

Abstract of Theses Accepted for the Award of Post-Graduate Degrees in the University of Agricultural Sciences, Dharwad

DOCTOR OF PHILOSOPHY

AGRONOMY

Investigations on Nutrient Management and Planting Geometry in Companion Cropping of Sunflower (*Helianthus annuus* L.) and Ashwagandha (*Withania somnifera* Dunal.)

H.T. CHANDRANATH

2006

MAJOR ADVISOR : Dr. B. T. PUJARI

Field experiments were conducted to find out suitable row proportion and nutrient management in sunflower and ashwagandha intercropping system at Regional Agricultural Research station, Raichur, UAS, Dharwad during late kharif season of 2004 and 2005 under rainfed condition. The experiments were conducted on medium black soil and laid out in randomized block design. In the experiment on effect of row proportions and seed rate levels of ashwagandha, intercropped sunflower recorded on par seed yield with that of sole sunflower. Among row proportions studied, the seed yield (1273 kg ha⁻¹) produced under 1:6 row proportion was significantly higher over the seed yield (1132 kg ha⁻¹) recorded under 1:3 row proportion and was on par with 1:4, 1:5 and 1:7. These row proportions also resulted in higher growth and yield components of sunflower. With respect to ashwagandha, the dry root yield produced under 1:6 (593 kg ha⁻¹) and 1:7 (609 kg ha⁻¹) row proportion was significantly higher than under 1:3 row proportion. The maximum net returns was

realized under 1:7 (Rs. 31,694 ha⁻¹). The sunflower intercropped with 100 per cent seed rate of ashwagandha recorded significantly higher dry root yield than with 50 per cent seed rate. Another study was focused on nutrient management in companion cropping of sunflower and ashwagandha. The results revealed that the seed yield of sunflower (1350 kg ha⁻¹) obtained with recommended fertilizer treatment (T₄) was significantly higher over recommended nitrogen (RDN) through organics + P & K through inorganics (T₅) (1109 kg ha⁻¹) and 75 per cent RDN through organics + 25 per cent N and entire P and K through inorganics (T₆). Similar trend was noticed with respect to growth and yield parameters of sunflower. The treatment T₄ realised significantly higher dry root yield (519 kg ha⁻¹) over T₅ (394 kg ha⁻¹) and T₆ (409 kg ha⁻¹). Maximum net returns was recorded with T₄ (Rs. 40,763 ha⁻¹) and closely followed by treatment T₇ (rs. 38,819 ha⁻¹).

Studies on Optimization of Agrotechniques to Maximise Productivity of Winter Maize (*Zea Mays* L.) and Evaluation of DSSAT v 3.5 CERES Maize Model

NAGARAJU

2006

MAJOR ADVISOR : Dr. Y.B. PALLED

Two field experiments were conducted at Agricultural College farm Dharwad during rabi seasons of 1998-99 and 1999- 2000 under irrigated condition. The results revealed that the single cross maize hybrid DMH - 2 planted during II and I fortnight of October recorded significantly higher grain yield (8553 and 8255 kg ha⁻¹ respectively), net returns (Rs. 30165 and 29145 ha⁻¹ respectively) and B:C ratio (3.09 and 3.02 respectively) over other planting date and varieties treatment combinations. Irrigation scheduling at 0.9 IW: CPE ratio with plant density of 11111 plants ha⁻¹ and 150 per cent recommended nitrogen application of 225 kg ha⁻¹ produced significantly higher grain yield (8894 kg ha⁻¹), net returns (Rs. 31959 ha⁻¹) and B:C ratio (2.96) as compared to other irrigation, plant density and nitrogen levels treatment combinations. The DSSAT v3.5 CERES maize model simulation studies on growth and yield due to the effect of genotypes and planting dates, irrigation

scheduling coupled with plant densities and nitrogen levels carried out by making use of minimum data sets genetic co-efficients for maize varieties, weather, soil experimental management details. The simulation results on LAI, days to anthesis and maturity, grain, stover and biomass yield, harvest index, grain weight, grains ear⁻¹, grain number m⁻², water used and nitrogen uptake were very accurate and within the permissible tendency (less than 10 per cent) towards over estimation or under estimated except for leaf number plant⁻¹ wherein CERES model over estimated to the extent of more than ten per cent which emphasized the need for precise estimation of PHINT value. In addition, the simulated NO₃ nitrogen accumulation, NO₃ nitrogen leaching and drainage water helped in the interpretation of input use such as water and nitrogen. It is concluded that DSSATv 3.5 maize models could be used in wider perspective in predicting the growth and yield of maize as influenced by agro techniques.

PLANT BIO-TECHNOLOGY

Post Transcriptional Gene Silencing (PTGS) of Tomato Leaf Curl Virus (ToLCV) in Tomato

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2006

MAJOR ADVISOR : Dr. P.U. KRISHNARAJ

Tomato, an economically important crop in many countries is plagued by many viral diseases including leaf curl caused by Tomato leaf curl virus (ToLCV) belonging to the genus begomovirus. Begomoviruses are small circular, single stranded DNA plant viruses. Yield losses usually vary from 28-92% making tomato cultivation unprofitable. Genetically engineering resistance is a viable alternative to genetically engineer tomato for protection against ToLCV. PTGS/RNAi is a novel gene regulatory mechanism that limits the transcript level by either suppressing transcription or by activating a sequence-specific RNA degradation process. We have cloned and characterized ToLCV-coat protein (TCP), replicase (TRP) and suppressor of PTGS (TRS) genes from a Dharwad local isolate. Constructs have been developed using all the three genes for the available gene silencing strategies viz., sense (s), antisense (as), ihp (sas) and HUTR

(heterologous 3-untranslated region). Coat protein (TCP) gene has been cloned and expressed in a prokaryotic system. As a comparative study plant expression vectors carrying TCP, TRP and TRS gene following different strategies were used for transgenic development through *Agrobacterium*. Analysis of putative To-transgenics showed positive for PCR, GUS, Dot blot and Southern blot analysis. Semi-quantitative PCR analysis of plants from TRP constructs showed drastic reduction in the virus inoculum compared to non-transgenic plants. The T₁-generation transgenic plants obtained from TRP constructs were positive for PCR and Dot blot analysis. Among different strategies tested for resistance to ToLCV in transgenics, those with sas/ihp construct showed significant resistance against ToLCV followed by HUTR, antisense (as) and sense (s). Similarly, among the three different genes tested, silencing was more in TRS constructs followed by TRP and TCP.

AGRICULTURE ENTOMOLOGY

Evaluation of New Generation Bt Genotypes, Sustainability of Cry Protein Expression, Computation of ETL, Effect on Aphid Predators and Development of IPM Module for Bt Cotton Under Rainfed Conditions

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2006

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Investigations were carried out on different sustainability aspects of Bt cotton genotypes, during 2004-05 and 2005-06 at Agricultural Research station, Dharwad. New generation Bt cotton MRC- 7201 with *cryIac* + *cry2ab* genes (BG-II) found to be best against bollworms. Under unprotected conditions the incidence of *Helicoverpa armigera* (Hubner) was 0.13 larva/ plant in MRC - 7201 (BG-II) with 5.05 percent damage which was on par with MRC-6322 Bt (BG-II). RCH 368 Bt was better than others with *cryIac* gene and was at par with RCH - 2 Bt. Interspecific Bt hybrids with *cryIac* RCH - 708 and MRC - 6918 were better over DCH - 32. Decline in expression was evident through bioassays and ELISA quantification. In RCH - 2 Bt with *cryIac* maximum mortality (>90%) of *H. armigera* and *Earias vittella* F. from 60 to 80 DAS. Mortality of *Pectinophora gossypiella* (saunders) larvae was 85.35 per cent at 80 DAS. Mortality of all the three boll worm neonates was maximum (>90%) between 40 to 80 DAS in RCH-2 BG-II with *cryIab* + *cry2Ab* genes and was effective against *Spodoptera litura* Fab. The concentration of Cry1Ac in RCH 2 Bt was 3.49 µg/g in leaves at 45 DAS which reduced to 1.39 µg/g by 105 DAS. In RCH - 2Bt BG-II , Cry1Ac concentration was

