

MASTER OF SCIENCE

AGRICULTURAL BUSINESS MANAGEMENT

Traditional and modern turmeric cultivation in Belgaum district of Karnataka –A comparative management appraisal

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2013

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Turmeric strictly speaking is a condiment crop which has been used for colouring, flavoring and medicinal purposes. It ranks fourth in area 3043583 ha and second in production 5933126 tonn in India. In Karnataka 18035 ha area and production 90448 tonn during year 2011-2012. The present study was conducted in Traditional and Modern Turmeric Cultivation in Belgaum District of Karnataka – A Comparative Management Appraisal, because this district having highest traditional and modern of turmeric cultivation. In this district two talukas were randomly selected namely Athani and Raibag farmers for turmeric cultivation. The study conducted in the year 2012-13 revealed that highest labour requirement was seen on traditional category farmers (78.64 man days) followed by modern farmers (67.20 man days) because most of the operations such as planting, harvesting, picking, weeding were human labour intensively more. The highest yield was obtained by modern farmers (27.68 qtls) followed by

traditional farmers (23.14 qtls). Among the two categories of farmers the total cost incurred by the traditional farmers were high (₹ 74898.74 per acre) as compared to modern farmer (₹ 67634.27 per acre). The average processing cost of traditional turmeric farmers was ₹ 9076.80 per acre as against ₹ 6724.20 per acre of modern farmers. The summation of regression co-efficients indicated for traditional farmers (0.92) and increasing returns to scale were observed from modern farmers (1.03). Total cost in quintal of turmeric value addition was ₹ 11027.02 and ₹ 11434.55 for traditional and modern farmers respectively. Marketing efficiency in modern farmers was 1.37 and in traditional farmers it is 1.25. The total net income from traditional farmers of ₹ 78977.03 per acre and modern farmers of ₹ 121697.43. Turmeric rhizome of high quality should be made available to the farmers at affordable rates to increase the use by farmers and to increase their profitability.

Market dynamics and price behaviour of groundnut in North Karnataka - An econometric approach

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2013

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The prices of most agricultural commodities are inherently susceptible to violent fluctuations, the economic consequences of which are dire. The present study was devoted to an analysis of the dynamics of market fluctuations in the arrivals and prices of groundnut in five different markets of North Karnataka viz., Bellary, Mundargi, Gadag, Raichur and Dharwad. Both secondary and primary data was utilized to fulfill the objectives. A multiplicative model of time series was used to analyze arrivals and prices for markets. Raichur and Dharwad markets showed increasing trend both in arrivals and prices. Seasonal indices of arrivals and prices of groundnut in selected markets revealed that the arrivals were at its peak during October-December. The highest arrival index was noticed in Raichur market in the month of October (443.18). Whereas lowest arrival index was noticed in Gadag market in February

month (10.69). The cyclical trend in selected markets showed that there were no constant period between cycles in both arrivals and prices. In long run, Raichur market showed highest coefficient of multiple determination (R^2) value of 0.68. Whereas, lowest coefficient of multiple determination (R^2) value of 0.15 was observed in both Gadag and Dharwad market. ARIMA model was employed to forecast the prices of groundnut in selected markets. Among five markets, the price forecast model for Mundargi market (1,1,1), (1,1,1) was found to be best models. There existed high market integration between Mundargi and Bellary markets. To analyze the marketing problems in groundnut primary data were collected from farmers and market functionaries. About 84 per cent of problem faced in competition of oil millers in the market intermediaries and about 30 per cent of problem in untimely tendering.

Dynamics of spot and futures market prices of cumin in India

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2013

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Cumin has commonly known as Jeera. This is one of the most important spice grown in India. The results revealed that growth rate in area under cumin was found to be positive, while production also showed increasing growth due to increased productivity. With this backdrop the present study was undertaken by collecting monthly prices of cumin in major cumin markets (Gujarat and Rajasthan) of India for a period of 21 years (1991-92 to 2011-12). The futures prices for cumin seed was also collected for the same period. The growth rate analysis revealed that production growth rate is highly significant. Hence, there is need to evolve some varieties with stable or sustained productivity in order to meet future demand. An increasing trend in prices was observed in all the markets, but the quantum of increase varied from one market to another. Price of cumin was found to be highest during off season and lowest during harvest

season. The higher monthly seasonal indices of prices were observed during September to October and lower during the months of March and April. Hence, the farmers should be educated to plan their marketing particularly in these months. Forecasting analysis was employed to quantify the variation in prices and also to forecast cumin seed prices. The forecasted prices in all the markets showed an increasing value. Co-integration analysis between spot and futures prices for cumin seed showed high co-integration between markets. Hence, cumin economy should take this advantage to encourage the production of cumin. The analysis revealed that, storing cumin and selling of it during off season would help the producer in getting higher returns. Finally it was recommended to disseminate the forecasted prices to farmers for their advantage.

AGRICULTURAL ECONOMICS

Production and marketing of major vegetables in Belgaum district –An economic analysis

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Vegetables are rich and comparatively cheaper sources of vitamins. India stands as the largest producer of vegetables in the world after China; it contributes over 13 per cent to the world vegetable production. The study was conducted in Belgaum district having second highest area under vegetables in the state. The area and production of major vegetables was increasing in the district during 2003-04 to 2011-12. The multi-stage random sampling

procedure was adopted to choose the 120 sample farmers from selected two taluks. The study revealed that vegetable production is more labour intensive and per hectare labour utilization was highest in case potato farms (78.77 man days) followed by onion farmers (70.25 man days), tomato farmers (66.37 mandays) and green chilli farmers (48.13 man days). The total cost incurred by farmers on potato cultivation was highest at ₹47299.86/ha as

compared to onion (₹ 31240.2/ha), green chilli (₹ 25797.37/ha), and tomato (₹ 27532.42/ha) and was attributed to high seed rate in potato. The net returns were quite high in vegetable production and it was highest in onion (₹ 93278.43/ha) and lowest was in case of green chilli (₹ 29452.63/ha). The Cobb-Douglass production function indicated decreasing returns to scale for all the vegetable crops. The MVP to MFC ratio for seed was 19.06, 3.10, 12.53 and 7.49 for onion, potato, green chilli and tomato farmers,

respectively indicated higher scope to intensify use of the input. The producer's share in consumer rupee for these major vegetables ranged between 50 to 58 per cent in Channel-I (through village merchant) and was between 45 to 55 per cent in Channel-II (through commission agent). Non-availability of labour was the major problem expressed by most of the respondents. High incidence of pest and diseases was another serious problem as experienced by many respondents.

An economic analysis of production of major crops in Dharwad district

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2013

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The cost of cultivation is an important economic indicator being taken into consideration by Government of India. Early 1970 farmers were using farm produced inputs for cultivation. It was after 1970, that is after the advent of green revolution, agriculture practices became more capital intensive and costlier. Therefore reliable and representative estimates about cost of cultivation of agricultural crops are obvious for formulating an appropriate strategy for planned agricultural development. The present study was under taken in Dharwad district. Random sampling technique was employed for selection of the sample farmers. Total sample size was 150. Chickpea, Cotton, Paddy, Soybean, Chilli and Maize were selected as a major crops. Analytical tools such as mean and averages, cobb-douglas production function, budgeting technique and garret ranking technique

were used. It was revealed from the study that farmers in the study area were inclining towards cultivation of commercial crops which gives more remunerative returns compare to food-grains. Farmers were not utilizing the inputs efficiently in cultivation of crops. Cost of cultivation of selected crops under rainfed situation was found to be ₹ 25181.16, ₹ 226269.66, ₹ 19324.56, ₹ 28178.37, ₹ 36986.72 and 21509.00 for chickpea, paddy, soybean, cotton, chilli and maize, respectively. Cultivation of cotton, chilli and maize under irrigated condition were found to be ₹ 34835.73, ₹ 36986.72 and ₹ 25811.04 respectively. It is more profitable to grow cotton under both irrigated (2.46) and rainfed (2.25) situations compare to chickpea (1.58), paddy (1.26), soybean (1.72), irrigated chilli (2.43), rainfed chilli (2.07), irrigated maize (1.88) and rainfed maize (1.80).

Impact of labour scarcity on the agricultural economy of Dharwad district

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Labourers constitute a vital input in agricultural production. Scarcity of farm labourers is a grave concern for the farmers, who may not even hesitate to abandon farming. Taking into consideration this pressing problems existing in agricultural economy, the present study was undertaken in Dharwad district of Karnataka state. Multistage random sampling procedure was adopted for the selection of the district, taluks, villages and farmers. A total of 120 farmers were selected for collecting the required information for the study. Tabular analysis, Compound Growth Rate Analysis, Markov Chain analysis and Garrett ranking technique were used for the analysis of data collected for the study. The study revealed that the labour demand exceeded labour supply during the eight months, viz. January, May, June, July, August, October, November and December. It

was also found that the labour scarcity reached its peak during the sowing and weeding operations in both *rabi* and *kharif* seasons. A shift in cropping pattern was observed among the different groups of crops. The shift was usually seen from High Labour Intensive (HLI) crops to other HLI crops and Less Labour Intensive (LLI) crops, from Medium Labour Intensive (MLI) crops to other MLI crops and LLI crops and from LLI crops to all the three groups. Owing to the labour scarcity and the associated high wage rate, the small farmers, who were unable to hire casual labourers, exhibited lower productivity levels for the HLI crops compared to the large farmers. Among the various reasons reported by the farmers, the migration of the labourers to the nearby villages for higher wages was opined as the most serious one contributing to labour scarcity.

Impact assessment of water management practices of Malaprabha Command area- an economic analysis

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2013

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The present study was conducted to know the impact of different irrigation methods on yield, income and water savings in major crops. Hebsur, Kumaragoppa, Kanakikoppa, Guralikatti, Hunasikatti, Mugnur and Naragund villages of Malaprabha command area were purposively selected since the interventions on scientific water management practices were implemented in these villages under RKVY project. The major occupation of the farmers was agriculture and the crops selected for the study were maize, wheat, chickpea and cotton. The border strip method of irrigation proved to be efficient in maize, wheat and chickpea with a yield of 47.86 q/ha, 28.50 q/ha and 20.75 q/ha respectively and the corresponding income was ₹ 37634.55/ha, ₹ 20851.01/ha and ₹ 89404.54/ha respectively. In maize, water savings was to the extent of 41.98 per cent and 38.12 per cent compared to flood and furrow

irrigation respectively. In wheat and chickpea it was 30.17 per cent and 34.82 per cent respectively under flood irrigation. In case of furrow irrigation it was 26.51 per cent and 22.93 per cent respectively. In cotton, alternate furrow irrigation was proved to be efficient with highest yield (20.36 q/ha) and income (₹ 82555.28/ha), with lowest water consumption of 9.65 ha cm. Incidence of pest and diseases, non availability of labour, lack of sufficient water supply, lack of power supply and non availability of credit in time were the major problems faced by the farmers. The intervention programmes were successful and there was significant improvement in the yield, income and water savings. Spread of many water management technologies were satisfactory as these were simple to adopt, cost effective and enhance the yield and income of the farmers substantially.

Engendering rural livelihoods in Karnataka: A Socio - Economic Assessment

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The study analyses the existing rural livelihood systems in Dharwad district of Karnataka state in terms of roles played by men and women in farm and non-farm activities, gender disparity in wage earning and decision making and problems faced by women at work. The multistage random sampling technique was employed to select 120 respondents comprising equal number of landless, marginal, small, medium and large farmers of the study area. Primary data required for the study were elicited from the

respondents by personal interview method using well-designed and pre-tested schedule. For processing the primary data to draw meaningful results, descriptive analytical tools, multiple regression model, Student's 't' test and Garrett ranking test were employed. The present study revealed that crop production was the main source of livelihood activity, while the other activities contributed insignificantly to the farm household's employment and income. The human labour employment was the highest

in the case of non-farm wage employment compared to crop production. The disparity in wages between male and female was higher in farm activity than in non-farm activities. The labour wages of male over female in farm activity were higher by 77.68 per cent while the corresponding figure in non-farm activity was 57.58 per cent. In farming, nearly 76 per cent of the decisions related to selection of crops/varieties were taken by adult males, while about 80 per cent of the financial decisions

were taken by the adult males. In most of the household's decisions related to education of family members, both men and women had almost equal participation in decision making, while in social matters like marriage of son/daughter, more than 70 per cent decisions were taken jointly. Women faced numerous problems at work, important ones of which were back pain due to continuous working, long working hours and harsh climatic condition at work.

Impact of on-farm demonstrations (OFD) on paddy yield and income of farmers in tank commands of Dharwad district

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The present study was conducted in Dharwad and Kalghatagi taluks of Dharwad district of Northern Karnataka. The major objective of the study was to analyse the impact and resource use efficiency in demonstrations of paddy. A sample of 120 farmers comprising of 60 demonstrated and 60 traditional farmers were selected randomly for paddy crop and data were elicited for the agriculture year 2010-11 through survey method. The analytical tools used were Cobb-Douglas production function, output decomposition model and Garrett's ranking. The estimated cost of cultivation of paddy in demonstrated field was ₹ 30,064.53 per hectare as compared to traditional field was ₹ 32,652.74. The paddy yield per hectare obtained was 45.89 quintals in demonstrated plots ₹ as compared to 37.66 in traditional farmers. The net returns per hectare in demonstrated farmers and traditional farmers was ₹ 11,193.40 respectively. The net additional

benefits from demonstrations were ₹ 13,760.07 per hectare. The additional returns over traditional farmers were ₹ 11,379.50 per hectare. The B:C ratio in demonstrated farmers was higher 1:1.82 as compared to traditional farmers 1:1.34. In ₹ 2,380.57 less per hectare than the traditional farmers. The multiple regression analysis in case of paddy revealed that, the variables included in the model like seeds, human labour and OFD component significantly influenced gross returns in demonstrated farmers and chemical fertilizer and plant protection chemicals significantly influenced gross returns in traditional farmers. The results of decomposition analysis indicated that total difference in output between demonstrated and traditional was 25.68 per cent and OFD component alone contributed 17.35 per cent. The major constraint in paddy production faced by the demonstrated farmers was low adoption due to non-availability of tank water.

Financial inclusion through joint liability group approach in Dharwad district – An economic analysis

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This study was undertaken to study the extent of financial inclusion in Dharwad district. A sample of 30 stakeholders and 60 Joint Liability Groups (JLGs) were selected. The major reasons for formation of JLGs given by stakeholders was to provide quantum of credit larger than micro-credit and easy accessibility to financial services (16.67 per cent). JLG members opined that the major reason was to reduce risk (38.33 per cent). In Dharwad district, Navalgund lead with the highest value of an Index of Financial Inclusion (IFI) with 0.5649 as first rank because of the high demand for credit. All the taluks contributed to the overall district IFI of 0.5607 this made Dharwad district to fall in high IFI category. To know the operation of No-frills accounts Operationalisation Index (OI) was employed and the results revealed that it was to the extent of 43.46 per cent. A total of 320 JLGs were covered in a span of three years under financial inclusion drive in Hubli Taluk. The flow of credit and recovery

was the highest in Hubli with 42.23 and 88.28 per cent respectively. The multiple regression analysis revealed that results were significant with R^2 value of 81.58 per cent in 2009 and 89.28 per cent in 2012. Theils entropy technique revealed that the highest concentration was in Navalgund (0.93). There was improvement in socio-economic status of JLG members. Gini co-efficient was used to know the income distribution of sample respondents in pre and post JLG situations and results were 0.6362 and 0.5979 respectively. The opinion of stakeholders was success in timely credit availability (76.67 per cent). The problems opined by stakeholders as revealed through Garrette analysis were lack of regular meetings and by JLG members was lack of skill and knowledge about JLG programme. Extent of concordance towards sustainability of JLGs was given by Kendall's W co-efficient (0.7998) and was significant at one per cent. A whole-hearted effort is called for from all the corners of the society.

Economics of production and marketing of garlic in North Karnataka

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2013

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Garlic (*Allium sativum* L.) is one of the most important bulbous spice crops both in India and world. India is the second largest producer of garlic in the world. In Karnataka state garlic is cultivated in the selected pockets as sole and inter crop, amounts to 2.01 per cent of the countries total garlic area, contributing 2.31 per cent to the countries garlic production. To study the economics of the production and marketing of garlic multi-stage random sampling was followed to select 120 farmers from Dharwad and Haveri district of northern Karnataka. Time series data (1999 to 2008) used to study the crop performance. In comparison with garlic area of Haveri district with Dharwad district indicated increasing trend. The per ha garlic total cost of production observed to be relatively higher for Ranebennur taluka farmers of Haveri district (₹ 43761.88) as compared to Kundagol taluka farmers of Dharwad district

(₹ 43499.70). The per ha net returns and B:C ratio for Kundagol farmers were observed to be higher (₹ 79098.84 and 2.81) as compared to Ranebennur farmers (₹ 77047.80 and 2.76). The summation of output elasticities indicated increasing returns to scale for Ranebennur taluk (1.70) as compared to Kundagol taluk (1.43). In both taluks the MVP to MFC ratio was less than unity for human and bullock labours, indicating the over utilization of these resources. The ratio was more than unity for seed, FYM, chemical fertilizer and plant protection chemical for both taluk farmers. In comparison with identified two marketing channels of Kundagol taluka, the producer's share in consumer rupee was found to be highest (90.49) under Ranebennur taluka marketing channel. Non-availability of labour and good quality seeds were considered as constraints by garlic sample farmers.

AGRICULTURAL ENTOMOLOGY

Screening of rabi sorghum genotypes for resistance against rice weevil [*Sitophilus oryzae* (L.)] and management through botanicals

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Studies on screening of rabi sorghum genotypes, assessment of biochemical basis for the grains resistance and evaluation of botanicals against rice weevil were carried out under laboratory conditions at Bijapur, University of Agricultural Sciences, Dharwad, during 2012-13. Among the 20 rabi sorghum genotypes evaluated for the resistance, the genotypes like M 35-1, KMJ 1, AKJ 1, RSJ 1 and CSV 216R possessed higher resistance to *S. oryzae* with respect to different characters like per cent grain damage (21.20, 27.20, 28.00 and 36.00% respectively) seed weight loss (4.43, 6.40, 5.60, 5.60 and 7.20g respectively), population buildup (25.50, 25.00, 15.00, 25.50 and 30.50 respectively) and germination percentage [KMJ 1 (100.00%), RSJ 1 (93.00%) and CSV 216R (91.50%)]. Whereas, BR 33, BJV 44, BRJ 204 and Phule Revati were susceptible to the pest. The physical parameters such as force [M35-1 (149.49), AKJ 1 (104.24), RSJ 1 (98.63), and KMJ 1 (98.39) N] and time required [7.51, 7.50, 7.46 and 7.37 sec. by the

genotypes KMJ 1, M 35-1, RSJ 1 and CSV 216R respectively] to crush the grains are having direct influence on the resistance power of the grains, whereas, other physical parameter viz., distance (size of the grain) has no effect either on susceptibility or resistance. The biochemical constituents viz., phenols [AKJ 1 (4.75), KMJ 1 (3.88) and M 35-1 (3.75) mg g⁻¹] and tannins [AKJ 1 (5.70), KMJ 1 (6.65), M 35-1 (6.01), RSJ 1 (4.75) mg g⁻¹ of the grain] are having direct influence on the resistance power of the grains, where as other biochemical constituent protein [BR 33 (13.49 mg), BJV 44 (12.94 mg), Phule Chitra (10.53 mg) and Phule Revati (10.30 mg) g⁻¹ grain] induces susceptibility in sorghum grains to rice weevil. Among the botanicals used for the management of rice weevil, neem seed kernel powder @5%, Clerodendron @5% leaf extract and Calotropis @5% leaf extract (19.93%, 19.03% and 18.00% mortality respectively) have strong potential in the management of rice weevil.

Varietal screening, loss estimation and management of cowpea pests

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2013

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The studies on screening of different cowpea genotypes against different pests, crop loss estimation and evaluation of newer insecticides against pod borers and sucking pests under field conditions were undertaken during *khari* 2012. Results indicated that morphological characters under study failed to exhibit any significant relationship with the flower and pod damage in relation to resistance or susceptibility, except days taken for 50 per cent flowering and maturity which showed positive correlation. Cowpea genotypes C-152 and DC-15 were categorised as moderately resistant and DC-47-1, GC-3, RC-101 and PGCP-6 as intermediate to pod borers. The avoidable losses varied from 47.23 to 62.52 and 48.51 to 62.91 per cent in C-152 and DC-15 varieties, respectively with quinalphos 25 EC @ 2.0 ml/l spray at different intervals. Highest seed yield of 14.49 and 14.05 q/ha was obtained in C-152 and DC-15, respectively when crop was protected by three sprays

with quinalphos 25 EC @ 2.0 ml/l at 40, 55 and 70 days after sowing (DAS) followed by two sprays at 55&70 DAS and 40&70 DAS. Efficacy of flubendiamide 480 SC @ 0.1 ml/l afforded highest protection against pod borers *Maruca vitrata*, *Cydia ptychora* and *Lampides boeticus* with 87.15, 100.00 and 100.00 per cent after second spray, respectively. The next best treatments were emamectin benzoate 5 SG @ 0.2 g/l (87.43, 79.88 and 85.30%) and profenophos 50 EC @ 2.0 ml/l + dichlorvos 76 EC @ 1.0 ml/l (86.33, 87.93 and 93.70%). Imidacloprid 17.8 SL @ 0.25 ml/l (80.50, 87.13, 83.00 and 88.09%), acetamiprid 20 SP @ 0.25 g/l (78.93, 88.97, 85.10 and 92.06%) and diafenthiuron 50 WP @ 1.0 g/l (58.49, 80.88, 80.14 and 71.42%) recorded higher protection against leafhopper (*Empoasca kerri*), thrips (*Megalurothrips* sp.), pentatomid bugs (*Nezara viridula*) and coreid bugs (*Riptorus pedestris*), respectively.

Surveillance and management of insect pests of groundnut crop with special reference to *Thrips palmi* (Karny)

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2013

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The present investigation was carried out to study the surveillance of groundnut pests along with natural enemies, screening for resistance against thrips and biochemical analysis of selected varieties, estimation of yield loss and economic injury level (EIL) and management of groundnut thrips using bio-pesticides and biorationals. The surveillance studies indicated higher incidence of thrips during last week of February and that of leafminer was during last week of February to first week of March. Incidence of *Spodoptera* was maximum between second and last week of the March. Similarly, coccinellids and spiders revealed that their peak abundance was observed between February last week to first week of the March and during last week of March, respectively. Experiment on screening resistance indicated variety TGLPS-3 found resistant to thrips incidence by recording

lower thrips population (4.8 thrips/terminal bud) and per cent foliage damage (18.18%) among twenty varieties used for screening. Biochemical analysis indicated that the leaf water ($r=-0.219$) and phenol content ($r=-0.850$) have negative relationship with thrips incidence. Results of yield loss estimation revealed increased thrips population resulted in to increased yield loss. Highest yield reduction was recorded in treatment plants with 20 thrips per terminal bud (1.54 g/plant) and estimated EIL for thrips was 7.28 per terminal bud. Management of groundnut thrips and leafminer study have shown that spinosad 45SC 0.2 ml/l found effective against both pests and among the biopesticides *Lecanicillium lecanii* at 6 g/l was most effective in reducing the thrips population and *Beauveria bassiana* @ 6 g/l was effective against leafminer.

Bio-ecology and management of grape mites

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2013

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Bioecology and management studies on two spotted spider mite *Tetranychus urticae* Koch infesting grapes were carried out during 2012-13. From roving survey it was evident that in Northern Karnataka mite incidence was severe with mean population of 18.41 ± 2.4 , 12.0 ± 1.8 , 11.7 ± 0.2 and 7.5 ± 0.8 per sq inch of leaf in Bijapur, Belgaum, Bagalkot and Koppal districts respectively. In Southern Karnataka population was negligible. Seasonal dynamics studied revealed maximum incidence of mites during 15th and 17th standard weeks with population of 25.5 ± 0.9 and 24.9 ± 1.4 at Bijapur and Atharga, respectively. The predatory arthropods observed were coccinellid beetle and predatory mite, *Euseius* sp. There was positive and significant correlation between mites and temperature where as negatively

significant negative relation with relative humidity. In laboratory study the fecundity of *T. urticae* reared on grape leaves was 66.53 ± 4.93 eggs/female. The female and male longevity was 15.09 ± 0.56 and 8.63 ± 0.30 days respectively. The period occupied by young stages was 12.55 ± 0.82 days. Bio-efficacy studies showed that hexythiazox 5.45 EC (1.5 mL/L), abamectin 1.9 EC (0.5 mL/L) and propargite 57 EC (2.0 mL/L) as highly effective acaricides against grape mites. With three sprays the mite incidence reduced from 185.21 to 3.67 per four leaves from hexythiazox application which rendered 355.81 quintal per hectare grape berry yield. From abamectin spray the population suppressed from 184.50 to 8.00 per four leaves where in the yield was 337.81 q/ha.

Phytotoxicity and bioefficacy of biorationals and Insecticides against sorghum shoot fly

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2013

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Investigations on Phytotoxicity and bioefficacy of biorationals and insecticides against sorghum shoot fly were undertaken at University of Agricultural Sciences, Dharwad during *Kharif* 2012-13. Among biorationals viz., NSKE, pongamia pod extract, Vitex negundo and plant mixture and oils viz., linseed and sunflower oil and among chemical insecticides viz., monocrotophos 36 SL, imidacloprid 17.8 SL, spinosad 45 SC, acephate 75 SP, indoxacarb 14.5 SC, carbaryl 50 WP, emamectin benzoate 5 SG, flubendiamide 480 SC, acetamiprid 20 SP and carbofuran 3G were found safe and they showed no phytotoxicity symptoms at recommended and four times the recommended dosage. Cypermethrin 25 EC (2 ml/l), lambda cyhalothrin 5 EC (2 ml/l), alphamethrin 10 EC (2 ml/l), fenvalerate 20 EC (2 ml/l), quinalphos 25 EC (8 ml/l), dimethoate 30 EC (6.8 ml/l) and malathion 50 EC (8 ml/l) found not safe to sorghum at four times the

recommended dosage at seedling stage. Among biorationals, at 21 DAE, NSKE (5%) recorded significantly least eggs (1 egg/plant) and on par with carbofuran 3G (30 kg/ha) which recorded 0.67 eggs/plant. At 28 DAE, NSKE (5%) sustained least dead heart due to shoot fly (27%) and found superior over other treatments and found next best to carbofuran 3G (30 kg/ha). NSKE (5%) recorded highest grain yield of 28.89 q per ha but found inferior to carbofuran 3G (30 kg/ha) (36 q per ha). Among chemical insecticides at 21 DAE, imidacloprid 17.8 SL (0.3 ml/l) found superior in reducing shoot fly oviposition by recording 0.87 eggs per plant and on par with carbofuran 3G (0.80 eggs/plant). At 28 DAE, imidacloprid 17.8 SL (0.3 ml/l) recorded 24.50 per cent deadhearts and yielded 33 q per ha. However it is found inferior to carbofuran 3G (30 kg/ha) which yielded 38.19 q per ha.

Management of thrips and mites in carnation using biorationals and new chemicals

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2013

MAJOR ADVISOR: Dr. R. S. GIRADDI

The present investigations were carried out under protected cultivation to study the seasonal incidence of thrips and mites on carnation, screening of carnation varieties against thrips and mites, to assess the effectiveness of biorationals and new chemicals for the management of thrips and mites. Seasonal incidence studies indicated that incidence of the thrips population on leaves and flowers was at peak during April and lowest during December and July. There was positive correlation between thrips population v/s temperature and relative humidity. Among the varieties, *Randez Vous*, *Liberty* and *Lisa* were identified as the best varieties by recording lowest thrips population, higher total number of flowers, good flowers, diameter of flowers and number of branches/plant and also recorded lowest malformed, unopened and discoloured flowers. Among

the biorationals evaluated against thrips, *Lecanicillium lecanii* @ 2 g/l was an effective treatment followed by *Beauveria bassiana* @ 2 g/l and NSKE @ 5%. With respect to mite, *L. lecanii* @ 2 g/l was found to be significantly superior followed by NSKE @ 5% and garlic chilly kerosene extract @ 0.5% + cow urine @ 5%. Among the new chemicals, sequential spray of Chlorfenapyr 10 SC followed by Fipronil 5 SC was found to be the best treatment against thrips followed by chlorfenapyr 10 SC – thiamethoxam 25 WG and Diafenthiuron 25 WP - Diafenthiuron 25 WP sprays. Similarly, Abamectin 1.9 EC - Abamectin 1.9 EC sprays recorded significantly less number of mites followed by diafenthiuron 25 WP - Diafenthiuron 25 WP and fenazaquin 10 EC -thiamethoxam 25 WG sprays.

Evaluation of few newer insecticide molecules against *Helicoverpa armigera* (Hubner) and its management in chickpea

B. B. BASAVANNEPPA

2013

MAJOR ADVISOR: Dr. R. A. BALIKAI

Investigations on evaluation of new molecules of insecticides and their toxicity, ovicidal action, field efficacy on *Helicoverpa armigera* (Hubner) with phenotypic and genetic variation in larvae on different hosts was carried out during 2012-13. Cyantraniliprole 10 OD was found to be most toxic to *H. armigera* with LC₅₀ value of 0.19 ppm followed by flubendiamide 480 SC (0.45 ppm), emamectin benzoate 5 SG (1.04 ppm) and chlorantraniliprole 18.5 SC (2.47 ppm). The mean egg mortalities of *H. armigera* were highest in thiodicarb 75 WP @ 1 g/l (88.33%) followed by flubendiamide 480 SC @ 0.1 ml/l (80.00%), indoxacarb 15.8 EC @ 0.3 ml/l (73.33%) and chlorantraniliprole 18.5 SC @ 0.15 ml/l (71.66%). Cent per cent protection over control after second spray was obtained by flubendiamide 480 SC @ 0.1 ml/l and emamectin benzoate 5 SG @ 0.2 g/l followed by cyantraniliprole 10 OD @ 0.3 ml/l (96.32%), indoxacarb 15.8 EC @ 0.3 ml/l (93.26%), chlorantraniliprole

18.5 SC @ 0.15 ml/l (93.26%). Higher B:C ratio was obtained by emamectin benzoate 5 SG @ 0.2 g/l (1:4.99) followed by flubendiamide 480 SC @ 0.1 ml/l (1:4.92), indoxacarb 15.8 EC @ 0.3 ml/l (1:4.82) and cyantraniliprole 10 OD @ 0.3 ml/l (1:4.50). Different colour morphs of *H. armigera* larvae were collected from ten host plants. Higher larval weight was recorded in chickpea and cotton. Longer larval length was noted in chickpea, red gram and cotton. Irrespective of host plants, greenish and dark green colour (23.5 and 23.0%, respectively) morphs were dominant. Characterization of *H. armigera* by RAPD-PCR showed genetic homogeneity in the larvae collected from different hosts. The highest number of 14 amplicon levels were produced by the primers H-18, followed by 13 levels by AB-11. An average of 7.42 amplicon levels per marker noticed were polymorphic with 1.3 polymorphic amplicons per marker.

