 days after germination it was significantly reduced the seed yield. Among the genotypes screened for two years PS-1466 and PK-1042 were found resistant to stem fly and high yielding. While JS-335 and Dsb-11 susceptible to high yielding and defoliation as per max-min and min-max method.

## AGRICULTURAL EXTENSION EDUCATION

### The impact of transformational leadership and innovative behavior on job performance of extension personnel

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2013

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A study was taken up with the objectives to develop transformational leadership scale, innovative behavior scale and also to determine the influence of transformational leadership and innovative behavior on job performance of extension personnel. The sample consisted of 100 KSDA extension personnel and 100 UAS extension personnel who were selected by accidental meeting technique. The scales developed to measure the Transformational Leadership and Innovative behavior of both extension personnel of University of Agricultural Sciences (UAS) and Karnataka State Department of Agriculture (KSDA) in this study were found reliable and valid. The questionnaire consisted of bio data schedule, transformational leadership scale, innovative behavior scale and job performance scale which were administered on the sample through personal contact. The analysis of correlation, test, regression analysis and factor analysis were made use of for analysis of the data. The results

revealed that the 6 to 7 extension personnel out of 10 extension personnel of UAS were high in transformational leadership, whereas 3 to 4 extension personnel out of 10 extension personnel of KSDA were high in transformational leadership. While, 3 to 4 extension personnel out of 10 extension personnel of UAS were high in innovative behavior, whereas 1 to 2 extension personnel out of 10 extension personnel of KSDA were high in innovative behavior. The majority (66.00 %) of the extension personnel of both the categories belonged to high performance category. The variables education, information seeking behavior, transformational leadership and innovative behavior correlated significantly with job performance of extension personnel. Only two variables namely information seeking behavior and transformational leadership were found to be significant in explaining the variation in the job performance of extension personnel.

### Analysis of livelihood security of rehabilitant farmers

JAGADAJYOTI BINKADAKATTI

2013

MAJOR ADVISOR: Dr. J. G. ANGADI

The present study was undertaken during the year 2012-13 in Upper Krishna Project (UKP) area of Bagalkot district of Karnataka state. The Ex-post facto research design was used for the study. In Bagalkot district, three Rehabilitation Centres (RC) were selected from each of Bagalkot, Biligi and Hungund taluks. Further, from each Rehabilitation Centre 20 rehabilitant farmers were selected to form a sample of 180 by using random sampling technique. The scale was developed and standardized to measure the Livelihood Security of rehabilitant farmers. Livelihood Security of the rehabilitant farmers was found to be 54.66 per cent. Among the components of Livelihood Security, physical capital (72.05%) and financial capital (68.28%) performed better, Human capital (63.59%) and social capital (55.24%) performed moderately and Natural capital performed poorly (48.77%). An equal (around thirty) per cent of rehabilitant farmers were found in all three categories (High, medium and low) of asset acquisition. Higher proportions of the rehabilitant farmers

(41.67% and 36.67%) were found in high asset acquisition category in case of financial and physical capitals. Family size, extension contact, decision making pattern, risk orientation and awareness about developmental interventions had highly positive and significant relationship with the Livelihood Security of the rehabilitant farmers. With regard to developmental interventions, cent per cent of the rehabilitant farmers availed benefit with respect to construction of house (100%) and free electricity (100%). As high as 90.56 per cent of the rehabilitant farmers availed benefit of Income Generating Schemes (IGS) in case of training programmes. Only 13.89 per cent of the rehabilitant farmers took the benefit of Government job quota. Extend free household electricity supply (80.56%), extend loan waivers scheme to nationalized banks also (70.00%) and good quality drinking water facilities (63.89%) were the major suggestions provided by rehabilitant farmers to improve their Livelihood Security.

## AGRICULTURAL MICROBIOLOGY

### Bioprospecting of pectinase enzymes from fungi

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2013

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The present study was conducted to isolate, and characterize fungi from diverse natural sources capable of producing pectinases. Based on the preliminary screening of 100 isolates, 48 isolates were found positive for pectinase production. Out of them, isolates RBF96 (3.25), RC27 (3.21) and DLP51 (3.21) possessed the highest potency index values compared to the reference strain *Aspergillus niger* MTCC1344 (2.99). Following the PCR based molecular methods, the isolates were identified as *Aspergillus niger*, *Aspergillus oryzae* and *Penicillium citrinum* respectively. Solid state fermentation (SSF) was carried out using various locally available agro-wastes as the carbon source. Citrus peel was identified as the most suitable substrate. The particle size of 2 mm, moisture level of 65 per cent, incubation temperature of 35°C, inoculum level of  $1 \times 10^7$  spores  $g^{-1}$  and the incubation time of six days were found optimum. After purification the maximum specific activity of 83.06

U  $mg^{-1}$  protein was obtained for polygalacturonase (PG) by *A. niger* RBF96 with seven fold increase in purification. Similarly, about six folds and five folds increases in purification were obtained for pectin lyase (PL) and pectin esterase (PE) in *P. citrinum* DLP51 and *A. oryzae* RC27 respectively. The molecular weights of PG, PL and PE, as determined by SDS-PAGE, were 45 kDa, 37 kDa and 31 kDa respectively. The purified PG showed maximum stability at pH 4.5, whereas, PL and PE showed at pH 6.5 and 5.0 respectively. The temperature of 50°C was found optimum. The orange pulp treated with (PG+PL+PE) at 100 U resulted in the highest juice yield (90.17%) and the highest clarity (96.28%). Similarly, in guava this treatment resulted in the highest juice yield (66.75%) and maximum clarity (37.57%). The organoleptic evaluation proved that pectinases could be used to improve the sensorial attributes of fruit juices.

## AGRONOMY

### Response of sugarbeet genotypes to nitrogen, potassium, planting methods and dates of sowing in Deccan Plateau of Peninsular India

HARISH H. DESHPANDE

2013

MAJOR ADVISOR: Dr. C. S. HUNSHAL

The field experiments were conducted at Agricultural Research Station, Mudhol (UAS, Dharwad) during *rabi* season of 2011 and 2012 to study the response of sugarbeet genotypes to nitrogen, potassium, planting methods and dates of sowing. In the first experiment, three sugarbeet genotypes (SZ 35, PAC 60008 and Magnolia) were allotted to main plots and five N and K<sub>2</sub>O levels (100, 120, 140, 160 and 180 kg N & K<sub>2</sub>O ha<sup>-1</sup>) to sub plots and were replicated thrice in split plot design. Magnolia with application of N and K<sub>2</sub>O @ 160 kg ha<sup>-1</sup> recorded significantly higher root, top and sugar yield (58.11, 14.93 and 8.61 t ha<sup>-1</sup> respectively) with maximum net returns and B:C (₹ 80,225 ha<sup>-1</sup> and 2.97 respectively). Genotype PAC 60008 showed better performance in its quality. In the second experiment, two planting methods viz., broad bed and furrows (BBF) & ridges and furrows and four dates of sowing viz., 1<sup>st</sup> fortnights (FN) of August, September, October and November were

evaluated in strip plot design with five replications. Growth, yield attributes and yield were significantly higher in BBF among planting methods and October 1<sup>st</sup> fortnight among the sowing dates. The sugarbeet planted during August 1<sup>st</sup> FN was poor in its quality, whereas other dates of sowing showed better quality. Planting in October 1<sup>st</sup> FN on BBF produced significantly higher growth, yield attributes and root yield (55.15 t ha<sup>-1</sup>) with higher net returns and B:C (₹ 81,656 ha<sup>-1</sup> and 3.56 respectively). The organoleptic evaluation of wine prepared out of Calixta with TSS level of 13.8° brix recorded highest score for its commercial acceptability. Calixta or Magnolia with TSS modification to 23° brix may be preferred for commercial alcohol production. Planting during October 1<sup>st</sup> FN on BBF (paired rows), with the fertilizer recommendation of 160:60:160 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O ha<sup>-1</sup> recorded higher yield. Genotype either Magnolia or PAC - 60008 can be preferred.

### Evaluation of sugar beet cultivars at different row proportions in intercropping with sugarcane and its nitrogen management

S. VISHWANATHA

2013

MAJOR ADVISOR: Dr. S. M. HIREMATH

Two field experiments namely. Intercropping of sugar beet cultivars with different row proportions in sugarcane and Performance of sugar beet to sources of nitrogen and liquid manures were conducted at Agricultural Research Station (ARS), Madhurakhandi (Dist. Bagalkot), University of Agricultural Sciences, Dharwad during the year 2010-11 and 2011-12. The first experiment consisted of evaluation of sugar beet cultivars (Cauvery, Shubhra, Magnolia and Calixta) with different row proportions (1:1, 1:2 and 1:3) in sugarcane. There were seventeen treatment combinations laid out in randomised complete block design with three replications. The second experiment was conducted to study the influence of sources of nitrogen (SN<sub>1</sub>, SN<sub>2</sub>, SN<sub>3</sub>, SN<sub>4</sub> and SN<sub>5</sub>) and liquid manures (LM<sub>1</sub>, LM<sub>2</sub>, LM<sub>3</sub>, LM<sub>4</sub> and LM<sub>5</sub>) on sugar beet. The experiment was laid out in split plot design with three replications where in sources of nitrogen and liquid manures were assigned to main and subplot, respectively. The results of first experiment indicated that sole sugarcane and sugarcane + sugar beet in 1:1 RP recorded significantly higher cane yield [101.39 and 96.66 (Avg. of all cultivars) t ha<sup>-1</sup>, respectively] and sugar yield [11.07 and 10.55 (Avg. of all cultivars) t ha<sup>-1</sup>, respectively] compared to sugarcane +

sugar beet in 1:2 and 1:3 RP. Sugar beet cultivars Cauvery and Shubhra recorded significantly higher tuber (85.58 and 79.84 t ha<sup>-1</sup>, respectively) and sugar yield (9.76 and 9.00 t ha<sup>-1</sup>, respectively) in sole cropping than intercropping treatments. In intercropping system sugar beet cultivars Cauvery and Shubhra in 1:3 and 1:2 row proportions recorded significantly higher tuber and sugar yield than 1:1 RP. Intercropping of sugarcane + sugar beet in 1:2 and 1:3 RP recorded significantly higher sugarcane equivalent yield, LER, ATER, SPI, total sugar yield, net returns when compared to 1:1 RP, but B:C was significantly higher in 1:1 RP. In second trial, application of 100 per cent RDN (120 kg ha<sup>-1</sup>) through inorganic fertilizer (IF) along with foliar spray of vermiwash (VW) (20%) and cow urine (CU) (10%) at 30 and 60 DAS (SN<sub>1</sub>LM<sub>4</sub>) recorded significantly higher tuber (80.13 t ha<sup>-1</sup>), sugar yield (9.28 t ha<sup>-1</sup>), net returns (Rs. 64528 ha<sup>-1</sup>) and B:C (2.49) than other treatment combinations. However, application of 75 per cent RDN through IF + 25 per cent RDN through vermicompost and poultry manure in equal proportions along with foliar spray of VW (20%) and CU (10%) at 30 and 60 DAS (SN<sub>2</sub>LM<sub>4</sub>) remained on par with SN<sub>1</sub>LM<sub>4</sub>.

## CROP PHYSIOLOGY

### Influence of 1-methylcyclopropene (1-MCP) on post harvest physiology and physico-chemical changes in alphonso mango (*Mangifera indica* L.)

ARUN VASANT MANE

2013

MAJOR ADVISOR: Dr. M. B. CHETTI

Investigation was carried out to find out the influence of 1-MCP (1-methylcyclopropene) on physical, physiological and physico-chemical changes and ripening behaviour in Alphonso mango (*Mangifera indica* L.) during 2011 and 2012 at the Department of Agril. Botany, College of Agriculture, Dr.BSKKV, Dapoli. The experiment consisted of 16 treatment combinations comprising 4 concentrations of 1-MCP and 4 storage conditions. Results revealed that fruits ripened early under ambient condition without 1-MCP treatment. Fruits kept under cold storage with 2000 ppb of 1-MCP exhibited significantly longer retention of green colour, firm texture and slow rate in physiological loss in weight, thereby delaying ripening compared to ambient condition. Total soluble solids, total sugars, reducing sugars increased while vitamin-A, titratable acidity and ascorbic acid content decreased rapidly until 14 DAT (days after treatment) in control and 21 days cold storage with 2000 ppb 1-MCP.