maximum at 60 DAS (3.42 µg/g) and that of Cry 2ab at 80 DAS (71.02 µg/g). The cry protein expression was maximum in leaves followed by squares , flowers and boll rind. Cry1Ac toxin was 3.80 µg/g in bottom leaves and 1.55 µg/g in squares in RCH - 2 Bt. Cry 2Ab concentration was more in squares than leaves. EIL of *H. armigera* were 3.5 early instar and 1.5 late instar larvae per plant. The ETL worked out was 2.0 early instars or 1.0 late instar larvae per plant in Bt cotton. The incidence of aphids, coccinellids, chrysoperla and syrphids did not vary significantly on RCH - 2 Bt and non - Bt hybrids. There was positive and highly significant correlation between aphid incidence and predatory population indicating safety of Bt cotton genotype to predators. *Chrysoperla carnea* Steph. fed with aphids from Bt and non Bt plants did not vary in biotic potential. The IPM module having components viz., seed treatment with Imidacloprid 70WS @ 10g /kg seeds, sowing okra as a trap crop, nipping at 70 DAS, application of NSKE 5.0%, HaNPV @ 500 LE/ha (100-110 DAS), endosulfan 35 EC and management of pink bollworm with 200 PB Rope- L per ha (70 DAS) found to be ideal with maximum yield (23.50 q/ ha) and net profit (Rs. 37301/- per ha) apart from effective management of insect pest complex in RCH- 2 Bt.

Studies on Pink Bollworm, *Pectinophora gossypiella* (Saunders) in Bt and Non Bt Cotton

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2006

MAJOR ADVISOR : Dr.K. BASAVANA GOUD

Investigations were carried out during 2004-05 and 2005-06 at college of Agricultural Dharwad, on the survey of pink bollworm infestation, reaction of Bt and non-Bt cottons infestation in Bt and non-Bt cotton, comparative development of pink bollworm on Bt and non-Bt cotton bolls and molecular characterization of pink bollworm. The pink bollworm infestation at different locations surveyed was significantly less in Bt cotton compared to non-Bt cotton. The maximum larval population, per cent green boll damage and locule damage was recorded in Bt cotton (5.44 larvae/50 bolls, 9.45% and 16.06%, respectively) and non-Bt cotton (10.75 larvae/50 bolls, 20.62% and 26.31%, respectively). Across the locations, Bt cotton recorded more GOBs per plant (18.47 to 21.07) and less BOBs per plant (4.05 to 4.98), more seed cotton yield (8.8 to 9.97 q/ ha) In all the Bt cotton hybrids the rosette flowers, larval population, green boll damage, locule damage was significantly low compared

to their non-Bt cotton counter parts. Among all the Bt cotton genotypes, significantly lower pink bollworm larvae, green boll damage and locule damage were registered in RCH-2 Bt (2.95 larvae/50 bolls) being on par with RCH-20 Bt (2.97 larvae/50 bolls, 5.56 % and 11.18 % respectively) and RCH-144 Bt (4.01 larvae/50 bolls). Significantly higher number of larvae, highest green boll damage and locule damage were recorded in DHB-290 (15.01 larvae/50 bolls, 28.26% and 40.74 %, respectively) being on par with DHH-11 (13.09 larvae/50 bolls). The seed cotton yield among Bt cotton hybrids ranged from 6.70 to 10.30 q/ha which was significantly superior over their non-Bt counter parts. The number of days taken for pupation was more (23.15 days) on Bt cotton compared to non-Bt cotton (18.76 days). Whereas, the pupal weight was less (18.15 mg) on Bt cotton compared to non-Bt cotton (25.67 mg). The mean number of polymorphic bands per primer was 6.71 and mean polymorphism of 91.01 per cent.

Vector Virus Relationship and Development of Organic Package for the Management of Chilli (Cv. Byadagi) Pests

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2006

MAJOR ADVISOR : Dr. R. S. GIRADDI

Investigations on the establishment of vector - chilli virus relationship, effect of organic soil amendments on the activity of pests of chilli, development of spray schedule involving biorationals, studies on the tritrophic interactions involving chilli cultivars, *Helicoverpa armigera* and *Trichogramma species* and evaluation of IPM modules carried out during 2004 and 2005 at the MARS, UAS, Dharwad. Vector-virus relationship revealed that among the insects, only aphids, *Aphis gossypii* and *Myzus persicae* were able to transmit the virus from diseased to healthy seedlings and virus was identified as poty virus. However, thrips, mites and whitefly failed to transmit the virus from diseased to healthy seedlings, in the current study. Tritrophic relationship studies indicated that, Byadagi Kaddi was the more preferred host for oviposition by both *H. armigera* and *Trichogramma species* and Tejashwini cultivar was least preferred host. *T. chilonis* was found to be the most potential in parasitising

H. armigera eggs, irrespective of the cultivars. Split application of neem cake @ 125 kg/ha + vermicompost @ 625 kg/ha at transplanting and 50 days later (with 50 per cent nitrogen) and nimbecidine and NSKE spray interventions later was found to be the most effective against chilli pests. Organic interventions were found safe to natural enemies. The treatment schedule with nimbecidine (four times) and a spray of vertimec was found to be effective against sucking pests. Where as, nimbecidine-nimbecidine-spinosad- GCKE - spinosad treatment was effective versus *H. armigera*. Predator's activity was normal in the biorationals treated plots. Module-I, comprising of marigold trap crop, vermicompost 2.5 t/ha, neemcake 250 kg/ha (without application of RDF), superimposed with neemazal 5 WAT, Diafenthuron 8 WAT, profenofos 11 WAT and neemazal 14 WAT, was found to be the most effective module against chilli pests. All IPM modules were found safe to predators in crop ecosystem.

PLANT PATHOLOGY

Molecular Characterization, Epidemiology and Management of Tomato Leaf Curl Virus (ToLCV) in Northern Karnataka

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2006

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Tomato leaf curl virus (ToLCV) disease is one of the most important viral diseases of tomato and causes substantial losses every year. Survey results revealed that ToLCV was present in all the fields visited in Belgaum, Dharwad, Gadag and Haveri districts. The disease incidence ranged from 4-00 per cent during rabi 2005 and 60-100 per cent in summer 2006. A few natural weed hosts viz., *Parthenium hysterophorus* (*Parthenium*), *Euphorbia geniculata* (*Bhedi soppu*), *Ageratum conyzoides* (*Ooral gida*), *Acanthospermum hispidum* (*Kadale mullu*), *Blainvillea rhomboidea* (*Ervapalha*) *Cass* and *Lachnera pusilla* L. showed positive for ToLCV infection in the PCR detection. The results of the cloning and nucleotide sequencing of the coat protein gene revealed that isolates from Belgaum, Dharwad and Haveri showed 95.10 to 99.60 per cent homology indicating they are closely related to each other. However, these isolates showed wide variation of upto 46.50 per cent divergence with some of the isolates of North Western Indian ToLCV 17

Nasik (AJ 10356) and North Indian ToLCV 19 Patna (AJ 810358). The survey, bioassay and RAPD-PCR analysis of whitefly vector revealed the prevalence of *Bemisia tabaci*-B-biotype in addition to the indigenous type in Dharwad region. Tomato planted during August and November showed slow progress of the disease and less incidence as there was high humidity and high rainfall, which suppress the vector activities whereas, maximum incidence was recorded in February and May planted crop. In the management of disease the sequential application of Imidachloprid (0.005%)- Triazophos (0.15%)- Thiamethaxam (0.05%)-Econeeem (0.5%) found effective with low disease incidence and better yield. The *Clorodendron inermis* and *Glyricidia* leaf extract application also found effective. In the field screening cultivars such as Nandi, Vybhav, Sankrant, and hybrids Utsav, HY 558, HY 530, NS-719 and NS-563 showed resistance reaction and the commonly cultivated Megha showed susceptible reaction.

Studies on Loss Assessment, Epidemiology and Management of Powdery Mildew of Chilli Caused by *Leveillula taurica* (Lev.) Arn.