Bioecology and management of mite, *Schizotetranychus baltazari* Rimando (Acari: Tetranychidae) on acid lime

PRAVEEN KOTTALAGI

2013

MAJOR ADVISOR: Dr. S. B. JAGGINAVAR

Bioecology and management studies on acid lime mite *Schizotetranychus baltazari* Rimando infesting lime were carried out during 2012-13 at college of Agriculture Bijapur. From roving survey it was evident that in Northern Karnataka mite incidence was severe with mean population of 317.98, 220.40, 117.4 and 0.55 per 20 leaves in Bijapur, Gulbarga, Bagalkot and Belgaum districts respectively. Maximum number of grade I marketable fruits were recorded from Belgaum and minimum was recorded in Bijapur. Highest numbers of infested fruits were observed in Bijapur and least was observed in Belgaum district. Seasonal dynamics studied revealed maximum incidence of mites were recorded during April and May months at Jumnal and Tadavallaga. The predatory mite was observed in both locations. There was positive and significant correlation between mites and temperature where as negatively significant negative

relation with relative humidity and rainfall. Maximum number of infested fruits observed in the month of April to May. Least was observed during November. In laboratory study the fecundity of *S. baltazari* reared on acid lime leaves was 55.75 ± 10.37 /eggs/female. The female and male longevity was 15.25 ± 0.56 and 8.58 ± 0.28 days respectively. The period occupied by young stages was 13.31 ± 1.19 days. Bio-efficacy studies showed that Spiromesifen 240 SC (0.50 ml/ l), Difenthiuron 50 SC (0.80gm/ l), hexythiazox 5.45 EC (1.5 ml/ l) and abamectin 1.9 EC (0.5 ml/ l) as highly effective acaricides against acid lime mite. With two sprays, the mite incidence reduced from 22.13 to zero mites per leaf from Spiromesifen application which rendered 28.20 tonnes per hectare lime yield. From Spiromesifen 240 SC and Difenthiuron 50 SC recorded the highest yield and net profit.

Optimisation of *Apis cerana* Fab. colonies for pollination in sunflower

SHIVANAGOUDA K. PATIL

2008

MAJOR ADVISOR: S. T. PRABHU

Studies on the pollinator fauna and their relative abundance, foraging behavior of different species of honey bees and determination of number of *A. cerana* colonies required for enhancement of yield parameters in sunflower were carried out during *kharif* and *rabi* seasons of sunflower crop in Haveri district during 2012. Hymenopterans were the most dominant pollinators and *Apis dorsata* constituted 31.43 per cent of the total pollinators in during *kharif* season and 33.26 per cent during *rabi* season. Foraging activity was seen throughout the day as well as throughout the observation period. The crop with *A. cerana* colonies recorded the

more bee activity in the morning (0700 h to 0900 h). Foraging activity is positively correlated with temperature and negatively correlated with relative humidity. There was an increase in the seed test weight to an extent of 20 to 98 per cent over control in the crop with bee colonies. Similarly there was increase in the per cent seed filling (3 to 12 per cent). Whereas increase in oil content (18 to 19 per cent) and increase in yield (27 to 68 per cent) was recorded in the crop with four bee colonies/acre, which was on par with two bee colonies/acre. Thus two *A. cerana* colonies per acre are required for optimum pollination and improving the sunflower yield.

Studies on snail, *Cryptozona semirugata* (beck.) on major field crops

A. G. SHILPA

2013

MAJOR ADVISOR: Dr. K. BASAVANAGOUD

The roving survey on the incidence level of *Cryptozona semirugata* (Beck.) on major crops grown in different villages revealed that, irrespective of the locations maximum population of snails and mean per cent plant damage was noticed during 28th Std week and 24th std. week, respectively in black soil in Hebbali Farm followed by Narenda and Kamlapur village. Across the locations, the snail population was maximum on bund followed by field near bund (FNB) and inside the field during the cropping period in all the villages surveyed. In Narenda and Chikkamalligwad villages where all the crops grown in red soil area were totally free from snail incidence. The comparative data on the fixed plot survey showed that the snail population was more on bund than FNB and inside the field. The per cent plant damage was more in FNB compared to inside field. Based on the per cent plant damage greengram

(11.32 and 4.27 %) was highly preferred crop than other crops grown in the surveyed areas. Snail population was positively and significantly correlated with rainfall, maximum and minimum RH, irrespective of the crops. The per cent plant damage and per cent leaf area consumption increased with increase in snail population from 2 to 10 per treatment at 7, 15 and 30 at days after sowing. The per cent plant damage and per cent leaf area consumption at 7 DAS was more compared to 15 and 30 DAS. Metaldehyde (94.83%), common crystal salt (89.03%), copper sulphate (72.22%) and bleaching powder (70.08%) proved highly effective in recording higher per cent mortality of snail in field experiment. Highest grain yield of 6.39 q/ha was registered with metaldehyde 2.5%. Common crystal salt revealed highest net returns of ₹ 25,328/- with a BC ratio of 3.03 compared to all other treatments.

Pollinator fauna, foraging activity and effect of bee attractants on seed yield of lucerne

V. T. CHAVAN

2013

MAJOR ADVISOR: Dr. SHASHIDHAR VIRAKTAMATH

Investigations were carried out to study the pollinator fauna, their relative abundance, foraging activity of various species of pollinators in different seasons and effect of bee attractants on bee visitation and yield of lucerne at Dharwad. As many as 38 species of pollinators were foraging on lucerne flowers. Of these, hymenopterans included 19 species forming 63.58 per cent of total pollinators. Lepidopterans included 17 species and dipterans 2 species which altogether constituted 36.42 percent of total pollinators. The most dominant pollinator was *Apis cerana* (29.62 %) followed by *A. florea* (19.57 %) and *A. dorsata* (14.39%). All the species of pollinators were active throughout the flowering season in summer, monsoon and winter. Higher activity of *A. cerana*, *A. florea*, non-*Apis* bees and other pollinators was observed during summer and winter season. But activity of *A. dorsata* was higher during monsoon and winter. Application of Fruit

boost, sugar solution, *Swertia densifolia*, *Fagara budrunga*, tuberose floral extract and Citral Z enticed more number of bees (4.50 to 12.70 bees /m²/ 5 minutes) compared to water sprayed crop (control) (3.67 to 5.20 bees /m²/5 minutes). Spraying of bee attractants improved the number of pods per plant (43.20 to 44.80 as against 42.87 pods/plant in control) as well as the number of seeds per pod (5.13 to 5.57 as against 5.03 seeds/pod in control). Highest yield was obtained from Fruit boost sprayed crop (220 kg/ ha). Sugar solution was the next best treatment in increasing the yield (200 kg/ ha) followed by *F. budrunga*, tuberose floral scented water, *S. densifolia* and Citral Z (145 to 180 kg/ ha). All the bee attractants enhanced the yield to the extent of 25.00 to 83.33 per cent over unsprayed crop. Germination of seeds and seed vigour index were enhanced by application of the bee attractants.

Studies on species composition and population dynamics of coccinellids

MEGHAR. RAIKAR

2013

MAJOR ADVISOR: Dr. K. BASAVANAGOUD

Investigations on species composition and population dynamics of coccinellids were carried out during 2012-13 at MARS, University of Agricultural sciences, Dharwad. Survey was carried out in three different ecosystems viz., agricultural, horticultural and organically grown crops. A total of 18 different species were collected. The species were *Coccinella transversalis* Fabricius, *Micraspis discolor* Fabricius complex, *Brumoides suturalis* Fabricius, *Cheilomenes sexmaculata* Fabricius, *Chilocorus melas* Weise, *Propylea dissecta* Mulsant, *Rodolia fumida* Mulsant, *Coelophora bissellata* Mulsant, *Epilachna vigiculntioctopunctata* Fabricius, *Telsimia bangalorensis* Kapur, *Harmonia octomaculata* Fabricius, *Scymnus castaneus* Sicard, *Illeis cincta* Fabricius, *Scymnus coccivora* Ayyar, *Illeis* sp. (Bistigmosa group), *Pseudaspidimerus flaviceps* Walker, *Hippodamia variegata* Goeze and *Scymnus nubilus* Mulsant. Parasitisation of predator, *C. sexmaculata* grubs and pupae by encyrtid parasitoid, *Homalolytes* sp. caused 15-94 and 15-95 per cent parasitization, respectively. During the cropping season, the activity of coccinellids

and aphids was noticed from 29-33rd and 29-31st standard week in sorghum, respectively; In maize the activity of coccinellids and aphids was noticed from 33-37th standard week, in cowpea the activity of coccinellid predators and aphids was noticed from 46th - 5th standard week. In safflower the activity of coccinellids and aphids was noticed from 48th - 51st and 47th to 51st standard weeks respectively. In Lucerne the activity of predatory coccinellids was noticed during 27-28th, 31-37th 40-43rd 51-4th standard weeks. Toxicity of various insecticides to the adults of *C. sexmaculata* and *H. variegata* was studied under laboratory condition. Fenvalerate (60%) and imidacloprid (63.33%) were found to be relatively safer to *C. sexmaculata* and Thiomethaxam and fenvalerate were found to be safer to *H. variegata* by causing 46.67 per cent mortality compared to other test insecticides. Whereas, dimethoate, dichlorvos, monocrotophos, Oxydemeton-methyl, methyl parathion, nimbicidine and malathoin were completely toxic with 100 per cent mortality to both the coccinellid species.

AGRICULTURAL EXTENSION EDUCATION

Awareness, accessibility and utilisation pattern of information and communication technology (ICT) projects by farmers of Belgaum district

VISHWATEJ RUDROJU

2013

MAJOR ADVISOR: Dr. J. G. ANGADI

This study was conducted in the year 2012-13 to elicit the knowledge and utilisation pattern of ICT projects by the farmers of Belgaum district. Among the various ICT projects in operation, four projects were selected for the study namely, Kisan Call Centre (KCC), e-Choupal, Krishi Marata Vahini and Raith Mitra Kendra's web portal. A sample of 140 respondents was selected randomly and was personally interviewed using pretested schedule. It was revealed that most of the respondents had high knowledge of KCC (40.00%), followed by medium knowledge of e-Choupal (39.29%) and Krishi Marata Vahini (37.14%) but low knowledge of Raith Mitra Kendra (30.71%). Most of farmers with high knowledge of all four ICT projects were young (53.33%) followed by middle age (22.03%) and old farmers (15.69%). It was also observed that 65.71 per cent of respondents were utilising information services

of KCC, 61.43 per cent and 55.71 per cent of them were utilising services of Krishi Marata Vahini and e-Choupal, respectively. Only, 35.71 per cent of respondents were utilising Raith Mitra Kendra's web portal for agriculture related information. Most of the farmers were utilising Krishi Marata Vahini (61.43%), e-Choupal (46.43%) for information regarding market prices, KCC (47.86%) and Raith Mitra Kendra (32.14%) for information regarding crop protection. Lack of adequate skills to use ICTs (73.57%) and lack of proper infrastructure (61.43%) were the major constraints in effective utilisation of ICT projects by farmers. Majority of the farmers had suggested for providing them training in operating ICT tools (74.29%), providing adequate knowledge of various ICTs projects (67.86%) and linking ICT projects with other services (61.43%).

Knowledge and opinion of farmers regarding bhoochetana programme

JAYASHRI S. MAVINAKATTI

2013

MAJOR ADVISOR: Dr. J. G. ANGADI

A study on knowledge and opinion of farmers regarding Bhoochetana programme was carried out during 2012-13. One hundred and fifty beneficiaries of Bhoochetana formed the sample for study. The data was collected by personal interview with the help of structured schedule which was developed keeping the objectives of the study. The results revealed that less than half the number of respondents (38.66%) possessed medium level of knowledge followed by low (34.00%) and high (27.34%) levels about Bhoochetana programme. Regarding opinion, majority of the respondents (74.00%) had favourable and highly favourable opinion towards the programme. Higher proportion of them (88.00%) opined that crop yields had increased after implementation of Bhoochetana programme followed by Bhoochetana works towards improving productivity in dryland agriculture (80.66%), standard of living has been increased due to the implementation of Bhoochetana

programme (80.00%), soil conservation work has speeded up due to the Bhoochetana programme (78.66%). Age, education, extension contact, extension participation and mass media participation were positively and significantly correlated with knowledge and opinion of the respondents. Enhanced soil productivity, checked soil and water erosion, increased yield level, reduced pest and disease infestation, helped in increasing the water holding capacity of the soil and increased cropping intensity were the benefits derived from the Bhoochetana programme. Income generating activities should be the main component of training programme (48.66%), need to conduct more extension educational activities (39.33%), adequate supply of inputs (35.33%), subsidy rate has to be increased (32.66%), timely provision of inputs (18.00%), frequency of visits of field staffs need to be increased (14.00%) were the suggestions given by the respondents.

Perception of farmers about functioning of raitha samparka kendras in Dharwad district of Karnataka

T. S. AVINASH

2013

MAJOR ADVISOR: Dr. K. A. JAHAGIRDAR

A Study on "Perception of farmers about functioning of Raitha Samparka Kendras in Dharwad district of Karnataka" was undertaken during 2012-13 with a sample of 120 farmers. The data was collected by personal interview method using structured schedule to assess the perception of farmers regarding functioning and programmes of Raitha Samparka Kendras (RSK), socio-personal characteristics of farmers seeking information, communication methods employed by extension personnel working in RSKs. The data was analysed using statistical tools viz., frequency, percentage and correlation. Majority of the respondents (71.60%) felt that the functioning of RSKs was 'more effective', while 20.80 per cent of the respondents felt 'effective' and remaining 7.50 per cent of the respondents felt 'less effective'. It was observed that majority of the farmers felt the functioning aspects of RSK like general aspects, technical information and extension activities organized by RSK and services provided to farmers were more useful. It was observed

that majority of the farmers felt the programmes of RSK were more useful. Whereas, majority of the respondents belonged to middle age (55.83%), high income category (37.50%), educated up to primary school level (21.66%). Majority of the farmers belonged to medium level category with respect to mass media exposure (44.16%), organizational participation (55.00%), cosmopolitanism (42.50%), scientific orientation (50.83%) and innovative proneness (53.33%). With respect to communication methods cent percent of the extension personnel employed individual, group and mass contact methods for transfer of technology. Annual income, land holding, mass media exposure, organizational participation, extension contact, frequency and purpose of visit, extension participation, cosmopolitanism, scientific orientation and innovative proneness were found to have positive and significant relationship with the perception of farmers on the functioning of RSKs.

A Study on entrepreneurial behavior of commercial seed growers of Dharwad district

K. N. ARCHANA

2013

MAJOR ADVISOR: Dr. K. V. NATIKAR

The present study was conducted in the year 2012-13 in Dharwad district of Karnataka state with a sample size of 180 farmers, constituting 90 seed growers and 90 other farmers. Random sampling procedure was used to select the sample. The data was collected with the help of structured interview schedule. The socio-economic profile of the respondents revealed that, majority (53.33%) of the seed growers belonged to middle age group, 36.67 per cent educated up to PUC, 42.22 per cent belonged to medium land holding category, 38.89 per cent belonged to high income category, 56.67 per cent had high level of farming experience, 77.78 per cent had low experience in seed production, whereas, majority of other farmers (62.22%) belonged to middle age group, followed by high

level of farming experience (71.11%). Most of the seed growers (48.89%) and 40.00 per cent of the other farmers belonged to high and low entrepreneurial behaviour categories respectively. Further, entrepreneurial behavioural characteristics such as innovativeness was high (40.00%) in seed growers and low (44.44%) in other farmers, achievement motivation was high (41.11%) in seed growers and low (35.56%) in other farmers, 46.67 per cent of the seed growers and 50.00 per cent of the other farmers belonged to intermediate and less rational decision making ability category respectively, risk orientation was high (43.33%) in seed growers and low (42.22%) in other farmers, leadership ability was high (45.55%) in seed growers and low (41.11%) in other farmers, management

orientation was high (44.44%) in seed growers and low (35.56%) in other farmers respectively. Majority of the seed growers consulted the formal sources like package of practice booklet (66.67%), informal sources like

progressive farmers (86.67%) and mass media sources like television (94.45%) regularly. Major constraints faced by seed growers were shortage of labourers, high labour wages and financial problems.

A study on awareness and usefulness of Yashaswini co-operative farmers health scheme in Belgaum district

C. H. PAVITRA

2013

MAJOR ADVISOR: Dr. L. MANJUNATH

The present study was conducted in the year 2012-13 in Belgaum district of Karnataka state with a sample size of one hundred and twenty beneficiaries of Yashaswini Co-operative Farmers Health Scheme. The data was collected with the help of structured interview schedule. Majority of the farmers (41.66 per cent) belonged to old age group and (40.83 per cent) belonged to middle age. There was significant difference in the education of the farmers. More number of farmers belong to nuclear type of family (72.50 per cent) and medium family size (46.66 per cent), high farming experience (50.83 per cent), small (2.6 to 5 acres) land holding (27.50 per cent), low annual income group (31.66 per cent), medium mass media exposure (45.83 per cent) high organizational participation (41.66 per cent). The overall awareness and perceived usefulness level of the beneficiaries was high i.e 44.16 per cent and 66.66 per cent respectively.

Most of them are undergone the direct benefits like eye operation, stomach ulcers, hernia, caesarean and uterus operation with 5,000 to 10,000 financial assistance. Age, education, family size, farming experience, mass media exposure, organizational participation showed positively and significantly associated with awareness level of beneficiaries of YCFHS. Age, education, family size, farming experience, organizational participation showed positively and significantly associated with perceived usefulness of the YCFHS. The prime constraints perceived by farmers were the card is valid only one year, remote areas clients have to travel long distance to reach the network hospitals, upper age limit is only 75 years. Further, suggestions offered were scheme should be any farmers, more number of hospitals should be included, card for 5 to 10 years validity period is better and there should not be any upper age limit.

A comparative study on dairy and non-dairy farmers in Belgaum district

KASHAPPA N. MALI

2013

MAJOR ADVISOR: Dr. R. B. BELLI

The present study was conducted in Belgaum district of Karnataka during the year 2012-13. The seventy two dairy and 72 non dairy farmers were selected randomly to constitute sample of 144. Structured interview schedule was used to collect the information through personal interview. Data was analyzed by using suitable statistical tools like mean, frequency, Standard deviation and correlation. The findings of the study revealed that most of dairy farmers (37.50%) had medium knowledge level and majority (65.28%) of them belonged to medium level of adoption category. The socio-economic profile of dairy and non dairy farmers revealed that 54.17 per cent of dairy farmers and 51.39 per cent non-dairy farmers belong to old aged, whereas nearly one third of dairy and non dairy farmers educated up to high school level. Fifty per cent of dairy and 43.06 per cent of non dairy farmers had

medium annual income and less than half (45.83%) of the dairy and non dairy farmers (40.28%) had big size of landholding. However, nearly fifty per cent (48.61%) of dairy and cent per cent of non dairy farmers had medium and low experience in dairying. Less than fifty percent (44.44%) of dairy and more than fifty percent (65.28%) of non dairy farmers had medium and low herd size. Majority (65.28%) of dairy and fifty percent of non dairy farmers had medium and low extension contact. Land holding, dairy experience, extension contact, cropping pattern and subsidiary occupation showed positive and significant relationship at 1% level of probability. The constraints expressed by dairy farmers were non availability of labour, insufficient bank finance for purchase of milch animals, lack of training and non remunerative price of milk.

AGRICULTURAL MICROBIOLOGY

Isolation and characterization of butanol producing *Clostridium* isolates from diverse sources

RAJASHEKAR M. UPPIN

2013

MAJOR ADVISOR: Dr. GEETA G. SHIRNALLI

There is an incessant fluctuation in oil prices besides increasing stress from environmental pollution. The microbial production of biofuel from renewable sources is gaining interest. Biobutanol has advantages over traditional fuel ethanol in terms of energy density and hygroscopicity. Therefore, the present study was conducted to isolate and characterize Butanol producing *Clostridium* sp from diverse sources. In the present study, 42 samples including soil, spoilt fruits etc .were collected from various natural sources from different locations of zone 8 of North Karnataka. A total of 130 biobutanol producing *Clostridium* isolates were isolated following standard Hungates roll tube technique. All the isolates that were Gram positive and forming endospores were considered to be *Clostridium* sp. Among these 47 isolates showed positive for indole production ,and gelatin liquefaction which are the main characters of Butanol producing *Clostridium* sp. Based on the

rifampicin sensitivity, curd formation and riboflavin production the isolates were tentatively identified as, *C. acetobutylicum*, C.NCP 262, *C. saccharoperbutylacetonicum*, *C.beijerinckii*. Fifteen isolates were selected based on their sources for detection of organic acids. viz acetic, propionic and butyric acid by high performance liquid chromatography. The highest production of acetic acid 37.11 mg/ml was detected in CL- 26(3) and the highest butyric acid of 3.49 mg/ml was detected in CL-12(2). and the highest production of propionic acid was found in CL-40(4) was 30.69 mg/ml, The strain ATCC 824 was produced 30.80 mg/ml of acetic acid ,6.85 mg/ml of butyric acid and 0.61 mg/ml of propionic acid respectively. The wide variations in the production of organic acids indicated genetic variability. Majority of the isolates belong to *C. acetobutylicum* which was habituated in diverse sources. Thus, efficient strains can be screened for Butanol production from biomass.

Influence of *Glomus macrocarpum* and fluorescent pseudomonads on growth and yield of chilli (*Capsicum annum* L.)

V. RAMESHA

2013

MAJOR ADVISOR :Dr. V. P. SAVALGI

An experiment entitled "Influence of *Glomus marocarpum* and Fluorescent pseudomonads on growth and yield of chilli (*Capsicum annum* L.)" was conducted at main Agricultural Research Station, University of agricultural sciences, Dharwad during Rabi 2012-13. Experiment laid out in completely randomised design under green house condition, consisting of 8 treatments and 6 replications, variety Byadagi dabbi, and treatments applied with different source and levels of rock phosphate and single super phosphate.

The highest yield parameters of chilli was recorded like plant height (43.16 and 85.17 cm), shoot length (33.41 and 60.57 cm), root length (14.46 and 25.33 cm), dry matter production (155 and 200 g/plant), and green chilli yield (250.05 g/plant) at flowering and harvesting in treatment (T₃) inoculated *Glomus macrocarpum* and Fluorescent pseudomonads with 50% rock phosphate and also highest content of plant nutrients was recorded at flowering and maturation in treatment T₃ inoculated *Glomus*

macrocarpum and Fluorescent pseudomonads with 50% rock phosphate i.e. Nitrogen (2.87 and 2.86%), phosphorus (0.30 and 0.49%), potassium (2.69 and 2.68%) which is significantly superior over the other treatments. Microbiological parameters recorded highest at flowering and harvesting in treatment (T₃) inoculated *Glomus macrocarpum* and Fluorescent pseudomonads with 50% rock phosphate parameters like, enzyme activity which includes dehydrogenase activity (7.13 and 6.1 µg

TFP/g soil/day) and phosphatase activity (22.43 and 21.64 µM PNP/g soil/h), microbial population of P solubilizers (35.60 and 31.20 cfu 10⁴), N₂ fixers (26.66 and 21.18 cfu 10⁴), Fluorescent pseudomonads (23.27 and 22.46 cfu 10⁴) and spore count (103.06 and 107.40/50 g soil), per cent root colonization (52.16 and 62.10), which is significantly superior over the other treatments and rest of the treatments were non significant at flowering and harvesting.

Studies on bacteria solubilizing both potassium and phosphorous and their effect on maize (*Zea mays* L.)

K. N. BASAVESHA

2013

MAJOR ADVISOR: Dr. V. P. SAVALGI

Bacteria solubilizing both potassium and phosphorus isolated by soil samples collected from different rhizosphere and crops from Dharwad, Haveri and Davanagere districts of Karnataka. The total 50 bacterial isolates were tested for their potassium and phosphorous solubilization and characterized upto genus level based on morphological and biochemical characters. *In vitro* evaluation of potassium and phosphorus solubilization by bacteria tested at different days after incubation (DAI). The maximum solubilization of K and P observed at 15 DAI ranges from 2.36 to 29.83 µg/ml and 3.44 to 14.25 per cent respectively. All the isolates were tested for beneficial traits like production of growth promotion substance and the amount of IAA and GA produced by the isolates ranged from 3.38 to 8.90 µg/25ml and 1.27 to 3.67 µg/25ml respectively. The efficient eight isolates of *Bacillus* species which solubilize both potassium and phosphorus was examined for their influence on growth, yield and nutrient content of

maize plant under green house condition. All the inoculated treatment with bacteria were recorded maximum dry matter content at 30, 60, and at harvest recorded in isolates K-PSB 32 with rock phosphate and mica were 12.80, 44.2 and 235.7 g/plant, respectively. The yield components as compared with uninoculated fertilizer control, the isolate K-PSB 50 with rock phosphate and mica were recorded the heights cob weight 144.9 g/plant and the highest grain yield 52.93 g/plant and other parameters, followed by isolate K-PSB 32 with rock phosphate and mica. From the present study, it was concluded the bacterial isolates K-PSB 50 and K-PSB 32 were efficient K-PSB isolates. They capable to solubilize both K and P from the mineral source of mica and tricalcium phosphate respectively under *in vitro* condition. They produced plant growth promoting substances such as IAA and GA resulting in increased biomass, total dry matter and cob yield of maize plant.

Studies on zinc solubilizing bacteria and their effect on growth and yield of maize (*Zea mays* L.)

P. SHRUTHI

2013

MAJOR ADVISOR: Dr. V. P. SAVALGI

Attempts were made to isolate zinc solubilizing bacteria from rhizosphere soil of different crops from Dharwad and Belgaum districts. A total of 30 bacteria isolates were tested for Zn solubilization and characterized upto genus level based on morphological and biochemical characters. The mechanisms involved in Zn solubilization and other agronomical beneficial traits were also analyzed for selected efficient strains. *In vitro* Zn solubilization by bacteria ranged from 5.57 ppm to 13.57 ppm. Gluconic acid was the main organic acid produced by the ZSB isolates. Thirteen isolates were tested for other beneficial traits like production of organic acid, production of siderophore and production of growth promoting substance. All the thirteen isolates produced gluconic acid. The amount of siderophore produced by the strains ranged from 0.35 to 0.91 µg/ml. The amount of IAA and GA produced by the strains ranged from 5.43 to 10.67

and 1.07 to 2.77 µg/ 25 ml respectively. Two efficient gram negative Zn solubilizing bacteria were also examined for their influence on growth and yield of maize plants under glass house condition. All the treatment with combined inoculation of ZSB-1 and ZSB-2 were found to increase growth parameters, nutrient content and yield components compared to control and with single inoculation of ZSB. The treatment T₁₆ (ZSB-1 + ZSB-2 + RD of NPK + 100% Zn) recorded the highest yield (75.70 g/plant) and other parameters followed by T₁₅ and T₁₄ (73.5 and 71.7 g/plant respectively). Population of ZSB, PSB, N₂ fixers and dehydrogenase activity in rhizosphere soil of maize were significantly higher in the treatment inoculated with ZSB-1 + ZSB-2 as compared to control and single inoculation. Thus it can be inferred that combined inoculation of zinc solubilizing bacteria have the potential to be use as bioinoculants.

Population dynamics of microbially enriched organic manures and their influence on microbial population and enzymatic activities of soil, growth and yield of tomato (*Lycopersicon esculentum* Mill.)

NANDINI MATH

2013

MAJOR ADVISOR: Dr. M. N. SREENIVASA

An experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to study the population dynamics of microbially enriched organic manures and their influence on microbial population and enzymatic activities of soil, growth and yield of tomato (*Lycopersicon esculentum* Mill.) during *kharif* 2012. The population of free living nitrogen fixers, phosphate solubilizing bacteria and *Trichoderma* sp. increased in all enriched organic manures upto 14th day after inoculation and later remains constant or decreased. Among the enriched manures vermicompost recorded highest microbial population and also nutrient content. Later effect of enriched organic manures on growth and yield of tomato was studied. The rhizosphere microbial population was significantly highest when enriched manures were applied in combination with RDF to the soil. The dehydrogenase and phosphatase

activities were significantly highest when enriched manures were applied with RDF at all the stages of crop growth. The plant growth parameters like plant growth, root length and dry matter production recorded were significantly highest at all the stages of crop growth when the combined application of enriched manures with RDF. The N, P and K concentration of plants were also significantly highest in the same treatment. The yield of tomato was significantly highest with the combined application of enriched manures with RDF as compared to unenriched manurial combination. Among all the treatments, the combined application of enriched manures with RDF resulted in significantly highest lycopene content. This study clearly brought out maximum population of inoculated organisms can be achieved on 14th day in all organic manures tried with an increase in the nutrient concentration of enriched organic manures.