There was a gradual rise in ethylene production till 14 DAT followed by decline at 21 DAT under ambient condition. The rate of fruit respiration was significantly higher under ambient condition compared to other treatments and the lowest was recorded in cold storage with 1-MCP (2000 ppb). Cold storage with 1-MCP showed gradual increase in total carotenoids till the end of storage period as against rapid increase under ambient condition. Ambient condition recorded maximum number of spongy affected fruits and the lowest was noticed with higher concentration of 1-MCP (2000 ppb) in cold storage. There was a constant degradation of chlorophyll content under ambient condition while, cold storage with 2000 ppb 1-MCP maintained significantly higher values till 26 DAT. The present findings clearly establish that cold storage with 1-MCP @ 2000 ppb holds a great potential in delaying fruit ripening ultimately prolonging the post harvest storage and shelf life by 10 – 12 days.

## FAMILY RESOURCE MANAGEMENT

### Role of women in organic farming and their family quality index in the selected agroclimatic zones of Northern Karnataka

RAJESHWARI M. DESAI

2013

MAJOR ADVISOR: Dr. P. R. SUMANGALA

The present study was conducted during the year 2012-13 to delineate the areas of participation of farm women in organic and conventional farming and to assess their Family Quality Index (FQI). A multistage sampling procedure with purposive sampling technique was adopted to select the sample. Fifty each organic and conventional farm women from three villages namely Hirehandigol, Ammangi and Kamadhenu were selected from Northern Dry Zone -3, Northern Transitional Zone-8 and Northern Hilly Zone-9 respectively. Thus the total sample of the study was 300. The results revealed that the work burden of the organic farm women in terms of man days with respect to preparatory tillage, seed activities, sowing activities, after care operations and threshing and processing activities was comparatively more than conventional farm women and it was found to be statistically significant also. The shift to organic production had positive impact on the socio economic status of the farming in all the

agro-climatic zones. The scores of variable components of FQI revealed that the organic farming families were slightly better in all the aspects viz., socio economic status, expenditure pattern, savings and investment, family health status, participation level and decision making. Hence, the FQI of organic farming families was significantly superior when compared to conventional farming families in all the three zones. Lack of encouragement, non availability of certified seeds, less rains, time consuming certification procedure, lack of proper storage facilities and lack of consumer awareness regarding organic markets were the major problems of organic farm women. Based on the felt needs of the organic farm women, training programmes on rain water harvesting, integrated farming system and bio fertilizers and bio pesticides utilization, marketing strategies and linkages, value addition to organic produces and scientific and organic methods of preservation of organic produces were suggested.

## GENETICS AND PLANT BREEDING

### Molecular mapping and marker association studies in diploid cotton (*Gossypium* spp.)

MALAGOUDA PATIL

2013

MAJOR ADVISOR: Dr. B. M. KHADI

Cotton is one of the most important commercial crops grown in India. It is the world's leading natural fibre crop and is the cornerstone of textile industries worldwide. In spite of several competitions from synthetic fibres, cotton continues to enjoy a place of prime importance in textile industry. As diploid cottons are well suited to rainfed ecosystem and can fulfil the increasing demand for medium staple nature of fibres, it still necessitates having diploid cottons with improved fibre quality. The present investigation was undertaken to construct the genetic map and to identify QTLs for important yield contributing and fibre quality traits using 50 polymorphic SSR markers in 154 recombinant inbred lines (RILs) derived from the cross between *G. herbaceum* variety Jayadhar and *G. arboreum* variety DLSa17. Genetic variability components revealed higher magnitude of variation for most of the traits. This was evidenced by high range and mean performance for different traits in RILs. *Per se* performance of RILs indicated the improvement over parents for various productivity

and fibre quality traits. Association among different traits under study revealed, significant association of seed cotton yield with ginning out turn and lint yield. Fibre length exhibited highly significant positive correlation with fibre strength (0.41) and fibre elongation (0.48). Genetic linkage map was constructed with 50 polymorphic markers. The total map length was 4033.95cM with average distance of 80.68cM between the markers. Out of 15 QTLs detected, seven QTLs were for seed cotton yield. The chromosome 6 harboured QTLs for more than one trait viz., ginning out turn, seed cotton yield, lint yield and uniformity ratio. Three QTLs each corresponding to seed cotton yield, lint yield and uniformity ratio were present between NAU2964 and MUSB1248. The construction of 'A' genome diploid map with SSR markers, can serve as a model for the advancement of cotton genetics and genomics. Adding additional markers to the existing map to saturate the map will assist in future map based cloning efforts and fine mapping studies.

### Targeted gene integration in cotton

SAVITA MANTRI

2013

MAJOR ADVISOR: Dr. I. S. KATAGERI

The use of zinc-finger nuclease as molecular scissors for targeted gene integration was recently adapted. In present investigation *cryIF* gene from *Bacillus thuringiensis* was chosen for targeted integration at d-cadinene site. The d-cadinene gene is involved in biosynthesis of gossypol which has antinutritional property. Thus targeted gene integration of *cryIF* at d-cadinene site will reduce gossypol and offers resistance against *Spodoptera litura*. To develop gene construct coding for ZFN proteins and nuclease enzyme to make insertion site at d-cadinene gene were necessary and therefore, 600 bp d-cadinene gene from conserved domain was cloned from Coker-321. By using these sequence information ZFN construct was designed using software [www.zincfingertools.com](http://www.zincfingertools.com). The complete pSOUP-zfn and pGREEN-*cryIF* constructs were developed at NRCPB, New Delhi. The *Agrobacterium* strain harbouring these vectors was used for genetic transformation. Before initiation of genetic transformation experiments, a complete protocol for *in vitro* somatic

regeneration in Coker-321 was established. Plants were regenerated within 48-50 weeks. MS media supplemented with 0.1 mg/l 2-4D + 0.5 mg/l kinetin induced calli and 0.01 mg/l 2-4D + 0.1 mg/l kinetin induced embryogenesis. Maximum somatic embryos produced plantlets when embryos placed on whatmann paper on MS media sealed with micropore tape. Genetic transformation was carried out using embryogenic calli as explants. Out of 280 calli clumps used for genetic transformation, calli proliferation was observed in only 95 on selection media. By about 20<sup>th</sup> week after cocultivation embryogenesis was observed. About 12 plantlets from 5 different embryogenic calli were established. However, 2 plants from 2 calli clumps were PCR and RT PCR positive for *cryIF* and *nrpII*. Gossypol was estimated from PCR positive plants and is on par with control Plants which shows possibility of random integration. However, by establishing more number of transgenic plants the possibility of targeted gene integration may be realized.

## HUMAN DEVELOPMENT AND FAMILY STUDIES

### Parenting stress of normal and developmentally challenged children: Correlates and intervention

NARMADA HIDANGMAYUM

2013

MAJOR ADVISOR: Dr. PUSHPA B. KHADI

Parenting stress of normal and developmentally challenged children with its correlates and intervention" was studied on a sample of 260 normal children, 71 mentally challenged and 36 hearing impaired. The total sample comprised of 314 fathers and 341 mothers. The results revealed that a higher proportion of parents of mentally challenged children had clinically significant level of parenting stress where in majority of the parents both fathers (64.10%) and mothers (68.90%) fell in clinically significant level. Similarly, among hearing impaired group also. Among normal group, 14.20 per cent of fathers and 12.30 per cent of mothers fell in this level. As the parenting stress was highest in mentally challenged group the correlating factors viz. parental, familial and community factors were studied on a sample of 65 parents employing standardised tools. The results revealed that extroversion, conscientiousness and openness to experience were correlated with parenting stress. However, mental health, self efficacy and individual resilience were not significantly correlated. Parenting stress was correlated with familial factors like family resilience but not with marital satisfaction and family relationship. Social support

was found to be negatively and significantly correlated with parenting stress. Parents who had low social support had highest score and lowest mean score among parents who had high level of social support. Parents who had high parenting stress were more dissatisfied with their parenting. Also parents of higher parenting stress had children who were in clinical range of problematic behaviour both internalizing and externalizing behaviour. On the basis of the results of the correlates of parenting stress of mentally challenged children an educational package was developed for parents to enhance their knowledge on intellectual disabilities, special education and stress management. The efficacy of the package was tested on 65 parents of mentally challenged children through an interrupted time series experimental research design. The post intervention revealed lower parenting stress in all the three domains viz. parental distress, parent child difficult interaction, difficult child as well as in total parenting stress. The gain in knowledge indices was 81.45 percent with a range of 68.18 to 95.45 per cent. Thus intervention program proved to be effective in enhancing knowledge index and in reducing parenting stress.

## MOLECULAR BIOLOGY AND BIOTECHNOLOGY

### Induced systemic resistance and validation of post transcriptional gene silencing in tomato against tomato leaf curl virus

SARITA V. GUND

2013

MAJOR ADVISOR: Dr. P. U. KRISHNARAJ

The efficacy of transgenic plants capable of PTGS was assessed in available  $T_4$  seeds of four transgenic events viz., A, C, D and E carrying ihp-TRP subjected for PCR based screening and gene segregation analysis. The bio-efficacy test of transgenic plants from three events viz., 'A', 'C' and 'E' in  $T_4$  and  $T_5$  generation indicated moderate resistance against ToLCV infection. The site of insertion of T-DNA carrying ihp-TRP genes was identified by recovering the genomic sequences flanking right border of T-DNA obtained from TAIL-PCR, identified the point of insertion on chromosome 1, chromosome 12 and chromosome 2 for 'A', 'C' and 'E' events respectively. Thirty *Pseudomonas* and five actinobacteria isolates were functionally characterized for ability of phosphate solubilization, nitrogen fixation, siderophore, indole-acetic acid and gibberellic acid production. Out of thirty five, twenty isolates were prospected for control of tomato leaf curl viral disease through seed priming, soil and foliar

application to tomato plants. Inoculation of five isolates, viz., AUDP326(4), AUDP360(2), AUDP139, AUDT217 and AUDT152 resulted in significant reduction in disease up to 60-80% and also could significantly promote plant growth. Significant increase in the level of PAL, PO, chitinase and phenolics were observed in inoculated plants compared to disease control. The SSH studies at early (32-36 DAS) and late stage (40-46 DAS) in AUDT217 inoculated tomato plants compared to uninoculated plants identified sixteen well annotated genes such as protease inhibitor, threonine deaminase and other. However, SSH studies involving inoculation of AUDT217 in the presence of ToLCV realized in the identification of twelve well annotated transcripts of genes in the plant such as metallothionein-like protein, ferredoxin-thioredoxin-reductase, metallocarboxypeptidase inhibitor and other which were further validated through real time PCR studies.

## PLANT PATHOLOGY

### Development of bud blight viral disease resistant transgenic tomato

GURUPADA B. BALOL

2013

MAJOR ADVISOR: Dr. M. S. PATIL

Tomato, an economically important crop in many countries is affected by many viral diseases including bud blight disease caused by the *Groundnut bud necrosis virus*, belongs to the family *Bunyaviridae* a member of group *Tospovirus*. Survey was carried out to assess the GBNV in major tomato growing regions of Dharwad, Belgaum, Haveri, Kolar and Bangalore rural districts during summer 2011. From the survey it is revealed that the highest incidence (68%) of bud blight was noticed in fields of Poovandahalli village in Kolar district, whereas least (12%) incidence of the disease was recorded at Singanalli village of Dharwad district. The coat protein (CP) gene of five GBNV isolates of Karnataka were cloned and characterized. The sequence similarity index revealed, that the GBNV-To-DWD coat protein gene sequence had 96.0 per cent homology with GBNV-To-BGM, 99.2 per cent homology with GBNV-To-HVR, 94.9 per cent homology

with GBNV- $T_0$ -KLR and 94.8 per cent homology with GBNV-To-BAN-R isolates. Highest homology of 99.2 per cent was found between CP gene sequences of GBNV-To-DWD and GBNV-To-HVR followed by 96.1 per cent between GBNV-To-BGM and GBNV-To-BAN-R. Therefore, GBNV- $T_0$ -DWD isolate was selected for plant transformation studies. The transgenic tomato (DMT-2) lines were developed by following *in planta* transformation method. PCR analysis of the genomic DNA isolated from  $T_1$  transformants demonstrated that the transgene was integrated in the genome of the twenty four out of thirty transgenic tomato plants. ELISA using the antibody against the coat protein indicated that the transgenic plants expressed the coat protein at varying levels. Bioassay results also indicated the coat protein mediated resistance by the stability of the transgene.