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2006

MAJOR ADVISOR : Dr. SRIKANT KULKARNI

Powdery mildew of chilli caused by *Leveillula taurica* (Lev.) Arn. is a major menace for chilli cultivation prevalent in chilli growing areas of Karnataka. Survey work revealed that, the average disease severity was found more in Bellary district (79.12%) followed by Gulbarga (75.63%) and least in Belgaum (43.05%). The observations on loss estimation revealed that, comparatively lower disease index with increase in dry chilli yield and also maximum BCR was recorded in plots receiving three sprays of Penconazole. Yield loss of 42.82 per cent was noticed due to powdery mildew in unsprayed plots. The chilli crop sown on 24th May showed least disease severity and slower disease progression, followed by crop sown on 3rd June and 13th June where lesser disease incidence and slower rate of disease progression was observed. Minimum temperature,

morning and evening relative humidities and rainfall were found significantly negatively correlated with disease severity. The aerobiological studies indicated that, more conidial counts were observed during November and December 2005 and 2006, which coincided with the critical stages of infection. The correlation studies between spore load, disease incidence and weather parameters indicated a negative relationship with all the weather parameters. Out of 226 genotypes / accessions screened, none of them were completely resistant, only three germplasm lines viz., Taiwan-7, Taiwan-8 and Taiwan-9, showed moderately resistant reaction and comparatively lower AUDPC value and they were considered as slow mildewers. Hexaconazole was found to be effective in control of powdery mildew and increased the yield with maximum BCR.

Investigations on the Etiology, Epidemiology and Integrated Management of Rhizome Rot Complex of Ginger and Turmeric

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2006

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The major constraint for cultivation of ginger and turmeric is the rhizome rot disease. The rhizome rot incidence of ginger was noticed in all the locations surveyed with the range from 5.50 to 45.60 per cent. The major diseases diagnosed were viz., soft rot caused by *Pythium aphanidermatum* (Edson) Fitzp, wet rot caused by *Fusarium solani* (Martius) Saccardo, bacterial wilt caused by *Ralstonia solanacearum* (Smith) Yabuuchi, *Sclerotium* rot caused by *Sclerotium rolfsii* Saccardo and root knot caused by *Meloidogyne arenaria* (Neal) Chitwood. The individual pathogen can cause rhizome rot or combination of pathogens also can cause rhizome rot. *Pythium aphanidermatum* was isolated from all the locations collected and found to be most predominant pathogen. *Ralstonia solanacearum* was detected only from the southern districts of Karnataka i.e., Kodagu, Chikmagalur, Hassan, Mysore, and Sagar. The incidence of rhizome rot of turmeric was meager as compared to ginger. The inoculum level studies revealed that, increase in per cent inoculum level increased the per cent disease incidence. In sequential inoculation studies, in case of both the crops i.e., ginger and turmeric, when first inoculated with *Meloidogyne arenaria* followed by other pathogens showed

maximum disease incidence as compared to individual inoculations. The results of isozyme analysis of three i.e., peroxidase, polyphenol oxidase and catalase studied for variability indicated that, there was slight amount of variation. RAPD data distinguished the twelve isolates into two major clusters A and B. The results revealed that, geographical locations of isolates were closely related. Maran and Vardha ginger varieties were considered as moderately resistant. CO-1 variety was considered as moderately resistant. Sowing in March significantly showed less disease incidence at both the locations of Sirsi and Bidar, which recorded 8.25 and 9.00 per cent respectively. The field experiment conducted at farmer field revealed that, there was significant increase in the per cent germination of rhizomes in solarized plot when compared to non solarized plot. Among the different treatments, rhizomes treated with Metalaxyl MZ @ 0.3 per cent+Soil application of *T. harzianum* @ 10 kg along with 25 t FYM/ha+Soil application of *Eupatorium* @ 10 t/ha recorded the highest per cent germination, lesser disease incidence, higher yield of 11720.20 kg/ha and more benefit cost ratio.

Epidemiology and Management of Alternaria Blight of Sunflower Caused by *Alternaria helianthi* (Hansf.) Tubaki and Nishihara

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2006

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Alternaria blight caused by *Alternaria helianthi* is one of the major diseases of sunflower. Raichur (47.1%) and Bagalkot districts (50.2%) recorded highest disease severity during 2004-05 & 2005-06. The 17 isolates of the pathogen collected from different locations were categorized

into eight groups viz., *Ah*-1 to *Ah*-8 based on morphological and cultural characters. The temperature of 30°C and pH of 7.0 were found ideal for the growth. Isolates *Ah*-5, *Ah*-7 and *Ah*-8 were found highly virulent, *Ah*-3 and *Ah*-6, moderately virulent whereas, *Ah*-1, *Ah*-2 and *Ah*-4 less

Abstract of Theses

virulent. Peroxidase and catalase isozyme banding pattern gave four and three distinct groups respectively. The spore load was maximum during August and September months. The disease severity was high in July, August and September sown crops, noticed decreased trend after October which gave higher yields. The PDI at 45 and 60 DAS was found negatively correlated with yield. Maximum temperature was negatively correlated, while minimum temperature, rainfall and relative humidity were positively correlated with PDI. *A. helianthi* was detected in infected seeds even after surface sterilization and survived up to 13 months in infected stalks under laboratory conditions. The entries GMU-125, 135, 216, 238, 293 and 65A41 were found resistant to Alternaria blight. The hybrids SH-177, SH-416 and PAC-8699 recorded least severity of the disease in farmer's field. The chlorophyll content decreased, while sugar and phenol content

were increased due to the infection of *A. helianthi*. The rate of increase was higher in resistant entries. The peroxidase and polyphenol oxidase activity increased in response to challenge inoculation of *A. helianthi*. Iprodione+carbendazim and captan were found effective as seed dressing fungicides. *In vitro* evaluation revealed that, iprodione+carbendazim, mancozeb, difenconazole, hexaconazole, penconazole and propiconazole were found effective. None of the plant extracts was effective. Among bioagents, *Pseudomonas fluorescens* was most effective. Propiconazole (0.1%) and hexaconazole (0.1%) were found effective in reducing the PDI and they gave higher yield. Propiconazole (0.1%) at 40 and 55 days was found effective and also economical. Salicylic acid (5 mM) and *Pseudomonas fluorescens* (0.5%) were found effective as ISR agents.

AGRICULTURALECONOMICS

Production and Value Addition in Naturally Coloured Cotton under Contract Farming - An Economic Analysis

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2006

MAJOR ADVISOR : Dr. L. B. KUNNAL

The present study was undertaken with an overall objective of economic analysis of coloured cotton production and value addition under contract farming in Dharwad distyric of Northern Karnataka. Multistage purposive sampling technique was adopted in the selection of the district, taluk, village and cultivators of naturally coloured cotton. Data collected pertains to the 80 farmers and 57 processing units comprising of one ginning unit, 11 spinning units, 45 weaving units and one garment unit during the agricultural year 2005-06. Statistical tools like tabular presentation; functional analysis, Timmer's and Kopp measure of technical efficiency were used to fulfil the objectives of the study. The average size of coloured cotton (DDCC-1) farm was 0.80 hectares grown under rainfed condition. The total human labour, bullock labour and tractor labour utilized per hectare of coloured cotton cultivation was 67.92 man days, 14.70 pair days and 1.43 hours, respectively. The average utilization of farmyard manure and seeds per hectare was 7.02 tonnes and 6.25 kg seeds, respectively. On an average the total cost incurred for coloured cotton cultivation and marketing was Rs. 15,934.30 and Rs. 440.64 per hectare respectively. The per quintal cost of production of coloured cotton was Rs. 1868.02, comprised of variable cost (Rs. 1,533.22) and fixed cost (Rs. 334.80), with B:C ratio of 1.21. The functional analysis indicated that the coefficient of multiple determination (R^2) was 0.92. The sum of elasticities (1.2971) indicated increasing returns to scale. The profitability ratio indicated that the land, seeds, farmyard manure, human labour, bio-pesticides and trichocards were under - utilized. The average technical efficiency of sample farmers was 75.65 per cent and majority of farmers were operating at technical efficiency between 70 to 80 per cent. The