Isolation and characterization of cellulolytic yeasts for bioethanol production

S. C. SAHOO

2013

MAJOR ADVISOR: Dr. GEETA G. SHIRNALLI

The present study was conducted in the Department of Agricultural Microbiology on bioethanol production from selected agro-residues with the objectives whether two step process i.e. hydrolysis and fermentation could be transformed into single step with the help of efficient cellulolytic

yeast strains, thus reducing the cost of bioethanol production. A total of 104 yeast isolates from various natural habitat mainly rotten fruit rinds, forest leaf litter, compost, fruit samples, food stuff and over matured paragrass were isolated on the basis of zone of hydrolysis of cellulose and

release of reducing sugars. Among these 31 cellulolytic yeasts were screened. Five efficient strains CY-52, CY-58, CY-59, CY-62 and CY-81 were chosen on the basis of release of maximum reducing sugars. The isolates were subjected for utilization of various carbon sources namely glucose, maltose, ribose, lactose, sucrose, arabinose, galactose, xylose and starch to know the sugar utilization efficiency. The efficient yeast strains were subjected on two delignified substrates *i.e.* paddy straw and sugarcane bagasse. Delignification was carried out using alkali at 3 per cent for 8 h. Recovery of cellulose was highest in case of sugarcane bagasse *i.e.* 695 mg g⁻¹ as

compared to paddy straw 564 mg g⁻¹. To know the enzymatic assay, filter paper activity and CMCase activity was conducted with the efficient strains out of which strain CY-59 isolate showed the highest activity *i.e.* 16.82 U ml⁻¹ and 12.99 U ml⁻¹ respectively. The yeast isolate CY-59 showed the maximum bioethanol production of 48.18 mg g⁻¹ and 60.51 mg g⁻¹ from paddy straw and sugarcane bagasse respectively which was on par to reference strain NCIM-3200 and commercial cellulase. Thus, it can be concluded that yeasts are able to induce cellulase for hydrolysis of the substrates and produce ethanol. Extrapolating more sources from nature can yield better strains.

AGRICULTURAL STATISTICS

Statistical analysis of areca nut yield in Uttara Kannada district

A. B. SRINATH REDDY

2013

MAJOR ADVISOR: Mr. Y. N. HAVALDAR

The statistical investigation of areca nut yield in Uttara Kannada district was conducted on secondary data of area, production, productivity (1980-2010) and weather parameters (1996-2010). The statistical tools namely non-linear models, decomposition analysis, correlation analysis, regression analysis, cluster analysis and ARIMA model were employed. Different nonlinear regression models were fitted to study the trend of areca nut area, production and productivity. Where, 4th degree polynomial and MMF model were best fit for the area and production. In case of productivity 4th degree polynomial was best fitted. The result of Hazell's decomposition analysis was indicated that mean area change was main factor contributing for the total change in production. The association of weather parameters on areca nut yield was measured using the Karl Pearson correlation, where there was non-significant relation

between yield and weather parameters. In case of production morning relative humidity showed significant correlation. Multiple regression models were found to be significant with high R² value in case of production. Backward regression model was used to determine highest contribution of independent variables (weather parameters) for the production of areca nut. The model showed that there was a significant effect of morning relative humidity and evening relative humidity on the production. Cluster analysis was carried out to study the pattern of rainfall in Uttara Kannada district. The results showed that fifth cluster was the largest cluster with highest mean rainfall. Forecasting of areca nut production for the next five years was employed based on ARIMA model. The results showed that there was a rapid increase in the production of areca nut.

Models to estimate milk yield In HF crossbred cow

ASHWINI HEBBAR

2013

MAJOR ADVISOR: Dr. S. N. MEGERI

The world cattle population is estimated to be about 1.3 billion. Indian cattle population is around 281 million. Holsteinare the primary dairy breed, bred for high milk production which are originated from Holland. Milk production is being most predominant for any dairy farm hence the estimation of milk yield is essential. For this purpose modeling is essential to know the performance of any animal. In this regard the study was undertaken by taking secondary data from the Dairy unit of main agriculture research station UAS Dharwad. The data was collected on 25 milking HF crossbred cow for the period from 1993-94 to 2010-11. Out of the 25 HF crossbred cows 18 were on born and 7 were purchased. Cobb Douglas model was used for estimation of 305 days milk yield and total milk yield in HF crossbred cow with high efficiency. Tri period moving

average was tried for each lactation of the high milk producing animal to fit the time series model. Lactation wise milk yield was estimated using various models out of those sixth degree polynomial was found to be best suitable in estimating individual 305 days and total milk yield up to four lactations followed by Sinusoidal model based on R², SE and RMSE values. The farm managers may use this model for milk yield estimation. The Weibull distribution was fitted for 305 days and total milk yield. The multiple linear regression equations were also tried using various parameters. The backward regression indicates the most contributing parameters were 305 days milk yield, lactation length and peak yield in estimating the life time milk yield. This would help in taking proper managerial decisions to remove low producing animals from the farm.

Multivariate analysis to study the impact of weather parameters on rain fed crops of Dharwad district

SURESH BANU LAMANI

2013

MAJOR ADVISOR: Dr. K. V. ASHALATHA

Present investigation was carried out in different taluks of Dharwad district to study the impact of weather parameters on rain fed crops by using multivariate analysis. Secondary data on area, production and weather parameters *viz.*, rainfall, temperature and relative humidity were collected from different sources. Among the different models, polynomial models were found to be suitable for weather parameters for all the taluks of Dharwad district. The Mann-Kendall test was used to study the trend of weather parameters. In case of rainfall, though on an average July month receives the maximum rainfall, distribution of rainfall is such that it slowly declines till mid of October. July peak reduced in last decade. For temperature though on an average all most all months received maximum temperature, July month experienced increased trend in last decade. Multiple linear

regressions indicated that only area and rainfall were contributing significantly to the production of rain fed crops, but relative humidity was also contributing significantly to the production of Paddy crop in case of Dharwad taluk. The transitional probability matrix were depicted a broader idea of change of the direction of area over a period of last twenty years. It was revealed that the retention of area was almost similar for all the selected crops in Dharwad taluk except Sorghum crop which noticed highest retention of area in case of Hubli, Kundagol and Navalgund taluks and Paddy crop had maximum retention of area in Kalaghatgi taluk. The highest direct effect was productivity and rainfall in case of Dharwad and Navalgund taluks. Highest direct effect was rainfall and maximum indirect effect was temperature in Hubli and Kalaghatgi taluks.

Spatial analysis of influence of climate on chilli

K. C. SURESH BABU

2013

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

The statistical investigation of impact of climate on chilli yield in Dharwad, Gadag and Haveri districts was conducted based on secondary data of Chilli yield (1998-2010), obtained from Directorate of Economics and Statistics, Government of Karnataka, Bangalore and the weather parameters (1995-

2012) were obtained from Assistant executive water gauge office sub-division-2, Dharwad. Different statistical techniques such as, correlation analysis, trend analysis, Mann-Kendall test, stepwise regression analysis and spatial lag models were employed for drawing inference. An effort is

made to build the suitable models for the trend of weather parameters by using different statistical models. The cubic model was found to be significant and best suited for the trends of rainfall, temperature and relative humidity of selected districts, followed by quadratic model. The results of Mann-Kendall test indicated that most of the months showed no trend for rainfall, temperature and relative humidity of Dharwad district, whereas relative humidity of Gadag and Haveri districts, showed an increasing and decreasing trend respectively in most of the months. Stepwise regression models have been employed to know the association between Chilli yield and weather parameters. There was a positive significant

effect of rainfall on chilli yield in Dharwad district. In case of Gadag district, the minimum temperature had negative significant impact on yield, whereas in Haveri district, the maximum temperature and minimum relative humidity had negative significant impact. The spatial dependence of the Chilli yield on weather parameters of Dharwad, Gadag and Haveri districts were observed and concluded that neighboring district weather parameters were directly or indirectly affect the yield of Chilli in the selected districts. In the present scenario of climate change the spatial analysis would serve as a strategic tool for predicting the yield levels of targeted crops.

Influence of weather parameters on pests and diseases of soybean [*Glycine max* (L.) Merrill]

GURURAJ B. BIJJARGI

2013

MAJOR ADVISOR: Dr. A. R. S BHAT

Soybean is a major oilseed crop of India. Pests (*Spodoptera litura* and *Cydia pythor*) and diseases (rust and purple seed stain) are major threat for the cultivation of soybean crop in India. The present study was envisaged by considering the importance of these two major insect pests and diseases. Experimental data were collected from AICRP on Soybean of Dharwad regarding pests and diseases of regions like Dharwad, Kalaghatagi, Bailhongal and Hukkeri. Meteorological data were collected from meteorological observatory of Main agricultural research station Dharwad. Assistant Executive Water Gauge Office Sub-Division-2, Dharwad for Kalaghatagi region, A.R.S Bailhongal for Bailhongal region and A.R.S Hukkeri for Hukkeri region. Several simple linear and nonlinear regression models were tried. The incidence of *Spodoptera litura* was more associated with maximum temperature and *Cydia pythor* with

maximum and minimum temperature. The incidence of rust was associated with maximum and purple seed stain was associated with relative morning humidity in all the regions. The present study demonstrated that in few cases cubic model and in few other cases quadratic model was more suited for all weather parameters. Multiple linear regression (MLR) models were also tried, these models were having high R^2 values both in case of pests and diseases and hence MLR is an improved model over the above models in explaining the variation in development of pests and diseases. The presence of insect pests and diseases caused yield reduction, there exist some relationship between insect variables, diseases variables and yield loss. Present study reveals that there is linear relationship exists between the insect variables, disease variables and yield loss in soybean.

AGRONOMY

Performance of maize hybrids to varying fertilizer levels in northern transitional zone of Karnataka

ABEL DAIKHO

2013

MAJOR ADVISOR: Dr. U. K. HULIHALLI

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad on deep black soil during *kharif* 2012 under rainfed condition to study the "performance of maize hybrids to varying fertilizer levels in Northern transitional Zone of Karnataka". The experiment included ten maize hybrids (CP- 818, NK-6240, 900 M Gold, Kaveri-25-K-55, Pinnacle, 30B07, Bioseed-9681, PAC-740, Hema and Arjun) and two fertility levels 100% recommended dose of fertilizer (RDF) (100: 50: 25 N P K kg ha⁻¹) and 150% RDF (150: 75: 37.5 N P K kg ha⁻¹). The trial was laid out in randomized completely block design with factorial concept and replicated thrice. Among maize hybrids 900 M Gold and NK-6240 were found superior and recorded significantly higher grain yield (64.6 and 62.0 q ha⁻¹, respectively) followed by CP-818, PAC-740 and 30B07 (59.3, 57.8 and 54.7 q ha⁻¹, respectively) compared to other hybrids.

Significantly lower grain yield was recorded with the hybrids Arjun and Hema (38.2 and 39.2 q ha⁻¹, respectively). The growth and yield components such as total dry matter production plant⁻¹, cob length, cob girth, number of grains cob⁻¹ and 100 grain weight were higher with a 900 M Gold, NK-6240, CP-818, PAC-740 and 30B07 as compared to other hybrids. Application of 150 per cent RDF recorded significantly higher grain yield of maize (52.7 q ha⁻¹) over 100 per cent RDF (50.4 q ha⁻¹). The increase in maize grain yield with 150 per cent RDF was to the tune of 4.5 per cent over 100 per cent RDF. This was attributed to higher growth and yield attributes with 150 per cent RDF over 100 per cent RDF. The economic analysis indicated higher net returns and B:C ratio with 900 M Gold and NK-6240 compared to other hybrids. However, the fertility levels did not influence significantly the net returns and B:C ratio.

Response of direct seeded rice to pre and post emergence herbicides and sowing dates

RAJASHEKHAR L. RAJAPUT

2013

MAJOR ADVISOR: Dr. B. N. ARAVINDA KUMAR

A field experiment was carried out during *kharif* 2012 at Agricultural Research Station, Mugad, University of Agricultural Sciences, Dharwad. The treatments consisted of two dates of sowing (before and after onset of monsoon) and six weed control treatments (pre-emergence (PRE) butachlor 1.5 kg/ha fb. 2 HW at 20 and 40 DAS, pretilachlor (PRE) 0.5 kg/ha fb. one intercultivation at 45 DAS, post emergence (POST) chlorimuron + metsulfuron methyl (Almix) 4 g/ha at 17 DAS fb. one intercultivation at 45 DAS, bispyribac sodium (POST) 25 g/ha at 17 DAS fb. one intercultivation at 45 DAS, cyhalofop butyl 0.1 kg/ha + pyrazosulfuron 0.025 kg/ha (POST) at 30 DAS fb. one intercultivation at 45 DAS and weedy check) and two control treatments weed free and farmer practice (2 IC + 1 HW). The experiment was laid out in a factorial RCBD with three replications. Before onset of monsoon sowing (June 2nd) recorded significantly lower weed density (32.3 m⁻²) and weed dry weight (7.89 g m⁻²) as compared to after onset of monsoon sowing (June 29th) (39.0 m⁻² and 8.79 g m⁻², respectively) at 30 DAS. Among weed control treatments, bispyribac sodium 25 g recorded

significantly lower weed density (9.9 m⁻²) and dry weight (1.72 g m⁻²) which was on par with butachlor 1.5 kg (13.9 m⁻² and 2.01 g m⁻², respectively) at 30 DAS. Weed control index was significantly higher in these two treatments (91.9 and 90.6, respectively) as compared to other treatments except weed free check at 30 DAS. Interaction effect was significant with respect to density of weeds at 30 DAS. Grain yield was significantly higher in June 2nd sowing (3217 kg ha⁻¹) as compared to June 29th sowing (3044 kg ha⁻¹). Among weed control treatments, bispyribac sodium 25 g and butachlor 1.5 kg recorded a higher grain yield (4158 and 4049 kg ha⁻¹, respectively). However, these were on par with weed free check (4541 kg ha⁻¹). The June 2nd sowing along with application of bispyribac sodium 25 g resulted in significantly higher nitrogen uptake by crop (78.32 kg ha⁻¹) and lower by weeds (5.93 kg ha⁻¹) and higher dehydrogenase activity (7.29 mg TPF formed g⁻¹ soil d⁻¹) at 60 DAS and also this treatment resulted higher net returns (Rs 58,419 ha⁻¹) and B: C ratio (4.01) compared to rest of the interactions.

Effect of nutrient management on growth, yield and quality of sesame (*Sesamum indicum* L.) in northern transition zone of Karnataka

M. MARTIN STANLEY

2013

MAJOR ADVISOR: Dr. R. BASAVARAJAPPA

A field experiment was conducted at Main Agricultural Research Station, UAS, Dharwad, Karnataka in medium black clay soil during *kharif* 2012 to study the effect of nutrient management on growth, yield and quality of sesame (*Sesamum indicum* L.) in northern transition zone of Karnataka. The experiment was laid out in RCBD, with 14 treatments and three replication. The treatments consisting of 100% nitrogen as basal, application of nitrogen in two equal splits (at the time of sowing and 30 DAS) and foliar application of 1.5% Urea and 1.5 % DAP at flower initiation stage, capsule initiation stage and in both the stages were tried in different combinations. Recommended dose of P₂O₅ and K₂O was applied commonly for all the treatments. The treatment receiving application of nitrogen in two equal

splits and DAP @ 1.5 % foliar spray first at flower initiation stage and second at capsule initiation stage recorded significantly higher sesame seed yield (730 kg ha⁻¹) and stalk yield (₹2393 kg ha⁻¹) along with higher seed oil content (49.43%) and oil yield (361 kg ha⁻¹). The total dry matter production per plant (20.73 g plant⁻¹), number of branches per plant (4.87), gross returns (₹ 36517 ha⁻¹), net returns (₹ 23141ha⁻¹) and B:C ratio (2.73) were also significantly higher by the treatment receiving application of nitrogen in two equal splits and DAP @ 1.5 % foliar spray first at flower initiation stage and second at capsule initiation stage compared to other treatments. The next best treatment was application of nitrogen in two equal splits and DAP @ 1.5 % foliar spray at flower initiation stage.

Sequential application of pre and post-emergence herbicides for weed control in Bt-cotton

K. S. CHETHAN

2013

MAJOR ADVISOR: Dr. S. R. SALAKINKOP

A field experiment was conducted during *kharif* 2012 to study the sequential application of pre and post-emergence herbicides for weed control in Bt-cotton at MARS, Dharwad. The experiment comprised of 14 treatments laid out in RCBD with three replications. Treatments consisted of pre-emergence application (Diuron @ 1.25 kg a.i. ha⁻¹ (T₁), post-emergence blanket application (Imezathapyr 0.075 kg a.i. ha⁻¹ (T₂) and Pyriithiobac 0.075 kg a.i. ha⁻¹ (T₄) and directed application (Oxyfluorfen @ 0.10 kg a.i. ha⁻¹ (T₃), Glyphosate @ 2.5 kg a.i. ha⁻¹ (T₅) and glufosinate ammonium @ 0.375 kg a.i. ha⁻¹ (T₆) at 35 DAS and sequential application of diuron @ 1.25 kg a.i. ha⁻¹ as pre-emergence fb post-emergence blanket spray of imezathapyr 0.075 kg a.i. ha⁻¹, pyriithiobac 0.075 kg a.i. ha⁻¹ and directed spray of oxyfluorfen @ 0.10 kg a.i. ha⁻¹, glyphosate @ 2.5 kg a.i. ha⁻¹ and glufosinate ammonium @ 0.375 kg a.i. ha⁻¹ spray at 55 DAS (T₇, T₉, T₈, T₁₀, T₁₁ respectively) were compared with weed free (T₁₂), weedy

check (T₁₃) and farmers practice (T₁₄). Among the herbicides, diuron @ 1.25 kg a.i. ha⁻¹ as pre-emergence fb glyphosate @ 2.5 kg a.i. ha⁻¹ or glufosinate ammonium @ 0.375 kg a.i. ha⁻¹ significantly reduced weed density, weed dry weight, nutrient uptake by the weeds at all growth stages and recorded good to excellent control of weeds. Weed control efficiency, total dry matter production and nutrient uptake by the crop were significantly higher in these treatments followed by pre-emergence application of diuron @ 1.25 kg a.i. ha⁻¹ fb oxyfluorfen @ 0.10 kg a.i. ha⁻¹. Pre-emergence application of diuron @ 1.25 kg a.i. ha⁻¹ fb glyphosate @ 2.5 kg a.i. ha⁻¹ recorded significantly higher seed cotton yield (2314 kg ha⁻¹), net returns (₹ 78,508 ha⁻¹) and benefit:cost ratio (3.92) followed by diuron @ 1.25 kg a.i. ha⁻¹ as pre-emergence fb oxyfluorfen @ 0.10 kg a.i. ha⁻¹ (2035 kg a.i. ha⁻¹ seed cotton yield, ₹ 66035 ha⁻¹ net returns and 3.48 benefit:cost ratio).

Response of mungbean genotypes to dates of sowing and foliar nutrition in *kharif* season

G. MADHU

2013

MAJOR ADVISOR: Dr. GANAJAXI MATH

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during *kharif* 2012. Treatments consisted of four dates of sowing (I FN June, II FN June, I FN July and II FN July) as main plots, three mungbean genotypes (DGGV-2, IPM-02-14 and SEL-4) as sub plots and foliar spray of 2 per cent DAP and without spray as sub sub plots. The experiment was laid out in split-split plot design with three replications. Among the dates of sowing, II FN June sown crop recorded significantly higher grain yield (1268 kg ha⁻¹), net returns (₹ 32226), B:C ratio (2.92). Similar trend was observed in growth and yield parameters such as plant height, number of branches LAI, dry matter production, number of pods, N, P, K uptake by crop. Among the genotypes, DGGV-2 recorded

significantly higher grain yield (1113 kg ha⁻¹), net returns (₹ 43060), B:C ratio (2.55), number of branches, (8.40), LAI, dry matter production, number of pods, protein content, N, P, K uptake by crop. Foliar spraying of 2 % DAP recorded significantly higher grain yield (1094 kg ha⁻¹), net returns (₹ 42328) and B: C ratio (2.50) number of branches, LAI, dry matter production, number of pods, protein content than no spray. Among the interactions, DGGV -2 genotype sown on I FN of June and 2 % DAP spray recorded significantly higher grain yield (1353 kg ha⁻¹), net returns (₹ 52306), B: C ratio (3.11). For late sown condition (I FN of July), DGGV-2 and IPM-02-14 were on par with each other with respect to yield (1009 kg ha⁻¹) and net returns (₹ 26145 and ₹ 24891).

Growth and yield of sesame (*Sesamum indicum* L.) As influenced by sources and levels of sulphur

B. RAMAKRISHNA

2013

MAJOR ADVISOR: Dr. H. T. CHANDRANATH

A field experiment was conducted during *kharif* season of 2012 on farmer's field at Marewad village of Dharwad district to study the sources (gypsum, single super phosphate and elemental sulphur) and levels of sulphur (10, 20, 30 and 40 kg ha⁻¹) on growth and yield of sesame (*Sesamum indicum* L.). The experiment was conducted in RCBD with factorial concept with three replications. Among the sources of sulphur, application of gypsum (637 kg ha⁻¹) and single super phosphate (655 kg ha⁻¹) recorded significantly higher seed yield compared to elemental sulphur (594 kg ha⁻¹). Application of sulphur through single super phosphate and gypsum resulted in higher yield attributes (number of capsules plant⁻¹, number of seeds capsules⁻¹ and seed weight plant⁻¹) leading to higher seed yield. Among levels of sulphur, an application of 30 and 40 kg ha⁻¹ resulted in significantly a higher seed yield (668 and 680 kg ha⁻¹ respectively). Control treatment recorded

significantly a lower seed yield (540 kg ha⁻¹). Growth parameters (plant height, number of primary branches plant⁻¹, leaf area index at harvest and dry matter production plant⁻¹) recorded significantly higher at 30 and 40 kg S ha⁻¹ compared to lower levels of sulphur. Single super phosphate and gypsum application also resulted in significantly higher oil content (48.68 and 48.68 % respectively) and protein content (25.63 and 25.54 % respectively), whereas among the levels of sulphur 30 and 40 kg S ha⁻¹ recorded significantly higher oil content (48.80 and 49.08 % respectively) and protein content (25.94 and 26.13 % respectively) compared to lower levels of sulphur. Significantly higher N, P, K and S uptake was observed at 30 and 40 kg S ha⁻¹ compared to lower levels. Sulphur application at 30 and 40 kg ha⁻¹ recorded significantly higher net returns (₹17717 and ₹17752 ha⁻¹ respectively) and B: C ratio (2.15 and 2.11 respectively) than lower levels.

Performance of cowpea [*Vigna unguiculata* (L.) Walp] genotypes during summer at different phosphorus levels

H. D. SHILPA

2013

MAJOR ADVISOR: Dr. S. Y. WALI

A field experiment was conducted to study the "Performance of cowpea genotypes during summer 2012 at different phosphorus levels" under irrigated condition in vertisols in the farmer's field at Mattihal Village of Basavan Bagewadi Taluk in Bijapur district. The experiment was laid out in a factorial RCBD design with three replications comprised of 12 treatment combinations of four genotypes (KBC-2, KM-5, IT-38956-1 and C-152) and three phosphorus levels (25, 50 and 75 P_2O_5 kg ha⁻¹). The results indicated that seed yield (1397 kg ha⁻¹), harvest index (0.51) and higher grain protein content (24.25) with IT-38956-1 owing to higher number of pods per plant (16.78) seed yield per plant (12.74 g)

and 100 seed weight (12.92 g) as compared to other genotypes. Phosphorus levels had a significant effect on growth and yield parameters. Application of 50 kg P_2O_5 ha⁻¹ recorded significantly higher seed yield (1087 kg ha⁻¹) than 25 and 75 kg P_2O_5 ha⁻¹. The higher yield was due to the higher yield parameters such as number of pods per plant (13.17), seeds per pod (13.25), 100-seed weight (12.33 g) and seed yield per plant (10.82 g). Higher interaction was recorded in cowpea genotype IT-38956-1 with application of 50 kg P_2O_5 ha⁻¹ for seed yield (1423 kg ha⁻¹), gross returns (42690 ₹ ha⁻¹), net returns (28493 ₹ ha⁻¹) and B:C(3.01) ratio compared to other interactions.

Standardization of production technology for transplanted organic chilli (*Capsicum annum* L.)

IRAPPA D. PATIL

2013

MAJOR ADVISOR: Dr. H. B. BABALAD

A field experiment was conducted to study the effect of organic nutrients, liquid organics and organic pest management practices on growth, yield and quality of chilli (*Capsicum annum* L.) at Bio-Resource Centre, Institute of Organic Farming, University of Agricultural Sciences, Dharwad during *kharif* 2012-13. The experiment was laid out in a split plot design with four organic nutrient management practices, four organic pest management practices with RDF + FYM and IPM as control treatment for comparison. Application of enriched compost (50%) + vermicompost (50%) equivalent to RDN + foliar application of humic acid @ 0.1% for nutritional management and *Verticillium lecanii* 2g l⁻¹ + NSKE 5 % at 20 & 60 DAT, sulphur 2g l⁻¹ + NSKE 5 % at 40 DAT, *Trichoderma harzianum* 2g l⁻¹ + NSKE 5 % at 80 DAT as plant protection system recorded significantly higher dry fruit

yield of chilli (1123 kg ha⁻¹) (M_4P_3) over other organic nutrient and plant protection treatment combinations and was on par with 100 % RDF + 10 t FYM + IPM (₹ 86353 ha⁻¹) and B: C ratio (4.06). Whereas former treatment noticed significantly lower fruit borer damage (12.56 %) and munda complex scoring (1.21) as compared to rest of the treatment combinations except RDF + FYM + IPM. The quality parameters mainly percent oleoresin content (13.20 %) and total colour value (252.96 ASTA units) was significantly higher with application of EC (50%) + VC (50%) equivalent to RDN + foliar application of panchagavya @ 5 % and *Verticillium lecanii* 2g l⁻¹ + NSKE 5 % at 20 & 60 DAT, sulphur 2g l⁻¹ + NSKE 5 % at 40 DAT, *Trichoderma harzianum* 2g l⁻¹ + NSKE 5 % at 80 DAT as compared to RDF + FYM + IPM practices but was on par with M_4P_3 .

Evaluation of sequential application of pre and post emergence herbicides for weed management in maize

VINOD R. CHOUGALA

2013

MAJOR ADVISOR: Dr. S. M. HIREMATH

A field investigation was carried out during *kharif* 2012 at Agricultural College Farm, Dharwad (Karnataka) to evaluate sequential application of pre and post emergence herbicides for weed management in maize. The experiment consisted of atrazine 1.25 (T₁), atrazine 1.25 fb atrazine 1.25 (T₂), atrazine 1.25 fb oxyfluorfen 0.1 (T₃), atrazine 1.25 fb oxyfluorfen 0.2 (T₄), atrazine 1.25 fb metribuzin 0.5 (T₅), atrazine 1.25 fb metribuzin 0.75 (T₆), atrazine 1.25 fb 2, 4-D 0.5 (T₇), weedy check (T₈), weed free check (T₉) and farmer's practice (T₁₀). The experiment was laid out in RCBD with three replications. The data on weed control rating revealed good to excellent control of weeds in post-emergence spray of oxyfluorfen and metribuzin at 7, 14 and 21 days after spray except T₇. Crop toxicity was noticed in post-emergence spray of oxyfluorfen 0.2 and metribuzin

0.75 at 21 days after spray, but crop recovered later. Significantly lower weed population and weed dry weight was recorded in T₉, T₃, T₄, T₅, T₆ and T₁₀ than other treatments. However, weed control index was higher in weed free check, atrazine 1.25 fb oxyfluorfen 0.1, atrazine 1.25 fb oxyfluorfen 0.2 and farmer's practice at 60 DAS. Grain yield was significantly higher in the T₉, T₃, T₄, T₅, T₆ and T₁₀ than other treatments. The various growth, yield parameters and nutrient uptake by maize followed the trend as recorded in grain yield. The economics of the study revealed that atrazine 1.25 fb oxyfluorfen 0.1 kg ha⁻¹ recorded higher net income (₹ 63604 ha⁻¹) and benefit: cost ratio (3.69) than weedy check. However, the treatments namely T₄, T₅, T₆, T₉ and T₁₀ remained on par with T₃.

Chemical weed management in pigeonpea in northern dry zone of karnataka

P. MANU

2013

MAJOR ADVISOR: Dr. M. B. PATIL

A field experiment was conducted during *kharif*, 2012-13 to study the effect of chemical weed management in pigeonpea using different herbicides at farmer's field Bijapur. The experiment was laid out in RCBD with ten treatments and replicated thrice. The weed management treatments include one pre-emergent and three post-emergent herbicides compared with recommended practice, farmer's practice, weed free plot and weedy check. Among the weed management treatments, lower weed population in the later stages (60, 90 and 120 DAS) of crop growth was observed with application of pendimethalin 30 EC (PE) @ 1kg a.i. ha⁻¹ + quizalofop-ethyl 5 EC (PoE) @ both 50 and 75 g a.i. ha⁻¹ followed by pendimethalin 30 EC (PE) @ 1 kg a.i. ha⁻¹ + imazethapyr 10% SL(PoE) @ 150g a.i. ha⁻¹. The weed dry weight showed decreasing trend with higher dosage of imazethapyr and quizalofop-ethyl. Application of pendimethalin

30 EC @ 1 kg a.i. ha⁻¹ (PE) followed by imazethapyr 10% SL @ 150g a.i. ha⁻¹ at 45 DAS coupled with intercultivation at 60 DAS recorded significantly higher plant height (126.87 cm), number of primary branches (12.70 plant⁻¹), total dry matter accumulation of crop (66.43 g plant⁻¹), weed control efficiency at 60 and 120 DAS (72.19 and 97.35 per cent respectively), seed yield (1537 kg ha⁻¹), gross returns (₹ 63003 ha⁻¹), net returns (₹ 42678 ha⁻¹) and benefit cost ratio (3.10), which was followed by recommended practice. Lower phytotoxicity rating (1.83) was recorded in imazethapyr 10% SL @ 100g a.i. ha⁻¹ and also at 150g a.i. ha⁻¹ (1.93). Higher uptake of nutrients (N, P and K) by pigeonpea was observed in weed free plot followed by pendimethalin 30 EC @ 1 kg a.i. ha⁻¹ + imazethapyr 10% SL @ 150g a.i. ha⁻¹ at 45 DAS + intercultivation at 60 DAS (83.62, 14.10 and 37.06 kg ha⁻¹ N, P and K, respectively).