### Variability in *Rhizoctonia solani* Kuhn, the causal agent of sheath blight of rice and its management

P. NAGARAJU

2013

MAJOR ADVISOR: Dr. M. K. NAIK

The study comprised of survey on prevalence and incidence of sheath blight of rice, collection of sheath blight pathogenic isolates for exploring cultural, morphological and molecular variability, evaluation of rice genotypes, influence of planting density, nitrogen level, botanicals and biocontrol agents and IDM against sheath blight of rice. The study identified

areas in Bellary, Koppal and Raichur districts affected by moderate to severe incidence of sheath blight when compared to areas in Mysore, Shimoga and Mandya during *kharif* 2006 and 2007. The diversity with respect to morphological and cultural characters of 32 isolates of *R. solani* on PDA revealed that the maximum radial growth of mycelia

was noticed in isolates RS-14, RS-16 and RS-18 each with 89.33 mm. Based on the morphological and cultural characteristics, the isolates of *R. solani* were grouped into four and designated as G1, G2, G3 and G4 where as the molecular analysis of variability using RAPD primer indicated into two major clusters such as C1 and C2 with 15 and 17 isolates, respectively. Among 139 rice genotypes screened under field condition, Aditya, Ajaya, Swarnadhan, Nidhi and Vikramarya were found resistant by scoring 1 grade. In the management of disease with fungicides, botanicals and bioagents, Hexaconazole, Validamycin and Carbendazim, Tricure

(Azadirachtin 0.03%), *P. fluorescens* (Pfr-1) were found effective in managing sheath blight. Application of 200 kg N per ha recorded higher disease severity and increased further with higher levels of nitrogen (350 kg/ha) when compared to recommended nitrogen and zero nitrogen fertilizer applications. Among different planting densities, the SRI method was found effective in reducing severity of sheath blight when compared to normal planting densities. In IDM trial, use of moderately resistant cv. IR 64 with spray of hexaconazole @0.1% was found effective in managing sheath blight disease.

### Molecular phylogenetic analysis of *Xanthomonas axonopodis* pv. *Punicae* isolates and bio-prospecting of selected botanicals and bio-agents against bacterial blight of pomegranate

BASAMMA

2013

MAJOR ADVISOR: Dr. V. I. BENAGI

Pomegranate, *Punica granatum* L., regarded as the "Fruit of Paradise" is subjected to various disease problems. Among diseases, bacterial blight caused by *Xanthomonas axonopodis* pv. *punicae* is one of the important diseases, which caused a great havoc in recent years. The present investigation was undertaken to assess the diversity among different isolates collected from different agroclimatic regions and to manage this disease effectively. Water soaked lesions on leaves were produced after six days of inoculation. All the eighteen isolates of *Xap* showed hypersensitive symptoms in *Nicotiana tabacum* leaves. Colony characters of eighteen *Xap* isolates varied from circular and entire colony shape; slightly to highly mucoid character. Among the varied temperature and pH levels tested, 28±1°C and pH of 6.0 to 7.0 were found optimum. All eighteen isolates of *Xap* produced fuscan pigment on LB agar after nine days of incubation. Among the bactericides, K-Cycline was found effective against

all isolates of *Xap*, which was significantly superior to rest of the bactericides. The multiplex polymerase chain reaction was performed using template containing DNA from *Xap* targeting 16S rRNA and *gyrB* gene by 16S rRNA and *gyrB* specific primers. High intensity of amplification of the gene specific products of 1537 bp and 491 bp corresponding to 16S rRNA and *gyrB* were obtained at annealing temperature of 57.5° C for 1 minute as compared to other temperatures.

Aqueous soapnut extract, *Pseudomonas fluorescens* strain [326(4)] and Pink Pigmented Facultative Methylophil (PPFM) strain 10L, CuSO<sub>4</sub>, ZnSO<sub>4</sub>, COC, Streptocycline showed inhibition zone. Average fruit yield of two locations recorded significantly higher fruit yield per tree in T<sub>9</sub> (COC 0.3% + streptocycline 0.05%) and T<sub>5</sub> (*P. fluorescens* strain 326 (4) 1.0% + soapnut 5.0%) which were on par with each other. The maximum C:B ratio was observed in COC + streptocycline (0.3+0.05%).

### SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

#### Studies on land degradation in the three agro-climatic zones of belgaum district, Karnataka

PRABHAVATHI KORAPROLU

2013

MAJOR ADVISOR: Dr. G. S. DASOG

A study was carried out to determine the extent of different land degradation types in Belgaum district on 1: 50,000 scale using remote sensing and GIS techniques. Out of 13,44,084.60 ha of total geographical area of Belgaum district, 3,96,059.5 ha land is degraded accounting for 29.47 per cent. Among the various land degradation types, sheet erosion (23.13 %) was the dominant land degradation type followed by rill erosion (5.76 %) and barren rocky/ stony waste (0.44%). Three micro-watersheds were selected one each from Northern dry zone (Yadawad), Northern transitional zone (Hukkeri) and Hilly zone (Khanapur) for characterization, soil fertility mapping and soil loss risk assessment using USLE. The soils of Yadawad micro-watershed were alkaline, low in organic carbon, available nitrogen, P<sub>2</sub>O<sub>5</sub> and sulphur content and deficient in Zn and Fe. The soils of Hukkeri

micro-watershed were neutral to slightly alkaline, low in organic carbon, available nitrogen and available phosphorus in two third of area. The entire watershed was found deficient in available sulphur, zinc and iron. The soils of Khanapur micro-watershed were slightly acidic to acidic in reaction. Available phosphorus, potassium and sulphur status was low in majority of the area. Nearly all of Yadawad micro-watershed depicted very low soil erosion risk class. Hukkeri micro-watershed had very low soil erosion risk in 34.9 per cent of TGA and low soil erosion risk in 17.6 per cent of TGA. The Khanapur micro-watershed exhibited a wide range of soil erosion risk with 41.22 per cent of TGA under low soil erosion risk class with substantial extent (16.12 %) under high soil erosion risk class because of topographic variation.

## MASTER OF SCIENCE

### AGRICULTURAL BUSINESS MANAGEMENT

#### Business performance of Malaprabha Cooperative sugar factory Ltd- M. K. Hubli

SHREEDEVI C. GANGANAVAR

2013

MAJOR ADVISOR: Dr. J. S. SONNAD

The Malaprabha Cooperative Sugar Factory Ltd was established in the year 1971 at M. K. Hubli in Belgaum district. The objectives of the study were to examine investment pattern, procurement management and processing activities., physical and financial performance indicators, marketing management of sugar and its by products and problems faced by the sugar factory management. The fixed capital investment in sugar factory was ₹ 6692.64 lakhs. However, the proportion of fixed capital was more; investment on machinery and equipments (43.69%) constituted a major part of the fixed capital. It was found that, net present value of the investment of the sugar factory was ₹ 1338.47 lakhs. The benefit cost ratio was worked out 3.93. The internal rate of return was 31.00 percent. The payback period was found to 2.54 years. Descriptive statistics and growth rates were computed for various performance indicators. The growth in physical performance indicators were duration of crushing season was

found maximum (231 days) in 2001-02 and average sugar recovery was found maximum (11.60%) during 2011-12. The compound growth rate of financial indicators viz., Share capital (24.82%), reserve funds (6.47%), owned funds (8.98%), fixed assets (14.52%), sale of by-products (22.30%) and current assets (10.17%) were significant. The current ratio was greater than unity. Tests of solvency, Test of efficiency and profitability, Test of financial strength and fixed asset ratios were found to be better. The production cost per quintal of sugar was ₹ 3350 during 2011-12. The average main and by-products like molasses, bagasse, filter cake and fiber were 12.99, 4.17, 35.31, 3.97 and 18.04 per cent respectively and similarly sugar losses in by-products like molasses, bagasse, filter cake and undetermined were 1.37, 0.82, 0.07 and 1.08 percent respectively. Problems faced by the factory were procurement, processing, marketing, financial, human resource and miscellaneous.

### Business performance of Emu farming in Dharwad district

VENKUBAI KHAJJIDONI

2013

MAJOR ADVISOR: Dr. S. B. MAHAJANSHETTI

Emu farming activity has a great potential for income and employment generation at commercial as well as small scale level. In India, not much work has been done on the management and economic aspects of Emu farming. The present study is an attempt in this direction. This study is proposed to address the business activities of Emu farming in Dharwad district, which is the major Emu farming district in north Karnataka. The present study relied on primary data collected from Emu farm operators. The data pertaining to their socio-economic status, cost of production, returns, marketing arrangements, awareness about Emu birds and problems faced in production and marketing of Emu birds were collected from Emu farmers through personal interview method using pre-tested schedule. The tools and techniques employed in the study area were tabular analysis and financial feasibility analysis. The results showed that the investment on large units was higher (₹ 97,87,800) as

compared to small units (₹ 9,41,140). The cost involved in large and small units were Rs 43,05,552 and ₹ 4,20,669 respectively. Around ₹ 1,03,83,448 and ₹ 5,74,331 of net returns were obtained from large and small rearing units respectively. The financial feasibility analysis on investment in Emu farming had indicated that the investment on business is financially feasible as the NPV for large unit and small unit was ₹ 8,60,90,543 and ₹ 47,16,840 respectively. Benefit-cost ratio of large unit was found to be 9.79 and in case of small units, it was 6.11. The internal rate of returns in both large and small units was 70 per cent and 49 per cent respectively. The payback period was 2.25 and 2.73 years in large and small Emu rearing units. The major problems observed in rearing were absence of local market, non existence of Emu products processing facility and absence of institutional arrangements for dissemination of market information.

### Business opportunities in minor millets in North Karnataka- an Economic analysis

GOURAVVA ALAGODI

2013

MAJOR ADVISOR: Dr. A. D. NAIK

Millets are one among the traditional group of cereal crops and are cultivated in areas where they produce a more dependable harvest compared to any other crops. Millets occupy an important place in the world food and nutrition economy. The growth on area, production and productivity of minor millets decreased significantly over the study period (2001-02 to 2010-11) both at district level and state level similar trend was observed in all the selected districts. The per hectare total cost of cultivation of Little millet, Foxtail millet and Bajra worked out to be ₹ 8,835.17, ₹ 9,438.9 and ₹ 9,740.81 respectively. Gross returns realized from one hectare of Little millet, Foxtail millet and Bajra grown by the sample farmers were ₹ 17326, ₹ 11,291.45 and ₹ 13087.76 respectively. For every rupee of investment in dehusked rice and flour of Foxtail millet

processing, about Rs. 1.48 was obtained as returns, indicating its profitability. For every rupee of investment in dehusked rice and flour of Little millet processing, about ₹ 1.40 was obtained as returns, indicating its profitability. The benefit cost ratio of instant energy food (1.82), instant dosa mix (1.99) and diabetic mix (2.69) was high showing the profitability. In this regard, there is need to understand the profitability of minor millet processed products. Therefore, in the present study, an attempt is made to find out the economics of minor millet production and its value addition in North Karnataka. Since the value addition is profitable over minor millets, farmers may be motivated to take up value addition to millets. Further, small scale entrepreneurs may be encouraged to establish the above enterprises for widening the minor millets industry.

### AGRICULTURAL ECONOMICS

#### Economic evaluation of micro irrigation programme in Bijapur district

N. ARAVINDAKUMAR

2013

MAJOR ADVISOR: Dr. R. S. PODDAR

Economic evaluation of micro irrigation programme in Bijapur district of Karnataka was carried out during 2012-13 in terms of physical and financial performance and changes in cropping pattern, cropping intensity and farm incomes in cultivation of horticultural and agricultural crops. Primary data were collected from 120 sample farmers in Bijapur and Indi taluks. Secondary data were collected from Departments of Horticulture and Agriculture, Bijapur. For analysis of data compound growth rate and tabular presentation were employed. Area coverage, disbursement of subsidy and beneficiary coverage showed significant growth rates of about 36 per cent, 38 per cent and 34 per cent, respectively from 2004-05 to 2011-12 in the district. Cropping pattern of micro irrigation adopter and non adopter farmers showed gross cropped area of 17.16 ha and 8.82 ha, respectively and net cropped area of 4.73 ha and 4.64 ha, respectively. While the cropping intensity on adopter

farms was about 363 per cent it was lower at 190 per cent on non adopter farms. The additional net returns from grape and lime cultivation under drip irrigation over furrow irrigation were ₹ 69,087/ha and ₹ 43,528/ha, respectively. Similarly, additional net returns from groundnut and maize cultivation under sprinkler irrigation over furrow irrigation method were ₹ 19,649/ha and ₹ 14,718 /ha, respectively. Clogging of emitters, poor quality of products, high cost of instalment, delay in sanctioning of loans and approval of subsidy and lack of technical support were some problems faced by farmers in adoption of micro irrigation system. The study suggested for larger quantum of subsidy especially for the small and marginal farmers and simplification of procedures for approval and subsidy disbursement in terms of number of documents, number of days required for approval etc with the help of modern information and communication technology tools.