actual and frontier use of different resources indicated that farmers could produce 11.27 quintals of coloured cotton output per hectare. The allocative efficiency of sample farmers was 58.5 per cent and economic efficiency was 44.28 per cent. The constraint analysis in naturally coloured cotton indicated that all the respondents (100%) faced the problem of non availability of resistant varieties. The net value added as a result of processing of *kapas* to lint was Rs. 327.53 per quintal of *kapas* processed, processing of lint to yarn was Rs. 2,281 per quintal of lint processed, processing of yarn to cloth was Rs. 5,351.54 per quintal of yarn processed. The average total cost incurred in processing of one quintal of cloth to garment (shirt) worked out to Rs. 31,246.80. The net value added as a result of processing of one quintal cloth to garment was Rs. 10,563.20. Study suggested specific skill improving training programmes for less efficient cotton growers from most efficient cotton growers. Farmers should get the coloured cotton ginned and sell the lint instead of selling *kapas*. The ginners, spinners and weavers should take extra care to maintain the purity and quality of coloured cotton to avoid mixing of coloured cotton with other cotton types as ginning, spinning and weaving is carried out on the same processing units. Further, intensified efforts are needed to increase the area under the crop as demand for naturally coloured cotton garments is increasing. The garments are available only in one colour i.e., almond but there is demand in different colours. Hence, the present ongoing research on coloured cotton needs to be intensified. Government may intervene to establish organized markets for this crop so that farmers can get remunerative prices, which in turn will lead to expansion of area under the crop.

AGRI.BUSINESSMANAGEMENT

Economic Performance of Agriclincs and Agribusiness Centres in South India

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2006

MAJOR ADVISOR : Dr. H. S. S. KHAN

The present study made an attempt to assess training needs of agripreneurs, their profile, model projects undertaken by them, some case studies, problems and suggestions, extent of loans issued and strategies adopted by the commercial banks under the scheme of AC and ABCs. Both primary and secondary information were used in the study. The primary data was collected from 135 trained agripreneurs scattered throughout South India. Secondary data was collected from MANAGE, NABARD, SLBCs and respective training institutes. Appropriate techniques like averages, percentages chi-square test, regression weighted average, standard deviation and project analysis techniques were used to analyse the data. The major source of information was found to be friends (74.81%) and information technology was the major training need of trainees. Around 61.48 per cent of the trainees were belonged to below age group of 31 and 63 per cent were graduates. Majority of the

agripreneurs (41.00%) undertaken the project of rural marketing dealerships of farm inputs and outputs. Results of the financial feasibility tests indicated that all the projects under the study were financially feasible and economically viable except project (4) which might be due to its service nature. Karnataka was found to be highest in both number of units (203) financed and amount of loan disbursed (Rs. 1318.64 lakh) which amounts to 74.91 per cent and 80.57 per cent respectively. All the commercial banks were being followed the strategies governed by RBI. High rate of interest and lack of subsidy component in the scheme was the major problem (93.25%) and linking the training institute with financial institutions for loan sanction was the major suggestion given by the agripreneurs (67.40%). Although trainees under the scheme of AC and ABCs undergone training most of them were not successful in starting their AC and ABCs.

Comparative Analysis of Rice Marketing System in Sri Lanka pre and Post Liberalization Period

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2006

MAJOR ADVISOR : Dr. H. S. VIJAYAKUMAR

Present study is an attempt to examine and compare the structural changes in rice marketing between pre liberalization and post liberalization periods in Sri Lanka. The study covered the period 1960-2004 and it was divided into two sub periods to represent before and after liberalization periods. Various analytical techniques viz., exponential function, linear and multiple regression technique, time series technique, Cobb-Douglas and frontier production function, coefficient of variation, nominal protection coefficient and B-C ratio were employed for analyzing the relevant data. Since marketing links with the production, efficiency in rice cultivation and profitability via competing crops were also studied during post liberalization era. Major policy changes on marketing under taken during post liberalization period were closing down of Paddy Marketing Board along with guaranteed price scheme, replacement of rice rationing scheme into the food stamp scheme, liberalization of rice imports, price stabilization through variable tariff and establishment of a food supply monitoring system. The growth analysis of area under rice showed a positive growth before liberalization and no growth after liberalization. Nevertheless, yield registered a positive growth in both periods but the

growth rate lowered in the post liberalization period. Production function analysis depicted that rice farming was technically and allocatively inefficient in post period; labour and fertilizer were excessively used and seed was under utilized. The B-C ratios were less than one for rice in all the districts studied indicating un-profitability in production but more than unity for all alternative crops studied. Producer price and retail price of rice increased in real terms during the pre liberalization era and declined in the post liberalization period. Seasonal price fluctuation reduced during the post liberalization regime over the pre liberalization regime due to deregulation of rice trade. Rice wholesale markets were well integrated during the post liberalization period indicating a positive role played by market liberalization policies. The value of Nominal Protection Coefficient suggests that Sri Lankan rice is uncompetitive in the international trade. The study stressed the need for a paradigm shift towards increasing farm income rather than increasing production to sustain rice farming in the open economy. The policies governing rice economy should focus on developing forward and backward linkages with private sector.

AGRICULTURAL EXTENSION EDUCATION

An Analysis of Sustainable Cultivation Practices Followed by Sugarcane Growers in Karnataka

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2006

MAJOR ADVISOR : Dr. L. V. HIREVENKANAGOUDAR

The present study entitled "An analysis of sustainable cultivation practices followed by sugarcane growers in Karnataka" was conducted in the year 2005-06 in Belgaum and Bagalkot districts of Karnataka with a sample of 180 respondents. The ex-post-facto research design was used for the research study. Knowledge test was developed to measure the knowledge of respondents about sustainable cultivation practices in sugarcane. The study revealed that both knowledge and extent of adoption of respondents were at moderate level. Cent per cent of the respondents had knowledge about preparing land into ridges and furrows, selecting setts from main crop, FYM in soil helps to increase nutrient availability and water holding capacity, mulching reduces evaporation rate and weeds and chemical tool of IPM. Majority had no knowledge regarding vermicompost and biofertilizer (*Azotobacter/Azospirillum*). Majority had adopted inorganic manures, deep tillage to incorporate left over debris, dipping setts in 0.1 carbendazim and planting disease free setts. Majority had medium technological gap (62.77%) and favourable attitude (65.00%)

towards sustainable cultivation practices. Education, management orientation, extension contact and achievement motivation of respondents had significant relationship with knowledge and extent of adoption. The regression analysis revealed that the selected independent variables put together explained 39.42 and 43.18 per cent variation in knowledge and adoption, respectively. The step-down analysis indicated that farming experience, attitude, extension contact and organizational participation had significant contribution in variation of knowledge and adoption. Around 50.00 per cent respondents had middle age, primary and middle school education, medium land holding and farming experience. Whereas, medium level in risk orientation, management orientation, achievement motivation, innovative proneness, deferred gratification and favourable attitude. Majority had awareness about Sugarcane Factory Extension Officer, Agriculture Assistants, Bank Officers and Private Consultant and regular participation in activities was found among members in Gram, Taluk and Zilla panchayat, Sugar Factory and Co-operatives.

HORTICULTURE

Genetic Studies and Management of Bacterial Wilt in Brinjal (*Solanum melongena* L.)