Response of hybrid napier genotypes to nitrogen levels

D. J. VINAY RAJ

2013

MAJOR ADVISOR: Dr. Y. B. PALLED

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, under Northern Transition Zone (Zone 8) of Karnataka on *allisols*. The treatments consisted of four genotypes of hybrid napier grass (APBN-1, DHN-6, CO-3 and CO-4) and three levels of nitrogen (180, 240 and 300 kg ha⁻¹). The experiment was laid out in RCBD (factorial) with three replications. The CO-3 genotype recorded significantly higher shoot height (83.62 cm), shoot girth (6.88 cm), green forage yield per clump (6.12 kg), total green forage yield (142.50 t ha⁻¹), total dry matter yield (35.64 t ha⁻¹) and crude protein yield (2729.80 kg ha⁻¹) compared to other genotypes. Application of 300 kg N ha⁻¹ recorded significantly higher shoot height (83.90 cm), shoot girth (6.91 cm), green forage yield per clump (7.59 kg), total green

forage yield (143.04 t ha⁻¹), total dry matter yield (35.75 t ha⁻¹) and crude protein yield (2921.38 kg ha⁻¹) compared to other nitrogen levels. The hybrid napier genotype CO-3 with 300 kg N ha⁻¹ recorded significantly higher total green forage yield (165.13 t ha⁻¹), total dry matter yield (41.29 t ha⁻¹) and crude protein yield (3414.18 kg ha⁻¹) compared to other treatment combinations. The hybrid napier genotype CO-3 with 300 kg N ha⁻¹ registered higher crude protein content (8.27 %), ether extract (3.83 %) and total ash content (12.33 %) compared to other treatment combinations. The economics of the study revealed that the hybrid napier genotype CO-3 with 300 kg N ha⁻¹ recorded the maximum net returns (₹ 1,02,522 ha⁻¹) and benefit cost ratio (3.22) compared to other treatment combinations.

Sequential application of pre and post emergence herbicides for weed management in chilli + onion + cotton intercropping system

NINGAPPA

2013

MAJOR ADVISOR: Dr. RAMESH BABU

A field investigation was carried out during *kharif* 2011 at farmer's field of Mugali village, Ron taluka in Gadag district under rainfed condition to evaluate the sequential application of pre and post emergence herbicides for weed management in chilli + onion + cotton intercropping system. The experiment consisted of 7 treatments involving four pre emergence herbicides *viz.*, pendimethalin 1.0 kg/ha, butachlor 1.0 kg/ha, oxadiargyl 90 g/ha and alachlor 1.0 kg/ha which were followed by (fb) post emergence application of oxyfluorfen 0.15 kg/ha at 45 days after sowing (only on onion rows) and compared with farmers' practice (3 HW at 20 days interval), weed free and weedy check. Pre emergence application of alachlor 1 kg/ha showed phytotoxicity on chilli and onion with phytotoxicity rating of 3.80 and 3.13 after 2 and 3 weeks after sowing, respectively. Pre emergence application of pendimethalin 1 kg/ha fb oxyfluorfen 0.15 kg/ha significantly reduced weed density (2.73) and weed dry weight (2.85 g/m²) with higher weed control index (66.7%) at 30 DAS. Weed

index was significantly higher in pendimethalin 1 kg/ha fb oxyfluorfen 0.15 kg/ha (14.1, 19.1 and 16.6% in chilli, onion and cotton, respectively). Nitrogen uptake by crops was significantly higher in pendimethalin 1 kg/ha fb oxyfluorfen 0.15 kg/ha in chilli (53.6 kg/ha), onion (77.0 kg/ha) and cotton (37.5 kg/ha) over weedy check (10.5, 14.2 and 21.1 kg/ha, respectively in these crops); while, lower nitrogen uptake by weeds was noticed in this treatment (29.3 kg/ha) compared to farmers practice (40.3 kg/ha) and weedy check (61.9 kg/ha). Application of pendimethalin 1 kg/ha fb oxyfluorfen 0.15 kg/ha recorded significantly higher yields in chilli (1279 kg/ha), onion (2201 kg/ha) and cotton (819 kg/ha) compared to farmers' practice (1064, 1925 and 667 kg/ha, respectively). This treatment also recorded significantly higher gross return ₹ 146752/ha, net return ₹ 110114/ha and B:C (4.01) ratio compared to farmers' practice ₹ 122543/ha, ₹ 88127/ha and 3.56, respectively).

Response of popcorn (*Zea mays* Var. *everta*) to nitrogen, phosphorus and potassium levels in northern transition zone of Karnataka

RAVIKANANNAVAR

2013

MAJOR ADVISOR: Dr. R. BASAVARAJAPPA

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka in medium black clay soil during *kharif* 2012 to study the response of nitrogen, phosphorus and potassium on growth, yield and quality of popcorn (*Zea mays* Var. *everta*) in northern transition zone of Karnataka. The experiment was laid out in randomized complete block design with factorial concept with three replications. A total of 12 treatment combinations consisting of three levels of nitrogen (75, 100 and 125 kg N ha⁻¹), two levels of phosphorus (50 and 75 kg P₂O₅ ha⁻¹) and two levels of potassium (25 and 37.5 kg K₂O ha⁻¹) with an absolute control (0:0:0 kg N:P₂O₅:K₂O ha⁻¹). The interaction effect of application of 125:75:37.5 kg N:P₂O₅:K₂O ha⁻¹ recorded significantly higher grain yield (3922 kg ha⁻¹) and stover yield (8883 kg ha⁻¹). The higher grain yield was attributed to higher total dry

matter production (271.44 g plant⁻¹), LAI (4.05), LAD (81.61 days), grains cob⁻¹ (584.27), 1000 grain weight (164.11 g), grain yield plant⁻¹ (141.94 g) and harvest index (39.33%). Also it recorded significantly higher uptake of N (204.22), P (35.24) and K (155.97) kg ha⁻¹ and available N (197.31), P₂O₅ (35.70) and K₂O (315.15) kg ha⁻¹ in soil after harvest. Application of 125:75:37.5 kg N:P₂O₅:K₂O ha⁻¹ recorded significantly higher protein content of 9.54 and 9.24 per cent, in grains and pops, respectively. But, popping percentage, expansion volume and flake size were not significantly influenced by NPK levels. The net returns (₹ 66,993 ha⁻¹) and B:C ratio (3.17) were significantly higher with the combination of 125:75:37.5 kg N:P₂O₅:K₂O ha⁻¹. The results obtained indicated that higher growth, yield and quality attributes were significantly superior and economically beneficial with application of 125:75:37.5 kg N:P₂O₅:K₂O ha⁻¹ to popcorn.

Performance of pigeonpea [*Cajanus cajan* (L.) Millsp.] varieties under broad bed and furrow cultivation in vertisols of model watershed of Dharwad

A. A. NADAF

2013

MAJOR ADVISOR: Dr. C. P. MANSUR

The field experiment was conducted at Singanahalli village model watershed of Dharwad in Northern Transition Zone of Karnataka on clay soil to study the performance of pigeonpea varieties under broad bed and furrow cultivation in vertisols of Model Watershed of Dharwad during 2012-13. The experiment was laid out in split plot design with three replication. There was 10 treatments combination comprising of two land management systems as main plots and five varieties as sub plots. Significantly higher seed yield (1322 kg ha⁻¹) and stalk yield (3921 kg ha⁻¹) were recorded in broad bed and furrow compared to flatbed. These was

improvement in moisture content in different soil depths (0-30 cm, 30-45 cm and 45-60 cm) at different growth stages of the crop in BBF compared to Flat bed. Growth and yield attributes followed the same trend. Among the pigeonpea varieties, BSMR-736 recorded significantly higher seed yield and stalk yield (1525 & 4150 kg ha⁻¹, respectively) over rest of the varieties and was followed by TS-3R across the land treatments. These two varieties recorded significantly higher number of pods, pod weight, seed yield and test weight per plant. Similarly variety BSMR-736 recorded significantly higher number of branches and dry matter production per

plant compared to rest of varieties followed by TS-3R. Interaction effect indicated that, significantly recorded higher seed and stalk yield (1684 & 4367 kg ha⁻¹, respectively) were in BSMR-736 planted on broad bed and furrow (BBF x V3) and was followed by TS-3R planted on BBF (BBF x V4, 1467 & 3933 kg ha⁻¹, respectively). This might be due to better response of BSMR-736 and TS-3R varieties to improved soil

moisture as well as higher nutrient availability resulting in higher uptake of N, P, K, S, Zn and B and contributed to increased seed yield and stalk yield. The higher gross returns (₹ 60639 & 52816 ha⁻¹, respectively) and net returns (₹ 40464 & 33121 ha⁻¹, respectively) were recorded in BSMR-736 and TS-3R planted on Broad Bed and Furrow compared to rest of the interactions.

Site specific nutrient management for target yield and recovery in sugarcane

S. S. SHREE HARSHA KUMAR

2013

MAJOR ADVISOR: Dr. S. A. GADDANAKERI

The field experiment was conducted during 2011-12 on farmer's field in Bijapur district, Northern Dry Zone of Karnataka to study the "Site Specific Nutrient Management for target yield and recovery in sugarcane", the experiment consists of seven treatments of which four treatments are target yield. Significantly higher cane yield (211 t ha⁻¹) was recorded in T₇ (target yield of 300 t ha⁻¹) and it was on par with T₆ (204 t ha⁻¹) i.e. a target yield of 250 t ha⁻¹ and T₅ (195 t ha⁻¹) i.e. a target yield of 200 t ha⁻¹ over rest of the treatments (T₄, fertilizer recommendation based on soil test, RDF and farmer's practice). The per cent increase in the cane yield among the target yield treatments was 44, 39 and 33 %, respectively in T₇ (target yield of 300 t ha⁻¹), T₆ (target yield of 250 t ha⁻¹) and T₅ (target yield of 200 t ha⁻¹) over the

treatment T₄ (target yield of 150 t ha⁻¹). The quality parameters viz., Brix %, Pol %, Purity %, Recovery % and CCS % did not differ significantly with respect to different treatments. However, higher sugar yield (24.36 t ha⁻¹) was obtained with treatment T₅ (target yield of 200 t ha⁻¹) by virtue of higher cane yield. Significantly higher nutrient uptake was recorded with the treatment T₇ (target yield of 300 t ha⁻¹) and was on par with T₆ (target yield of 250 t ha⁻¹) and T₅ (target yield of 200 t ha⁻¹). Significantly higher net returns (₹ 3,65,656 ha⁻¹) was obtained in T₇ (target yield of 300 t ha⁻¹) and was on par with T₆ (₹ 3,56,753 ha⁻¹) (target yield of 250 t ha⁻¹) and T₅ (₹ 3,43,443 ha⁻¹) (target yield of 200 t ha⁻¹). The lower net returns was recorded with Farmers' practice (₹ 1,61,380 ha⁻¹).

Response of niger (*Guizotia abyssinica* cass.) to date of sowing, plant geometry and cycocel under rainfed condition

K. M. VASANTHA KUMAR

2013

MAJOR ADVISOR: Dr. V. S. KUBSAD

A field experiment was conducted to study the response of niger (*Guizotia abyssinica* Cass.) to date of sowing, plant geometry and cycocel under rainfed condition at AICRP on Sorghum, Main Agricultural Research Station, Dharwad during kharif 2012. The experiment was laid out in RCBD (Factorial) with three factors along with single control. The first factor comprising three dates of sowing (I FN July, II FN July and I FN August), second factor including two plant geometries (45×10 cm and 60×10 cm) and third factor was two levels of cycocel at 30 DAS (500 ppm and 1000 ppm) with control (II FN June at 30×10 cm plant geometry). Among the dates of sowing, I FN July sown crop recorded significantly higher seed yield (639 kg), net returns (₹ 16053 ha⁻¹) and B:C ratio (1.91).

Plant geometry of 45×10 cm recorded significantly higher seed yield (615 kg ha⁻¹), net returns (₹ 14190 ha⁻¹) and B:C ratio (1.81). Cycocel spray @ 1000 ppm recorded significantly higher seed yield (614 kg ha⁻¹), net returns (₹ 13922 ha⁻¹) and B:C ratio (1.79). Interaction effects showed that, July I fortnight sowing at 45 cm x 10 cm plant geometry with application of cycocel @ 1000 ppm at 30 DAS recorded significantly higher seed yield (675 kg ha⁻¹), net returns (₹ 17673 ha⁻¹) and B:C ratio (2.00) as compared to others. The growth and yield components of niger viz., number of branches per plant, number of capitula per plant, number of seeds per capitulum, seed weight per capitulum, test weight and N, P, K uptake by crop were also significantly higher.

Effect of biofertilizers and foliar application of organic acids on growth and yield of soybean [*Glycine max* (L) Merrill]

N. N. LINGARAJU

2013

MAJOR ADVISOR: Dr. C. S. HUNSHAL

A field experiment was conducted during kharif 2012 to study "Effect of biofertilizers and foliar application of organic acids on growth and yield of soybean" at Main Agricultural Research Station, Dharwad under rainfed condition. The experiment was laid out RCBD with factorial concept and with three replications. The experiment consisted of four P-Solubilizers biofertilizers (PSB, VAM, PSB + VAM and Control) and five foliar spray of organic acids (Humic acid, Lecithin, Citric acid, Malic acid and control). Dual inoculation of PSB+VAM recorded significantly higher seed yield of soybean (3358 kg ha⁻¹) to that of VAM alone (3079 kg ha⁻¹), PSB alone (3054 kg ha⁻¹) and uninoculated control (2888 kg ha⁻¹). Among the foliar application of organic acids 0.1% humic acid at flower initiation recorded significantly higher seed yield (3253 kg ha⁻¹) of soybean compared to control

(2982 kg ha⁻¹). The interaction of biofertilizers and foliar application of organic acids revealed that higher seed yield of soybean (3596 kg ha⁻¹), net returns (₹ 60171 ha⁻¹) and B: C (4.0) was obtained with the treatment combination of dual inoculation of PSB+VAM with foliar spray of 0.1% humic acid at flower initiation compared to control (2790 kg ha⁻¹, ₹ 45257 and 3.7). Similar trend was observed in growth and yield parameters such as plant height, number of branches, LAI, dry matter production, number of pods plant-1, seed yield plant-1 and nutrient uptake. Soil properties viz., available soil nutrients (N, P₂O₅ and K₂O) after harvest of soybean crop and microbial activity at different crop growth stages was significantly higher with the treatment combination of dual inoculation of PSB+VAM with foliar spray of 0.1% humic acid at flower initiation.

BIOTECHNOLOGY

Functional and expressional quantitation of selected micro RNAs in response to low temperature and NaCl stress conditions in leaf and root tissues of *Arabidopsis thaliana*

H. V. CHAITHRA

2013

MAJOR ADVISOR: Dr. B. FAKRUDIN

The discovery of miRNAs has led to a fundamental change in the understanding of complex biological mechanisms involved in plant responses to stress tolerance. In this study, the expression of seven selected miRNAs was studied in *Arabidopsis thaliana* plants experiencing low temperature and salt stress separately. The selected miRNAs were *in situ* hybridized with Locked Nucleic Acid (LNA)-modified oligonucleotide probes. Among the tested miRNAs, expression of miR161, miR168,

miR171 and miR397a in leaf tissues and miR171 and miR397a in root tissues was recorded in control plants. Elevated expression of miR171 and miR397a was recorded in both tissue types of low temperature treated plants. A set of four miRNAs viz., miR171, miR395b, miR399e and miR399 showed their up regulation in both tissue types upon NaCl (300 mM) treatment. Expression of miR168 was recorded only in leaf tissues, and on the other hand, down regulation of miR397a was recorded

in both tissue types in response to NaCl stress. The miRNA stem-loop RT-PCR assay indicated gradual increase in the expression of miR171 and miR397 with the highest of 4.28 and 3.49 fold changes in leaf tissues of *A. thaliana* plants experiencing low temperature stress and 6.5 and 6.3 fold up-regulation of miR171, 0.8 and 0.9 fold down-regulation of miR397a and 3.4-3.5 fold up-regulation of miR399 and miR399e in leaf and root tissues, respectively, at 24 hrs of exposure to

salt stress. The RT-qPCR assay recorded reduced levels of miRNA target gene transcripts viz., *SCL6 III*, *SCL6 IV*, *LAC2*, and *LAC17* in response to low temperature and *SCL6 III*, *SCL6 IV*, *APS1*, *APS4* and *AGO1* transcripts in response NaCl treatment in both tissue types of *Arabidopsis thaliana* plants. The study points at the possibility of modulating low temperature and salt tolerance in plants through the down regulation of specific cognate genes.

Antiphytopathogenicity of bioagents and expression analysis of selected defence genes in rice in presence of actinobacteria and *Rhizoctonia solani*

SNEHAL JAGANNATH SHINDE

2013

MAJOR ADVISOR: Dr. S. K. PRASHANTHI

A total of fifty bioagent isolates comprising *Trichoderma*, pseudomonad, PPFM and *actinomycete* spp., were screened against rice sheath blight pathogen *Rhizoctonia solani* under in vitro condition and potent isolates were selected for in vivo assay. Five potent isolates from each of the biocontrol agent was further evaluated against *R. solani* under glasshouse condition. Of the fifteen efficient bioagent isolates evaluated, combined treatment of Actinomycete isolate (IABT-A7) was promising with reduced disease parameters, lesion length and number of dried leaves and enhanced the plant growth parameters viz., the plant height, number of tillers, root length, root biomass. Potential actinomycete (IABT-A7) isolate was identified as Actinopolymorpha spp., through Amplified rDNA Restriction Analysis (ARDRA). Expression of the key genes involved in Induced Systemic Resistance (ISR) and Systemic Acquired Resistance (SAR) were analysed by real-time PCR. Gene expression and

quantum of expression was profiled at different time intervals 24 hr, 48 hr, 72 hr and 120 hr after infection of pathogen from treatments viz., seed treatment of IABT-A7, combined treatment of IABT-A7 (seed+soil+foliar), only bioagent (IABT-A7) treatment, treated control (only pathogen) and healthy plant. Jasmonic Acid (JA) pathway related genes, *OsAOS2*, *OsJMT1*, *OsJAMYB* showed the differential expression in all the treatments and at all time intervals over the treated control. ET biosynthesis gene, *OsERF1* was up regulated in all treatments at 48 hr, 72 hr and 120 hr over treated control. The relative up regulation of these genes was highest in combined treatment over control. *OsPRIb*, a key gene for SAR pathway was up regulated in only pathogen treated samples and up regulated up to 12 fold at 48 hr. The master regulator defence gene *OsNPR1* was constantly expressed at all intervals over untreated plant.

Studies on differentially expressed genes for fibre development in diploid cotton (*Gossypium arboreum* L.)

ATULSURESH HANDE

2013

MAJOR ADVISOR: Dr. I. S. KATAGERI

A global gene expression profiling study at initiation and elongation stages of fibre development in *Gossypium arboreum* L. was undertaken to identify key genes using Fuzzy-linted and Fuzzy-lintless lines. Scanning electron microscopy revealed no difference in fibre initials but showed difference at elongation stage. Overall 278 transcripts were differentially expressed during fibre initiation and elongation stage in fuzzy-lintless line. The network covers range of transcription factors like AP2-EREBP, C2H2, and WRKY up-regulated at 0 dpa and down-regulated at 10 in *F1* line and similarly phytohormones like abscisic acid, auxin, brassinosteroid, ethylene, gibberellin, and salicylic acid expressed differentially. Transcripts coding TPS, UGE, EXPANSINS, AGPs, BGAL13, UGT74B1, TUBs, ACO and LTPs coding for energy and cell wall metabolism were down-regulated at 10 dpa in *F1*

line. Down-regulation of transcripts related to signal transduction like RLKs, LRR-family protein, Ca^{2+} and ROS resulted to the loss of co-ordination during the 0 dpa. Down-regulation of miscellaneous factors having role in stress response and cell growth like HSPs and SPDS3 at elongation stage suggested probable role in cell elongation. In SSH study, based on the putative functions of genes expressed in preferentially fibre elongation stage in forward library of fuzzy-linted line included ADF2, ACO1, β -galactosidase, β -glucanase, γ -tubulin, XTH32/XET32, EF1, CBL, CaM, PCY and PLC. About 155 novel genes having no similarity in the database were also found in this study. Attempt was made for validation of the same set of genes through quantitative real-time PCR which showed high correlations with the expression levels in morphology, microarray and SSH.

Candidate gene prediction in qtl regions and expression analysis in field evaluated near isogenic lines (NILs) carrying stay-green and water use efficiency qtl combinations in three recurrent background of *rabi* sorghum

GAURAV N. CHAUDHARI

2013

MAJOR ADVISOR: Dr. B. FAKRUDIN

Stay-green (stg) and water use efficiency (wue) are important target traits considered for improving drought tolerance in sorghum. The zygosity of introgressed quantitative trait loci (QTLs) of stg and wue was determined in three recurrent backgrounds of NILs derived from SPV86, SPV570 and M35-1. The NILs were field evaluated to assess impact stg and wue QTLs. Significant positive correlations were observed between yield and stay-greenness of different stages in SPV 570 background indicating NILs possessing stg trait have significant yield advantage under post-anthesis drought stress condition. Three different ab initio gene prediction algorithms viz., FGENESH, GENSCAN, GENMARK indicated number of predicted genes anchored within targeted QTLs. Five genes (*NSP*, *NAD*, *PHD*, *MADS*, *MLO*) for stay-green QTL *qSTG1A* (1.82 Mbp), *ten* (*IAA*, *SORBIDRAFT*, *CYP450*, *GAG/POL*, *PK*, *GENE X*, *UGTS*, *MTC*, *AGP16*,

VP25) for *qSTG2* (2.54 Mbp) and one (*SF CC1*) for *qSTG3* (2.18 Mbp) were predicted on sorghum chromosome No. 3 and 1, *qCID2* (2.33 Mb) on chromosome 10. Based on the predicted features and functions of candidate genes, total of 24 predicted genes from different transcription factor families like *MADS*, *PHD*, *NAD*, *EIF-4A* and *SPLICING FACTOR*, *CYP450*, *IAA* were tested for their expressional analysis through quantitative real-time PCR in 15, 30 and 45DAF leaf tissue samples from introgressed line with M35-1 genomic background. Among all tested samples most of the candidate genes were found to be up regulation with fold change of 3 to 6 and 6 to 10 folds. Senescence related gene *DINI* was down regulated in M-35-1 introgressed lines. Result indicated the potential use of stg and wue QTL pyramided lines for improving sorghum performance under drought stress.

Metagenomic and culture-dependent study of herbicide treated soil

RAKSHITA BHATT

2013

MAJOR ADVISOR: Dr. NARAYAN MOGER

Metagenomics is a relatively new branch of science which holds promise to study the microbial diversity and functionality as a whole on the basis of the nucleic acid content of the total community in a define niche. Soil health relies heavily on its microflora which has been found to be severely affected by the faulty agricultural practices like prolific usage of synthetic chemicals like herbicides and others. This study was planned to have an insight of the short-term effect of herbicides on the native soil microbial community. The direct method of extraction of high quality soil microbial community DNA was standardized. This was followed by studying of the effect of herbicides on the native soil microflora by two standard approaches; culture-based and metagenomics. Culture-based study concluded the selective inhibition of gram-positive organisms by alachlor, butachlor and pendimethalin. Further PCR

amplification was done using 16S rDNA universal primers for diversity study. DGGE was done for the 16S rDNA amplicons to see the similarity and diversity in different herbicide treated samples. The soil sample without any herbicide treatment showed the highest diversity index. The amplicon sequencing was done using ion torrent sequencing technology, to support the study. The sequence analysis was done using MG-RAST server, which concluded that soil microflora in the sample which did not receive any herbicide posses the maximum organism abundance as well as functional abundance, in contrast with those samples which were treated by herbicides. Hence it was concluded that the application of alachlor, butachlor and pendimethalin reduces the soil microflora, both in terms of organism and functional abundance during the incubation period of three days.

BIOCHEMISTRY

Biochemical efficacy of homa organic farming practices in okra (*Abelmoschus Esculentus* var. Arka Anamika)

RAJEEV KUMAR

2013

MAJOR ADVISOR: Dr. P. W. BASARKAR

A field experiment laid out in CRBD with 18 treatments replicated thrice was conducted during *kharif* 2012 to study the biochemical efficacy of Homa organic farming practices in okra (*Abelmoschus esculentus* var. Arka Anamika). The conventional control (CC) and control without homa (CWH) were maintained almost 1 km away. The soil type was red black. The non-homa ash was collected after burning the agricultural waste. Agnihotra homa (AH) was performed at sun rise and sun set and Om Tryambakam homa (OTH) was performed for 3-4 h daily during experimental period. Liquid organic manures viz, Panchgavya Jeevamruta and Gloria Biosol (GB) were prepared. The non-homa ash, AH ash, OTH ash and GB were used for soil and foliar application. Soil and foliar

application of GB was significantly superior over organic control in yield attributes. Significant increase in microbial population in soil, ctivities of soil dehydrogenase and phosphatase was observed. Macro and micro nutrient status of soil and okra fruits in homa treatments was significantly superior over organic control. Glaring increase was observed in okra fruits in its ascorbic acid content and in P (58%), K (98%), Cu (52%), Zn (48%), Mn (17%) and Fe (23%) contents over organic control. Significant reduction was observed in the incidence of powdery mildew (36%), *alterneria* leaf spot (57%), insect attack by fruit borer (38%) and *Spodoptera litura* larvae per plant (68%) due to soil and foliar application of GB and different homa treatments.

CROP PHYSIOLOGY

Influence of growth regulators on growth phyiology, yield and yield components in onion (*Allium cepa* L.) genotypes

B. P. ROOPA

2011

MAJOR ADVISOR: Dr. C. M. NAWALGATTI

A field experiment was conducted during *Kharif*, 2011 at Main Agricultural Research Station (MARS) University of Agricultural Sciences, Dharwad to study the effect of plant growth regulators on growth physiology, yield and yield components in onion (*Allium cepa* L.) genotypes. The experiment consists of nine treatments viz., The foliar spray of chlormequat chloride at four levels (500, 750, 1000 and 1250 ppm), two levels of mepiquat chloride (750 and 1500 ppm), two levels of triacontanol (1000 and 2000 ppm) and control. The onion genotypes used in the study are Nasik red and Arka kalyan. The experiment was laid out in split plot design with three replications. The foliar spray of these chemicals were taken at 40 DAS and 60 DAS. The results of the experiment reveled that, the plant height was increased with the application of triacontanol (1000 and 2000 ppm) as compared to control. While, it was significantly decreased with the application of mepiquat chloride followed by chlormequat chloride in both the genotypes. Among the treatments, chlormequat chloride @ 1000 ppm

has increased significantly number of leaves at all the stages except at harvest stage. The growth parameters viz., LAI, LAD, AGR, RGR, NAR, CGR, BMD had significantly higher values with the application of 1000 and 1250 ppm chlormequat chloride. It was noticed that, the total dry matter content (TDM) has been significantly increased in the treatment of chlormequat chloride (1000 and 1250 ppm) as compared to other treatments. The same treatment also significantly enhanced the biochemical parameters viz., Chlorophyll 'a', Chorophyll 'b', total chlorophyll and nitrate reductase. Similarly bulb yield was significantly higher with the application of chlormequat chloride (1000 ppm) as compared to other treatments and the lowest yield was obtained in control. The increase in bulb yield was due to increase in bulb length and bulb diameter. Among the genotypes Arka kalyan was found more superior than Nasik red with the respect to all the characters. From the study, it is inferred that the application of chlormequat chloride @ 1000 ppm is found to be more economic.

Effect of nutrients on physiology, yield and yield components and disease incidence in blackgram (*Vigna mungo* L. Hepper)

AKSHATA S. PATIL

2013

MAJOR ADVISOR: Dr. C. M. NAWALAGATTI

A field experiment was conducted during *kharif* 2012 to study the effect of nutrients on physiology, yield and yield components and disease incidence in blackgram (*Vigna mungo* L. Hepper) at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The experiment was laid out in complete randomized block design having twelve treatments with three replications. Foliar application of KNO₃ (0.5%), MnSO₄ (0.3%), ZnSO₄ (0.3%), MgSO₄ (0.5%), H₃BO₃ (0.2%), CuSO₄ (0.2%), FeSO₄ (0.3%), MnSO₄ (0.3%) + CuSO₄ (0.2%), ZnSO₄ (0.3%) +

FeSO₄ (0.3%), H₃BO₃ (0.2%) + CuSO₄ (0.2%), KnO₃ (0.5%) + FeSO₄ (0.3%) and Control (unsprayed). The treatments were imposed at 30 DAS after sowing. Significant differences were observed for various morphological, dry matter partitioning, biochemical and yield and yield attributes due to disease incidences. The foliar application of nutrients significant increases in plant height, dry matter in leaf stem and reproductive parts and total dry matter content was due to treatments as compared to control. the growth parameters viz., LAI, AGR, CGR, NAR, SLW and LAD increased

significantly due to the application of MnSO_4 (0.3%), followed by MgSO_4 (0.5%). The biochemical parameters viz., chlorophyll 'a' and 'b' and total chlorophyll content, nitrate reductase activity, and peroxidase activity were significantly increased as compared to control due to the application of 0.3% of MnSO_4 followed by 0.5% of MgSO_4 these treatments are less incidence of diseases as compared to control. The application of MnSO_4 (0.3%), also recorded higher seed yield is followed by 0.5% of MgSO_4 the

application of MnSO_4 (0.3%) + CuSO_4 (0.2%), and H_2BO_3 (0.2%) + CuSO_4 (0.2%) also increased seed yield was due to higher number of pods per plant, pod yield per plant, test weight, harvest index and quality parameters viz., crude protein content were significantly increased due to the MnSO_4 (0.3%) was less incidences of diseases. From the point of economics MnSO_4 (0.3%) was more effective followed by 0.3% of FeSO_4 and economically in increasing the yield and net returns.