#### Comparative economics of sugarcane processed for sugar and jaggery

S. RITESH

2013

MAJOR ADVISOR: Dr. L. B. KUNNAL

The present study was conducted in Belgaum and Bagalkot Districts, Karnataka during 2012-2013. From the respective districts Raibag and Mudhol taluks were having more number of jaggery producing units and sugarcane crop is heavily concentrated in these districts and hence were selected for the study and from each taluk 30 farmers growing sugarcane for sugar production 30 farmers growing sugarcane for jaggery preparation were selected by using multistage sampling method. It was observed that annual growth rates in area and production in Belgaum district were positive but negative growth in productivity whereas in Bagalkot district and Karnataka state as a whole area, production and productivity showed positive growth. The total cost incurred by sample farmers in sugarcane grown for sugar and jaggery production was ₹ 56,723 per acre and ₹ 55,942 per acre respectively. However the net returns realised per acre of sugarcane grown for jaggery preparation was

higher (₹1,42,095) as compared to sugarcane grown for sugar production (₹ 62,026). Further, the ratio of MVP to MFC was positive and greater than unity for setts, FYM, PPC, human labour, bullock labour and machine labour indicating underutilization while chemical fertilizer had positive but less than unity indicating over-utilization for both sugarcane grown for sugar and jaggery production. Shortage of electricity and water were the major problems in sugarcane production followed by non-availability of labour, non-availability of improved varieties. Delay in harvesting and delay in payment of bills were the major problems in marketing of sugarcane followed by long waiting period of produce in sugar factory, low price. And obtaining permit from sugar factory. High commission charges, unnecessary deductions, delay in payments, transportation and storage problems were major problems in marketing of jaggery.



## Production, trade competitiveness and varietal trait preferences in chickpea in Karnataka-an Economic analysis

KADLI VINAYAKA

2013

MAJOR ADVISOR: Dr. G. N. KULKARNI

The study was conducted in Gulbarga and Dharwad districts of Karnataka using primary data under Tropical Legumes-II (TL-II) project to analyze varietal adoption, their impact on yield, income, resource efficiency, constraints and trait preferences of farmers in addition to secondary data to assess area, production and productivity growth and export and import performance and trade direction in chickpea. There was a stable and positive growth in area (4.46%), production (9.72%) and productivity (5.90%) of chickpea in India (2000-01 to 2011-12) during the period. The countries like Tanzania Republic (84.87 %), Myanmar (47.10 %) were the most stable exporters of chickpea to India. With the varietal interventions, there was increased area allocation, yield and income from cultivation of improved cultivars over age-old variety, Annigeri-1 across districts. Improved varieties namely, JG-11 (22% to 23%), and BGD-103 (16% to 17%) occupied considerable area to the total chickpea area with a reduction in area under Annigeri-1 (over 90%) before to 46%

after varietals intervention. Across baseline and early adoption periods there was a marginal variability in the quantum of inputs used for Annigeri-1 and JG-11 varieties and hence the cost of cultivation. For Annigeri-1 it was relatively more (₹ 8377/acre to ₹ 9796/acre) compared to JG-11 (₹ 7646/acre to ₹ 9172/acre) due to more use of PPCs, fertilizers and human labour. The resource use efficiency, (Cobb-Douglas production function) showed that they were not optimally used in the cultivation of both JG-11 and A-1. The farmers across districts preferred improved chickpea cultivars with respect to production and market traits compared to Annigeri-1. The presence of disease resistance (DIR) assigned a high Garrett's score in both districts in respect of varieties namely, JG-11 (GS: 60.33), BGD-103 (GS: 64.87), and JAKI-9218 (GS: 65.00). Low yielding character was a most important constraint with respect to Annigeri-1 variety (GS: 74.89) across farms and districts.

## AGRICULTURAL ENTOMOLOGY

### Bioefficacy of newer insecticides and non chemicals against mulberry thrips and their safety to silkworms

POORNIMA M. HOLEYANNAVAR

2013

MAJOR ADVISOR: Dr. S. G. RAYAR

The investigations on Bioefficacy of newer insecticides and non chemicals against mulberry thrips and their safety to silkworms was carried out during summer, 2012. Roving survey carried out in selected villages of Dharwad and Haveri districts during summer revealed that the thrips (*P. mori*) population in Dharwad district ranged from 12.59 (Dharwad) to 14.84 (Belagali). While in Haveri district (Chalageri) the population was as high as 48.18 thrips per top three leaves on V-1 mulberry. Bioefficacy of insecticides and non chemicals revealed that acetamiprid 20 SP @ 0.25 g/l, profenophos 50 EC @ 2 ml/l, spinosad 45 SC @ 0.25 ml/l and fipronil 5 SC @ 1 ml/l offered complete protection against thrips upto five days after spraying. While, buprofezin 25 SC @ 0.2 ml/l, diafenthiuron 50 WP @ 0.75 g/l, DDVP 76 EC @ 1 ml/l, vermiwash @ 5 per cent, Fish oil rosin soap 2 ml/l and *Lecanicillium lecanii* 2 g/l significantly reduced the

thrips population upto three days of spraying over water spray and untreated treatment. Mulberry leaves sprayed with *L. lecanii* @ 2 g/l were safe for feeding mulberry silkworm from a day after spray. While, fish oil rosin soap @ 2 ml/l and vermiwash @ 5 per cent were safe to silkworms from fifth and sixth day after spraying. Fipronil was safe from eleven days after spray. Buprofezin was safe for silkworm from 23 days onwards. Profenophos, acetamiprid and spinosad were safe from 49, 50 and 50 days after spraying respectively. Mulberry leaf yield was significantly enhanced by spraying spinosad (724.20 g/plant) followed by fipronil (710.00 g/plant) on mulberry against thrips. Mulberry leaf quality viz., moisture (73%), chlorophyll (41.93 SPAD value), protein (22.07%) and sugar (11.37%) were more in fipronil sprayed leaves and the same treatment recorded higher effective rate of rearing (97%) and cocoon yield (734.18 g/df).

### Management of *Thrips tabaci* (Lindeman) in drill sown onion under dry land conditions

MALLINATH NIRGUDE

2013

MAJOR ADVISOR: Dr. A. P. BIRADAR

A roving survey was under taken from seedling stage to till harvest of the crop in Bijapur district covering Bijapur, Sindagi, Indi and Basavana Bagewadi talukas during Kharif 2012. Maximum mean population of thrips were recorded in Muddebihal (39.3) and Basavana Bagevadi (17.1) taluka. Higher number of spiders (1.2) and coccinellid beetles (1.1) were found in Sindagi taluka and Basavana bagewadi talukas. A field experiment was conducted at Regional Agricultural Research Station Bijapur, University of Agricultural Sciences, Dharwad during kharif 2012/13. Totally five dates of sowing were made at 10 days interval starting from 15/06/2012 to 25/07/2012. Sowing the crop on 25/07/2012 followed by 15/07/2012 emerged as better and optimum dates and for onion sowing. The maximum mean population of spiders (11.50) and coccinellid beetles (10.25) were noticed in the crop sown on 15/06/2012 at

physiological stage. Minimum per cent leaf curl was noticed from the crop sown on 25/07/2012 during seedling stage, vegetative stage and physiological maturity stage of onion crop. Another field experiment was laid out at RARS, Bijapur to know the efficacy of newer insecticides and botanicals on the incidence of onion thrips during kharif 2012. Among the different thrips management treatments, lowest mean population thrips per five plants was recorded in thiamethoxam 25 WG (61) followed by imidacloprid 70WG (92.33). Organics viz., nimbecidine, vermiwash and *Verticellium lecani*, were moderately effective against onion thrips. Among the different chemicals tested for thrips management in onion, Thiamethoxam 25 WG and Imidacloprid 70WG were significantly superior among organics / chemicals tested and recorded higher BC ratio (1:3.6 and 1:1.35).

## AGRICULTURAL EXTENSION EDUCATION

### Resource use and their contribution to livelihood of farm families

ANIL D. BIRADAR

2013

MAJOR ADVISOR: Dr. S. S. DOLLI

The study was conducted in Bijapur and Chitradurga districts to analyze the resource use and their contribution to the livelihood of farm families. Two villages from each district and twelve respondents each from small, medium and large farmers category from each village were selected by stratified sampling procedure constituting the sample of 144 farmers. The important findings of the study were, higher proportion of the farmers (41.67%) in Chitradurga district had medium level of training participation while low training participation (69.44%) was found among Bijapur farmers. The

cropping intensity in the black soil was higher among medium farmers (200%). The average number of fruit trees per acre (1.7 trees/acre) was found higher among small farmers in both the districts. Fifty percent of large farmers of Bijapur district had wells. Borewells were found to be higher among large farmers of Chitradurga district (91.67 %). The overall water use efficiency was found higher in Chitradurga district (1.50 kg/ac/cm) followed by Bijapur (0.72 kg/ac/cm). Water use efficiency was found comparatively higher among small farmers of Chitradurga (0.79 kg/ac/cm)

and Bijapur district (1.68 kg/ac/cm). Farm families of Bijapur district had higher deficit in food (7.73q/yr) as compared to Chitradurga (5.48q/yr), but in case of fodder and fuel, Chitradurga had higher deficit than Bijapur district. In Bijapur district, soil resource was found highly significant relation with cropping intensity. While in Chitradurga, water resource was found to

have highly significant association with cropping intensity, land productivity and livelihood status. Low soil fertility (52.78%) and high soil erosion (48.61%) were the most expressed problems in both districts. It is important to focus the extension efforts to educate farmers on nutrient management, crop rotation and resource use efficiency.

### Attributes of IPM technologies as perceived by the Bt cotton growers

SHANKRAPPA HUDED

2013

MAJOR ADVISOR: Dr. S. V. HALAKATTI

The present study was conducted in Haveri district of Karnataka state during the year 2012-13. The Ex-post-facto research design was used for the study. In Haveri district Haveri, Baydagi and Hirekerur talukas were selected since they had maximum area under Bt cotton cultivation. From each taluka five villages were randomly selected and ten farmers were randomly selected from each village forming a sample size of 150 farmers. The findings of the study revealed that majority (57.33%) of Bt cotton growers belonged to middle age, 26.67 per cent of the farmers studied up to high school and 48.66 per cent of the Bt cotton growers had medium experience. Nearly sixty per cent (56.67%) of the farmers belong to semi-medium land holding category. Considerable per cent (60.66%) of the Bt cotton growers had medium annual income. In case of cultural

method except border crops (63.54%) other practices were perceived as having high relative advantage by the respondents. With respect to overall perceived attributes of IPM technologies, more than one third (34.66%) of the respondents were noticed in medium level of perceived attributes of IPM technologies. Nearly forty (39.33%) per cent of farmers were noticed in low adopter group of IPM practices of Bt cotton crop. Perceived attributes such as relative advantage, compatibility, observability and trialability had positive and significant relationship with adoption of IPM technologies. A majority (83.33%) of the respondents expressed the problem of lack of knowledge regarding use of pheromone traps and bio-agents followed by 78.66 per cent highlighted the constraints of lack of knowledge about mechanical practices in management of pests.

### Perception of National Horticulture Mission and its impact on crop diversification among the beneficiaries in Dharwad district

N. A. SANTHOSH

2013

MAJOR ADVISOR: Dr. A. BHEEMAPPA

The present study on perception of National Horticultural Mission and its impact on the beneficiaries in Dharwad district was conducted during 2012-13. Sample consisting of 150 beneficiaries of NHM programme was randomly selected from all the five talukas. The data was collected by personal interview method using pre tested interview schedule. The results showed that majority of farmers belong to middle age group (54.67%), primary school education (56.67%), medium family annual income (49.33%), low extension participation (63.33%) and low level of mass media participation (46.67%). In the entrepreneurial characteristics majority were observed in medium level of economic motivation (72.67%) intermediate level of decision making ability (64.67%), medium category of innovative proneness (59.33%), management orientation (46.00 %) and medium risk orientation (37.33%). Around one-third of farmers were noticed in high perception (37.33%) about the implementation of programme. The overall mean perception scores shows that the perception of objectives and selection of beneficiaries with a mean score of 2.75 was ranked first followed by perception about subsidy (2.57 mean score) and

technical support (2.18 mean score) were noticed in second and third rank perception category respectively. Crop diversification index (CDI) change after NHM programme implementation reveals the positive change in Hubli (1.20%) and Kalaghatagi (1.19%) talukas, but negative change was noticed in Dharwad (10.34%), Navalagund (1.17%) and Kundagol (1.13%) talukas. All the farmers expressed the benefits of technical guidance and field inspection followed by supply of planting material (92.67%). Majority of farmers expressed the constraints of non disbursement of subsidy at proper time (94.67%) and incidence of pest and diseases (86.67%). Majority of farmers suggested for timely release of subsidy (91.33%) and subsidy released as one time grant (94.16%). All the extension officers highlighted the constraints of less staff and timely non-submission of required records by beneficiaries, followed by 92.86 per cent expressed the constraint of interference by local political institutions and non-availability of fund for equipping office. All the extension officers suggested for specialized training and adequate conveyance facility for effective implementation of the programme.