PRABHUDEVA S. AJJAPPALAVARA

2006

MAJOR ADVISOR : Dr. P. R. DHARMATTI

The investigation on genetic studies and management of bacterial wilt in brinjal (*Solanum melongena* L.) were carried out during 2003-06 in the Olericulture unit, Department of Horticulture, University of Agricultural Sciences, Dharwad. The nine genotypes including local cultivars were used for the study based on their *per se* performance and horticultural traits. Twenty hybrids developed using line x tester design were shown wide range of resistance to bacterial wilt with considerable magnitude of heterosis for yield and quality attributing characters. The two crosses DWD - 1 x Malapur and DWD - 1 x Rabakavi were found to be best yielders and resistant to wilt incidence over two years and these two crosses can be commercially cultivated in the farmers field. Combining ability analysis revealed that all the characters studied were predominantly governed by non additive gene action. The inheritance study for bacterial wilt resistance in four F² populations has fit into a 3:1 ratio indicates the

single dominant gene governed the resistance. Among the segregating populations studied, very high frequency of transgressive segregants for fruit weight (8.91%) and fruit yield per plant (6.44%) were observed in the F² population of DWD - 1 X Malapur. Among mutagens, gamma rays response was good compared to ethyl methane sulphonate for the improvement of local cultivar Malapur for the bacterial wilt. The bacterial wilt resistant mutants were observed in the 5 and 10 Krd gamma rays treatments in the M₂ generation and no fruit set was observed in M₁ generation of EMS treatments. The impact of soil amendment on bacterial wilt incidence revealed that the gypsum level 250 kg per ha reduced the wilt incidence significantly compared to control and lower levels. In the crop rotation experiment the wilt incidence has reduced to 59.10 and 58.52 per cent with maize and sorghum., respectively compared to monocropping sequence (82.31%) of brinjal.

Studies on Production Technology of Turmeric (*Curcuma longa* L.)

I. M. MANNIKERI

2006

MAJOR ADVISOR : Dr. P. R. DHARMATTI

Field experiments were conducted for two seasons during kharif 2003 and 2004 in the Olericulture Unit, Department of Horticulture, University of Agricultural Sciences, Dharwad, to evaluate the organic manures, intercrops and weed management practices in turmeric production. Among the different organic manures, application of vermicompost (@ 15.65 t/ha) was found superior for all the growth and yield parameters. Application of vermicompost resulted in the highest fresh rhizome yield (33.62 t/ha), cured rhizome yield (6.74 t/ha) and was closely followed by the application of pressmud (@ 15 t/ha). Application of pressmud (@ 15 t/ha) realized the maximum B:C ratio (2.71:1) followed by the application of poultry manure (@ 6.43 t/ha) (2.60:1) and vermicompost (@ 15.65 t/ha) (2.31:1). Among the different intercropping systems, sole crop of turmeric was found significantly superior for all the growth and yield parameters, fresh rhizome yield (23.46 t/ha) and cured rhizome yield (4.40 t/ha). Growing of okra as an intercrop has significant

influence on all the growth and yield parameters of turmeric and it has realized maximum fresh rhizome yield (20.38 t/ha) and cured rhizome yield (3.95 t/ha). Turmeric+tomato cropping system was realized maximum B:C ratio (2.66:1) followed by turmeric + french bean (2.53:1) and turmeric + okra (2.22:1). While, sole cropping of turmeric realized the B:C ratio of 2.18:1. Among the different weed control treatments, weed free control (hand weeding) recorded significantly highest weed control efficiency (100%), fresh rhizome yield (26.27 t/ha), cured rhizome yield (5.59 t/ha) and B:C ratio (2.74:1). Among the herbicides, chlorimuron (@ 9.0 g a.i./ha) was highly toxic to turmeric crop and application of pendimethalin showed the maximum weed control efficiency (76.24%) recorded significantly higher fresh rhizome yield (26.67 t/ha), cured rhizome yield (5.59 t/ha) and B:C ratio (2.39:1) followed by application of chlomazone (@ 1.0 kg a.i./ha).

MASTER OF SCIENCE**AGRONOMY****Studies on the Effect of Organic Manures on Growth, Yield and Quality of Chilli (*Capsicum annuum* L.) Under Northern Transition Zone of Karnataka**

M. THIMMA NAIK

2006

MAJOR ADVISOR : Dr. G. B. SHASHIDHARA

A field experiment was conducted to study the effect of organic manures on growth, yield and quality of chilli (*Capsicum annuum* L.) at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif 2005-06. In experiment was laid out in RBD with four organic source and their combinations. The RDF with and without FYM kept as control. Application of FYM + 100 RDF (772.2 kg/ha) recorded significantly higher fruit yield over sole application of organics and RDF alone. However, the different combinations of organics viz., FYM (50%) + poultry manure (50%) (727.6 kg/ha), vermicompost (50%) + FYM (50%) (713.51 kg/ha), FYM (50%) + neem cake (50%) (710.6 kg/ha) and poultrymanure @ 7.5 t/ha (708.2 kg/ha) also recorded yield on par with FYM + 100 per cent RDF. The growth and yield components,

NPK uptake at harvest also followed the same trend as that of fruit yield. The quality parameters like oleoresin per cent and yield increased by 13.89, 6.6, 3.7 and 2.3 per cent with application of poultry manure @ 7.5 t/ha, vermicompost 10 t/ha, FYM (50%) + vermicompost (50%), FYM (50%) + neem cake (50%) as compared RDF alone. The extractable similar value also increased by 2.9 to 6.0 with application of FYM (50%) + poultry manure (50%), FYM (50%) + neem cake (50%) over RDF alone. The maximum net returns is higher with application of RDF (Rs.28,614) followed by RDF + FYM @ 10 t ha⁻¹ (Rs.27,996), poultry manure @ 7.5 t ha⁻¹ (Rs.24,952), FYM (50%) + poultry manure (50%) (Rs.24,755).

Response of Maize (*Zea mays* L.) Genotypes to Planting Densities in Drill Sown Paddy Tract of Karnataka

ASHOK B. AGASIBAGIL

2006

MAJOR ADVISOR : Dr. G. V. NAYAK

A field experiment was conducted at Agricultural Research Station, Mundgod, University of Agricultural Sciences, Dharwad on clay loam soil during kharif 2005-06 under rainfed condition to study the performance of maize genotypes with four different planting densities. In the present investigation, five maize hybrids; EH 434042, Dekalb super 900 M, KH-517, KHHM-101 and MRM - 3824 were tried at four planting densities; 60 cm x 30 cm (55,555 plants ha⁻¹), 45 cm x 30 cm (74,074 plants ha⁻¹), 60 cm x 20 cm (83,333 plants ha⁻¹) and 60 cm x 15 cm (1,11,111 plants ha⁻¹). The experiment was laid out in a split plot design with 20 treatments replicated thrice. Dekalb super 900 M (5538 kg ha⁻¹) recorded on par yield with KH - 517 (5449 kg ha⁻¹) and EH - 434042 (5314 kg ha⁻¹) which differed significantly from KHHM-101 (3765 kg ha⁻¹) and MRM - 3824 (4160 kg ha⁻¹). The yield components such as cob

length, cob diameter, number of grains cob⁻¹, thousand grain weight, harvest index and stover yield were higher in Dekalb super 900 M, EH - 434042 and KH-517. Hybrids Dekalb super 900 M, EH - 434042 and KH - 517 produced high total dry matter plant⁻¹ as compared to KHHM - 101 and MRM - 3824. Planting densities of 74, 074 (45 cm x 30 cm), 83,333 (60 cm x 20 cm) and 1,11,111 (60 cm x 15 cm) recorded 9, 25 and 28 per cent higher grain yield, respectively than planting density of 55,555 plants ha⁻¹ (60 cm x 30 cm). Increase in planting density led to reduced growth and yield attributes, whereas LAI, LAD increased. Grain yield per plant decreased, while grain yield per unit area increased, as plant density increased. The economic analysis indicated higher net returns and B:C ratio from Dekalb super 900M, KH-517 and EH - 434042 than KHHM - 101, MRM -3824 and from 83,333 plants ha⁻¹ and 1,11,111 plants ha⁻¹.