FOODSCIENCE & NUTRITION

Development and evaluation of foxtail millet (*Setaria italica*) based vermicelli

PRAGYA PANDEY

2013

MAJOR ADVISOR: Dr. USHA MALAGI

Foxtail millet (*Setaria italica*) is the second-most widely planted species of millet. It is nutritionally superior to conventional food grains and exhibits hypoglycaemic effect due to presence of higher proportion of unavailable complex carbohydrate and resistant starch. Vermicelli is a popular instant food product which is tasty and easy to make, liked by people of all walks of life, irrespective of age and changing lifestyles. Hence, an attempt was made to develop foxtail millet based value added vermicelli. Standardization trials indicated that acceptable foxtail millet vermicelli could be developed by incorporating 50 per cent processed foxtail millet flour, 20 percent black gram dhal flour and 1 percent fenugreek seed powder in the standard vermicelli recipe. Developed vermicelli were evaluated for sensory, nutritional and storage quality. The overall sensory score for designed foxtail millet vermicelli was

7.6 in comparison to control which scored 8.4. The results indicated that foxtail millet vermicelli exhibited good cooking quality, percent solubility (30.67 %) and short cooking time (5.03 min). Cooking loss decreased significantly in both control and foxtail millet based vermicelli (8.84 – 6.74, 12.30 – 10.85 g/100g, respectively) at the end of storage period. Nutrient analysis revealed that, the moisture, protein, fat, ash, crude fiber and carbohydrate contents of developed vermicelli was 6.73, 14.32, 0.21, 1.42, 0.32, 0.45 and 77.0 per cent respectively with high dietary fibre content (22.17 %; soluble- 4.90 % and insoluble-17.4%). The developed foxtail millet vermicelli was acceptable and could be stored well beyond six months. Thus, the study presented an upshot of potentials of foxtail millet as a natural designer health food for the future.

Supplementation of omega-3 rich food on growth and cognitive performance of preschool children

JUBISMITA GOSWAMI

2013

MAJOR ADVISOR: Dr. BHARATI V. CHIMMAD

Omega-3 fatty acids are important for growth, development and cognitive abilities. Flaxseed (*Linum usitatissimum*) being an exceptionally rich vegetarian source of omega-3 fatty acids. An investigation was undertaken to assess the impact of supplementation of omega-3 rich flaxseed *laddu* in on growth and cognitive performance of preschool children. The study was conducted in two separate groups of children (25 in each) administered either flaxseed *laddu* (experimental group) or wheat *laddu* (placebo group) for three months. A matched control group was also maintained. Results of dietary intervention revealed that there was significant increase in height from 102.99 cm to 103.37 cm and weight from 12.92 kg to 14.88 kg after intervention in children of experimental group. In the children of placebo group increase in height from 102.85 cm to 103.19 cm and weight from 12.98 kg to 13.09 kg after intervention was observed. In control group there was increment in height from

103.70 cm to 104.10 cm and weight from 12.80 kg to 13.17 kg. A cent percent shift in nutritional status of wasted and stunted children to normal nutritional status was observed in the children of experimental group. A significant improvement in cognitive scores for conceptual skills from 19.00 to 20.20, visual skills was observed from 5.00 to 6.84 and memory skills from 3.54 to 6.12 after intervention was observed in the experimental group. It was also indicated that the children in experimental group were more active than others. Educational counselling of parents about significance of omega-3 fatty acids on growth and cognitive performance of preschool children was highly successful. Omega-3 enriched flaxseed *laddu* exhibited good acceptability among consumers across the society. Thus the study indicated that omega-3 flaxseed *laddu* was proved to be beneficial in improving nutritional status and cognitive parameters.

Quality characteristics of toast bread developed from composite flour of dicoccum Wheat (*Triticum dicoccum* Schrank Schuebl)

YOMBOMBAM

2013

MAJOR ADVISOR: Dr. NIRMALA YENAGI

The present investigation was carried out to study the quality characteristics of dicoccum wheat varieties for development of fiber enriched toast bread. Two dicoccum wheat varieties (DDK-1025 and DDK-1029), one commercial dicoccum wheat and one check bread wheat UAS-304 were studied for nutritional, functional and processing qualities. Dicoccum wheat based toast bread was standardized for optimum addition of dicoccum flour, sugar, salt and fat, enriched with medicinal herb. Developed toast bread was assessed for nutritional and storage quality. Dicoccum wheat varieties were high in protein, ash, crude fiber, dietary fiber and trace elements such as Mn, Cu, Zn and Fe contents as compared to bread wheat. Among the dicoccum wheat varieties DDK-1029 exhibited better functional properties for preparation of toast bread. The organoleptically acceptable optimized dicoccum wheat toast bread was developed by composite flour mix of dicoccum and refined flour in

75:25 proportions and addition of 6g sugar, 1.5g yeast, 1.5g salt and 25g fat with one per cent chakramuni herb. The protein, fat, ash, crude fiber and dietary fiber contents of dicoccum toast bread were significantly higher than refined flour. Among the dicoccum wheat varieties the nutritional profile of DDK-1029 toast bread was good. The crude fiber content of developed toast bread was significantly higher than commercial toast bread. Enriched toast bread of dicoccum wheat enhanced the crude fiber by 20-25 per cent. The dietary fiber content of refined flour toast bread was 2.74 per cent whereas in dicoccum wheat toast bread with and without enrichment ranged from 12.04-15.49 and 13.71-16.08 respectively. The enriched dicoccum toast bread was found acceptable during the storage period of one month. The study indicates that dicoccum wheat flour can be used in bakery to enrich the dietary fiber content of toast bread as healthy food.

FORESTRY-PLANTATION TECHNOLOGY

Influence of containers, potting mixtures in nursery, spacing and nutrient management in early field establishment of *salacia chinensis*

J. SOMASHEKAR

2012

MAJOR ADVISOR : Dr. K. S. CHANNABASAPPA

Salacia chinensis is an important medicinal plant found throughout India including Andaman and Nicobar Islands. This plant having a greater importance in modern medicine which leads to commercial cultivation. The over exploitation of this plant in forest which leads to depletion of population in forest. In view of this, an experiment was undertaken during 2011-12. Raising good quality seedlings at nursery stage is a very important aspect for success of any plantation programme. Spacing and integrated nutrient management are the two important factors which influence the growth and productivity of plants. A nursery experiment was conducted at College of Forestry, Sirsi, Uttara Kannada district of Karnataka. Geographically nursery is situated at 14°36' N latitude and 75°53' E longitude and an altitude of 619 m MSL. Mean annual rainfall is 2657 mm, most of which is received between June to October. Temperature varies from 9.5°C to 35°C. The experiment was laid out in factorial completely randomized design (Factorial CRD) with three replications. The present experiment revealed that, root trainers and poly bags did not show significant differences in plant growth of *Salacia chinensis*. The data revealed that the effect of different potting mixtures had significant effect on plant growth. Maximum plant growth was recorded in 2: 1: 1 with 1 g DAP at all stages of seedling

growth followed by 2: 1: 1 with 5 g VAM. At 12 MAT, 2:1:1 with 1 g DAP recorded maximum growth parameters (12.66 cm plant height, 4.02 mm collar diameter, 20.8 number of leaves) fresh and dry weight of leaves, root and stem in gram (9.16 and 1.83), (7.27 and 1.45), (11.24 and 2.70) followed by 2: 1: 1 with 5 g VAM. The field experiment was conducted at Agricultural Research Station, Malagi of Mundgod, Uttara Kannada District of Karnataka. The place is situated at 14°38' N latitude and 75°00' E longitude at an altitude of 490 m above mean sea level (MSL). The experiment was laid out in split plot design with the spacing 0.5 × 0.5, 0.5 × 1 and 1 × 1 m in main plot and fertilizer levels in subplot. Planting was taken up with one year old *Salacia chinensis* seedlings. Spacing and nutrient levels recorded significant difference in plant growth among treatments. Wider spacing (1 x 1 m) along with 10 tons FYM + 50:100:50 NPK kg/ha recorded significantly maximum plant growth over other treatments (plant height 43.28 cm, collar diameter 7.27 mm, number of leaves 20.2) followed by 1 x 0.5 m with 10 tons FYM + 50:50:50 NPK kg/ha (plant height 42.08 cm, collar diameter 7.16 mm, number of leaves 20.0). Significantly lower (plant height 21.96 cm, collar diameter 5.79 mm, number of leaves 17.6) recorded in 0.5 x 0.5 m with control.

FORESTRY-WATERSHED MANAGEMENT

Studies on effect of integrated nutrient management on early establishment of *Casuarina equisetifolia* plantation in sharawati watershed area

PARASHURAM NAVI

2013

MAJOR ADVISOR: Dr. G. V. DASAR

Nutrients are basic resources for the growth and productivity of trees. Application of organic manures and inorganic fertilizers helps for growth and productivity of trees. A field trial was conducted to investigate the effect of integrated nutrient management on early establishment of *Casuarina equisetifolia* plantation in Sharawati watershed area of Uttara Kannada district during 2011-2012. The plantation of one year old *Casuarina equisetifolia* was selected and experiment was planned with split plot design. The organic manure were imposed as a main plot treatments viz., Bio fertilizer culture (VAM-7.5 kg/ha), Farm yard manure @ 5 tonnes/ha, Vermicompost @ 2.5 tonnes/ha and Control. Application of inorganic fertilizers viz., 100: 50: 100 N, P₂O₅, K₂O in kg/ha, 150: 75: 150 N, P₂O₅, K₂O in kg/ha, 200: 100: 200 N, P₂O₅, K₂O in Kg/ha and Control as a subplot treatments. The plant growth parameters viz., Plant height, Collar diameter, Crown diameter and Number of branches were recorded at every three month interval. The results indicated that plant

height, collar diameter, crown diameter and number of branches were recorded significantly higher in vermicompost @ 2.5 tonnes/ha along with 200: 100: 200 N, P₂O₅, K₂O from 3 MAT to 12 MAT as compared to other treatments. The treatment vermicompost @ 2.5 tonnes/ha along with 200: 100: 200 N, P₂O₅, K₂O were recorded significantly higher nutrient content in different tree parts viz. Nitrogen (leaf- 1.78%, branch- 0.96% and bark- 0.6%), Phosphorus (leaf-0.55%, branch-0.51% and bark- 0.53%) and Potassium (leaf-1.53%, Branch- 1.68% and bark- 0.71%) over the other treatments. The soil pH and electrical conductivity showed non-significant effect in all treatments. The organic carbon showed significantly higher (0.88%) in vermicompost @ 2.5 tonnes/ha with 200: 100: 200 N, P₂O₅, K₂O kg/ha at 12MAT. The treatment vermicompost @ 2.5 tonnes/ha along with 200: 100: 200 N, P₂O₅, K₂O were recorded significantly higher available Nitrogen (143.79 kg/ha), Phosphorus (29.06 kg/ha) and Potassium (87.02 kg/ha).

FOREST GENETIC RESOURCES

Provenance variation in seed and seedling traits of jamun (*Syzygium cumini*, Skeels) In Uttara Kannada district

LOKANNAVAR RAKESH

2012

MAJOR ADVISOR: Dr. H. SHIVANNA

The study on "Seed source variation in seed, germination and seedling attributes of Jamun (*Syzygium cumini* Skeels) in Uttara Kannada district of Karnataka" was conducted at college of Forestry, Sirsi. The study was laid out by following completely randomized design with eight treatments (seed sources) and three replications. The maximum fruit length (21.26 mm), fruit diameter (14.79 mm), fruit test weight (370.71 g) were recorded in Mundgod seed source. Seed length (15.20 mm), seed width (8.42 mm) and test weight (53.25 g) were recorded highest in Mundgod seed source. However Sirsi seed source recorded the least for both fruit and seed parameters. Among the fruits collected from different seed sources, pulp weight, pulp content and pulp to seed ratio were 2653.25 g 2.46 g, 74.46% and 65.13 recorded highest in Mundgod seed

source. Maximum germination was recorded in Mundgod seed source (90.66%) and least was noticed in Sirsi seed source (69.33 %). At 120 days after germination, maximum seedling height was recorded in Mundgod seed source (47 cm) and least was in Sirsi seed source (40.63cm). Similar trend was observed for collar diameter in Mundgod and Sirsi seed sources. The shoot length and root length traits were higher in Mundgod seed source (48.16 cm and 24.07 cm) at 120 days after germination and lowest was in Sirsi seed source (37.23cm and 17.36 cm). The highest fresh shoot biomass (10.25g) was recorded for Mundgod followed by Yellapur seed source (9.25 g), least was in Sirsi seed source (5.13 g). Thus Mundgod seed source emerged to be most promising one.

Provenance variation studies on fruit, seed and seedling, traits of *Zanthoxylum rhetsa* - A tree under high exploitation in Central Western Ghats

JYOTHI B. PATIL

2012

MAJOR ADVISOR: Dr. H. SHIVANNA

The study on Provenance variation studies on fruit, seed and seedling, traits of *Zanthoxylum rhetsa* - a tree under high exploitation in Central Western Ghats was conducted at college of Forestry, Sirsi. The study was laid out by following completely randomized design with six treatments (seed sources) and four replications. The fruit length, fruit width, fruit test weight were 6.09 mm, 4.19 mm and 21.29 g respectively in Sirsi seed source which was found highest. Seed length, seed width and test weight and volume were 2.84 mm, 1.75 mm and 10.40 g, 0.037 mm³ in Sirsi seed source which was found to be superior from rest of the seed sources. However Kumta seed source recorded the least for both fruit and seed parameters. Among the different pre treated seeds, the highest germination percentage was found to be 45% in boiling water for five min with cow dung treatment for three days, followed by only cow dung treatment for two days (42%). There was an increase of 68.64 per

cent in mean daily germination due to boiling water for five min with cow dung treatment for three days as compared to control. Maximum germination was recorded in Sirsi seed source (45.29%) and least was noticed in Kumta seed source (26.45 %). At 180 days after germination, maximum seedling height was recorded in Sirsi seed source (37.11 cm) and least was in Kumta seed source (24.88 cm). Similar trend was observed for collar diameter in Sirsi and Kumta seed sources. The shoot length and root length traits were higher in Sirsi seed source (33.45 cm and 17.01 cm) at 120 days after germination and lowest was in Kumta seed source (22.65 cm and 12.96 cm). The highest fresh shoot biomass (9.43 g) was recorded for Sirsi followed by Siddhapur seed source (9.05 g), least was in Kumta seed source (8.18 g). Thus it is inferred that for any further Improvement/ breeding work, Sirsi seed source was found most promising.

Provenance variation of *Cassia fistula* L. for pod, seed and seedling traits from agroclimatic zones of Northern Karnataka

RENUKANAYAK

2013

MAJOR ADVISOR: Dr. H. SHIVANNA

Cassia fistula, a member of the family Caesalpinaceae is an important tree with lot of medicinal properties commonly called as 'Amaltas'. Recently this species is gaining more popularity for its medicinal value. The pods and seeds are economically important part having medicinal properties. With this point in view the present study was carried out in College of Forestry, Sirsi during 2012-2013. The study was laid out by following CRD design with five treatments (provenances) and three replications. The average pod weight and length was 59.28 g, 57.60 cm. The average seed length, seed width, seed test weight and volume was 6.80 mm, 5.96 mm, 16.68 g and 12.18 mm³. Hilly zone recorded the highest for pod and seed parameters. The study was laid out by following factorial CRD with five treatments (provenances) as main treatment and

12 pre-sowing treatment with three replications. Out of twelve different seed treatments tried, the maximum germination percentage (81.47%) was recorded in Cold water soaking for 24 h after that dipping in H₂SO₄ for 1 min. The other quality indices viz, mean daily germination, peak value, germination value, germination rate of seedling also high in this treatment. Significantly increased the seedling growth attributes was observed in hilly zone viz, seedling height, collar diameter, shoot fresh, root fresh, shoot and root vigour index, shoot to root ratio, total leaf area, relative water content and Chlorophyll content by 38.20 cm, 3.74 mm, 8.50 g, 4.55 g, 3775.80, 1231.39, 2.14, 1358.79 cm², 90 per cent and 21.90 mg/ g fresh weight respectively at 180 days after planting. The study identifies the Hilly zone as the best provenance for *Cassia fistula*.

GENETIC AND PLANT BREEDING

Genetic analysis of free threshability trait in dicoccum wheat [*Triticum dicoccum* (Schrack) Schuebler]

C. H. NAGARAJU

2013

MAJOR ADVISOR: Dr. S. A. DESAI

Dicoccum wheat (*Triticum dicoccum* (Schrack) Schuebler) is nutritionally superior compared to other wheats and it provides valuable source of resistance genes. Because of fragile rachis and non-free threshing kernels, it makes difficult in harvesting and threshing. A study was conducted to find out the inheritance pattern of free threshability in dicoccum wheat using biometrical technique generation mean analysis. Experimental material was generated by crossing DDK-1025, a non free threshing variety with two advanced free threshable mutant lines (ML-1 and ML-2) and further developing a set of six generations (P₁ P₂, F₁ F₂, BC₁ and BC₂) for two crosses. Gene effects for threshability, yield and other related traits were estimated during Rabi 2013. Threshability coupled with yield and yield components like number of tillers, number of spikelets per spike, number of grains per spike and thousand grain weight exhibited considerable variation

indicating the scope for effective selection to improve these characters. Dominant gene action with interaction effect (dominant x dominant) influenced the free threshability. Presence of rachis is dominant to absence of rachis and it controlled by single dominant gene. Association analysis revealed, high positive correlation of grain yield with number of tillers per plant, number of spikelets per spike, number of grains per spike and thousand grain weights in both the crosses. Strong association between threshability and rachis was noticed. Frequency of transgressive segregants in respect of free threshability was higher in BC₂ population compared to F₂ and BC₁ generations. The investigation revealed that the cross DDK-1025 x ML-2 was the potential source for improving the free threshability and yield. However, DDK-1025 x ML-1 may be regarded as potential source population for yield components like number of spikelets per spike and spike length.

Genetic variability studies for grain quality including productivity traits in mini core collections and promising varieties of sorghum [*Sorghum bicolor* (L.) Moench]

ASHWINI KARADI

2013

MAJOR ADVISOR: Dr. S. T. KAJJIDONI

An investigation was carried out to assess nature and magnitude of genetic variability parameters, association and path analysis for different quantitative characters for productivity and grain quality traits involving 208 mini core, 24 selected mini core and 16 selected promising varieties during rabi season of 2011-12 and 2012-13 at AICSP, UAS Dharwad. Highly significant differences were found for all characters in mini core and selected mini core and selected promising varieties, except for true density among promising varieties. High estimates of PCV, GCV, heritability coupled with GAM were recorded for most of characters except for bulk density and true density in mini core and similar estimates

were also recorded in selected mini core except for plant height, true density, seed size, seed protein and seed amylopectin. Similarly seed yield per plot and fodder yield per plot among selected promising varieties. Seed yield per plant exhibited highly significant positive association with plant height, ear head width, 100 seed weight, seed volume and seed size in mini core and selected mini core collections and among selected promising varieties, seed yield per plot exhibited significant positive association with ear head width, 100 seed weight and bulk density at both levels. Path analysis revealed that, direct positive contribution of plant height, ear head width and 100 seed weight towards

seed yield per plant at both levels in mini core but only at phenotypic level in selected promising varieties. Similarly, fodder yield and seed size had high positive direct effects on seed yield per plot at both levels among selected mini core collections. Among mini core, IS-19975 was

superior for seed yield per plant, similarly IS-13459 for seed protein, IS-13782 for seed amylose in selected mini core. SVD-803 for grain yield, Phule Vasudha for seed protein, SVD-808 for seed amylose among selected promising varieties.

Genetic variation among traditional landraces of rice with specific reference to nutritional quality

T. N. SATHISHA

2013

MAJOR ADVISOR: Dr. P. M. SALIMATH

Developing the rice varieties with enhanced iron and zinc content is an important strategy to alleviate micronutrient malnutrition. The study was under taken to know the genetic variability, diversity for grain yield and micronutrient content in 130 traditional land races of rice. ANOVA revealed highly significant differences among the genotypes for all the quantitative traits. High PCV, GCV, heritability and genetic advances were recorded for grain yield (kg/ha), while these were moderate for other productivity and nutritional traits. Iron and zinc contents were positively correlated, while there is no correlation of protein and zinc content with grain yield. On the basis of Mahalanobis D² statistics the genotypes were grouped into eight clusters. The highest intra-cluster distance was recorded for cluster-IV. The genotypes from cluster V may be crossed with those in cluster VII as they are more diverse. The grain yield (kg/ha) has maximum contribution towards the genetic divergence followed by zinc and iron

content. Assessment of the stability of micronutrients is done on 36 genotypes to analyse the pattern of genotype x environment interactions (GEI) and environmental stability for iron, zinc and protein concentrations in grain using the Additive Main Effects and Multiplicative Interaction (AMMI) statistical model. Results indicated that the effects of genotypes, environments and GEI were significant ($P < 0.05$) for both micronutrients and protein content. The AMMI model identified Damber Sali and Belgium Basmati as the most stable genotypes for grain iron content, while Damber Sali was the stable for grain zinc, Ambemohar-1 as the most stable genotype for grain protein content and Dodiga-1 stable genotype for grain yield across the four environments. These genotypes which are stable and superior for micronutrients and protein content are good candidates for using as a donor in breeding programme to improve nutritional quality in rice.

Genetic divergence studies in a germplasm collection of safflower (*Carthamus tinctorius* L.)

K. P. PAVITHRA

2013

MAJOR ADVISOR: Dr. RAJESH S. PATIL

A collection of 150 safflower germplasm accessions was evaluated to study genetic divergence, trait association and path coefficients for 15 quantitative traits in augmented design during rabi 2011-12 at Agricultural Research Station, Annigeri, UAS, Dharwad. Analysis of variance revealed highly significant differences among the genotypes for eight characters. The traits, plant height, rosette period, days to fifty per cent flowering, days to maturity and number of seeds per capitulum were less influenced by environment. High broad sense heritability with high genetic advance as per cent mean was noticed for number of seeds per capitulum and biological yield per plant. High heritability with moderate GAM was noticed for rosette period. These traits can be considered in selection of genotypes for crop improvement. The two accessions, GMU 3638 and GMU 3663, out yielded the best check A-2 and five accessions viz., GMU 3705, GMU 3781, GMU 3739, GMU 3798 and

GMU 3787 had high oil content. Correlation study revealed that seed yield per plant exhibited positive significance with plant height, capitula per plant, number of seeds per capitulum, biological yield and harvest index and negative significance with rosette period, days to fifty per cent flowering and days to maturity. Path analysis revealed that all significantly correlated traits exhibited positive direct effect on seed yield except days to maturity. The genetic divergence studies classified the accessions into 24 clusters by employing D² statistic. Genetic divergence was mostly due to biological yield followed by harvest index and plant height. The accessions belonging to Clusters XIII, V, VI and VII could be used for crop improvement as they had high seed yield. Molecular characterization using 38 SSR markers revealed high polymorphism among the accessions. No resistance to alternaria disease was found in the germplasm screened using detached leaf method.

Heterosis and combining ability studies in rabi sorghum

PRATEEKSHAS. KHADI

2013

MAJOR ADVISOR: Dr. B. D. BIRADAR

An investigation was carried out in rabi sorghum at Regional Agricultural Research Station, Bijapur, during rabi 2011-13 to evaluate 28 new hybrids (without reciprocals) developed through diallel mating design along with their 8 parents and one check (DSH-4) for generating information on combining ability of parents and hybrids and heterosis in respect of grain yield and its components. Apart from this investigation was also aimed to know the variability and inheritance pattern of charcoal rot resistance in F₂ of two crosses. Hybrids showed highly significant differences for all the characters studied except 1000-grain weight. The estimates of SCA variance was higher in magnitude compared to GCA variance for all the characters indicating the predominance of non-additive gene action and good scope for heterosis breeding. Among parental lines, Phule Vasudha and PKV Kranti manifested highest gca effects for yield components and were good general combiners. Majority of the hybrids exhibited significance of better parent heterosis in all

the 15 characters studied confirming predominance of non-additive gene action. The crosses DSV-4 × PKV Kranti and DSV-4 × PKV Kranti exhibited higher significant positive sca effect in desirable direction for grain yield. On the basis of *per se* performance, exploitable heterosis, GCA effects and gene action involved in the expression of grain yield, its component characters, the hybrids DSV-4 × PKV Kranti, DSV-5 × PKV Kranti, DSV-5 × PKV Kranti and DSV-4 × Phule Vasudha were considered to be the best for exploitation in sorghum breeding programme. Both the crosses DSV-4 × CSV-216R and DSV-5 × CSV-216R exhibited large amount of variability for charcoal rot resistance characters. The high heritability was recorded for number of nodes crossed and length of infection which indicated that less influence environment. The inheritance for number of nodes crossed indicated complementary gene action (9:7) for the cross DSV-4 × CSV-216R, while single dominant gene (3:1) for the cross DSV-5 × CSV-216R.

Genetic analysis of oil quality, yield and its components in recombinant inbred lines of groundnut (*Arachis hypogaea* L.)

JESSU ASHISH

2013

MAJOR ADVISOR: Dr. H. L. NADAF

An investigation on genetic analysis of oil quality, yield and its components in recombinant inbred lines of groundnut was undertaken during *kharif* 2011 and *kharif* 2012 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad. The experimental material comprised of 816 RILs derived from GPBD-4 × GM 4-3 along with these two parents and five checks in 2011 *kharif* and 2012 *kharif* and 86 selected lines evaluated in 2012 *kharif*. These Recombinant Inbred Lines (RILs) were grown in a replicated

yield trial by adopting RBD design and observations were recorded on eleven quantitative characters, eight fatty acids, two foliar diseases. Significant genetic variation was observed in Recombinant Inbred Lines (RILs) studied as evidenced by wider range and high PCV and GCV for most of the characters studied. High heritability with high genetic advance were recorded for 100- kernel weight, pod yield, kernel yield, oil yield, oleic acid, linoleic acid, and O/L ratio. Character association study revealed positive association of pod weight

per plant, days to 50 per cent flowering, days to maturity, oil content with pod yield. Oleic acid and linoleic acid were negatively and significantly correlated, whereas O/L ratio had significant positive correlation with oleic acid and significant negative correlation with linoleic acid. The superior

Recombinant Inbred lines identified for pod yield were RIL No. 723 (6549 kg/ha), 192 (6516 kg/ha), 600 (6371 kg/ha), 718 (6227 kg/ha), 750 (6005 kg/ha), for high oleic acid 38 (73.4%), 812 (73.3%), 39 (71.2%), 34 (71%), 816 (68.6%) all these lines are medium resistance (score 5-6).

Morphological, biochemical and anatomical basis for biotic stress resistance in cotton

YALLAPPAS. HARIJAN

2013

MAJOR ADVISOR: Dr. B. M. KHADI

The present investigation was carried out at ARS, Dharwad Farm, during 2012-13. 190 recombinant inbred lines were screened for the identification of disease reaction as parents are differentially reacted to Alternaria and bacterial blight disease, male and female parents recorded resistant and susceptible reaction to Alternaria and bacterial diseases. Among all RILs, only few were grouped into highly resistant (DCHRIL 37, DCHRIL 126) and highly susceptible (DCHRIL 47, DCHRIL 164) but none of them were immune for all three diseases. For pest reaction, all RILs showed various reactions viz., resistant, tolerant, susceptible and highly susceptible. Biochemical observations revealed that reducing sugar was low in case of resistant lines where as gossypol and phenol content was high. The histological study showed that the highly resistant RILs had more number of cortical cells, number of palisade parenchyma cells and distance between lower

epidermis and phloem of leaf midrib, less thickness of leaf lamina, distance between upper and lower epidermis and breadth of midrib. 190 RILs were grouped into three clusters based on yield and yield related traits and 80 RILs based on fibre traits were grouped into ten clusters, which indicated the presence of appreciable amount of genetic diversity. The seed cotton yield per ha was the largest contributor with 92.19 per cent towards divergence among the yield and yield related traits and the 2.5 per cent span length was the largest contributor with 45.85 per cent towards divergence among the fibre traits. Parental polymorphism survey was done using 88 heterologous SSR primers to know their transferability. Out of 88, 41 primers showed their presence in cotton. The primer pairs of NLRR, VuRS02A2R and VuRS01K16R showed polymorphism between parents which react differently for disease reaction.

Genetic diversity studies for yield, fibre traits and sucking pests (Thrips and Jassids) in cotton (*Gossypium hirsutum* L.)

G. K. NISHANTH

2013

MAJOR ADVISOR: Dr. I. S. KATAGERI

In the present study, a total of 480 germplasm lines of *G. hirsutum*, which includes collections (indigenous and exotic), released varieties and lines developed from different breeding strategies, evaluated at ARS, Dharwad Farm, during 2011-12, under Augmented Design-II. Wide range of difference for various characters was observed in all these germplasm lines. The range for seed cotton yield (kg/ha), boll number, boll weight, ginning out turn, halo length was respectively 404.00 to 3472.22 kg/ha, 2.10 to 21.40 bolls/plant, 3.04 to 6.76g, 25.00 to 45.00 per cent, 21.25 to 35.25 mm. They were grouped into twenty two clusters based on yield and yield related traits and 49 germplasm lines were grouped into eight clusters based on fibre traits, which indicated the presence of appreciable amount of genetic diversity. The seed cotton yield per ha was the largest contributor (37.63 per cent) followed by boll number (33.01 per cent) and number of sympodia (12.25 per cent) towards divergence and among fibre traits, the 2.5% span length was the largest contributor (34.79 per cent) followed by maturity coefficient (14.78%)

and uniformity ratio (13.72 per cent) towards divergence. Although, the experiment was under protected condition for insects, due to severe incidence of jassids, the presence of phenotypic variability for jassid reaction was prominent; therefore observation on jassids damage was recorded and classified 44, 310 and 126 lines as resistant, tolerant and susceptible respectively. To validate their reaction to jassids the experiment was repeated in year 2012-13 with 20 germplasm lines comprising of resistant, tolerant and susceptible types and 5 checks in protected and unprotected conditions. Under protected condition experimental mean of thrips and jassid load was 1.70/leaf, 0.98/leaf respectively, whereas in unprotected condition mean thrips and jassid load was 6.91/leaf, 1.58 /leaf respectively crossing threshold limit. Reducing sugar was low in resistant lines whereas gossypol and phenol content was high. Lines SEC-6, FQT-36 showed resistance to jassids and CPD-1015 recorded as resistant to both jassids and thrips, based on pest reaction (symptoms) and biochemical components present

Genetic analysis of powdery mildew resistance, seed yield and its component traits in sunflower (*Heliantus annus* L.)