## AGRONOMY

### Effect of sowing dates on microclimate, growth and yield of wheat varieties

RAMESH JATTI

2013

MAJOR ADVISOR: Dr. S. I. HALIKATTI

A field experiment was conducted to study the Effect of sowing dates on microclimate, growth and yield of wheat varieties on medium black soil at MARS, UAS, Dharwad during *rabi* 2012-13 under protective irrigation laid out in split-plot design with twelve treatment combinations, assigning sowing dates ( $D_1$ : 43<sup>rd</sup> SMW;  $D_2$ : 45<sup>th</sup> SMW;  $D_3$ : 47<sup>th</sup> SMW and  $D_4$ : 49<sup>th</sup> SMW) to main plots and varieties ( $V_1$ : DWR-162;  $V_2$ : UAS-304 and  $V_3$ : MACS-6222) to sub plots with three replications. Significantly higher grain yield of wheat was obtained in early sown 43<sup>rd</sup> SMW (40.89 q ha<sup>-1</sup>) compared to 47<sup>th</sup> (27.98 q ha<sup>-1</sup>) and 49<sup>th</sup> SMW (23.67 q ha<sup>-1</sup>) but on par with 45<sup>th</sup> SMW (36.77 q ha<sup>-1</sup>). Delayed sowing in 45<sup>th</sup>, 47<sup>th</sup> and 49<sup>th</sup> SMW recorded reduced grain yield (10, 31 and 39 %, respectively) compared with 43<sup>rd</sup> SMW. The variety DWR-162 registered significantly higher grain yield (34.13 q ha<sup>-1</sup>)

over MACS-6222 (29.54 q ha<sup>-1</sup>) but on par with UAS-304 (33.14 q ha<sup>-1</sup>). Among the interactions, sowing of DWR-162 in 43<sup>rd</sup> SMW recorded significantly higher grain yield (42.21 q ha<sup>-1</sup>), straw yield (75.57 q ha<sup>-1</sup>), growth and yield components, net returns (₹ 87742 ha<sup>-1</sup>) and B:C ratio (3.54). Temperature had significant effect on growth and yield of wheat. Early sown wheat in 43<sup>rd</sup> SMW took more GDD (1897.5 °C days) and duration (104 days) to attain maturity. Delayed sowing in 45<sup>th</sup>, 47<sup>th</sup> and 49<sup>th</sup> SMW reduced the duration by 3, 13 and 15 days, respectively compared to 43<sup>rd</sup> SMW. Also it had higher Light Absorption Ratio and NDVI values at various phenophases compared to other sowing dates. The microclimatic parameters *viz.*, canopy temperature and Relative Humidity were highest at crop bottom but decreased with height, being least at top of the canopy.

### Effect of sowing time and row spacing on the productivity of sesame genotypes during summer in UKP command area

MANJUNATH I. TALLUR

2013

MAJOR ADVISOR: Dr. S. B. KALAGHATAGI

Field experiment was conducted during summer 2012 at Agricultural Research Station, Almel to study the Effect of sowing time and row spacing on the productivity of sesame genotypes during summer in UKP command area. There were three genotypes (DS-1, SSD-3 and SSD-5), two row spacing 30 cm and 45 cm (3,33,333 and 2,22,222 plants ha<sup>-1</sup> respectively) and two sowing dates (January last week and February second week). Experiment was laid out in Split-Split plot design with three replications. The seed yield of SSD-3 (1111 kg ha<sup>-1</sup>) was higher owing to significantly higher number of capsule (61), number of seeds per capsule (48) and seed weight per plant (6.94 g). The 30 cm row spacing recorded significantly higher seed yield (1189 kg ha<sup>-1</sup>) than 45 cm row spacing (975 kg ha<sup>-1</sup>). The higher yield was due to the significantly higher performance of yield parameters viz., number of seeds per capsule (46)

and 1000-seed weight (3.73 g). The crop sown during January last week recorded significantly higher seed yield (1142 kg ha<sup>-1</sup>) than the crop sown during February second week (1022 kg ha<sup>-1</sup>). The higher yield was due to the significantly higher number of capsules per plant (58) and number of seeds per capsule (47). The genotype SSD-5 at 30 cm row spacing recorded significantly higher seed yield (1269 kg ha<sup>-1</sup>) over other interactions followed by genotype SSD-5 at 45 cm row spacing (928 kg ha<sup>-1</sup>). The genotype SSD-3 with January last week of sowing had significantly higher seed yield (1320 kg ha<sup>-1</sup>) compared to other interactions. Higher interaction effect of sesame genotype SSD-3 sown during January last week at 45 cm row spacing recorded higher seed yield (1329 kg ha<sup>-1</sup>), gross returns (₹ 54851 ha<sup>-1</sup>), net returns (₹ 40533 ha<sup>-1</sup>) and B:C (3.83) compared to other interactions.

### CROP PHYSIOLOGY

#### Role of zinc in drought tolerance in sorghum

M. S. NALINA

2013

MAJOR ADVISOR: Dr. R. V. KOTI

A field experiment was conducted during *rabi* 2012 to study the role of zinc on physiology, yield, yield components, grain zinc content in sorghum in receding soil moisture situation at Main Agriculture Research station, University of Agriculture sciences, Dharwad. The experiment was laid out in completely randomized block design (RCBD) with eleven treatments in three replications. The treatments consisted of soil application of ZnSO<sub>4</sub> (10 kg/ha), seed hardening with CaCl<sub>2</sub> (2%) and ZnSO<sub>4</sub> (0.5%). and foliar application of ZnSO<sub>4</sub> (0.5%) and urea (2%) individually and in combination. Significant differences were observed for various morphological, total dry matter, biochemical and yield and yield attributes due to zinc application and seed hardening treatments. The seed hardening treatments with CaCl<sub>2</sub> and ZnSO<sub>4</sub> individually and in combination showed

significant increase in plant height, TDM, SPAD and proline content as compared to control. The enzyme activity of total SOD increased with foliar application of ZnSO<sub>4</sub> (0.5%) + Urea (2%), ZnSO<sub>4</sub> (0.5%) and further peroxidase activity increased in seed hardening with CaCl<sub>2</sub> (2%) + ZnSO<sub>4</sub> (0.5%). The leaf and grain zinc content was significantly higher in seed hardening with CaCl<sub>2</sub> (2%) + ZnSO<sub>4</sub> (0.5%) and foliar application of ZnSO<sub>4</sub> (0.5%) respectively. The leaf and grain nitrogen content was significantly higher in foliar application of urea (2%) and foliar application ZnSO<sub>4</sub> (0.5%) + urea (2%) respectively. The seed hardening with combination of CaCl<sub>2</sub> (2%) + ZnSO<sub>4</sub> (0.5%) in receding soil moisture content recorded higher grain yield, panicle length, panicle width, 1000 grain weight and seed zinc content.

#### Effect of agrochemicals on physiological traits, yield and fibre quality on compact cotton

MALLIKARJUN G. BIRADAR

2013

MAJOR ADVISOR: Dr. B. C. PATIL

A field experiment was conducted to study the effect of agrochemicals under different plant population in compact cotton (DSC- 8) during *kharif* season of 2012 at Agricultural Research Station, Dharwad Farm. The experiment was laid out in split plot design with three replications consisting five main treatments (plant population / spacing) and four sub treatments. The agrochemicals included were mepiquat chloride (growth retardant) sprayed at 90 DAS to curtail vegetative growth and Ethrel (defoliant) sprayed at 140 DAS to facilitating mechanical picking. Wider spacing recorded more number of bolls and boll weight resulting in highest seed cotton yield as compared to closer spacing. Among agrochemicals application of mepiquat chloride + Ethrel recorded more number of bolls with higher yield. The non of the quality parameters were affected due to agrochemical spray. All the morphological parameters

viz., number of leaves, leaf area, number of monopodia, sympodia and nodes per plant, partitioning of dry matter in leaves, stem and reproductive parts were higher in wider spacing (60x20 cm) as there is less competition for growth resources among the plants. Higher rate of photosynthesis, stomatal conductance, SPAD value (chlorophyll content), partitioning of assimilate in reproductive parts and delayed senescence of leaves with higher LAI, LAD and SLW which helped in increasing the photoassimilate supply for an extended period (to reproductive sink) by mepiquat chloride and synchronized boll opening by ethrel contributed for more number of bolls and better boll set. Thus, it is found that combined application of mepiquat chloride and ethrel treatment with a spacing of 60cm X20 cm (83,333 plants per ha) is optimum to get higher seed cotton yield in these genotypes.

### EXTENSION AND COMMUNICATION MANAGEMENT

#### A study on women related schemes implemented by panchayat raj

SUMAN M. PUJAR

2013

MAJOR ADVISOR: Dr. UMA S. HIREMATH

The study was conducted in the year 2012-2013 in Dharwad taluk of Dharwad district of Karnataka with a sample size of 420 women beneficiaries of different schemes implemented by Uppin-Betageri Gram Panchayat. The data was collected on awareness, knowledge, socio-economic change, problems and suggestions about women related schemes with the help of pre-tested structured interview schedule. Majority of the women beneficiaries belonged to old age group (43.62%), forward caste (55.55%), illiterate (63.88%), married (61.11%), nuclear family (63.33%), farm labours (63.05%), low level mass media participation (67.77%), medium level extension participation (54.64%)

and cosmopolitaness (72.45%). Majority of stake holders (78.33%) were aware of selected Panchayat schemes. Cent per cent of the stake holders were having awareness about every scheme related to house, employment and pension. Level of awareness of stake holders about Panchayat schemes found to be above average (58.34%). More than eighty five per cent of community leaders (87.50%) were aware of Panchayat schemes. More number of women beneficiaries were having medium knowledge level (38.62%) about women related schemes. Women beneficiaries had higher level of knowledge with respect to the schemes SGRY (60.00%), SGSY (50.00%), NFBS (45.00%). After availing benefit

from the scheme, beneficiaries improved socially and economically. In social change more than fifty per cent of women beneficiaries became member of the SHG group (50.56%). Majority of beneficiaries had high economic change by housing scheme (81.25%) and considerable change by pension (46.00%) and employment schemes (25.00%). More number of women beneficiaries had problems in housing (36.25%) followed by

pension (26.00%) and employment schemes (21.25%). Major problems faced were delay in payment of money, no fixed time for disbursement of wage and improper distribution of food grains. They suggested to increase the pension amount (56.00%), employment days (57.50%) and direct distribution of money to the beneficiaries for house construction and renovation (67.50%).

### Knowledge and opinion of stakeholders and beneficiaries about supplementary food provided in Anganwadis

PRATIBHA C. SALUTAGIMATH

2013

MAJOR ADVISOR: Dr. (Mrs.) D. A. NITHYASHREE

The research study was conducted in four villages of Dharwad district of Karnataka state during 2012-13 to know the Knowledge and opinion of stakeholders and beneficiaries about supplementary food provided in Anganwadis. Ex-post facto research design was employed in the present research study. From each village 40 stakeholders and 40 beneficiaries were randomly selected. Stakeholders were community people, parents and anganwadi teachers. Beneficiaries were adolescent girls, pregnant women, lactating mothers and anganwadi children. Thus the total sample selected for the study was 320. The data was collected from the selected sample through personal interview with the help of pretested structured interview schedule. The collected data were tabulated and analyzed by using suitable statistical tools. The results showed that comparison of knowledge of beneficiaries, stakeholders and anganwadi teachers about supplementary food provided in anganwadis. There was significant difference observed between these three groups on knowledge about supplementary food provided in anganwadis. On the whole anganwadi teachers had high knowledge when compared to stakeholders and

beneficiaries. In case of opinion 45 per cent of the beneficiaries had favourable opinion, 40.84 per cent of stakeholders had highly favourable opinion and 60 per cent of anganwadi teachers had favourable opinion about supplementary food provided in anganwadis. In case of beneficiaries age, education level, land holding, organizational participation and cosmopolitaness were positively and significantly related to knowledge level. In case of stakeholders education level, organizational participation, extension participation and scientific orientation were positively and significantly related to knowledge level. Organizational participation was negatively and significantly related to opinion of beneficiaries. Education level, extension participation and scientific orientation were positively and significantly related to the opinion of respondents. Majority of the respondents had medium level of knowledge about anganwadi activities, food and health facilities provided in anganwadis. Hence concerned functionaries should take adequate steps to create awareness by organizing camps and trainings to increase the knowledge level of beneficiaries and stakeholders about the programme.