Studies on the Influence of Age of Seedlings Under Different System of Rice Intensification (SRI)

B. N. MANJUNATHA

2006

MAJOR ADVISOR : Dr. R. BASAVARAJAPPA

A field experiment was conducted during kharif season of 2005 at Agricultural Research Station, Siruguppa to study the influence of age of seedlings under different system of rice intensification. There were 15 treatment combinations, comprising three methods of planting and five age of seedlings laid out in a split plot design. Methods of planting exerted significant influence on growth and yield of rice. Modified SRI method recorded significantly higher grain yield (6342 kg ha⁻¹), straw yield (7233 kg ha⁻¹), number of panicles per hill (61.52), number of grains per panicle (167.25), panicle length (21.63 cm) and test weight (20.83 g) followed by recommended SRI method over the normal method of planting. Transplanting seedling of 9 and 12 days old seedlings recorded significantly

highest grain (6017 and 6018 kg ha⁻¹, respectively) and straw yield (7019 and 6935 kg ha⁻¹, respectively) over the 15, 18 and 21 days old seedlings. Higher water use (124.96 cm) was under normal method of planting when compared to recommended SRI (84.96 cm) and modified SRI method (84.96 cm). Similarly, significantly higher WUE recorded with modified SRI method (73.13 kg ha⁻¹ cm⁻¹) but were on par with each other but significantly superior over normal method of planting (40.85 kg ha⁻¹ cm⁻¹). The maximum gross returns (Rs. 42,128 ha⁻¹) and net returns (Rs. 24,378 ha⁻¹) were recorded with modified SRI method over the normal recommended SRI methods and normal method similar trend was noticed with B:C ratio also.

Effect of Time of Sowing, Spacing and Seed Rate on Seed Production Potentiality and Quality of Fodder Cowpea (*Vigna unguiculata* (L.) Walp)

KRISHNA D. KURUBETTA

2006

MAJOR ADVISOR : Dr. S. C. ALAGUNDAGI

The field experiment was conducted during kharif 2005 on medium deep black clay soil under rainfed condition at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, to study the effect of time of sowing, spacing and seed rate on seed production potentiality and quality of fodder cowpea. The treatments consisted of combination of three times of sowing (June second fortnight, July first fortnight and July second fortnight), two-row spacing (30 cm and 45 cm) and three seed rates (20, 25 and 30 kg ha⁻¹). The experiment was laid out in split-split plot design with three replications. The cowpea sown in June second fortnight recorded significantly higher seed yield, haulm yield and harvest index (925 kg ha⁻¹, 4442 kg ha⁻¹ and 0.20 respectively) compared to July first fortnight and July second fortnight sowing. June second fortnight sowing also recorded significantly higher growth parameters at harvest viz., leaf area index (2.09), fresh weight (372.12 g plant⁻¹), total

dry matter (65.22 g plant⁻¹) and dry matter accumulation in leaves, stem and reproductive parts. The proximate quality parameters of seed and haulm and the seed quality parameters were not significantly influenced by time of sowing. The row spacing of 30 cm recorded significantly higher growth and yield attributes, seed yield (743 kg ha⁻¹) and haulm yield (4198 kg ha⁻¹) compared to 45 cm. The row spacing did not significantly influence the proximate quality of seed and haulm and also seed quality. Seed rate had no significant influence on growth, yield, proximate quality of seed and haulm and seed quality of cowpea. Significantly higher interaction was recorded in fodder cowpea with June second fortnight sowing with 30 cm row spacing at 30 kg ha⁻¹ seed rate for seed yield (1056 kg ha⁻¹) haulm yield (4970 kg ha⁻¹), net income (Rs. 28282 ha⁻¹) and benefit cost ratio (4.71).

Studies on Efficiency of Herbicides in Groundnut (*Arachis hypogaea* L.) - Wheat (*Triticum aestivum* L.) Cropping System

SOMASHEKHAR S. MUTNAL

2006

MAJOR ADVISOR : Dr. C. A. AGASIMANI

A field experiment was conducted at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif and rabi seasons of 2005-06 to study the efficiency of herbicides in groundnut-wheat cropping system. There were 7 treatment combinations in each crop and experiment was laid out in randomized complete block design with three replications. In kharif groundnut weed control treatments differed significantly. The treatment butachlor @ 1.5 kg/ha PE + 2 IC at 30 and 40 DAS + 1 HW at 45 DAS in kharif groundnut and in rabi wheat triasulfuron @ 15 g/ha at 20 DAS recorded significantly lower weed population and weed dry weight next only to weed free check. In groundnut application of butachlor @ 1.5 kg/ha PE + 2 IC at 30 and 40 DAS + 1 HW at 45 DAS

resulted in highest pod yield (2353 kg/ha) and was on par with pretilachlor @ 1.5 kg/ha PE + 2 IC at 30 and 40 DAS + 1 HW at 45 DAS, alachlor @ 1.5 kg/ha PE + 2 IC at 30 and 40 DAS + 1 HW at 45 DAS and weed free check. The higher pod yield over weed free check is due to suppressing weed seed germination and seedling development at early stages due to the effect of pre-emergent herbicides. In wheat application of triasulfuron @ 15 g/ha at 20 DAS resulted higher grain yield (3028 kg/ha) but was on par with weed free check (3182 kg/ha). In groundnut maximum net income of Rs. 20150/ha and benefit cost ratio of 1:1.20 was obtained with butachlor, whereas in case of wheat triasulfuron recorded maximum net return of Rs. 15996/ha and benefit cost ratio of 1:1.47.

CROP PHYSIOLOGY

Physiological Investigations in Diccum Wheat Genotypes

SARFRAZ A. BILGI

2006

MAJOR ADVISOR : Dr. D. I. JIRALI

A field experiment was conducted at the University of Agricultural Sciences, Dharwad, farm during rabi, 2005-06 to find out the physiological basis of yield variations in different diccicum wheat species under normal irrigated conditions. The experiment consisted of 10 genotypes belonging to cultivated species viz., *Triticum diccicum*, Shrank laid out in randomized block design with three replications. The results of the investigations revealed a wide variation among the genotypes with respect to various morphological, bio-physical and physico-chemical characters studied. Among the genotypes, MACS2961, MACS2956, DDK1029 and DDK1025 exhibited superiority over rest of the genotypes in yield while giving a better response to most of the yield contributing characters such as increased stomatal resistance leaf temperature,

transpiration rate and protein content. Besides these genotypes also had higher leaf area duration and matured early. The present investigation also revealed that the cultivars with high relative water content exhibited lower leaf temperature. However, it was noted from the present study that cultivars had different adaptive mechanisms. It is inferred from the present investigations that by considering all the mechanisms and the relative performance of genotypes with respect to various characters, the genotypes MACS2961, MACS2956, DDK1029 and DDK1025 would be better suited for normal irrigated conditions and the information generated could be more useful in breeding for the combination of traits for higher yield stability under normal irrigation conditions.

GENETICS AND PLANT BREEDING

Combining Ability Analysis Involving Land races of Grain Cowpea [*Vigna unguiculata* (L.) Walp]

INDRANI KALUBOWILA

2006

MAJOR ADVISOR : Dr. M. S. UMA

A study was conducted to estimate heterosis, combining ability and gene action in 12 different traits in cowpea through line x tester analysis involving three lines and 16 testers. The 48 hybrids along with 19 parents were grown in randomized complete block design with three replications at Botany Garden, UAS, Dharwad during Kharif 2005. The analysis of variance showed significant difference among the genotypes for all the characters, except number of branches and number of seeds per pod, indicating the presence of considerable genetic variability among parents. The combining ability analysis revealed that variances were significant for all characters, except number of main branches for parents and crosses, number of seeds per pod for parents and pod length for testers. The magnitude of dominant component was higher than additive component indicating the role of non-additive gene action. The line V-118 and testers IC 202784, IC 202782 and Goa local were good general combiners for yield and its components. The study on heterosis over mid

parent, better parent and standard check revealed that hybrids had high heterotic effects for all the characters and highly significant values were observed for clusters, pods, pod yield and seed yield per plant. Estimates of sca effects and heterosis showed that best cross combinations for seed yield were V-118 x IC 202782, followed by V-118 x IC 202784. In general, the superior crosses had moderate D² values with higher heterosis for productive characters. Nineteen parents were evaluated for their nutrient composition and processing quality during Summer 2006. Wide variation was observed in composition among genotypes and IC 202784 was rich in more nutrients viz., Nitrogen, protein, Phosphorus, Potassium and Magnesium. Assessment of processing quality showed that the greatest volume increase after soaking in genotype IC 259081, while maximum weight increase in IC 202786. Among 19 parents, 12 genotypes showed high potential for cooking and five genotypes for "shandige" preparation.

Genetic Variability and Divergence Studies in Linseed (*Linum usitatissimum* L.)