NAGAYYA V. VACHADMATH

2013

MAJOR ADVISOR: Dr. K. G. PARAMESHWARAPPA

Investigations have been carried out in sunflower in two seasons to study the Heterosis and combining ability for various yield and component traits through partial diallele analysis and inheritance pattern of powdery mildew resistance and gene actions governing eight quantitative traits using six generation mean analysis in the experimental block of Department of Genetics and Plant Breeding at the Main Research Station, University of Agricultural Sciences, Dharwad during kharif 2012 and rabi 2012, respectively. The study clearly revealed the major role of additive and non-additive gene actions in respect of for yield and yield related traits and also indicated the role of interactions of genetic components like additive x additive (i) effects and dominant x dominant (I) effects for yield and yield related traits. Further screening study revealed that the

male lines ID-5, ID-9 and PS 1070, female lines CMS 17A and CMS 335A and three of the hybrids CMS 17A x ID-5, CMS 17A x ID-9 and CMS 335A x PS 1070 showed resistance to powdery mildew and results obtained from F_2 segregating generation of five crosses in the sunflower such as CMS 17A x ID-5, CMS 17A x ID-9, CMS 335A x PS 1070, CMS 7-1A x ID-5 and CMS 7-1A x ID-9 revealed that powdery mildew disease resistance is controlled by polygenic inheritance. As regards to heterosis and combining ability the results revealed that CMS 335A x PS 1070, CMS 17A x ID-5 and CMS 17A x ID-9 exhibited higher heterosis over better parent and males ID-5, ID-9 and PS 1070 and females CMS 17A and CMS 335A have been the best general combiners for seed yield and its components.

Genetic variability studies in minicore collection set of pigeonpea (*Cajanus cajan* (L.) Millsp.) and molecular characterization in special relation to sterility mosaic disease, fusarium wilt and protein content

K. H. NETHRAVATHI

2013

MAJOR ADVISOR: Dr. B. R. PATIL

A minicore collection set comprising 192 pigeonpea accessions were evaluated in an augmented design during 2012-13 kharif at Botanical garden, Main Agricultural research Station, University of Agricultural Sciences Dharwad. The genotypes were evaluated for the genetic parameters, correlation, and path coefficient analysis and for reaction to

fusarium wilt (FW), sterility mosaic disease (SMD) and protein content. High genotypic and phenotypic co-efficient of variation, was recorded for the characters viz., Number of primary branches per plant, number of pods per plant and seed yield. However High heritability coupled with high genetic advance as per cent of mean was exhibited by the characters

viz., plant height, days to fifty per cent flowering, days to maturity, seed yield per plant, harvest index and specific gravity. Aforesaid characters may be stressed during selection for genetic gain. The accessions, ICP13270, ICP3049, PUSA-92 and MA-29 recorded significantly high seed yield per plant compared to the standard check, (Maruti). These genotypes can be considered for hybridization programme. Divergence studies classified the accessions into 9 clusters. The intra cluster distance was maximum in cluster VII (146.77). Selection of genotypes from these divergent groups would result in higher magnitude of heterosis for the

characters concerned. Based on phenotypic observations 48, 50 and 46 accessions were selected for molecular characterization of FW, SMD and protein content respectively employing a set of 150 simple sequence repeat (SSR) primers. The allele size's ranged from 100 to 220 bp for fusarium wilt, 100 to 300 bp for sterility mosaic disease and 100 to 200 for protein content. These markers can be successfully used for molecular characterization of genotypes. Most abundant motif's in the present study were AT based (AT, AAT, TTAT) followed by TC class of repeats. Such repeats may be emphasized during marker assisted selection.

Diversity analysis among selected short duration chickpea cultivars and breeding lines based on agronomic traits and STMS markers

SYEDA ASMA KOINAIN

2013

MAJOR ADVISOR: Dr. V. S. HEGDE

The experiment was conducted during 2012-13 at IARI Centre, Dharwad (E_1) and Genetics Division, IARI, New Delhi (E_2) involving 30 short duration chickpea cultivars and breeding lines to study the genetic diversity based on morphological and STMS markers. The analysis of variance revealed significant differences among the genotypes for all the characters except for early vigor at E_1 and for all the characters at E_2 . Mahalanobis's D^2 analysis revealed that 30 genotypes were grouped into eight clusters at E_1 and 5 clusters at E_2 . The distance values for all the 435 pairs of genotypes for different traits at E_1 ranged from 2.0 between ICCV2 and BGD9920 to 19.1 between ICCV4958 and Karikadale and at E_2 it ranged from 0.7 between BGD9706 and JG11 to 47.9 between BGD132 and BG1103. Crossing between these genetically diverse genotypes may result in promising derivatives for grain yield and other agronomically important traits. The study showed that 100-seed weight followed by days to maturity, number of pods/plant, biomass/plant contributed maximum to genotypic

divergence at E_1 and at E_2 days to fifty per cent flowering, seed yield/ plot, 100-seed weight has contributed maximum to the genotypic divergence. The genetic diversity studies using STMS markers revealed that among the primers used PIC was highest for the STMS primer CAM0443 and CAM0886, which indicated that these primers might be an effective and useful tool to determine the genetic differences among the genotypes and to study the phylogenetic relationship. The STMS marker profiles resulted in seven clusters at nearly 52 per cent similarity revealing that the presence of genetic diversity at molecular level was high among the selected genotypes. The highest similarity index was observed between BGD72 and Annigeri-1 whereas the lowest similarity index between BGD9920 and ICCV2944. The correlation between morphological and STMS dissimilarity matrices was positive 0.079 and non significant ($p < 0.001$, random permutations) for both locations suggesting that the two systems gave different estimates of genetic relations among the genotypes.

HUMAN DEVELOPMENT AND FAMILY STUDIES

Emotional intelligence, general mental ability and academic achievement of adolescents

WONCHANOE. ENNY

2013

MAJOR ADVISOR: Dr. GANGA YENAGIRI

The study was conducted to know the emotional intelligence, general mental ability and academic achievement of adolescents. The sample consisted of 200 adolescents (100 boys and 100 girls) of age ranging from 13 to 19 years drawn randomly from different schools of urban and rural areas in Dharwad taluk during 2012-2013. Emotional intelligence was measured using Bar-On emotional intelligence: youth version by Bar-On and Parker (2000), general mental ability was assessed by using standard Raven progressive matrices by Raven (1936), socio economic status was measured by using socio-economic scale by Aggarwal *et al.*, (2005) and academic achievement was assessed by taking the average percentage of two previous year annual examination marks. The result revealed that, there was significant difference between urban and rural adolescents on general mental ability and academic achievement but no significant difference was observed between urban and rural adolescents on emotional

intelligence. Gender difference was found to be significant at 5 per cent level of probability on emotional Intelligence but gender difference was found to be non significant on general mental ability and academic achievement of adolescents. Influence of age, type of family, size of family, parent's education, parent's occupation and family income on emotional intelligence, general mental ability and academic achievement was found to be non- significant. Socio economic status showed a significant association with general mental ability but no significant association was observed with emotional intelligence and academic achievement of adolescents. A significant association and correlation was observed between general mental ability and academic achievement but no significant association and correlation was found between emotional intelligence and general mental ability, and also between emotional intelligence and academic achievement of adolescents.

Influence of home environment on personality traits of adolescents

LEEMA RAJKUMARI

2013

MAJOR ADVISOR: Dr. SARASWATI C. HUNSHAL

The present study on influence of home environment on personality traits of adolescents was conducted in the year 2012-13 in Dharwad taluk of Karnataka. The sample for the study comprised 256 adolescents (128 boys and 128 girls) who were selected from 8th, 9th, 10th standard, PUC-I and PUC-II classes from urban and rural areas. Self-structured questionnaire was used to collect background information of the subjects. The Big Five Inventory developed by John *et al.*, (1991) was used to assess the personality traits and Home Environment Inventory developed by Mishra (1983) was used to assess the home environment of the subjects. The results revealed significant difference between the urban and rural adolescents in some of the personality traits such as agreeableness, conscientiousness and emotional stability wherein the urban adolescents were better in conscientiousness whereas the rural counterparts were better in agreeableness and emotional stability. Further results on the influence

of home environment on the personality traits of adolescents indicated that almost all the components of home environment had significant influence on the personality traits of adolescents except control and punishment. The Protectiveness dimension had significant influence on agreeableness, emotional stability and openness to experience while Conformity on extroversion, agreeableness, conscientiousness and openness to experience, Social isolation on extroversion, agreeableness and conscientiousness and Reward on agreeableness and conscientiousness and deprivation of privileges on extroversion, agreeableness, conscientiousness and openness to experience and Nurturance on conscientiousness, emotional stability and openness to experience and Rejection on all the personality traits and Permissiveness on extroversion dimensions of personality. However, control and punishment dimensions had no significant influence on any of the personality traits.

Influence of home environment on concept development of rural, tribal and urban preschool children

VIJAYLAXMI S. NAYAK

2013

MAJOR ADVISOR: Dr. LATA L. PUJAR

A study on "Influence of home environment on concept development of rural, tribal and urban preschool children" was carried out in Ranebennur taluk of Haveri district, Karnataka state during 2012- 2013. The sample for the study comprised of 120 preschool children of whom 40 were from rural, 40 from tribal and 40 from urban area of Ranebennur taluk. From each area 20 boys and 20 girls in the age group of 3-5 years were selected randomly from 24 Anganwadis. Mohite Home Environment Inventory (1990) and Bracken Basic Concept Scale (2006) were used to assess home environment and conceptual skills of preschool children. To assess the socio economic status of the family, the scale developed by Aggarwal et al. (2005) was used. Percentages, correlation coefficient, one way ANOVA, 't' test and Modified chi- square were used for analysis of the data. The results of the present investigation revealed that majority of children had

average level of concept development and belonged to moderate level of home environment in rural, tribal and urban group. There is significant difference between age and concept development among tribal group. However, older children performed better than younger children. Gender difference was observed in rural group on concept development of preschoolers. There is significant relationship between parent's education and family income with the concept development of children among urban group. Gender and age of the preschoolers had no significant influence on home environment of rural, tribal and urban groups. Among urban group father's occupation, family income and socio economic status had significant relationship with home environment. There is no significant relationship between home environment and concept development in rural, tribal and urban groups

Intelligence and nutritional status of Lambani school children

SHWETA NAIK

2013

MAJOR ADVISOR: Dr. SUNANDA K. ITAGI

A study on the intelligence and nutritional status of 135 lambani school children was conducted at Hoovinahadagali taluk, Bellary district during 2012-13. All the children of 9-11 years of age studying in 4th and 5th standards were selected from 5 government primary schools. The nutritional status was assessed by using anthropometric measurements (height and weight), Socio Economic Status by Agarwal scale (2005), academic achievement in terms of previous year grades, intelligence by WISC- III – Wechsler intelligence test for school children and level of participation in extracurricular activities by self structured questionnaire. The results revealed that there was highly significant differences found in mean height and weight of children with respect to their NCHS norm values in both groups by age and gender. About 40 per cent of children had normal nutritional status while 60 per cent of children indicated short, long or chronic type of malnutrition. The children with normal nutritional status were better in

processing speed followed by perceptual organization, verbal comprehension and freedom from distraction as compared to malnourished children. On the whole 82.7 per cent children possessed to average IQ followed by 12 per cent superior, 4 per cent low average and only 1.3 per cent high average IQ range group. With respect to academic achievement 6.7 and 28.14 percent possessed A⁺ and A grades, remaining 65.16 percent secured B and C grades. On the whole most of children indicated medium level of participation (65.33%) and equal proportion of children indicated low as well as high level of participation in extracurricular activities. There was positive and highly significant difference found between nutritional status with intelligence, academic achievement, socio economic status and level of participation. Hence, increase in the Socio economic status improves the nutritional status of children in turn the intelligence, academic achievement and improves the level of participation in extracurricular activities.

MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Development of single chain fragment variable monoclonal antibody against banana bunchy top virus coat protein

B. S. SHILPA

2013

MAJOR ADVISOR: Dr. NARAYAN MOGER

Banana bunchy top virus (BBTV) is a destructive pathogen in banana cultivating areas worldwide. The symptoms induced by BBTV are similar to those caused by abiotic factors and other vascular diseases. This lack of unambiguous symptoms necessitates early diagnosis of BBTV infections. The most commonly used diagnostic tool for BBTV detection is immunological assays, which is dependent on the availability of highly specific antibody to differentiate the viruses. Production of antibody using phage display technology needs pure protein therefore, BBTV/CP was bacterially expressed. A 531bp PCR product containing coat protein coding region of BBTV was amplified using BBTVCPF and BBTVCPR primers and the amplified product was cloned into the pTZ57R/T and further subcloned in to the pQE30. After transformation the clones were confirmed through PCR and sequencing. Amplification with expected size of 531bp and 100% homology with other isolates showed integrity of the clone. Further, the

coat protein appeared to be expressed at 3hr after induction with 1mM IPTG. A band of 21kDa on the gel confirmed that coat protein was really fused to the His-tag. Further, 10mg/litre of the coat protein were purified using His-tag purification kit. Four round of biopanning was performed by coating purified BBTV/CP in to the immunotube using Tomlinson library. The fourth biopanning reading (1.9) showed higher binding specificity to BBTV/CP. These were subsequently used for scFv monoclonal for BBTV/CP. Finally the randomly selected scFv clones were screened with ELISA. ELISA reading showed that two clones had higher binding affinity to BBTV/CP. The sequencing of the clones showed 85% homology with the scFv antibody gene (JN887438.1). The selected clone is highly specific to BBTV/CP as there was no cross reaction with banana CMV and groundnut GBV. Further, the sensitivity test results imply that the developed scFv antibody can detect at the concentration of 20µg/ml.

Molecular and expression analyses of pigeonpea transgenic lines carrying *cry1Ac* against *Helicoverpa armigera*

VIJAYLAXMI GOWDA

2013

MAJOR ADVISOR: Dr. B. FAKRUDIN

Production of pigeonpea, an important pulse crop in India, is constrained by insect pests such as pod borer, *Helicoverpa armigera* (Hübner). Development of transgenic pigeonpea expressing cry genes is considered as an important strategy to manage this pest. A set of five transgenic pigeonpea lines - iabtpML43, iabtpML46, iabtpML49, iabtpAL52 and iabtpAL55 in Asha and Maruti backgrounds was studied for their immunity to *H. armigera*. The transgenic lines recorded significant differences in mortality of neonate *H. armigera* larvae compared to non-

transgenic controls. A larval mortality of 66.00 per cent (leaf) to 79.16 per cent (pod) was recorded across tissue types in insect bioassays. The survivors fed on transgenic leaf, flower and pod tissues of different transgenic lines recorded reduced larval weight compared to the larvae fed on non-transgenic plant tissue. The Cry1Ac protein concentration ranged from 515.48 to 938.92 ng/g fresh weight across tissue types. Both insect mortality and expressions levels recorded by the transgenic lines tested were rather low and need to be improved further. The absolute quantification

of cry1Ac in transgenic lines was done in leaf tissues which ranged from 0.0075 ng to 15.2 ng/g of fresh weight. The results indicated the potential use of cry1Ac gene in managing the pod borer in pigeonpea. The site of integration of transgene was attempted: in case of iabtpML46 line, 159 bases recorded homology with pigeonpea genome scaffold 31566 with a

query coverage 98% and 22 bp in scaffold 134122 with query coverage 87%. The recovered flanking sequences of three lines though recorded varied degree of similarity to pigeonpea genome scaffolds, they also shared contamination of vector backbone to varied degrees. A systematic molecular characterization of these transgenic lines is required.

PLANT PATHOLOGY

Studies on anthracnose of soybean Caused by *colletotrichum truncatum* (schw.) Andrus and Moore

B. T. NAGARAJ

2013

MAJOR ADVISOR: Dr. SHAMARAO JAHAGIRDAR

The investigations on soybean anthracnose caused by *Colletotrichum truncatum* (Schw.) Andrus and Moore included main aspects, viz., survey for disease, variability study of pathogen, identification of susceptible stages of infection, in vitro and field screening of fungicides, integrated management of disease and screening of available genotypes. A roving survey was conducted during kharif 2012; maximum disease severity in Belgaum district (30.56 PDI); minimum severity was noticed in Dharwad (28.98 PDI). During summer 2013, maximum disease severity was observed in Bailhongal (28.24 PDI); minimum severity was noticed in Athani (22.76 PDI). Variability study indicated that, there was much difference in colony colour ranging from cottony white to dark grey, the spore shape was only truncate type and there was no difference with respect to spore size of *Colletotrichum truncatum* isolates. Molecular variation existed among the isolates of *C. truncatum*

helped to distinguish the isolates of *C. truncatum* from major soybean growing areas of the country. Study on susceptible stages of infection revealed that the mean maximum disease severity was obtained by inoculating the plants before flowering (40 DAS) followed by 10 DAS and seed inoculated plants. Among the fungicides evaluated, propiconazole, carbendazim, difenconazole, iprodione + carbendazim and trifloxystrobin + tebuconazole at 0.1 per cent were found very effective in inhibiting the growth of mycelium. Field evaluation of fungicides indicated that seed treatment with carboxin+ thiram (2g/kg) or captan (2g/kg) + foliar spray of trifloxystrobin + tebuconazole @ 0.1% at 55 DAS was found very effective in reducing the soybean anthracnose and enhancing the seed yield. The genotypes DSB 12 and DSB 20 showed highly resistant reaction while, JS 335 showed highly susceptible reaction against anthracnose both in glasshouse and field conditions

Pearl millet rust (*Puccinia substriata* Ell. and Barth. var. *indica* Ramachar and Cummins) and its integrated management in Northern dry zone of Karnataka

H. NAGARAJA

2013

MAJOR ADVISOR: Dr. P. V. PATIL

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is the most drought and heat tolerant crop with highest water use efficiency under drought stress. It is grown as a nutrient rich food source for human and as a fodder crop for livestock. In Karnataka pearl millet is largely cultivated in northern districts comprising Bijapur, Bagalkot, Gulbarga, Raichur, Koppal and Belgaum accounting for 87 per cent of the area and production in the state. Pearl millet in Karnataka presently suffers from many fungal diseases. Among them rust caused by *Puccinia substriata* var. *indica* is a potential destructive disease in recent years causing severe yield loss. Hence, the present investigation was carried out with different objectives aiming at the integrated management of this disease. Roving survey conducted during Kharif 2012 in different taluks of Bijapur and Bagalkot districts indicated varying intensities in different taluks. Rust severity was higher in Basavana Bagewadi taluk (42.96 %) followed by Bijapur (40.11 %) and Sindagi (38.88 %) taluks of Bijapur district and in Bagalkot district, Hunagund taluk recorded maximum rust severity (35.18%) followed by Badami (27.15 %) and Bagalkot (17.77 %) taluk. In loss assessment studies among different

pearl millet genotypes to rust, irrespective of the fungicidal spray significantly higher per cent disease index was recorded in the genotype MRB 2232 (32.33 %). And higher seed yield (44.83 q ha⁻¹) and 1000 seed weight (12.81 g) was recorded in the genotype GK 1135 compared to other genotypes. Under *in vitro* condition irrespective of the concentrations, hexaconazole among fungicides, neem oil among botanicals and cow urine among ITK^S recorded maximum inhibition of uredospore germination of 98.18, 88.83 and 82.14 per cent, respectively. In Integrated Disease Management (IDM), the spray schedule hexaconazole @ 0.1% -hexaconazole @ 0.1% recorded least rust severity (15.30 %), higher seed yield (30.50 q ha⁻¹) with higher benefit : cost ratio (1 : 2.40) followed by the spray schedule hexaconazole @ 0.1% - neem oil @ 1.0 %. Among 42 pearl millet genotypes screened against rust, none of the genotype showed immune or highly resistant reaction, four genotypes showed resistant (EBT 10-37, EBLT 10-3, LPRT 10-11 and EMRT 10-17), 18 genotypes each as moderately resistant and susceptible and remaining two genotypes as highly susceptible

Organic management of purple blotch of onion caused by *Alternaria porri* (Ellis) Cif

VINAMRATA G. PATILKULKARNI

2013

MAJOR ADVISOR: Dr. M. G. PALAKSHAPPA

Onion is one of the most important commercial vegetable crops of India. The crop is subject to attack by a number of diseases, of which purple blotch caused by *Alternaria porri* is serious and also a major limiting factor in cultivation of onion. Survey during Kharif 2012-13 revealed that purple blotch was found in all parts of Northern Karnataka and was severe in Haveri district. Isolation and pathogenicity to onion plants was proved. *Trichoderma harzianum* was most effective against *A. porri*, followed by *T. koningii*. Among the plant extracts maximum inhibition of mycelial growth of *A. porri* was recorded with *Azadirachta indica* followed by *Ocimum sanctum*. Among the organics tested against *A. porri*, Cow urine followed by Neem cake was highly inhibitory to *A. porri*. Among the organic combinations with antagonists tested against *A. porri*, Cow urine plus *T. harzianum* showed maximum inhibition of mycelial growth. Among

the combinations of organics and botanicals tested against *A. porri*, maximum inhibition of mycelial growth was recorded in Cow urine plus *O. sanctum*. Combinations of organics and amendments were tested against *A. porri*; maximum inhibition of mycelial growth was recorded in Cow urine plus Pongamia cake. Influence of weather parameters on purple blotch of onion at different date of sowing revealed that maximum temperature was positively correlated with number of lesions, lesion size and per cent disease index at all four different date of sowing and in the late sown crop (third week of July). The field studies on organic management of purple blotch of onion revealed that seed treatment with *T. harzianum* @ 10g/kg -spray of Panchagavya 5%+ Neem Seed Kernel Extract 5% proved best with least per cent disease index and bulb weight, bulb diameter, yields compared to unsprayed check.

Studies on the blast of pearl millet caused by *Pyricularia grisea* (Cooke) Sacc. in Northern Karnataka

V. K. BHOJYANAIK

2013

MAJOR ADVISOR: M. M. JAMADAR

Pearl millet [*Pennisetum glaucum*(L.)R.Br.] one of the common millets grown as a nutrient-rich food source for human and as a fodder crop for livestock. Among the several diseases, the blast caused by *Pyricularia grisea* (Cooke) Sacc. has emerged as a serious disease affecting both forage and grain production in pearl millet resulting economic loss. In the present investigation, the roving survey carried out during *kharif* 2012 revealed that, the highest disease intensity was observed in Koppal district (76.1%) while least was in Bijapur (31.1%) district. The disease appeared as small, water soaked, later developed as spindle shaped spots with grayish white center with a brown margin. Morphologically *Pyricularia grisea* (Cooke) Sacc., produced hyaline to pale olive, pyriform conidia, 3-celled with 2-septa and measured 17.5–24.0 x 6.5–8.0 µm. Cultural studies indicated carrot and Czapek's agar (9.0 cm each) among the solid media and Richard's medium (393.0 mg) among different liquid media supported significantly highest mycelial growth while maximum

growth of fungus reached on 14th day of incubation. Variability studies of *P. grisea* isolates revealed, maltose and sucrose (396.3 mg each) as the best carbon sources while sodium nitrate (407.1 mg) supported significant maximum growth among the nitrogen sources. Isolates Pg4 (Ilakal) and Pg3 (Sindagi) recorded significantly maximum mycelial growth at 25°C whereas temperature range of 20 - 30°C and pH range of 6.5 to 7.5 was favourable for growth of all the isolates under study. *In vitro* bioassay revealed mancozeb75WP (93.30%), captan70+ hexaconazole5 75 WP (93.17%) among the non-systemics and tricyclazole75WP (87.78%) among the systemic fungicides significantly inhibited pathogen. Among botanicals commercial-product; Soldier (71.54%) and tulasi (70.93%) significantly inhibited *P. grisea* growth while no bioagents were effective. All the 24 genotypes screened were susceptible (Grade 5-6) to highly susceptible (Grade 7-9) to *P. grisea* under natural infection conditions.

Studies on leaf spot of tomato caused by *Septoria lycopersici* Speg

ABHIJEET S. KASHYAP

2013

MAJOR ADVISOR: S. LINGARAJU

Tomato (*Solanum lycopersicum* L) regarded as poor man's apple, is one of the widely grown and most popular vegetable crops belonging to family solanaceae. *Septoria* leaf spot (*Septoria lycopersici* Speg.) is one of the most devastating foliar diseases in humid regions, particularly during the periods of rainfall, incurring loss both at pre and post-harvest stages in tomato. The isolated fungus grown on potato dextrose agar produced dull white mycelium conidia were hyaline, flexuous and filiform with 1-9 septations. The conidia measured 30.30 to 75.00 µm in length and 2.2 to 3.0 µm in breadth. Successful pathogenicity of the fungus on tomato was proved following Koch's postulates by inoculating using the spore suspension. Cultural studies revealed that among solid media, potato dextrose agar and tomato leaf extract agar were found to be good for growth of *S. lycopersici*. Among the liquid media, Potato dextrose broth

and Tomato leaf extract broth supported maximum dry mycelial weight of fungus on 13th day of incubation. Physiological studies revealed that optimum pH range of 6 to 7 was favourable for growth and sporulation of pathogen. Maximum dry mycelial weight was obtained in temperature range of 20 to 25°C. Alternate cycles of 12 hours light and 12 hours darkness favoured the maximum radial growth and dry mycelial weight of *S. lycopersici*. Tomato variety L-15 was found to be resistant against *Septoria* leaf spot under glasshouse conditions. Among the ten fungicides evaluated *in vitro* against *S. lycopersici*, Hexaconazole, Propiconazole and Carboxin + Thiram gave total inhibition of the fungal growth at all concentrations. Among antagonists tested *in vitro*, *Trichoderma harzianum* gave maximum inhibition of mycelial growth. Effective field management of the disease was obtained by Azoxystrobin with B:C ratio of 4.71:1.

Studies on banded leaf and sheath blight of maize caused by *Rhizoctonia solani* f.sp.sasaki EXNER

LAXMAN SINGH RAJPUT

2013

MAJOR ADVISOR: Dr. S. I. HARLAPUR

Banded leaf and sheath blight of maize caused by *Rhizoctonia solani* f.sp.sasaki Exner is an important disease which results in heavy yield loss. The investigations include main aspects viz., survey, variability of pathogen, *in vitro* evaluation of fungicides, bioagents, botanicals and management of the disease. The results of the investigations are summarized hereunder. The roving survey on the disease severity revealed that, maximum disease severity was observed in Kalagtagi (52.45%) followed by Mundgod (51.54%). Minimum severity was noticed in Bailhongal (15.72 %). Highest disease severity observed in black soil under irrigated area on DKC8101 hybrid in Kalagtagitaluka of Dharwad district. Six isolates collected from different part of Northern Karnataka were studied for their variability. The isolates showed variability in morphological and cultural characters. Among six isolates, isolate Rsm6 (Kalagtagi) was found to be fast growing, maximum sclerotial size

(3.1mm), oval shape and red brown sclerotia, minimum time took for initiation of sclerotial production (8 days) and highest number of sclerotia per plate (115). The *in vitro* studies on fungicide evaluation at various concentrations, indicated Propiconazole 25% EC and Carbendazim 50% WP were found most effective in inhibiting the growth of the fungus. The plant extracts viz., nimbidine and NSKE at 5 and 10 per cent concentrations were effective against the pathogen. Among the biocontrol agents evaluated, *Trichoderma harzianum* found effective against the pathogen. Field studies on the management of the disease revealed that, seed treatment with *Pseudomonas fluorescens* @ 10 g kg⁻¹ seed followed by two sprays of Propiconazole 25 EC @ 0.1% at 30 and 40 DAS found most effective treatment and resulted in lowest PDI (20.40%). This treatment increased grain yield (40.72%) and fodder yield (44.68%) over untreated check

Studies on integrated management of powdery mildew of blackgram caused by *Erysiphe polygoni* DC

T. S. CHANNAVEERESH

2013

MAJOR ADVISOR: Dr. SHRIPAD KULKARNI

Powdery mildew caused by *Erysiphe polygoni* DC is one of the major constraints in the production of black gram. Incidence of black gram powdery mildew was maximum in Belgaum district (68.72%) and minimum in Gadag district (20.23%) during study period. The rDNA-ITS sequencing of *E. polygoni* indicated that Dharwad isolate is having more than 90 per cent homology with reported *E. polygoni* isolates in NCBI genebank. The per cent reduction of chlorophyll was more in susceptible variety than in resistant cultivar. Higher amount of total sugar, reducing sugar and non-reducing sugar were recorded in susceptible variety compared to resistant cultivar. Non-reducing and total sugar were synthesized at faster rate in susceptible cultivar than in resistant cultivar. Healthy leaves of resistant cultivar had 8.34 mg/g total phenols and it was increased to 16.78 mg/g after infection. Accumulation of total phenols was at faster rate in resistant cultivar (101.19%) compared

to susceptible cultivar (33.85%). LBG-17 showed resistant reaction and four genotypes had highly susceptible reaction against powdery mildew under glasshouse condition. Among the 126 genotypes screened under natural condition only three genotypes were resistant, 14 moderately resistant and others had susceptible reaction. Among various fungicides tested *in vitro* azoxystrobin 250% SC @ 0.1 % was most effective in inhibiting conidial germination. Whereas, azadirachtin @ 5% and *Bacillus subtilis* @ 6g/L were found most effective among botanicals and bioagents respectively. In field evaluation azoxystrobin 250% SC @ 0.1% (916 kg/ha), azadirachtin 1500 ppm (1:10) @ 5% (591 kg/ha) and *B. subtilis* @ 6g/L (590 kg/ha) were superior with least PDI and higher seed yield. Host range studies indicated the ability of the *E. polygoni* to survive on *Euphorbia geniculata* (Pill pod spurge garden) and serve as collateral host.