### FORESTRY

### Morphological and chemical characterization of different fruit morpho types in *Garcinia indica* Choisy

M. NIVEDITHA

2013

MAJOR ADVISOR: Dr. A. KRISHNA

South Asia is a rich repository of Tropical Fruits Trees (TFT). One such important TFT species which is gaining popularity in recent days because of its economic significance is *Garcinia indica* Choisy. The fruit rind is rich in Hydroxycitric acid (HCA), an important biologically active plant metabolite used as an anti-obesity drug. Systematic characterization of physico-chemical characters of available germplasm would provide knowledge on the extent of genetic diversity in the fruits species and facilitate in identifying the superior genotypes with desired character for domestication. Therefore it is important to evaluate species and understand its character which has greater impact on the productivity. With this background the present investigation was taken up in the College of Forestry, Sirsi. The trees were grouped based on the fruit colour into four major types viz. red; green; orange and yellow morpho types. The red and yellow morpho showed more variation in evaluated traits than the orange or green morpho. Fruit colour and fruit apex shape were more variable

than others and were useful to discern different types. Fruits of yellow morpho were the heaviest (57.87 g) and orange morpho had lighter fruits (15.41 g) and other two morpho were intermediate. Nutritionally fruit rinds of 'red morpho' were the richest in Vitamin C (Ascorbic acid 465 mg per 100 g dry weight) which is 15 times higher than an orange. It is also a richest source of anthocyanin (70.51 mg/ 100 g dry weight). Green and red morpho type fruit contain high amount of HCA than other two morpho-types (20.35 g per 100 g dry weight and 19.5 g per 100 g dry weight respectively). Major fatty acid found in seed butter morpho type is stearic and oleic acid, ranging from 56.40% to 60.88% and 31.97% to 39.17% respectively. Overall the present study indicates opportunities for phenotypic selection and quantitative improvement of the traits. All the morpho-types are showing highly significant variation for one or the other traits. Hence all the four morpho-types have equal importance and they are playing vital role in one or the other way.

### Assessment of mangrove floral diversity and variability of *Rhizophora mucronata* Lam. in Coastal Uttara Kannada district

PAVANKUMAR GUDADARI

2013

MAJOR ADVISOR: Dr. G. V. NAYAK

The investigation on Assessment of floral diversity and Variability of *Rhizophora mucronata* in coastal Uttara Kannada district was conducted at Sharavathi River and Aganashini River estuary. The study was conducted by laying 10×10 m plots by dividing each River into low stream (0-0.5 km), middle stream (0.5-1 km) and upstream (1.0-1.5 km). The species composition was more in Aganashini river estuary i.e., 12 families comprising 14 genera and 18 species than Sharavathi River (13 families comprising 13 genera and 16 species. Density of regeneration recorded more in downstream of Sharavathi River (5320 species/ hectare). The highest Shannon diversity recorded in middle stream of Aganashini River (2.16). The highest alpha diversity was recorded in downstream of Aganashini River (17 species). Variability studies on plant height, Diameter at breast height (DBH), leaf length, leaf width in *Rhizophora mucronata* was conducted and also water salinity, soil salinity and threat to Mangrove

ecosystem. The plant height varied significantly from downstream to upstream range of Sharavathi River and Aganashini River. Highest tree height, DBH and leaf breadth were recorded in downstream of Aganashini River viz. (8.19 m, 112.47 mm and 92.17 mm respectively). The highest leaf length was recorded in Sharavathi River of downstream (198.73 mm). The highest water salinity and soil salinity were recorded in downstream of Aganashini River viz., (3.99 ppt and 10.53 dS/m respectively). However the water salinity, soil salinity was low in Sharavathi River in all streams compared to Aganashini River. The highest browsing was recorded in downstream range of Sharavathi River (15%). Significantly highest wood felling was recorded in upstream of Aganashini River (30 %) and downstream of Sharavathi River (43 %). Among the threats to mangroves browsing and wood felling has major causes of degradation and no pest infestation was observed.

### Standardization of nursery techniques in *Callophylum inophyllum* L.

PRAKASH DODDAMANI

2013

MAJOR ADVISOR: Dr. B. S. JANAGOUDAR

*Callophylum inophyllum* L. is one of the medicinal trees which belong to the family Clusiaceae. It is commonly called as *Callophylum inophyllum*. The seed kernels of this tree yield 50-73 per cent of bluish yellow to dark green viscous oil, popularly known as Domba or Tamanu Oil which is used as a preservative for ships and boats. It can be used in conventional diesel engines in its pure form or as a blend with mineral oil. Hence, this species is considered as one of the commercially important Tree borne oil yielding species and used as an alternative source for biofuel. The oil is also employed as a remedy for rheumatism, ulcers and skin diseases. In view of standardizing the nursery techniques of this commercially important species a study on seed germination by studying on seed weight class and effect of soil media and organic

manures on seedling growth was carried out at College of Forestry, Sirsi during 2011-12. Out of different seed weight classes on seed germination and 6.50 – 8.50 g seed weight class recorded maximum germination per cent (67.77 %) and also with respect to mean daily germination, peak value, germination value and germination rate. The growth of *Callophylum inophyllum* was found better in the soil media constituting red soil, sand, FYM in 2:1:1 proportion and 30 g vermicompost and 20 g of poultry. The poultry manure application increased the seedling growth attributes viz., seedling height, collar diameter and number of leaves by 60.31, 26.78 and 34.97 per cent, respectively. The poultry manure added treatments also showed the highest fresh weight (44.86 g) and dry weight (30.66 g) of seedlings.

### GENETICS AND PLANT BREEDING

#### Comparative evaluation of forage sorghum crosses for yield and other quality parameters [*Sorghum bicolor* (L.) Moench]

N. PADMASHREE

2012

MAJOR ADVISOR: Dr. K. SRIDHAR

Investigation aimed to assess combining ability (GCA and SCA) and study the heterosis for yield and quality traits in forage sorghum. Thirty six hybrids derived from mating six testers with six lines in L x T design along with their parents and checks were evaluated. Based on the GCA estimates it has been found that the parents 324A, EC 507897 were good general combiners for green fodder and dry fodder yields, stem weight, stem girth and also for number of leaves. The parents 324 B, PC 507880 and SSG 59-3 were found to be the good combiners for plant height and number of tillers. Parents 275A and EC507897 were found to be good combiners for crude protein content. The SCA effects of crosses

revealed that the crosses 324A x EC 507897, 324A x SSG 59-3 were best specific combiners for most of the traits. The estimates of mid-parental, better parental and economic/standard heterosis indicated that the crosses 324A x EC 507897 and 324A x PC 507880 exhibited higher green fodder yield, dry fodder yield, stem weight, stem girth and number of leaves. The cross 275A x SSG 59-3 recorded the lowest HCN value, the *per se* performance of the other two hybrids 275A x GD6519 and 275 A x EC 507897 were superior over the checks for crude protein content along with other morphological traits like green fodder yield, dry matter yield, leaf length and leaf width.

#### Study of induced genetic variability for grain size, grain mold tolerance and productivity related traits in *kharif* sorghum (*Sorghum bicolor* L.)

Y. ANAND

2013

MAJOR ADVISOR: Dr. S. T. KAJJIDONI

An investigation was carried out at All India Coordinated Sorghum Research Project (AICSRP), Main Agricultural Research Station (MARS), Dharwad during *kharif* 2012 to study genetic variability for grain size, grain mold tolerance and productivity related traits in *M<sub>2</sub>* progenies of *kharif* Sorghum. Different doses of gamma rays (300Gy, 350Gy and 400Gy) were used to irradiate seeds of DSV-6 and CSV-15. Genetic variability was significant for yield and yield contributing traits among the *M<sub>2</sub>* progenies. Results indicated relatively higher mean performance in *M<sub>2</sub>* progenies of 400Gy dose for most of the characters studied including grain size in both genotypes. The GCV and PCV estimates showed wide variation for most of the characters in segregating *M<sub>2</sub>* progenies. High GCV, PCV, heritability and GAM were observed for grain yield per plant in *M<sub>2</sub>* progenies of both genotypes. The positive significant correlation was noticed for grain yield per plant with earhead length and 100-seed weight in 300Gy and 350Gy *M<sub>2</sub>* progenies of both genotypes. Path analysis revealed that earhead

length had highest positive direct effect on grain yield in *M<sub>2</sub>* progenies of DSV-6 treated with 300Gy and the trait 100-seed weight showed positive direct effect on grain yield in the *M<sub>2</sub>* progenies of 400Gy. Among *M<sub>2</sub>* progenies of CSV-15 genotype, the trait 100-seed weight had highest positive direct effect on grain yield followed by earhead length in each irradiated dose of *M<sub>2</sub>* progenies. Reaction to grain mold disease revealed that most of the *M<sub>2</sub>* progenies exhibited hard grain, semi loose compactness and medium glume coverage and were tolerant to grain mold disease. Among all six *M<sub>2</sub>* progenies of two genotypes, higher number of superior progenies were recorded for three traits viz., earhead length, grain yield per plant and 100-seed weight in CSV-15 as compared to DSV-6 progenies. However, when comparison was made for superior progenies common to all three traits, *M<sub>2</sub>* progenies of DSV-6 and CSV-15 recorded almost same number of superior progenies and these needs to be advanced to next generation to confirm their superiority.

#### Genetic analysis of charcoal rot resistance, stay-green and yield traits in sorghum [*Sorghum bicolor* (L.) Moench]

SUNIL PURANIK

2013

MAJOR ADVISOR: Dr. G. M. SAJJANAR

Genetic analysis of charcoal rot resistance, stay-green and yield traits in six generations of two crosses M35-1 x CSG0818 (cross1) and CSV216R x CSG0818 (cross2), was done during *Rabi* 2012-13 at RARS, Bijapur. Generation mean analysis revealed that all additive, non-additive and interactions were significant for SPAD3 and non-significant for SPAD1, SPAD2, number of nodes crossed and length of spread in cross1. However, significant dominant effects for SPAD1, additive effects for SPAD2, number of nodes crossed and additive x dominant gene interaction effects for length of spread, additive and dominant x dominant interaction effects for SPAD3 were observed in cross2. Significant additive, dominant, additive x additive and dominant x dominant effects were observed for days to 50% flowering (DFL) in both the crosses, for plant height, panicle weight,

panicle breadth, grain yield, fodder yield, 1000 seed weight in cross2, but significant additive effects for plant height in cross1. Significant additive x additive and dominant x dominant interaction effects were observed for fodder yield in cross1, significant dominant action and additive x dominance and dominance x dominance interactions for panicle length in cross2, and all the gene action and interaction effects were non significant for remaining yield traits. In both the crosses, association of SPAD readings was negative with charcoal resistance traits and DFL and positive with all other yield traits; in cross1 the association was positive with 1000 seed weight. Heritability was moderate for SPAD1, panicle weight, grain yield, low for SPAD2, length of spread, fodder weight, and high for DFL, panicle length, panicle breadth, 1000 seed weight in both the crosses, and high

and moderate for SPAD3 in cross1 and cross2, respectively. Heritability was low for number of nodes crossed and high for plant height, moderate for fodder weight in cross1 and moderate for number of nodes crossed and plant height in cross2. The estimates of PCV, GCV and GAM were low for

SPAD values, high for charcoal resistance, panicle weight, panicle breadth, grain yield, 1000 seed weight, moderate for plant height, fodder yield and low for DFL in both the crosses. Genetic advance for panicle length was low in cross1 and moderate in cross2.