AJIT K. RAJANAVAR

2006

MAJOR ADVISOR : Dr. T.E. NAGARAJA

A field experiment was conducted during rabi 2005 in randomized block design with three replication consisting of sixty five genotypes, to study the genetic variability, correlation, path analysis, genetic divergence and formulation of selection index for productivity traits and disease resistance against powdery mildew in linseed (*Linum usitatissimum* L.). The study revealed wide range of variability, high heritability and high genetic advance as per cent of mean for number of branches per plant, number of capsule per plant and seed yield. Correlation study revealed highly significant association of seed yield with number of branches per plant, number of capsule per plant, 1000 seed weight and harvest index. The maximum positive direct effect on seed yield per plant was exhibited by 1000 seed weight followed by harvest index at genotypic level. Sixty five genotype were grouped into fourteen clusters based on D² analysis. Higher inter cluster distance was noticed between cluster VII and cluster

XIV. While higher intra cluster value was noticed in cluster V. The genotype in cluster IX showed highest cluster mean values for 1000 seed weight, harvest index and seed yield per plant. Selection indices involving number branches per plant, 1000 seed weight and harvest index was the best, which showed the high relative efficiency. The number of branches per plant exhibited high heritability coupled with high genetic advance where as, 1000 seed weight and harvest index showed moderate and high heritability coupled with moderate genetic advance, respectively. So these characters should be considered while making selection. The LC-54, SHEELA, RL- 24106 and RL-24109 were found resistant against powdery mildew disease. SLS - 65 and Parvati were found to be promising for yield and also to the character combination based on selection index. Hence these genotypes may be utilized for further improvement through the isolation of superior recombinants in the segregating population.

In vitro Regeneration Protocol for Alternaria Resistance in Sesame (*Sesamum indicum* L.)

S.G. PRAVEEN

2006

MAJOR ADVISOR : Dr. R. LOKESHA

With a sole objective of creation of somaclonal variants that are resistant to Alternaria fungus from highly susceptible genotypes employing *in vitro* cell line selection using pathotoxin as the selection pressure followed by regeneration in sesame (*Sesamum indicum* L. Pedaliaceae) was attempted. Callus was induced on MS media supplemented with 0.5 mg NAA, 1.5 mg Kinetin, 1.5 mg BAP per liter (B medium) using direct seeding method of popular cultivated *Sesamum indicum* genotypes viz. E8, Gulbarga local white (GLW) and brown (GLB), Tumkur local white (TLW) and brown (TLB), WII (highly susceptible for alternaria blight) and RT 273 (resistant to Alternaria blight). The callus was induced in 11 days with E8 responding best (91.27%) followed by GLB (89.29%), WII (88.73%), TLW (86.08%), TLB (81.81%), GLW (85.74%) and RT273 (77.42%). Callus was maintained for three cycles of sub-culturing on B medium. A brown powder form of *Alternaria Sesami* pathotoxin was

crystallized, incorporated in different strengths (0,100, 200..... 1000 ppm) and tested for callus survival of all genotypes. Callus of all susceptible genotypes survived up to 300 ppm whilst RT 273 up to 700 ppm. RT273 callus continued to survive and proliferate when inoculated with susceptible callus simultaneously in a single bottle at 400 ppm. Complete death of the callus in all the genotypes was noted following 8 hours exposure to UV rays. Exposing the callus of susceptible genotypes to UV rays for one hour followed by plating on MS media with 1000 ppm pathotoxin could generate a total of 13 somaclones (5 from GLB and 8 from E8). Nine somaclones (4 of GLB; 5 of E8) were successfully subcultured (70%) and found to proliferate on B medium. The regeneration of resistant plants from the somaclones is underway. Confirmation of both somaclones at callus level and plants regenerated thereon through molecular markers has been proposed as the future line of work.

Genetic and Breeding Investigations in Tomato (*Lycopersicon esculentum* Mill.)

PURNANAND G. KULKARNI

2006

MAJOR ADVISOR : Dr. O. SRIDEVI

Tomato (*Lycopersicon esculentum* Mill.), an extremely popular vegetable around the world is the focus of large agricultural industry. Two investigations viz., biparental mating and diallel mating were carried out during kharif 2005-06 in Botany garden of Agriculture College, Dharwad. Biparental mating was carried out to assess the variability generated and to compare the efficiency of inter population biparental mating over intra population biparental mating and of biparental mating over selfed population for yield and its important components. Intrapopulation mating involved the crosses within each F_2 population of MHTM-256 and S-4-14 while interpopulation mating was carried out between selected F_2 plants of MHTM-256 as male with selected F_2 plants of S-4-14 and vice-versa. Of the two the best F_2 population (S-4-14) was selfed to get F_3 progeny. The results revealed that mean values, in general were high in F_3 than BIPs because of wider variability generated in BIPs especially intermating populations. The magnitudes of GCV, PCV, heritability and genetic advance

were enhanced in BIPs for all the characters studied than the selfed population. Among BIPs, inter population mating exhibited high heritability and genetic advance for plant height, average fruit weight and yield. Biparental mating also resulted in shift in the magnitude as well as direction of correlation coefficients. Fruits per plant exhibited high direct effect and primary brand high indirect effect via fruits per plant on yield. Inter population mating showed high frequency of superior segregants for yield. Diallel mating was carried out with seven parents and 18 quantitative and quality traits were evaluated. The results indicated that, heterosis over midparent, better parent and commercial check was exhibited by all the characters. S22 x L-15, S-22 x Sivap and Co-3 x Solan Vajra were the top heterotic hybrids for yield over check (MHTM-356). Combining ability analysis revealed that, S-22, Solan Vajra, Local type and L-15 were good general combiners whereas S-22 x L-15, S-22 x Sivap and Co-3 x Solan Vajra were the best specific combiners.

Genetic Diversity for Productivity and Quality Characters in Chilli (*Capsicum annuum* L.)

P. SRILAKSHMI

2006

MAJOR ADVISOR : Dr. H. D. MOHAN KUMAR

An investigation on chilli germplasm was carried out during kharif 2005 at ARS, Devihosur. The core objective of the work was to estimate the extent of variability and diversity in the available 100-germplasm entries along with Byadgi Dabbi and Byadgi Kaddi. Considerable variability for most of the characters was indicated by analysis of variance. High phenotypic and genotypic coefficient of variation was observed for quality traits, fruits per plant and dry fruit weight. These characters are of economic importance and there is scope for improvement through selection. High heritability coupled with high genetic advance as per cent mean was noticed for biochemical parameters, fruits per plant, dry fruit weight, fruit length, fruit diameter, secondary branches suggesting the involvement of additive gene action. Strong correlation of yield with number of fruits per plant, primary branches, plant height, secondary branches, plant height, secondary branches, fruits per plant and test weight

was observed. Biochemical characters were positively associated with fruit characters viz., fruit length, fruit diameter and stalk length. The path analysis indicated that fruit length, number of fruits per plant, plant height, primary branches and test weight have positive direct effects on dry fruit yield. Genetic diversity in the available germplasm assessed by using D^2 statistic, 102 genotypes were grouped into 15 clusters which had high range of inter cluster D^2 values. Four characters viz., yield per plant, fruit diameter, number of fruits per plant and stalk length were the chief contributors towards genetic divergence. Hybridization of cluster XV with other clusters suggested as it was most divergent from other clusters. Genotypes DCA 147, DCA 57 for high fruit yield, DCA 97, DCA 111, DCA 66 for desirable fruit characters, DCA 111, DCA 43 for disease resistance along with Byadgi Dabbi for high colour value are identified as the most promising collections.

Evaluation of S_2 Progenies Derived from Base and Improved Populations for Alternaria Leaf Blight Resistance in Sunflower (*Helianthus annuus* L.)