Studies on seed-borne fungal diseases of sesame with special reference to *Alternaria sesami* (Kawamura) Mohanty and Behera

P. L. RADHA

2013

MAJOR ADVISOR: Dr. S. N. CHATTANAVAR

Sesamum or otherwise called as sesame, (*Sesamum indicum* L.) locally called as *til*, belongs to family Pedaliaceae, originated from East Africa. Sesame oil is known for its excellent nutritional, medicinal, cosmetic and cooking qualities for which it is considered as 'the queen of oils' in the West and in Tamil as '*nallennai*' meaning good oil. A large proportion of sesame is used for producing edible oil, while purely white sesame seeds are in demand on conventional markets due to their higher oil content. Sesamum oil is used for manufacturing perfumed oils and for medicinal purposes. Sesamum cake is a rich source of protein, carbohydrates and mineral nutrients such as calcium and phosphorous. The present investigation studies were carried out on seed-borne fungal diseases of sesame with special reference to *Alternaria sesami* (Kawamura) Mohanty and Behera during 2012-13 which included testing of sesame seed samples for seed borne mycoflora,

evaluation of seed health testing methods, seed to plant transmission studies and management of *Alternaria* leaf spot of sesame. Seed health testing of sesame seed samples collected from different parts of northern Karnataka revealed the dominance 12.94% of *Alternaria sesami*. Deep freezing method revealed only the presence of saprophytic fungi like *Aspergillus* sp. and *Penicillium* sp. Among different seed health testing methods, standard blotter method was found to be good for detecting the seed-borne infection of *Alternaria sesami* to an extent of 91.63% in sesame. The pathogenic ability of seed borne infection of *A. sesami* was proved in seed transmission study. Seed dressing fungicide viz., @ 0.2% Hexaconazole and Avatar 0.3% (Hexaconazole + Zineb), bio-agent i.e., *Trichoderma harzianum* @ 10 g/kg seeds and botanical @ 5 ml of *Allium sativum* were found as the most effective in eliminating seed-borne infection of *A. sesami*.

Studies on seed borne diseases of cotton in Northern Karnataka

PUSHPA S. HANASI

2013

MAJOR ADVISOR: Dr. M. S. L. RAO

Thirty eight seed samples of cotton (Both Bt and Non-Bt) collected from different private companies and research institute in northern Karnataka were subjected to initial seed health testing by standard blotter method. The results of this investigation revealed the predominance of *Fusarium moniliforme*, *Alternaria alternata* followed by species of *Curvularia* and *Aspergillus*. For detecting seed-borne bacterial infection, semi selective MSSXAN media and XAN-D media was used. Investigation on standardization of seed health testing methods in diagnosing seed-borne fungal infection in cotton, revealed the efficacy of standard blotter method in diagnosing *Alternaria* and *Curvularia*, whereas 2,4-D blotter method was found to be good for detecting *Fusarium* in cotton seed samples. The pathogenic ability of seed borne fungi viz. *A. alternata*, *Fusarium* sp. and *Xanthomonas axonopodis* pv *malvacearum* was proved in transmission studies. Study on the location of seed borne fungi in the infected cotton

seeds revealed that *Alternaria alternata*, *Aspergillus* spp. and *Curvularia* sp. was noticed on the pericarp, where as *Fusarium* sp was noticed in both pericarp and endosperm. Among the six seed dressing fungicides tested against seed borne fungal infections by rolled towel method, carboxin + thiram @ 0.2% was found most effective. Out of the eight plant extracts tested, *Azadirachta indica* was found to be most effective @ 10%. Among the four bioagents tested, *Pseudomonas fluorescens* showed least seed infection @ 0.8%. Among the four priming agents tested, *Pseudomonas fluorescens* + jelly was found to be most effective. Under field experiments, Seed treatment with acid delinted + imidacloprid + (carboxin + thiram) @ 0.2% along with foliar spray with hexaconazole @ 0.1% at 40 DAS was found to be most effective against *Alternaria* blight and for bacterial blight, seed treatment with streptomycin (500 ppm) + Imidacloprid was found to be good followed by carboxin + thiram @ 0.2%.

Studies on leaf blight of Bt cotton caused by *Alternaria* spp

G. H. ANIL

2013

MAJOR ADVISOR: Dr. S. A. ASHTAPUTRE

Cotton is a major fibre crop of global importance and has high commercial value next to food grains. Among the various diseases, *Alternaria* leaf blight disease is gaining importance due to its increased incidence. A survey was carried out during kharif 2012 in North Karnataka. The maximum disease was recorded in Raichur, Belgaum and Bellary districts. Morphological variability test showed that conidia of different isolates were separated by 1-7 vertical and 3-9 horizontal septae, the isolates from Shaktinagar and Raladoddi showed maximum size of 34.60×7.40 and 33.55×9.10 μ m, respectively. The least size of the conidia was recorded in Dharwad (11.29×2.56 μ m) followed by Agsikoppa (14.45×3.62 μ m). Among the twelve isolates, eight isolates showed resemblance with conidial measurements of *Alternaria macrospora* described by Ellis M. B. and remaining four isolates were found to be different from *Alternaria macrospora* morphologically. Maximum width of mycelia was observed

in Tagalladoddi (1.99 μ m) followed by Navali (1.85 μ m) isolates on potato dextrose agar. Five isolates showed irregular and seven isolates showed smooth colony margin. Chicknasbi, Kadagmanadoddi and Tagalladoddi isolates showed excellent sporulation on PDA. All the isolates inoculated on healthy cotton plant showed symptoms. More variability was observed between Tagalladoddi and Raladoddi isolates and less variability was observed between Annigeri and Dharwad through molecular variability test. Among the 199 cotton genotypes screened, 50 genotypes showed moderate resistant, 69 genotypes showed moderate susceptible and 80 genotypes were found highly susceptible and among 14 commercial Bt cotton hybrids screened, nine hybrid were found moderately susceptible and the remaining five hybrids were highly susceptible to *Alternaria* leaf blight disease. In field evaluation of nine different fungicides, propineb (0.2%) showed better control of the disease with maximum yield.

Epidemiology and management of sugarcane rust caused by *Puccinia melanocephala* H. and P. Syd

SUMANGALAE. NALWAR

2013

MAJOR ADVISOR: Dr. A. R. HUNDEKAR

Sugarcane rust caused by *Puccinia melanocephala* H. and P. Syd. has become a major constraint in sugarcane growing areas. A survey indicated an average disease severity of 45.22 Percent Disease Index (PDI) recorded in northern parts of Karnataka: Maximum severity of 50.60 PDI was observed in Belgaum district followed by Bagalkot (39.85 PDI) district. The study revealed that 2 per cent dextrose solution, a temperature range of 15 to 25°C and relative humidity of 80 - 85 per cent were found to be optimum for uredospore germination of *P. melanocephala*. Among three sugarcane genotypes, phenol contain was more in CoM 265 which was followed by Co 86032 and Co 2001-15. Reducing and non reducing sugars were more in healthy leaves than in diseased leaves. The correlation study revealed that maximum temperature was negatively significantly correlated with PDI of all three genotypes, viz. Co 08001

Co 07007 and Co 94012. RH and rainfall were positively significantly correlated with PDI of Co 94012. *In vitro* evaluation of non-systemic and combifungicides revealed that all fungicides at 0.25 per cent completely inhibited uredospore germination. A combi product (Captan 70% + Hexaconazole 5% WP) @ 0.2 was found to be effective which was followed by (Hexaconazole 4% + Zineb 68% WP) and Zineb 75% WP. At 0.15 per cent all systemic fungicides completely inhibited the uredospore germination. Whereas Tebuconazole 25% EC was effective at 0.1 per cent against *P. melanocephala*. Disease management study revealed that two foliar sprays of Tebuconazole 25% EC @ 0.1 per cent was effective in reducing the severity of sugarcane rust disease. The sprays increased the yield parameters and were most cost effective in case of all the three sugarcane genotypes

SOILSCIENCE

Response of chickpea (*Cicer arietinum* L) to identified micronutrients constraints under vertisol of Malaprabha Command area in Karnataka

MAHANTESH S. KARAJANAGI

2012

MAJOR ADVISOR: Dr. P. L. PATIL

A study was undertaken to identify micronutrients constraints using GIS technique in Vertisols of Dundur village under of Malaprabha Command area, Karnataka and response of chickpea crop to identified micronutrients constraints. Surface soil samples collected at 200 m grid interval were analyzed for pH, EC, CaCO₃, OC, N, P, K, S, Zn, Fe, Cu, Mn and B and mapped by GIS technique. Soil fertility maps revealed that, major portion of the study area was deficient in available N, P, S, Zn, Fe and B with higher level of available K, Cu and Mn. The results on field experiment with chickpea as test crop revealed that, application of FeSO₄ + ZnSO₄ each @ 25 kg ha⁻¹ + Borax @ 5 kg ha⁻¹ along with recommended dose of fertilizer (RDF) recorded the highest plant height, number of branches and dry matter production at all the growth stages

followed by FeSO₄ + ZnSO₄ each @ 10 kg ha⁻¹ + Borax @ 2.5 kg ha⁻¹ along with RDF. The yield, yield components and crude protein content were also significantly superior over all other treatments with the application of FeSO₄ + ZnSO₄ each @ 25 kg ha⁻¹ + Borax @ 5 kg ha⁻¹ along with RDF. Application of FeSO₄ + ZnSO₄ each @ 25 kg ha⁻¹ + Borax @ 5 kg ha⁻¹ along with RDF recorded significantly higher total uptake of N, P, K, S, Zn, Fe and B by chickpea. There was improvement in available Fe, Zn and B status in soil after harvest of crop due to application of FeSO₄ + ZnSO₄ each @ 25 kg ha⁻¹ + Borax @ 5 kg ha⁻¹. The higher additional benefit was also realized with the application of FeSO₄ + ZnSO₄ each @ 25 kg ha⁻¹ + Borax @ 5 kg ha⁻¹ compared to all the other treatments.

Effect of water soluble fertilizers on growth, yield and oil content of groundnut in a vertisol of Northern transition zone of Karnataka

VAKADA MANASA

2013

MAJOR ADVISOR: Dr. N. S. HEBSUR

A field experiment was conducted at Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad, during Rabi/Summer 2011-12 to know the effect of water soluble fertilizers on growth, yield and oil content of groundnut (cv. TAG 24) in a Vertisol of Northern Transition Zone of Karnataka. There were 10 treatment combinations consisting of combination of FYM and reduced recommended dose of NPK through soil application as basal and foliar spray of soluble fertilizers at 30, 45 and 60 days after sowing (DAS). The experiment was laid out in a Complete randomized block design with three replications. Application of FYM + 100% RDF + foliar spray of fertilizers at 30, 45 and 60 DAS recorded higher pod yield (5615 kg/ha) which was 22 % higher over application of 100% RDF (4601 kg/ha). However, it was on par with the treatment receiving

FYM + 85 % RDF + foliar spray of fertilizers at 30, 45 and 60 DAS. The concentration of major and micro nutrients was higher in kernel compared to haulm at harvest. The concentration of nutrients as well as uptake was highest in the treatment receiving FYM + 100% RDF + foliar spray of fertilizers at 30, 45 and 60 DAS at all the crop growth stages. The concentration of nutrients was highest at 30 DAS and decreases as the crop growth advances. The uptake of nutrients was positively and significantly correlated with dry pod yield and oil yield. The nutrient status of the soil after harvest of the groundnut was higher in the treatment receiving FYM + 100% RDF + foliar spray of fertilizers at 30, 45 and 60 days after sowing. But the treatment receiving FYM + 85 % RDF + foliar spray of fertilizers at 30, 45 and 60 DAS recorded the highest B:C ratio.

Effect of nitrogen and phosphorus levels and ratios on growth, yield and nutrient uptake by groundnut in Northern transition zone (zone 8) of Karnataka

L. SHIVAKUMAR

2013

MAJOR ADVISOR: Dr. B. M. RADDER

A field experiment was conducted during Kharif 2012 to study the effect of nitrogen and phosphorus levels and their ratios on growth, yield and nutrient uptake by groundnut in northern transition zone of Karnataka at MARS, Dharwad under rainfed situation. The experiment comprised of eleven ratios of nitrogen and phosphorus fertilizers (0.00 to 1.00) at a constant potassium fertilizer rate (25 kg K₂O ha⁻¹) laid out in randomized complete block design with three replications. Influence of the N/P ratios on the growth and the yield parameters were found to be significant. Treatment receiving N/P ratio of 0.50 (30 kg N, 60 kg P₂O₅) recorded significantly higher growth parameters viz., leaf area plant⁻¹ (17.31 dm²), leaf area index (4.53), Leaf area duration (113.27 days) and total dry matter production (36.00 g). Further, the same treatment produced significantly higher number

of filled pods plant⁻¹ (17.47) and 100 kernel weight (38.50 g) resulting in higher dry pod yield (3310 kg ha⁻¹). Nitrogen and phosphorus ratios tested significantly influenced the quality parameters of groundnut. N/P ratio of 0.50 (30 kg N, 60 kg P₂O₅) accounted for significantly higher oil content (45.70 %), oil yield (1115 kg ha⁻¹) and higher kernel yield (2441 kg ha⁻¹). Nutrient uptake studies indicated significantly higher uptake of 147.04 kg N, 23.30 kg P₂O₅, 118.48 kg K₂O and 10.93 kg S ha⁻¹ with N/P ratio of 0.50. In general, there was a reduction in soil fertility compared to initial status. Among different N/P ratios, N/P ratio of 0.50 resulted in higher net monetary returns of ₹ 1, 01,426 ha⁻¹ and B: C of ratio 4.16. Therefore, N/P ratio of 0.50 was found to be promising for optimized production of groundnut under rainfed condition.

Effect of foliar nutrients on yield, quality and nutrient uptake by soybean [*Glycine max* (L). Merrill]

V. SARAVANA KUMAR

2012

MAJOR ADVISOR: Dr. N. A. YELEDHALLI

A field experiment was conducted at Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad during kharif 2012 to study the effect of foliar nutrients on yield, quality and nutrient uptake by soybean. The experiment was laid out in randomized complete block design (RCBD) with three replications and nine treatments. The soil of the experimental site was clay in texture, pH was 8.20, EC of 0.12 dS m⁻¹, available nitrogen, phosphorus, potassium and sulphur was 219.6, 34.08, 376.3 and 12.4 kg ha⁻¹ respectively and hot water soluble boron was 0.52 mg kg⁻¹ and

the organic carbon was 0.75 per cent. Foliar application of soluble starter NPK @ 2 per cent + sulphur spray @ 2 per cent at 45 DAS and soluble booster NPK @ 2 per cent + boron spray @ 0.15 per cent at 65 DAS resulted in significantly higher seed yield (33.84 q ha⁻¹) which was 48 per cent higher than the control receiving only water spray. This treatment was also on par with the foliar application of boron @ 0.15 per cent at initial pod initiation stage (31.95 q ha⁻¹). The increase in yield was due to enhanced yield contributing components viz., more nodes, flower, seed test weight, higher dry matter

production and its efficient distribution. Further, oil content, oil yield, protein content, N, P, K uptake and net returns were higher with the foliar application of soluble starter, booster dose of NPK, sulphur and boron individually or in combination at different stages. However, the higher benefit:cost ratio was

with the foliar application of boron @ 0.15 per cent at initial pod initiation stage. The study clearly indicates that the foliar application of nutrients play a key role in achieving more nodes, retain flower, develop the pod, increase test weight and quality of soybean.

Studies on phosphorus status of vertisols and response of Bt cotton to phosphatic fertilizers in northern transitional zone of Karnataka

S. H. RAMYA

2013

MAJOR ADVISOR: Dr. N. S. HEBSUR

An investigation was carried out to study the available phosphorus status, distribution of different fractions of phosphorus and response of Bt cotton to applied phosphatic fertilizers in Vertisols (0-30 cm) having P status below and above 33.50 kg P₂O₅ per ha in the farmer's fields of cluster of villages of Dharwad district viz., Sulla, Byahatti, Kusugal, Hebsur, Ingalalli, Kiresur, Rottigwad, Siraguppi, Bandiwad and Dattur. Soils were alkaline (7.10 to 8.94), non saline (0.06 to 0.40 dS/m), calcareous (55 to 245 g/kg), low to medium in available nitrogen (94 to 344 kg/ha), phosphorus (15.5 to 39.50 kg/ha) and sulphur (10.20 to 31.5 kg/ha) and medium to high in potassium (310 to 635 kg/ha). Among the different inorganic forms of P, Ca-P was the dominant fraction which ranged from 40.40 to 63.56 ppm and contributed about 9.57 to 24.41 per cent to total-P whereas, saloid-P was the smallest fraction which ranged from 1.30 to 3.95 ppm

contributing about 0.39 to 1.05 per cent to total-P. The dominance of different P fractions in these soils followed the order: Ca-P > Red-P > Al-P > Occl-P > Fe-P > Saloid-P. Ca-P had positive and significant correlation with pH ($r=0.928^{**}$), EC ($r=0.371^{**}$) and calcium carbonate ($r=0.969^{**}$). Saloid-P had positive and significant correlation with organic carbon and all the P forms except Ca-P. Average P concentration in petiole and whole plant, total P uptake and yield of Bt cotton obtained in the farmer's fields of different villages followed the order Bandiwad > Rottigwad > Kusugal > Hebsur > Dattur > Byahatti > Kiresur > Sulla > Ingalalli > Siraguppi. Response of Bt cotton (988 kg/ha) to applied phosphatic fertilizer was poor in Vertisols having P₂O₅ > 33.50 kg ha⁻¹. However, a good yield (1090 kg/ha) response to applied fertilizers was observed in low P status soils.

Response of maize (*Zea mays* L.) to graded doses of nitrogen under varying levels of soil salinity in vertisol of Ghataprabha command area

RAJESH RAWAL

2013

MAJOR ADVISOR: Dr. V. B. KULIGOD

A field experiment was conducted to study the influence of graded doses of nitrogen on maize under varying levels of soil salinity in Roogi village of Mudhol taluk during *kharif* 2012. The experiment comprised of four salinity levels and four nitrogen levels. Growth parameters and yield attributing parameters were found significantly higher at lower salinity level of < 2 dSm⁻¹. Treatment receiving 225 kg N ha⁻¹ had better growth over the treatment receiving 150 kg N ha⁻¹. Crop growth was not influenced by higher doses of nitrogen under saline conditions (> 4 dSm⁻¹). The highest crop yield of 8.31 t ha⁻¹ was observed under < 2 followed by 2-4 dSm⁻¹. Application of increased level of nitrogen resulted significant increase in yield. Application of 225 kg N ha⁻¹ (6.74 t ha⁻¹) recorded maximum

yield. Higher doses of nitrogen application under saline condition (> 4 dSm⁻¹) did not enhance the crop yield. Reduction in NPK uptake was recorded with the increase in soil salinity. Application of 225 kg N ha⁻¹ recorded the maximum NPK uptake. The K/Na ratio decreased with increasing salinity and the highest K/Na ratio of 50.0 was found at 225 kg ha⁻¹ N application under < 2 dSm⁻¹ salinity. Available NPK content was maximum at salinity level < 2 dSm⁻¹ and the lowest was at 6-8 dSm⁻¹. Increased soil salinity decreased grain protein content but starch content increased with the increase in soil salinity. The highest protein content was recorded at salinity level < 2 dSm⁻¹. Increased soil salinity registered decrease in the net returns. The higher net returns and B:C ratio was obtained at salinity level < 2 dSm⁻¹.

Studies on ferrous sulphate and zinc sulphate application on yield and quality of byadgi chillies in calcareous vertisol of Northern transitional zone of Karnataka

C. K. SUCHITHRA

2013

MAJOR ADVISOR: Dr. B. I. BIDARI

A field experiment was conducted during *kharif* 2012 in the farmer's field at Agadi village in Dharwad district to study the "Response of Byadgi chillies to ferrous sulphate and zinc sulphate application in calcareous Vertisol in northern transitional zone of Karnataka". The experiment consisted of ten treatments with three replications. Results showed that application of ferrous sulphate @ 25 kg ha⁻¹ to soil on 30th DAT + foliar spray of 0.5 percent ferrous sulphate on 60th and 90th DAT recorded highest fruit yield (17.17 q/ha) closely followed by treatment that received soil + foliar application of zinc sulphate (16.60 q/ha). Ferrous sulphate applied treatments recorded comparatively higher fruit yield than zinc sulphate applied treatments. Highest colour value (274.23 ASTA units) and oleoresin content (18.07%) in red chillies were recorded with soil (25 kg/ha) + foliar (0.5%) application of ferrous sulphate. Foliar spray of zinc sulphate (0.5 %) on 60th and 90th DAT produced minimum per cent discoloured fruits (5.26%) and treatments receiving only ferrous sulphate application recorded comparatively higher discoloured fruits than treatments receiving zinc sulphate application (T₃ and T₅). Control

recorded maximum per cent discoloured fruits (6.12%). Combined foliar spray of ferrous sulphate and zinc sulphate (each 0.5%) at 60 and 90 DAT resulted in marginal decreased colour value (230.11 ASTA units) but numerical increase in discoloured fruits (5.54%) compared to individual foliar spray. Highest iron (196.63 mg/kg) and zinc (86.59 mg/kg) contents in red fruits were noticed in treatments receiving soil + foliar application of ferrous sulphate (T₆) and zinc sulphate (T₇) respectively. Potassium content of whole red fruits had a significant positive correlation with colour value (0.79**) and oleoresin content (0.81**). Iron and zinc contents of whole red fruits were positively correlated with colour value (0.65* and 0.63* for iron and zinc, respectively). Zinc content of whole red fruit possessed significant negative relationship with per cent discoloured fruits (-0.84**). Per cent discoloured fruits possessed significant positive relationship with leaf nitrogen content (0.66*), while potassium, iron and zinc contents possessed significant negative relationship. Highest B:C ratio (5.31) was obtained due to soil + foliar application of ferrous sulphate (T₆).

Response of maize to long-term biometanated spentwash application under vertisols of northern transition zone of Karnataka

C. M. RUBEENA

2013

MAJOR ADVISOR: Dr. V. B. KULIGOD

A field experiment was conducted in the long-term trial on distillery spentwash application established since 2003 at the Main Agricultural Research Station, UAS, Dharwad. The study was carried out during *kharif* 2012 to know the response of maize to long-term biometanated spentwash application under Vertisols of Northern transition zone of Karnataka. Experiment consisted of seven treatments and 3 replications. Results

revealed that long-term application of 1½ recommended nitrogen through spentwash was superior with respect to the growth parameters like plant height, chlorophyll content and dry matter production and yield parameters like cob length, cob circumference, cob weight, number of rows per cob, number of seeds per row, number of seeds per cob and test weight. Both growth and yield parameters complemented each other in realising higher

grain and stover yield. Spentwash application had also increased the nutrient uptake by the maize. Long-term application of spentwash improved the physico-chemical properties of the soil. Application of spentwash to supply 1½ recommended nitrogen significantly reduced the soil bulk density and increased porosity, aggregate stability and maximum water holding capacity. The soil reaction and soluble salts were not adversely affected by the long-term application of spentwash. Soil salinity remained

within the critical limit of four dSm-1 even after nine years of spentwash application. The available nutrient status of soil was found to be higher in the plots applied with 1½ recommended dose of nitrogen through spentwash. The soil dehydrogenase and phosphatase enzyme activities increased due to the long-term spentwash application. Application of distillery spentwash to supply 1½ times recommended nitrogen recorded the highest net returns and B:C ratio.

Studies on the use of spentwash as a source of potassium on maize productivity and soil properties

V. M. RAVINDRA

2013

MAJOR ADVISOR: Dr. K. K. MATH

A field investigation on “Studies on the use of spentwash as a source of potassium on maize productivity and soil properties” was conducted in sandy clay loam soil in the farmer’s field at Sameerwadi during *kharif* 2012. The experiment was laid out in randomized block design with seven treatments replicated four times. The recommended dose of potassium (RDK) to maize was substituted with spentwash at 0, 25, 50, 75, 100, 150 and 200 per cent levels. The bio-methanated spentwash used for the study was neutral in reaction with high soluble salts content. Application of spentwash to maize to substitute 50 per cent RDK significantly improved growth and yield attributing characters when compared to its application at higher levels but was on par with application of only chemical fertilizer. Application of spentwash in conjunction with potassic fertilizer at 50 per cent level produced 7.3 t ha⁻¹ of grain yield and it was on par with the treatment receiving RDK only through chemical fertilizer and the

treatment with 25 per cent substitution of RDK with spentwash but significantly superior to the treatments receiving higher levels of spentwash. The uptake of nutrients by the crop was significantly increased with the use of two sources of potassium each at 50 per cent level when compared to the treatments receiving 100, 150 and 200 per cent RDK only with spentwash but it was on par with the treatment receiving only chemical fertilizer and the treatment with 25 per cent substitution of RDK with spentwash. Application of distillery spentwash at different levels caused improvement in soil physical environment, organic carbon, available nutrients status and dehydrogenase enzyme activity in the soil. However, its addition to soil also resulted in build up of total soluble salts content in soil which is undesirable. Combined application of spentwash and potassic fertilizer in 1:1 ratio was better as indicated by higher B:C ratio than the treatment receiving only potassic fertilizer.

Effect of organic and inorganic sources of nutrients on soil fertility and yield of brinjal (*Solanum melongena* L.)

JAVED U. MUJAWAR

2012

MAJOR ADVISOR: Dr. K. K. MATH

A field experiment was conducted to investigate “The effect of organic and inorganic sources of nutrients on soil fertility and yield of brinjal” during *kharif* 2010 at the MARS, UAS, Dharwad. The experiment was laid out in Typic *Haplustert* under irrigation in RBD with nine treatments replicating thrice. The treatments included were RDF with and without FYM, 100 and 75 per cent organics, INM (50% organics + 50% inorganic fertilizers) and liquid organics like beejamrutha, jeevamrutha and panchagavya alone and in combination with above treatments except RPP and RDF. The results revealed that the treatment with RDF+FYM recorded significantly higher fruit yield (5.24 t ha⁻¹) and it was on par with RDF and organics and chemical fertilizers applied each at 50 per cent level either alone or with liquid organics. The uptake of nutrients like nitrogen, phosphorus, potassium and sulphur and micronutrients namely copper, iron, manganese and zinc increased significantly due to application of part of recommended nitrogen through organics. The

available nitrogen, phosphorus, potassium and sulphur and DTPA extractable micronutrients namely copper, iron, manganese and zinc status of soil was significantly influenced by the application of chemical fertilizers along with organics and the maximum values were recorded in the treatment receiving RDF+FYM. Dehydrogenase enzyme activity in soil was higher in the treatments with FYM and vermicompost applied along with chemical fertilizers and the highest value was recorded in the treatment receiving RDF+FYM (40.90 µg TPF/g soil/day). Thus, the study emphasizes that in brinjal cultivation, chemical fertilizers can be substituted with FYM and vermicompost without losing appreciable fruit yield. This also improves the soil fertility and quality of fruit in addition to saving 50 per cent cost on chemical fertilizers. The findings assume greater significance in the present context where in the development of multi-nutrients deficiency in soil and scaling up of the cost of chemical fertilizers severely limiting crop productivity.

Effect of magnetic treatment on irrigation water quality, soil properties and growth of sunflower crop

ASHWINI H. GUDIGAR

2013

MAJOR ADVISOR: Dr. MANJUNATHA HEBBARA

Experiments were conducted to study the effect of magnetic treatment on irrigation water quality, soil properties, leaching efficiency of salts and growth of sunflower crop during 2011- 2012 at College of Agriculture, UAS, Dharwad. Four separate experiments were conducted to achieve the objectives. Irrigation waters with different salinity levels of *i.e.*, 2, 4, 6, 8, 12 and 16 dS m⁻¹ were obtained by equilibrating natural saline soil with good water in the ratio of 1:3 and used in the studies along with GW (0.6 dS m⁻¹). For magnetic treatment, the waters were passed through the magnetic device as required for each study. The one-time magnetic treatment of irrigation water significantly decreased electrical conductivity but the effect on pH was variable. With multiple magnetic treatments, the difference between treated and untreated became increasingly narrow. The calcium, magnesium, sodium and sodium adsorption ratio also followed the same trend. The magnetic treatment also had mollifying effect on residual sodium carbonate of water. In

general, the decrease was of higher magnitude at lower level of water salinity. Intermittent irrigation with magnetized water significantly decreased soil pH but increased soil salinity. Soil exchangeable calcium, sodium and exchangeable sodium percentage decreased due to irrigation with magnetized water. Soil water soluble calcium, magnesium and sodium decreased due to magnetized water irrigation. The magnetic treatment significantly decreased the dispersible clay content over non-magnetized water use. Leaching a saline soil with magnetized water removed more salts from the soil compared to leaching with non-magnetized water. Soils leached with magnetized water had significantly higher leachate salinity and lower soil salinity compared to leaching with non-magnetized water. The magnetic treatment significantly increased germination percentage, plant height and dry matter yield in sunflower over non-magnetized water use. The magnetic treatment increased the K/Na ratio and improved its salt-tolerance

Studies on zinc and boron nutrition on yield, quality and nutrient uptake in Cauliflower (*Brassica oleracea* var. *Botrytis* L.) under Northern transition zone of Karnataka

BASAVARAJ SHIVANNANAVAR

2013

MAJOR ADVISOR: Mr. C. M. POLESHI

A field experiment was conducted at 'New orchard' of University of Agricultural Sciences, Dharwad during *kharif*, 2012 to study the effect of zinc and boron on yield, quality and nutrient uptake by cauliflower. The soil of the experimental site was low in available Zn (0.47 mg kg⁻¹) and available B (0.49 mg kg⁻¹). There were 10 treatments involving recommended dose of fertilizer (RDF), soil application of ZnSO₄ @ 25 kg ha⁻¹ and borax @ 2 kg ha⁻¹ individually and in combination, foliar application of ZnSO₄ and borax each @ 0.5% individually and in combination, soil and foliar application of ZnSO₄, soil and foliar application of borax and gypsum equivalent to sulphur content in 25 kg of ZnSO₄. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications and ten treatments. RDF @ 150:100:125kg: N:P₂O₅:K₂O ha⁻¹ and farm

yard manure @ 25 t ha⁻¹ were applied to all the treatments. Soil application of ZnSO₄ @ 25kg ha⁻¹ along with borax @ 2 kg ha⁻¹ contributed for the significantly higher yield (27.91 t ha⁻¹) increasing up to 30.53 per cent over RDF (21.39 t ha⁻¹). However, treatments receiving soil and foliar application of ZnSO₄, soil and foliar application of borax, individual soil application of ZnSO₄ and borax were on par with each other. The experimental soil being deficient in zinc and boron, a good response of crop to the applied zinc sulphate and borax was noticed. Further, yield attributes (diameter, weight and density of curd), quality parameters (crude protein, ascorbic acid content and total soluble solids), nutrient uptake (N, K, Zn and B), available zinc and boron status and net returns were higher with the soil application of ZnSO₄ and borax in combination.