### Genetic improvement for yield, fiber colour and inheritance studies in naturally coloured *Gossypium hirsutum* cotton

ANIL B. BASAVAREDDERA

2013

MAJOR ADVISOR: Dr. (Mrs.) S.M. MANJULA

Cotton is one of the most important commercial crop of India and world's leading natural fiber crop. Globally cotton of commerce is white linted, while naturally coloured cottons are available in shades of brown and green. Eco-friendly cottons are very small niche market. The lint colour is linked with undesirable traits especially low yield and poor fiber quality. The present investigation was undertaken to explore new variability, to widen the genetic base for improvement of yield and fiber quality which fulfill the increased demand of colour cottons suitable for textile industry, to know the inheritance of fiber colour and preliminary molecular studies with SSR markers. The material used in this study comprised of stabilized lines,  $F_2$  populations derived from coloured and white cotton crosses,  $F_3$  and  $F_4$  lines derived from intra (HxH) and interspecific (HxB) crosses. Genetic variability components revealed moderate magnitude of variation for most of the traits studied. Three medium brown genotypes (DMB-1053, DMB-1023 and DMB-1093) possessed good fiber strength of > 24 g/tex. Three dark brown genotypes

(DDB-1054, DDB-1014 and DDB-1104) were superior to the check DDB-12 for productivity coupled with good fiber strength ranging from 22.7 to 24.6 g/tex. Dark brown genotype, DDB-1039 possessed fiber strength of 25.3 g/tex. High degree of genetic variability was observed in  $F_4$  lines derived from intraspecific crosses compared to interspecific crosses indicating the elimination of *Gossypium barbadense* genome content with the advancement of generation. In intraspecific lines narrow sense heritability ( $h^2_{NS}$ ) estimation indicated high and moderate values for yield and fiber length respectively while interspecific lines showed low to moderate values for yield and fiber length respectively. The inheritance study for fiber colour indicated fiber colour is controlled by a pair of genes with duplicate epistatic (15:1) gene interaction. SSR marker study among colour and white cotton genotypes indicated that the genotypes used were diverse. Use of additional markers in mapping populations will assist in identifying polymorphic markers linked to fiber colour and fiber development among coloured cotton lines.

### Genetic variability studies for yield and yield components and reaction to tomato leaf curl virus in segregating population of tomato (*Solanum lycopersicon* L.)

SHARANAPPA K. PUJAR

2013

MAJOR ADVISOR: Dr. SUMA C. MOGALI

An investigation was carried out to study the nature and magnitude of variability generated and character association for different quantitative and qualitative traits in the segregating population of Pusa Ruby and CLN2768A. The experiment was carried out during kharif, rabi and summer seasons of 2011-13 at Botany Garden, AC, UAS, Dharwad. In  $F_2$  progenies, there was low variability for days to 50% flowering, High variability for number of inflorescences/plant, number of flowers/plant, number of fruits/plant and fruit yield/plant. Whereas, moderate variability was observed for plant height. Heritability estimates in broad sense was high for number of flowers/plant, number of fruits/plant. In  $F_3$  population, considerable amount of genetic variability was noticed for plant height, number of inflorescence/plant, number of flowers/plant, and fruit yield/plant. Moderate variability was observed for pericarp thickness and lycopene content. Heritability estimates was more for number of inflorescences/plant, number of flowers/plant, Fruit yield/plant, pericarp thickness, ascorbic acid and lycopene content. In  $F_2$  and  $F_3$  progenies,

Fruit yield/plant had highly significant positive association with plant height, number of primary branches/plant, number of flowers/plant and number of fruits/plant, average fruit weight. Path coefficient analysis revealed that number of flowers/plant and number of fruits/plant, average fruit weight, had the highest positive direct effect on fruit yield at both the genotypic and phenotypic levels. Family number 247 exhibited the highest between family variance for traits like number of fruits/plant, average fruit weight, pericarp thickness, total soluble solids, ascorbic acid and lycopene content indicating ample scope for further selection. Screening for ToLCV diseases resistance revealed that, out of 24  $F_3$  families of tomato, none of the plants showed immune reaction to the ToLCV incidence. Majority of the  $F_3$  families have recorded moderate or resistant reaction to ToLCV. Among the  $F_3$  families resistant reaction was recorded for plant No. 30, 35, 47, 60, 62, 136, 145, 160, 167, 168, 169, 179, 184, 276, BC1, CLN2768A. These can be validated by further stringent screening on large scale to be utilized in resistance breeding to ToLCV.

### Genetic variability for flowering and yield characters in sugarcane (*Saccharum officinarum* L.)

P. L. PRIYANKA

2013

MAJOR ADVISOR: Dr. SANJAY B. PATIL

The present investigation was taken up at ARS, Sankeshwar to study the floral behaviour of commercial sugarcane varieties and to study variability and character association for productivity and their component traits in pre-selected clonal progeny population. Further, to identify productive progenies with respect to sugar/jaggery yield and quality parameters combining shy/non flowering features. Characterization of flowering based on intensity and days to flowering indicated that, genotypes viz., SNK 632, SNK 044, SNK 814 and CoC 671, are early profuse flowering types and other three commercial genotypes viz., CoM 0265, Co 94008 and Co 86032 could be characterized as moderate flowering types. The other variety CoM 88121 where in no floral primordial were recorded, confirming its non flowering feature. The GCV and PCV for cane height, internodal length, number of millable canes (NMC), cane yield and juice brix%, were higher,

whereas moderate variability was observed for cane girth and single cane weight (SCW). The association studies revealed that, single cane weight, number of millable canes and cane height were the strongest with cane yield. The path analysis shows that, NMC, number of internodes and SCW had higher direct effect on cane yield. The repeatability studies indicated that juice brix% (10<sup>th</sup> month) and flowering per cent were significantly repeatable across clonal generations. Among 145 pre-selected clonal progenies studied in the present investigation, 14 were found better for cane, sugar and jaggery yield. Among these 14 genotypes, SNK 09229 (6%), SNK09 271 (14%), and SNK 09377 (1%) were sparse flowering types and rest of the genotypes were non-flowering. Genotypes SNK 09221 and SNK 09212 are superior over best check for cane, sugar, jaggery yield and quality parameters along with non flowering feature.

## HORTICULTURE

### Studies on effect of pruning and crop load on quality and Yield of Pomegranate (*Punica granatum* L.) Cv. Kesar

ZAID AHMED M. USTAD

2011

MAJOR ADVISOR: Dr. M. K. SHAIKH

Pomegranate is an important fruit crop of arid region. The standard practice of pruning and crop load are lacking and there is no proper farm business data on its cost of production. With a view to standardize of these practice and to get an accurate figure on cost of cultivation of pomegranate, a field trial was conducted in pomegranate orchard of the Bijapur farmer. There were totally 15 treatments (3 main pruning treatments with 5 sub crop load treatments) which were replicated 3 times with objective to Study the effect of pruning and crop load on quality and yield of pomegranate Cv. Kesar. The data showed that severe pruning and retaining 40 fruit load in the tree resulted in recording

highest average fruit weight as compared to control. This treatment however reduces the overall yield of the tree. It is possible that the higher average fruit weight observed in the severe pruned tree may fetch higher price in the market, thus compensating loss in the yield. With regard to quality of the fruit, the fruit developed on tree which were subjected to severe and mild pruning with 40 fruit load per tree were superior in respect of hundred aril weight, total soluble solid, reducing and non reducing sugars content. The results shows that the total annual returns for the pomegranate orchard of one hectare were ₹ 379650.00 and net return (net profit) were ₹ 355590.

## MOLECULAR BIOLOGY AND BIOTECHNOLOGY

### Metagenome analysis of curd

NOELIN CHINNU THOMAS

2013

MAJOR ADVISOR: Dr. P. U. KRISHNARAJ

Curd or *dahi* is a product obtained by lactic fermentation of cow or buffalo milk or mixed milk through the action of single or mixed strains of lactic acid bacteria. It has a mild pleasant flavor and sweetish aroma with an acidic taste, a creamy white color with a smooth glossy surface, cream layer on top and negligible whey separation. Till date, research on curds concentrated on culture-dependent approaches. Application of metagenomics helps to study the microbial communities directly extracted from the food matrix which bypasses the need for isolation and lab cultivation of individual species. Five different curds were used as initial starter cultures for the preparation of samples under laboratory conditions. The modified protocol for DNA isolation from curd gave concentration ranging from 2158-5414 ng/μl. The primer pair HDA1-HDA2 amplified hypervariable V<sub>3</sub> region of 16S rRNA gene from curd samples. Using

DGGE, a reference identification ladder was constructed using the already reported bacterial species in curd. The DGGE profile generated by the samples was estimated for microbial structure and diversity using three indices which showed samples C, D and E to be superior. Based on the results obtained, curd D and E were carried forth for library construction and amplicon sequencing. The results showed that *Firmicutes* (59% and 73.57%) formed the major phylum in the metadata sets of samples D and E respectively. There was proportionate variation in *Lactobacillus* and *Streptococcus* population in either of the curd samples, yet the ratio of both the genera remained nearly 1:1. Pyrosequencing technique was indeed a promising tool in understanding the phylogenetic relationship among microbes that share the same ecosystem, thereby, provided a new arena of biodiversity surveillance.

### Mining for blast resistance genes and expression analysis of *pi2* gene in rice (*Oryza sativa* L.)

KISHOR D. INGOLE

2013

MAJOR ADVISOR: Dr. S. K. PRASHANTHI

Rice blast caused by *Magnaporthe oryzae* is one of the most serious diseases of rice in all rice growing regions of the world. The disease can be effectively managed by the deployment of R-genes and hence mining the resistant genes might be the base for breeding programme. In the present study, three well characterized genes viz., *Pi1*, *Pi2* (*Piz-5*) and *Pi5* that are known to confer broad spectrum resistance to blast were mined from 83 landraces of rice from Karnataka state (India) by using PCR based molecular markers. The results indicated the presence of *Pi1* gene in 39 landraces, accounting for gene frequency of 46.98 per cent. *Pi2* and *Pi5* genes were present in 60 landraces accounting the gene frequency of 72.28 per cent. Sequencing based allele mining approach was used to analyse allelic variants of *Pi2* from 16 landraces harbouring *Pi2* gene with varying blast reaction across India. Among 16 *Pi2* variants, 469 polymorphic sites with total

570 mutations and 191 InDels were found. 206 mutations with 29 InDel events were observed among *Pi2* resistant and susceptible variant. Comparative modeling and Ramachandran plot of *Pi2* variant from resistant and susceptible landrace revealed significant differences among them. One potential novel *Pi2* allelic variant from landrace Vanasuraya was identified for the first time among 16 landraces exhibiting different reaction types against the *M. oryzae* population which can be used in rice breeding programmes to enhance blast resistance. Effector-triggered immunity (ETI) was assessed through expression analysis of *Pi2* gene in two different genetic backgrounds of rice by real-time PCR assay. *Pi2* gene in CO-39 genetic background (C101A51) exhibited 95 and 65.54 per cent higher expression level than that of LTH genetic background (IRBLz5-CA) at leaf and neck blast stage, respectively.

### Generation of transgenic tomato carrying stacked endochitinase (*ech42*) and endoglucanase (*bgn*) genes

U. UGALE SHARAD

2013

MAJOR ADVISOR: Dr. NARAYAN MOGER

Transgenic tomato lines (cv. Pusa Ruby) were generated by using *Agrobacterium tumefaciens* strain LBA4404 harboring endochitinase (*ech42*) and endoglucanase (*bgn*) genes stacked in binary vector (pBI121) under CaMV 35S promoter. Ten putative transformants in T<sub>0</sub> generation were confirmed by PCR using *nptII*, *ech42* and *bgn* specific primers. Progenies of two transgenic tomato lines, pRAGS2 and pRAGS7 showed the presence of transgenes in the T<sub>1</sub> generation. Transgene integration and copy number of transgene was assessed using PCR, Dot blot, Southern hybridization in T<sub>2</sub> progenies of transgenic line, pRAGS2. Southern hybridization using DIG-labelled *ech42* specific probe revealed the presence

of two copies of transgenes. Semi-quantitative RT-PCR showed expression of *ech42* and *bgn* at transcript level in progenies of transgenic line, pRAGS2. Chitinase and glucanase assay revealed 4.09 and 3.93 fold higher expression of *ech42* and *bgn*, respectively in T<sub>2</sub> progeny of pRAGS2 compared to non-transgenic control plant. Bioassay of progenies of pRAGS2 against *Alternaria solani* showed 2.97 times reduction in the leaf area infection compared to non-transgenic plant. In food poison technique, crude protein extracts obtained from transgenic plant showed 83.39 per cent inhibition, whereas non-transgenic control plant showed only 54.97 per cent inhibition against *Sclerotium rolfsii* at 1000 μg of crude protein.

## PLANT PATHOLOGY

### Onion twister disease: Etiology, their characterization, epidemiology and integrated management

SURESH PATIL

2013

MAJOR ADVISOR: Dr. V. B. NARGUND

In recent years, twister disease of onion has become epidemic in coastal tract and other onion growing districts of Karnataka which caused heavy loss. Survey carried out during *kharif* and *rabi*/summer 2011-12 and 2012-13 revealed highest PDI 26.71 in Uttar Kannada district. Typical symptoms of the disease: twisting of leaf, neck with blight as well as dieback (anthracnose), scanty root system with galls and showing fungal growth was noticed. Artificial inoculations of onion seedlings with *Colletotrichum gloeosporioides*, *Fusarium oxysporum*, *Meloidogyne* spp. alone and in combinations expressed twister disease symptoms. Metabolomic changes like increased total sugars and growth hormones (IAA and GA) were seen. A two year pooled correlation analysis of weather parameters on incidence and severity showed that cumulative rainfall contributed more (0.97) to disease development followed by maximum temperature (0.41). Among the different planting dates, least incidence was recorded in 15<sup>th</sup> January.

Molecular identification of fungi by amplification of ITS rDNA region was done, sequenced and confirmed as *C. gloeosporioides*, *C. acutatum*, *Glomerella acutata*, *F. oxysporum* and *Gibberella moniliformis*. Sequences were deposited in genbank. Specific amplification of CgInt region at 450 bp for *C. gloeosporioides*; for *C. acutatum* CaInt region at 490 bp and for *F. oxysporum* at 550-570 bp was obtained. PCR-RFLP with *HaeIII* resulted in a characteristic pattern of three fragments. *In vitro* evaluation of fungicides revealed triazole and combi products were effective in inhibiting growth of both fungal pathogens. Botanicals as consortia of plant extracts (Neem, Prosopis, Clerodendron and *Vinca rosea*) and bioagent *Trichoderma harzianum* were also effective. Integrated management of twister disease revealed that, T<sub>5</sub> (Adoptive + Nutrient module) recorded least PDI 20.50 and 19.86 with maximum yield of 67.33 t/ha and 39.36 t/ha at Dharwad and Kumta locations respectively.

## SEED SCIENCE AND TECHNOLOGY

### Biochemical and molecular basis of seed priming in soybean seed

G. B. PRADEEPKUMAR

2013

MAJOR ADVISOR: Dr. N. K. BIRADARPATIL

A laboratory experiments was conducted to study the biochemical and molecular basis of seed priming in soybean seed and to assess the storability of primed seeds of soybean at Seed Quality and Research Laboratory, NSP (Crops), UAS, Dharwad. The experiment was compromised of fresh and old seed lots of soybean Cv. JS- 335 having initial germination of 90 per cent (High vigour) and 70 per cent (Low vigour) as factor-I and the different priming treatments such as hydration for two hours (Hydro priming), priming with GA<sub>3</sub> (50 ppm), PEG-6000 (200 g/1000 ml), KH<sub>2</sub>PO<sub>4</sub> (0.5%) as factor-II. Experiments were laid out with two factorial CRD. The positive effect of priming in improving the seed quality parameter was better witnessed in low vigour seed lots compared with high vigour seeds. Though the high vigour seed lots recorded higher germination (95.1%), vigour index (3028), dry weight of seedlings (110.77 mg) and lower EC (0.677 dS m<sup>-1</sup>) after priming as compared to low vigour seed lots

which recorded (75.3%), (2067), (81.63 mg) and (1.492) respectively. The rate of increase in germination percentage was higher in low vigour seed lot (8.82%) as compared to high vigour seed lot (3.03%). Among the primed seeds, the seeds treated with 50 ppm GA<sub>3</sub> recorded higher seed quality parameters viz., germination per cent (88.5), root length (20.42 cm), shoot length (12.73 cm), seedling vigour index (2947) and seedling dry weight (101.71 mg). The high vigour seed lot recorded more protein (38.28%) and sugar content (27.64) as compared to low vigour seed lot which recorded (37.36%) and (27.05%) respectively. Seeds primed with GA<sub>3</sub> after 48 h recorded significantly higher protein (39.03%) and sugar content (30.72%) as compared to unprimed seeds (36.74%) and (24.54%) respectively. The GA<sub>3</sub> recorded higher amylase (3.03), invertase (2.87) and DNA content (285.08 µg/g) after 48 h of priming as compared to control (2.08), (2.03) and (228.05 µg/g) respectively.

### Influence of spacing and method of planting on seed yield and quality of foxtail millet (*Setaria italica*) varieties

HAREESH NAVALE

2013

MAJOR ADVISOR: Dr. A. S. CHANNAVEERSWAMI

To study the influence of spacing and method of planting on seed yield and quality of foxtail millet varieties experiment was conducted at ARS, Hanumanamatti, during *kharif* 2012. Between varieties studied, variety V<sub>1</sub> (HMT100-1) recorded significantly higher dry matter production at harvest (8.77 g/plant) and less days to flower initiation (41.44), 50 per cent flowering (50.72) and panicle initiation (54.72) with significantly highest panicle length (16.87 cm), panicle weight (4.46 g), yield per hectare (17.36 q), harvest index (43.04%), test weight (2.58 g), germination (97.83%), seedling length (21.68 cm), seedling dry weight (0.47 mg/10 seedlings) and seedling vigour index (2124) over variety PS-4. Between spacing, S<sub>2</sub> (30 × 15 cm) recorded significantly higher plant height, number of leaves and tillers, dry matter production (8.41 g/plant) with lesser days to flower initiation (41.56), 50 per cent flowering (50.72) and panicle initiation (55.28). It also recorded significantly higher panicle length

(16.74 cm), panicle weight (4.15 g), harvest index (42.89%), test weight (2.59 g), germination (97.28%), seedling length (21.10 cm), seedling dry weight (0.46 mg/10 seedlings) and seedling vigour index (2053) over S<sub>1</sub> (30 × 10 cm) spacing. Among planting methods, P<sub>1</sub> (one row skipping after every two rows) recorded significantly highest panicle length (17.11 cm), panicle weight (4.55 g) followed by P<sub>2</sub> (one row skipping after every three rows). P<sub>0</sub> (no row skipping) and P<sub>2</sub> recorded 15.83 and 16.83 q per hectare seed yield and were at par but superior over P<sub>1</sub> (14.05 q). P<sub>1</sub> recorded significantly higher plant height, number of leaves and tillers and lesser days to 50 per cent flowering (50.33) and panicle initiation (55.08). P<sub>1</sub> and P<sub>2</sub> planting methods recorded significantly higher germination (97.50 and 96.92%), seedling length (21.26 and 21.06 cm), seedling dry weight (0.48 and 0.46 mg/10 seedlings) and seedling vigour indices (2009 and 2044) respectively.

### Standardization of hybrid seed production techniques in Brinjal (*Solanum melongena* L.) under protected condition

MAINAVATI DESHI

2013

MAJOR ADVISOR: Dr. N. K. BIRADARPATIL

Two field experiments were carried out for standardizing the hybrid (PH-9) seed production techniques in brinjal under protected condition during *kharif* 2012-13 season at Hi-tech Horticulture Unit, Saidapur Farm, University of Agricultural Sciences, Dharwad and seed quality parameters were conducted in the Seed Quality and Research Laboratory, Seed Unit, University of Agricultural Sciences, Dharwad. The first experiment

consisted of two growing condition (open, shade house) with four levels of spacing (S<sub>1</sub> = 60 × 45 cm, S<sub>2</sub> = 60 × 60 cm, S<sub>3</sub> = 60 × 75 cm and S<sub>4</sub> = 60 × 90 cm) and it comprised of eight treatments with three replications in Randomised Block Design in factorial concept. Between two growing condition, shade house grown condition recorded significantly higher fruit set (19.90 %), fruit yield (25.97 t/ha), seed yield (169.42 kg/ha),



germination (82.8 %) and vigour index (1426) as compared to open field condition. Among the spacings, higher fruit set (18.99 %), fruit yield (27.95 t/ha), seed yield (203.99 kg/ha) with better seed quality traits were recorded with 60 x 75 cm spacing. Similarly, a second experiment was conducted in shade house to know the effect of pollen viability of male parent and stigma receptivity of seed parent and this experiment consisted of 24 treatment combinations comprising of four levels of pollen viability as one factor and six levels of stigma receptivity as another factor, laid

out with RBD in factorial concept. Use of fresh pollen recorded significantly higher fruit set (28.61 %) and seed yield (15.36 g/plant), seed germination (73.1 %) and seedling vigour index (1185) followed by one day stored pollen (27.94 %, 14.69 g/plant, 71.6 % and 1155, respectively). Significantly higher fruit set (32.02 %), seed yield (19.17 g/plant) with better seed quality traits were recorded in the treatment of pollination one day after emasculation ( $S_2$ ) compared to pollination four ( $S_3$ ) and five days after emasculation ( $S_6$ ).

### **Productivity enhancement, varietal characterization and mycoflora assessment in niger (*Guizotia abyssinica* CASS.) seed production**

P. DIVYA

2013

MAJOR ADVISOR: Dr. R. GURUMURTHY

The field and laboratory experiments were conducted on productivity enhancement, varietal characterization and seed mycoflora assessment in niger seed production during *kharif* 2012 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The first experiment was laid out in split plot design into three replications, the main plot consisted of four different dates of sowing and sub plot consisted of six treatments of nutrients and PGR. Among the four different dates of sowing, first fortnight of June ( $D_1$ ) recorded significantly higher number of seeds per capitula (40.70), seed yield per plant (9.55 g/plant), test weight (9.44 g), germination (93.44%), seedling vigour index (2197) and oil content (40.53%). Among the micronutrients and plant growth regulators, Boron foliar spray @ 0.5% ( $N_1$ ) recorded higher number of capitula per plant

(202.65), number of seeds per capitulum (37.03), thousand seed weight (9.41 g), seed yield per plant (11.44 g), seed yield per plot (0.84 kg), seed yield per hectare (560.34 kg) and oil yield per hectare (225.66 kg) germination percentage (91.08%), seedling vigour index (2647) and oil content (40.27%). Morphological characterization of niger genotypes based on leaf colour, leaf shape, leaf size, leaf hairiness, leaf margin, stem colour, stem hairiness, stem pigmentation, days to 50% flowering, petal colour and anther colour was found to be more reliable for varietal identification during seed production. In the study of seed mycoflora among the thirteen genotypes of niger, all genotypes were infected. Totally four fungi species viz. *Fusarium* sps, *Penicillium* sps, *Alternaria* sps and *Aspergillus* sps were associated with the seeds of niger genotypes.

### **SOILSCIENCE**

#### **Productivity and quality of soybean as influenced by levels of nitrogen and sulphur nutrition**

SANTOSH BHOSAGI

2013

MAJOR ADVISOR: Dr. S. I. TOLANUR

The survey was conducted during May 2012 on available nitrogen and sulphur status of the soybean growing soils of Dharwad and Kalaghatagi taluks. A total of 100 samples were collected, the location of sampling point was recorded using GPS device. The processed samples were analyzed for available nitrogen and sulphur status. The study revealed that, of the total surveyed samples, majority of soils were low in available nitrogen sulphur in both the taluks and low (80% and 52% of samples) to medium (18 % and 40% of samples) in available sulphur in Dharwad and Kalaghatagi taluks respectively. Based on this information, a field experiment was conducted during *kharif* 2012 with treatments involving three levels of nitrogen and four levels of sulphur levels using soybean as a test crop. The effect of N and S levels on response of soybean revealed that, the significantly higher growth and yield attributes were recorded in the treatment receiving

40 kg N and 20 kg S  $ha^{-1}$  with highest B:C ratio (3.97). The optimum N:S ratio (10:6) and quality parameters, namely oil content (19.73% ), oil yield (460.15 kg  $ha^{-1}$ ) and protein content ( 39.82% ) was highest in the same treatment receiving N 40 kg  $ha^{-1}$  and S 20 kg  $ha^{-1}$ . Treatment receiving 40 kg N  $ha^{-1}$  and 20 kg S  $ha^{-1}$  also recorded the highest total uptake of N (227.56 kg  $ha^{-1}$ ), P (23.33 kg  $ha^{-1}$ ), K (55.11 kg  $ha^{-1}$ ) and S (14.70 kg  $ha^{-1}$ ). The highest residual N (231.00 kg  $ha^{-1}$ ) and S (14.23 kg  $ha^{-1}$ ) was found in the treatment receiving 50 kg N  $ha^{-1}$  and 40 kg S  $ha^{-1}$ , however The highest available P (27.28 kg  $ha^{-1}$ ) was recorded in the treatment receiving 50 kg N  $ha^{-1}$  and 20 kg S  $ha^{-1}$  but effect was non significant. The highest available K (347.33 kg  $ha^{-1}$ ) was recorded in the treatment receiving 40 kg N  $ha^{-1}$  and 30 kg S  $ha^{-1}$ . The treatment with 40 kg N  $ha^{-1}$  and 20 kg S  $ha^{-1}$  was found to be promising in increasing the soybean productivity and quality.