Effect of organic and inorganic sources of nutrients on soil fertility and productivity of maize (*Zea mays* L.)

BHIMAPPA K. CHANNAL

2013

MAJOR ADVISOR: Dr. K. K. MATH

A field investigation on the effect of organic and inorganic sources of nutrients on productivity and nutrient uptake by maize and soil fertility was carried out during *kharif* 2011. The experiment was laid out on Typic Haplustert in RBD with twelve treatments replicated thrice. The recommended dose of nutrients was given through organics [FYM, vermicompost (VC) and poultry manure (PM)] and chemical fertilizers. There was improvement in growth and yield contributing characters due to application of RDF with PM and it was on par with RDF + VC and RDF + FYM but significantly superior to other treatments. Combined application of organic manures and chemical fertilizers to supply recommended nutrients in 1:1 ratio along with recommended FYM improved growth and yield contributing characters and hence grain yield in maize over the treatments with the 100 per cent organics. The uptake of nutrients by maize increased significantly with incorporation of organic

manures with RDF and the highest uptake was recorded in the treatment with PM. Similarly, uptake of nutrients in the treatments with organics and fertilizers each at 50 per cent level with recommended FYM also recorded higher uptake of these nutrients than RDF and the treatments with 100 per cent organics. Water holding capacity, organic carbon, available N, P, K, S and DTPA-extractable Cu, Fe, and Mn and activity of dehydrogenase enzyme in soil improved due to substitution of fertilizer N with organics and the extent of improvement was higher at 100 per cent level. The highest net returns was realized in RDF + PM treatment. The present investigation revealed that application of PM at 1.0 t ha⁻¹ along with the recommended dose of chemical fertilizers increases the productivity of maize and improves soil fertility. Further, 50 per cent recommended dose of chemical fertilizers to maize can be substituted with organic manures without losing appreciable quantity of yield.

SEED SCIENCE AND TECHNOLOGY

Standardization of seed production techniques and storability in green gram (*Vigna radiata* (L.) Wilczek)

PUSHPALATHA

2013

MAJOR ADVISOR: Dr. M. N. MERWADE

A field experiment was carried out to study the effect of three spacings viz., S₁- 30 x 10 cm, S₂- 30 x 15 cm and S₃- 37.5 x 10 cm and three fertilizer levels viz., F₁- 20:50 NP kg/ha, F₂- 31.25:62.50 NP kg/ha and F₃- 37.50:75 NP kg/ha on crop growth, seed yield and quality of green gram cv. DGGV-2. Among the three spacings significantly more number of branches per plant, pods per plant, pod yield per plant, seeds per pod, seed yield per plant and seed yield per ha (1167 kg), 100 seed weight, seed germination (91.56 %), seedling vigour index (3077) were noticed in S₂ followed by S₃, whereas plant height was maximum in S₁. Similar results on seed yield and quality parameters were recorded in F₂, whereas plant height and number of branches per plant were maximum in F₃ level. Interaction (S x F) effect was found non-significant for both crop growth and seed quality parameters but seed yield components were significantly higher in S₂F₂ treatment combination. A laboratory experiment was carried out

under ambient condition for eight months to evaluate storage performance of six varieties viz., V₁- LGG-460, V₂- SML-668, V₃- DGGV-2, V₄- DGGV-4, V₅- S-4 and V₆- Chinamung with five seed treatments viz., T₁- control, T₂- garlic paste @ 5 g/kg, T₃- custard kernel powder @ 10 g/kg, T₄- castor oil @ 5 ml/kg and T₅- deltamethrin EC @ 0.05%. Among the varieties, LGG- 460 was found to be a good storer by recording less value for quantitative parameters and less percent decline in qualitative parameters. Seed treated with castor oil and deltamethrin has retained higher seed quality with less quantitative losses against control during eight months of storage period. Interaction (V x T) effect was found non-significant for both quantitative and qualitative parameters. In general, LGG- 460 seeds treated with castor oil retained higher seed quality well above Minimum Seed Certification Standards with minimum quantitative losses as against untreated seeds of S-4 variety for eight months period.

Studies on identification of suitable provenance and application of plant nutrients for quality seed production of maize hybrid (GH0727)

K. S. SIDDARUDH

2013

MAJOR ADVISOR: M. R. ESHANNA

Field experiment was conducted to investigate the response of maize hybrid (GH-0727) to foliar micronutrients spray and provenance effect on growth, seed yield and quality. Experiment was laid out in RBD in factorial concept with three replications during *kharif* of 2012-13. First factor consists of two locations (L₁- Kalloli, L₂- Bailhongal), second factor is plant nutrition with ten levels comprises of three soil application (FeSO₄, ZnSO₄ and FeSO₄+ZnSO₄ with RDF and six foliar application treatments (FeSO₄, ZnSO₄, KNO₃, urea, DAP, 19:19:19 NPK with RDF) and control. The results revealed that the seeds produced at Kalloli exhibited significantly increased growth parameter like plant height at 30, 60 and 90 days (31.79, 174.05 and 195.63cm, respectively), and yield parameters

cob length (13.94cm), Cob diameter (14.15cm), seed weight per plant (122.1g), seed yield (17.42q/ha), hundred seed weight (27.93g) and seed quality parameters germination (94.33%), seedling vigour index (3636). Significantly higher effect was recorded with the treatment (T₅) RDF+ ZnSO₄ @ 0.5% (Foliar) in different stages (30 & 50 DAS) on plant height at 30, 60 and 90 days (32.15, 177.98 and 199.83 cm, respectively), and seed yield parameters length of the cob (15.47cm), cob diameter (14.70cm), seed weight per plant (131.54g), seed yield (17.75q/ha), hundred seed weight (32.17g) and seed quality parameters like germination (94.63%), vigour index (3863). Treatment combination of (L₁xT₅) location Kalloli with RDF+ ZnSO₄ @ 0.5% (Foliar) treatment recorded significantly higher

plant growth, yield and quality parameters such as plant height at 30, 60 and 90 days (32.80, 179.13 and 201.90 cm, respectively), and yield parameters length of the cob (16.13cm), cob diameter (14.79cm), seed

weight per plant (132.30g), seed yield (18.49 q/ha), hundred seed weight (32.67g) and seed quality parameters like germination (95.10%), vigour index (3959).

Studies on standardization of hybrid seed production techniques under shade house and open field conditions in tomato (*Solanum lycopersicum* L.)

PRATIK PATIL

2013

MAJOR ADVISOR: Dr. RAVI HUNJE

A field experiment was carried out at Hi-Tech Horticulture unit, Saidapur farm and seed quality analysis at seed quality testing and research laboratory National Seed Project, UAS Dharwad during 2012-13 to study the effect of growing conditions and plant spacing on growth, seed yield and quality of tomato hybrid seed production and to know the pollen viability of pollen parent and stigma receptivity of seed parent in hybrid seed production of tomato Pusa hybrid-2 parental line under shade house. The growing condition shade house registered significantly higher plant height at 90 DAT (186.54 cm), leaf area (131.75 dm²/plant⁻¹), leaf area index (4.32) more number of days to 50 per cent flowering (36 days), days to fruit maturity (91.42 days), fruit set (67.6%), seed yield per hectare (187.1kg), seed germination (92.5%) and seedling vigour index (1766). Hence, higher yield and quality of tomato hybrid seeds can be obtained under shade house condition compared open condition. The spacing 60 x 60 cm recorded significantly higher number of fruit set (71.1%),

seed yield per plant (6.0 g), seed germination (92.3%) and seedling vigour index (1815) and spacing 60 x 45 cm recorded significantly higher seed yield per hectare (170.6kg). The significantly higher fruits set (67.68%), number of seeds per fruit (114.83), germination percentage (92.40%), seed vigour index (1648) and seedling dry weight (5.50 mg⁻¹⁰) recorded when two day stored pollen is used for crossing and pollination two days after emasculation of stigmas recorded significantly higher fruits set (67.68%), number of seeds per fruit (114.83), germination (94.33%), seed vigour index (1760) and seedling dry weight (5.86 mg⁻¹⁰). Significantly higher Fruits set (75.2%), number of seeds per fruit (129), germination (97.33%) and seed vigour index (1934) were recorded in treatment combination of two day stored pollen used for pollination of two days after emasculated Stigma and this treatment combination has noticed, better fruits set percentage, seed yield and seed quality

Effect of foliar application of micronutrients on seed yield, quality and storability in soybean [*Glycine max* (L.) Merrill]

B. M. SHRUTHI

2013

MAJOR ADVISER: Dr. D. S. UPPAR

The field experiment was carried out to find out the effect of foliar application of micronutrients on seed yield, quality and storability in soybean [*Glycine max* (L.) Merrill] at Main Agricultural Research Station, Dharwad during *kharif* 2012. The experiment consisted of eight treatments viz., T₀ - Control, T₁-ZnSO₄ @ 0.3%, T₂ - Boron @ 0.2%, T₃ - KNO₃ @ 0.5%, T₄ - ZnSO₄ @ 0.3% + Boron @ 0.2%, T₅ - ZnSO₄ @ 0.3% + KNO₃ @ 0.5%, T₆ - Boron @ 0.2% + KNO₃ @ 0.5%, T₇ - ZnSO₄ @ 0.3% + Boron @ 0.2% + KNO₃ @ 0.5% and treatments were imposed at 30 and 45 DAS. It was laid out in randomised block design with three replications. Foliar application of ZnSO₄ @ 0.3% + Boron @ 0.2% + KNO₃ @ 0.5% at 30 and 45 DAS recorded significantly higher plant height (58.70 cm), more number of leaves per plant (95.67) and leaf area index (5.08), number of pods per plant (39.67), number of seeds per

pod (2.51), seed weight per plant (7.89 g), seed yield per plot (1.67 kg), 100 seed weight (14.10 g) and seed yield per hectare (2655 kg) compared to control (52.60 cm, 74.70, 3.98, 34.47, 2.14, 6.32g, 1.42 and 2281 kg, respectively). The storage experiment was conducted in the laboratory of Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad from October 2012 to April 2013. The seeds obtained from foliar application of ZnSO₄ @ 0.3% + Boron @ 0.2% + KNO₃ @ 0.5% at 30 and 45 DAS recorded higher germination percentage (92.72 %), root length (9.26 cm), shoot length (7.10 cm), seedling length, seedling vigour index (1529), seedling dry weight (41.95 mg) and oil content (18.1%) as compared to control (85.00 %, 14.4, 13 cm, 2321, 100.47 mg and 16%, respectively) at the end of six months of storage period.

Studies on standardization of hybrid seed production techniques under shade house and open field conditions in bitter melon (*Momordica charantia* L.)

YADAV SANTOSH SHIVAPPA

2013

MAJOR ADVISOR: Dr. T. A. MALABASARI

The field experiment was carried out to study the effect of growing condition viz., G₁-open field and G₂- shade house and four spacing viz., S₁-120 x 60 cm, S₂-120 x 75 cm S₃-120 x 90 cm and S₄-150 x 100 cm on crop growth, seed yield and quality of hybrid seed production in bitter melon cv. Pusa hybrid-2. The results revealed that plant height (463.22 cm), number of branches per plant (32.42), leaf area (73.72), number of fruits per plant (24.16), seed yield per plant (102.34 g), seed yield per ha (1021.02 kg), 100 seed weight (125.17 g), seed germination percentage (85.50), seedling vigour index (3326) was significantly higher under shade house than open field condition. Whereas, number of seeds per fruit (24.58) and seed weight per fruit (5.30g) was significantly higher in open field condition. Among the spacing, number of branches per plant (27.17), leaf area (72.17), number of fruits per plant (21.67), number of seeds per fruit (22.67), seed weight per fruit (5.33 g),

seed yield per plant (112.80g), seed yield per ha (1044.44 kg), 100 seed weight (27.92 g), seed germination percentage (84.50), seedling vigour index (3280) was significantly maximum in 120 x 90 cm (S₃). The second experiment was carried out to study the effect of period of pollen storage and pollination day after flower opening on fruit set, seed yield and quality parameters. Among the three period of pollen storage fresh pollen recorded significantly higher fruit set (72.36%), fruit weight (98.42 g), seed weight per fruit (4.12 g), seed yield per plant (59.34 g), seed germination percentage (75.00) and vigour index (2369). The different pollination days after flower opening, pollination on the day of flower opening recorded significantly higher fruit set (71.43%), fruit weight (97.78 g), seed weight per fruit (4.04 g), seed yield per plant (58.48 g), seed germination percentage (75.00) and vigour index (2364).

studies on integrated nutrient management on seed yield and quality of cowpea (*Vigna unguiculata* (L) Walp) Cv. DC-15

KOTESHI LAMANI

2013

MAJOR ADVISOR: Dr. D. S. UPPAR

A field experiment was carried out during *kharif* season 2012 at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to investigate the effect of integrated nutrient management on seed yield and quality of cowpea Cv.DC-15. The field experiment comprised of nine treatments including control with three replications and it was laid out in Randomised Block Design (RBD). The experimental data revealed that application of 25:50:25 kg NPK ha⁻¹ + vermicompost @ 2 t ha⁻¹ + seed treatment with *Rhizobium* 500 g ha⁻¹ (T₁) recorded significantly higher seed yield per ha (1280 kg/ha), number of pods per plant (14.17), pod length (20.87 cm), number of seeds per pod (14.80), pod weight per plant (27.11 g)

and seed yield per plot (0.57 kg). Plant growth parameters also significantly correlated with treatment T₁ such as plant height (37.22 cm), number of nodules per plant (27.61), dry weight of nodules per plant (356.50 mg), days to pod initiation (57.37) and chlorophyll content (60.22). Seed quality parameters also significantly increased viz; 100 seed weight(10.33g), germination percentage (97.33), seedling length (51.54 cm) seedling vigour index (5016), seedling dry weight (6.39 mg), protein content(24.99%) and lower electrical conductivity(0.194 dSm⁻¹) and it was on par with 25:50:25 kg NPK ha⁻¹ + FYM @ 5 t ha⁻¹ + seed treatment with *Rhizobium* 500g ha⁻¹ compared to control (25:50:25 kg NPK ha⁻¹ + FYM @ 5 t ha⁻¹).

Evaluation of rabi sorghum [*Sorghum bicolor* (L.) Moench] genotypes for seed, seedling, seed health and plant morphometric traits

R. B. GOUDAR

2013

MAJOR ADVISOR: Dr. ASHOK S. SAJJAN

Experiment was conducted at the Regional Agricultural Research Station Bijapur during two consecutive, seasons of rabi 2011-12 and 2012-13 for evaluation of rabi sorghum genotypes through morphological characters. The laboratory experiment was conducted by using chemicals, image analyzer and seed health was carried out at Seed Quality and Research Laboratory at National Seed Project, UAS Dharwad. Sixty rabi sorghum genotypes were grouped into different groups based on the seed, seedling and plant morphological characters. The results of quantitative traits revealed that among the sixty rabi sorghum genotypes, some of them were high yielding and they produced bold quality seeds. The highest seed yield was observed in IS23992 in 1st season (2974.94 kg ha⁻¹), 2nd season (2983.85 kg ha⁻¹) and pooled results (2979.39) followed by IS 30079 (2794.98 kg ha⁻¹). Seeds were subjected to NaOH, KOH-bleach test and

seedling growth response to GA₃. Based on biochemical tests, the genotypes were classified based on colour pattern they produces when soaked in chemicals. Genotypes IS1233 (78.32%), IS2382 (74.00%) shown higher response to GA₃ chemical and based on presence or absence of seedborne pathogens and percent of infection of seed borne pathogens on the seeds, the sorghum genotypes were classified into different groups. The percent of infection varied and some of the genotypes were resistant for specific seed borne pathogens (EP59- for *Aspergillus spp*, *Botrytis spp* and *Curvularia spp*, Phule Maulee- for *Penicillium Spp*, *Fusarium Spp* and *Rhizopus Spp*). The genetic diversity of sixty rabi sorghum genotypes were studied based on the yield related traits by using Mahalanobis D² analysis and the sorghum genotypes were grouped into fifteen clusters.

Effect polymercoat and seed treatment chemicals on seed storability and field performance of chickpea

P. P. SUSHMA

2013

MAJOR ADVISOR: B. S. VYAKARANAL

The laboratory and field experiment was carried out with two factorial concept in CRD and RCBD design respectively. First factor consisted of varieties viz., BGD103 (desi) and BG1105 (Kabuli), second factor consists of eight treatments. The results of present investigation revealed that seed storability and field performance was superior in BGD 103 (desi type) as compared to BG1105 (Kabuli type). Significantly high seed germination (82.91%), vigour (1888), seedling dry weight (166.27mg), and test weight (30.66 g) and less EC value (0.973 dSm⁻¹) was found at the end of storage period. Minimum plant height (41.39cm) with maximum number of branches (19.25) per plant, less number of days taken for 50 per cent flowering and maturity (46.29 and 92.9) number of pods per plant (28.90), number of seeds per plant (35.46), seed weight per plant (4.33 g), seed yield per hectare (14.42 q) was recorded in BGD103 during

field experiment. At the end of storage period, treatment combination of polymer coated seed (10 ml/kg) along with deltamethrin 2.8 EC @ 0.4 ml/kg of seed + vitavax power @ 2 gm/ Kg of seed treatment combination recorded significantly higher seed germination (87.13%), shoot and root length (8.39 cm and 15.63 cm), seedling vigour index (2093), seedling dry weight (177.12 mg), test weight (29.21g), and lower EC value (0.831dSm⁻¹) as compared to T₁. In the field experiment significantly higher number of branches (21.30), number of pods per plant (31.91), number of seeds per plant (39.39), seed weight per plant (4.38g), seed yield per hectare (14.58q), with good germination percentage (98.51), shoot length (12.46 cm), root length (20.66 cm), seedling vigour index (3264), seedling dry weight (226.30mg), test weight (32.55g) and lesser EC value (0.324 dSm⁻¹) was recorded in T₈ as compared to T₁.

Seed Production and Seed storage studies in Cosmos (*Cosmos sulphureus*)

A. RASHMI

2013

MAJOR ADVISOR: Dr. V. K. DESHPANDE

Two field experiments to ascertain the physiological maturity and the influence of fertilizer levels and pinching manually or chemically on seed yield and quality and a storage study of cosmos seeds as influenced by containers and desiccant were conducted in the Department of Seed Science and Technology, UAS, Dharwad during kharif 2011-12. The experiment on physiological maturity of seed crop consisting of seven stages of harvesting the capitulum from 10 to 40 days after anthesis (DAA) with an interval of five days, exhibited the increase in seed dry weight, decline in seed moisture content and change in seed colour. Seeds harvested at 25 DAA recorded maximum fresh and dry weight (8.80 g and 7.90 g/1000 seeds) with seed moisture content, germination and seedling length as compared to early or delayed harvests. The second experiment results revealed that pinching the seedlings in the field

manually or chemically (Mepiquat Chloride @ 500 ppm) at 15 (DAT) showed significant decrease in plant height and increase in number of flower bearing branches, seeds per capitulum and seed yield (60.90 kg/ha) with better seed quality parameters. Among the fertilizer levels, higher fertilizer level (270:180:110 kg/ha NPK) resulted in more number of branches, seeds per capitulum and higher seed yield (54.09 kg/ha) with better seed quality parameters. The seed storage experiment in the laboratory involving four containers viz; aluminium foil, polythene bag (700 gauge), plastic bottle and cloth bag with or without silica gel revealed that, seeds stored in aluminium foil with silica gel (10 g/kg seeds) was found better upto six months of storage with high germination (86.63%), seedling vigour (1488) and other seed quality parameters as compared to seeds stored in cloth bag.

Synchronization studies in sunflower hybrid DSFH-3 and influence of boron spray and nipping on seed yield and quality of R-line (RHA-IV-77)

SATISH PATIL

2013

MAJOR ADVISOR: Dr. R. B. JOLLI

The field experiment was carried out to study the effect of plant spacing viz., P₁-60x30cm and P₂-60x45cm and five Staggered sowing viz., S₁: Both the parental seeds are sown on the same day, S₂: Male parent seeds are sown 2 days earlier to female parent seeds, S₃: Male parent seeds are sown 4 days earlier to female parent seeds, S₄: Male parent seeds are sown 2 days later to female parent seeds and S₅: Male parent seeds are sown 4 days later to female parent seeds on seed yield and quality of sunflower hybrid seed production of DSFH-3. The results revealed that plant height (146.71cm), head diameter (13.05cm), number of seeds (1007.48/head), seed set (83.32%), seed yield (1.65kg/plot), seed yield (12.57q/ha), 100 seed weight (4.75g), germination (96.27%), seedling vigour index (3902) was significantly higher in P₂ than P₁. Among the staggered sowing, number of seeds (996.13/plant), head diameter (13.12cm), seed set (84.27%), seed

yield (1.67kg/ plot), seed yield (12.60q/ha), 100 seed weight (4.77g), germination (96.17%), seedling vigour index (3890) was significantly maximum in S₄. The second experiment was carried out to study the effect of nipping of side branches and boron spray to enhance seed set, seed yield and quality in restorer line (RHA-IV-77) of DSFH-3. Boron spray @ 0.2 percent recorded significantly higher seed set percentage (76.76%), number of seeds (911.53/ head), seed weight (1.65kg/ plot), seed yield (11.75q/ ha), germination (96.4%) and vigour index (3937) compared to without boron spray. Nipping of side branches at button stage recorded significantly higher set seed percentage (78.83%), number of seeds (904.03/head), seed weight (1.63kg/ plot), seed yield (11.66q/ha), germination (96.00%) and vigour index (3890) compared to no nipping.

Effect of controlled modified atmospheric package on viability and vigour of soybean seeds during storage under ambient conditions [*Glycine max* (L.) Merrill.]

S. R. SWAPNA KUMARI

2013

MAJOR ADVISOR: Dr. V. K. DESHPANDE

Laboratory experiment was conducted at the Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad during April 2012- March 2013 to study the effect of modified atmospheric storage conditions on storability of soybean seeds (cv.JS-335) under ambient conditions. The freshly harvested seeds were exposed to various combinations of inert gases Viz., T₁- 80% CO₂ + 5% O₂ + 15% N₂, T₂- 75% CO₂ + 5% O₂ + 20% N₂, T₃- 50% CO₂ + 5% O₂ + 45% N₂, T₄-25% CO₂ + 5% O₂ + 70% N₂, T₅-20% CO₂ + 5% O₂ + 75% N₂, T₆- 15% CO₂ + 5% O₂ + 80% N₂, T₇-50% CO₂ + 00% O₂ + 50% N₂, T₈- 50% CO₂ + 10% O₂ + 40% N₂, T₉-25% CO₂ + 10% O₂ + 65% N₂, T₁₀- 20% CO₂ + 10% O₂ + 70% N₂, T₁₁-15% CO₂ + 10% O₂ + 75% N₂, T₁₂-100% CO₂ + 00% O₂ + 00% N₂, T₁₃-00% CO₂ + 00% O₂ + 100% N₂, T₁₄-Vacuum packing, T₁₅-seeds stored in polythene bag with normal air, T₁₆-storage in cloth bag(control). The results revealed that, the seeds stored with gaseous combination of 80% CO₂ + 5% O₂ + 15% N₂, in 700 gauge polyethylene

bag maintained better quality traits in terms of germination(82.45%) and vigour(2469) up to the end of twelve months of ambient storage by recording higher root length (18.47 cm), shoot length (15.96 cm), dehydrogenase enzyme activity (0.268 OD value), oil content(17.34%), protein content(36.49%) and less seed leachate (1.093 dSm⁻¹) and minimum moisture content(8.024%) followed by vacuum packaging storage (Germination -81.23% and 2355) compared to those stored in polythene bag with atmospheric air and in cloth bag. It is also seen that seeds stored in polythene bag with 80% CO₂ + 5% O₂ + 15% N₂ retained germination above minimum seed certification standard even at the end of twelve months storage period. the same results were also seen in vacuum packaging and seeds stored in polythene with 75% CO₂ + 5% O₂ + 20% N₂ where as it was only up to seven months and five months period in case of polythene bag with normal air and cloth bag respectively

Effect of seed dormancy breaking treatments on seed quality and storability of forage legumes

S. R. KAVITA

2013

MAJOR ADVISOR: Dr. VINOD KUMAR

Laboratory experiment was conducted to investigate the effect of seed dormancy breaking treatments on seed quality and storability of forage legumes during April 2012 to February 2013 at Department of Seed Science and Technology, University of Agricultural Sciences Dharwad. The seeds of *Stylosanthes hamata*, *Stylosanthes guianensis* and *Desmanthus virgatus* were subjected to different treatments viz., T₀: Control (untreated), T₁: Mechanical scarification, T₂: Hot water soaking for 5 min, T₃: H₂SO₄ treatment for 2 min, T₄: Soaking the seeds in 20% Sodium hydroxide solution for 15 min., T₅: Soaking the seeds in PEG-6000 solution @ 200 g/litre for 48 hrs, T₆: Soaking the seeds in 1000 ppm Ethrel solution for 24 hrs, T₇: Smoke treatment (exposing the seeds to the *Eupatorium odoratum* smoke) for 30 min and T₈: Hot air treatment at 80°C for 10 min in hot air oven. Monthly observations were taken to know the seed quality. The results revealed that in *Stylosanthes hamata* seeds which were

mechanically scarified with sand paper significantly recorded the higher germination (73.5%), root length (4.30 cm), shoot length (4.62 cm), seedling vigour index (656), seedling dry weight (25.75 mg), electrical conductivity (0.348 dS m⁻¹), field emergence (64.0%) and lower hard seed per cent (9.50) at the end of eleven months of storage period. In case of *Stylosanthes guianensis* and *Desmanthus virgatus*, acid scarified with conc.H₂SO₄ for 2 min. significantly recorded the higher germination (80.0 and 60.3%), root length (4.10 and 4.45 cm), shoot length (5.45 and 6.73 cm), seedling vigour index (756 and 673), seedling dry weight (31.00 and 30.00 mg), electrical conductivity (0.410 and 0.452 dS m⁻¹), field emergence (80.8 and 59.0%) and lower hard seed per cent (zero and 15.75) at the end of eleven months of storage period compared to other treatments. In all the three legumes maximum viability and vigour maintained upto five to six months.

SILVICULTURE AND AGROFORESTRY

Effect of integrated nutrient management on *Tectona grandis* (Linn.f.) with special reference to bio fertilizers

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The increasing cost of chemical fertilizers accompanied with its various noted harmful effects had put thrust on adopting new sources of nutrition for plants. The use of bio-fertilizers or integrated nutrient management is not new to the society only the thrust is new, as there are ample of evidences of use of bio-fertilizers in agricultural crops but it is contemporarily new in forestry species. Keeping these emerging requirements in mind the present study was conducted at Agricultural Research Station (ARS) Malagi during period 2012-13. In the present study which was conducted on one year old teak plantation, in total fourteen treatments was there including control. The treatments were applied solitary as well as in combination for which various morphological and qualitative parameters were recorded. Among all the treatments T₉ which was integrated combination of FYM + NPK + PSB (1 Kg/plant+50% of RDF+100 g/plant) showed best performance among all the treatments recording highest plant height, collar diameter, number of leaves and leaf area per plant i.e. 127.79 cm, 24.13 mm, 18.13 and

422.53 cm² respectively at the end of 8 MAT; which showed an increase of 259.90 % (plant height), 215.00 % (collar diameter), 97.06 % (number of leaves) and 74.79 % (leaf area per plant) over Initial readings. Lowest among all the parameters was recorded in control (T₁₄). Among the bio-fertilizer treated plants dual inoculation recorded better performance over triple inoculation and highest among all the parameters was recorded in T₁₃ (PSB + Azospirillum). Among qualitative parameters maximum root to shoot dry weight ratio was recorded in VAM + PSB (2.17) and maximum sturdiness quotient was recorded in NPK applied treatment (53.84). Among the given treatments soil pH varies within the range of 5.54 to 6.07; whereas electrical conductivity varies within 0.02-0.09 ds/m and organic carbon was recorded in the range of 0.99-1.48%. For the available nitrogen, phosphorous and potassium was recorded maximum in the integrated treatment of FYM + NPK + Azospirillum 207.20 Kg/ha, 68.00 Kg/ha and 252.30 Kg/ha, respectively.