K. G. JAYAPRAKASH

2006

MAJOR ADVISOR : Dr. R. L. RAVIKUMAR

Alternaria leaf blight is a major foliar disease of sunflower. Only partial resistance has been reported in *Helianthus* species. Recurrent selection was practiced for two cycles to increase the level of resistance. In the present study, the S_2 progenies derived from different selection cycles of two populations were studied for their reaction to Alternaria leaf blight, seed yield and yield components during kharif 2005 under natural epiphytotic conditions. 70 and 90 Progenies derived from population I and population II respectively were evaluated separately in randomized complete block design with 2 replications. The progenies studied showed significant difference for all the characters viz., days to ray floret opening, plant height, head diameter, 100 seed weight, number of seeds per plant, volume weight, PDI and seed yield per plant. There was no high level of resistance among the progenies studied. The progenies of population I recorded lower mean PDI compared to population II. The heritability for

PDI was moderate in population I and high in population II. The genotypic and phenotypic coefficient of variation was high with high heritability and GAM for seed yield in progenies of both populations. The results of correlation and path analysis indicated that number of seeds per plant was an important yield contributing character followed by head diameter and 100 seed weight, in both the populations at both genotypic and phenotypic levels. Based on progeny performance, the effect of selection cycle was not significant for seed yield and PDI in population I. There was no definite trend of improvement for PDI and seed yield in selection cycles. The result indicated that two selection cycles were not sufficient to improve the resistance and seed yield significantly. However: 38 in population I and 20 in population II- were identified as superior progenies based on higher seed yield and less PDI over the check Morden. In general, the progenies of population I were superior to population II as it had wide genetic base.

Evaluation and Characterization of a Minicore Subset in Groundnut (*Arachis hypogaea* L.)

C. MADHURA

2006

MAJOR ADVISOR : Dr. P. V. KENCHANAGOUDAR

An experiment on groundnut accession was conducted involving 191 genotypes and nine check varieties during kharif 2005 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad to evaluate for morphological and agronomic characteristics to estimate genetic parameters, phenotypic diversity and to identify potential

germplasm lines for crop improvement. Analysis of variance revealed significant differences among genotypes for all characters except for days to maturity. Very high coefficient of variation was reported in per cent of sclerotium and high for yield per plant, test weight, late leaf spot and rust. Genetic parameters revealed high GAM and relative heritability

Abstract of Theses

for pod yield per plant, late leaf spot, rust and per cent of sclerotium in all the four botanical types viz., Virginia bunch, Virginia runner, Spanish bunch and Valencia. The association analysis revealed that pod yield per plant exhibited significant positive association with test weight, oil content, shelling per cent and SMK per cent. All the morphological traits except growth habit and pod constriction and all the ten quantitative traits revealed significant contribution towards multivariate polymorphism. Cluster analysis depicted that quantitative characters were found less important in contributing morphological diversity. The best three accessions were

ICG 9507, 14985 and 12625 and were present in the different clusters so can be effectively in breeding programme. Among all, only twenty five accessions with two ruling cultivars were subjected to RAPD assay using twenty primers to assess the molecular diversity. The polymorphism per primer ranged from 60 to 100 per cent. The genetic similarity (Sij) ranged from 0.56 to 0.93 and the PIC values ranged from 0.1 to 0.49 some accessions like ICG 9507, 1255 were diverse from the cultivar GPBD-4 and ICG 2381, 11322 and 5662 were diverse from the cultivars JL-24, could be efficiently used in breeding programme.

Evaluation of Groundnut Varieties for Confectionery Traits and Selection of Donors for Their Improvement

B.C. AJAY

2006

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

Groundnut, once a principal oil seed crop, now is increasingly recognized for its confectionery quality. Seventeen varieties of Karnataka were evaluated for test weight, oil and protein content, fatty acid profile and late leaf spot resistance. None of the varieties were suitable for confectionery purpose, although a few varieties had some desirable traits like GPBD 4 (high protein, and O/L ratio, low saturated fatty acid and resistance to late leaf spot). Mutant 28-2 (bold seed and resistance to late leaf spot). Dh 3-30 (low oil) , S 230 (high O/L ratio) and Dh8 (low saturated fatty acid). To identify donors with bold seeds, 188 mini core germplasm accessions were assessed for test weight, the most important confectionery trait. Further, eleven bold seeded accessions were evaluated for other confectionery traits. Among them, ICG 12625 (high protein), ICG 2381 (low saturated fatty acid and high O/L ratio) were found superior.

None of the accessions were highly resistant to late leaf spot. Varieties were also assessed for morphological traits viz., leaf shape, stem pigmentation, pubescence, growth habit, pod beak, pod reticulation, pod constriction, flower colour, seed colour and branching pattern. Based on those traits, varieties except Dh 40 , s 230 and Dh 43 were not clearly distinguishable. Varieties were subjected to RAPD assay using 20 primers and the similarity ranged from 67 to 97%. Based on both the criteria germplasm accessions exhibited more diversity than varieties thus revealing their usefulness for enhancing the varietal diversity. Based diversity and existence of complimentary traits the following crosses viz., GPBD 4 x ICG 13787, TMV 2 X ICG 13787, JL 24 X ICG 13787, TAG 24 X ICG 13787, GPBD 4 X ICG 8760, TMV 2 X ICG 8760, JL 24 X ICG 2381, GPBD 4 X ICG 2381 and GPBD 4 x ICG 2862 were proposed

Studies on Variability, Correlation, Morphological and Molecular Diversity in Dry Chillies (*Capsicum annuum* L.)

VANI S. KULKARNI

2006

MAJOR ADVISOR : Dr. O. SRIDEVI

An investigation was undertaken during kharif 2005 at Botany Garden of University of Agricultural Sciences, Dharwad with three experiments. The experiment I consisted of evaluation of chilli germplasm for productivity, its component traits, genetic diversity, correlation and path analysis. The analysis variance indicated significant differences among the genotypes for all the characters under study. Yield and fruit related traits, exhibited high GCV, PCV and high heritability coupled with high genetic advance. Correlation study for yield per plant showed significant positive association with all growth related, yield related and fruit related traits. Plant height, fruit diameter, fruit surface area, pericarp weight showed negative direct effect while all other characters showed positive and high direct effect. The 55 genotypes were grouped into 14 clusters. Cluster XIV having IC-16 genotype showed maximum average mean value for plant height, fruits per plant and yield per plant. RAPD analysis with 20 random primers showed high polymorphism with primer OPJ-01

and OPJ-10. No correlation was observed between morphological and molecular diversity. Segregating F4 populations of chilli was source material for experiment II, in which genetic variability, correlation and path analysis were estimated. Variability studies revealed high within family variance for most of the characters in all the populations indicating its segregating nature. High phenotypic variance was for productivity traits was observed in S-32 x LCA-312 and S-32 x SK populations. In all the populations, plant growth characters showed positive association with yield. Path analysis revealed that number of fruits per plant had maximum direct effect on yield per plant. In experiment III, 20 selected F4 families were screened for thrips and mites resistance. Pest susceptibility index and yield stability ratio of above families indicated that, families involving S-32 x SK, S-32 x LCA-312 crosses showed high resistance with high yield in pest environment than checks which could be attributed to resistance of parent S-32 to leaf curl complex.

Studies on Induced Mutagenesis in Niger (*Guizotia abyssinica* Cass.)

PREMJYOTI C. PATIL

2006

MAJOR ADVISOR : Dr. S. GANGAPRASAD

A field experiment was conducted at Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad during kharif 2005 and 2006 summer, to study the induced mutagenesis in niger. Two varieties of niger viz., N-71 and IGP76 were selected. N-71 was irradiated with five doses of gamma rays (24, 26, 28, 30, 32 kR) and EMS (0.3, 0.5 and 0.6%) was treated with three doses on two genotypes N-71 and IGP76. Mutagenic damage was more pronounced with EMS treatments compared to gamma irradiated populations. In LD50 of gamma irradiation for N-71 was in between 30-33 kR. In case of EMS it was in between 0.5 to 0.7 per cent irrespective of genotypes. Among four chlorophyll mutants maculata, xantha, chlorina and striata, maculata and striata were more common in EMS, xantha and chlorina were more common in gamma irradiated population. Three treatments of gamma (24, 28 and 32 kR) on

N-71 and two treatments of EMS (0.3 and 0.6%) on N-71 and IGP76 were advanced to M₂ generation. EMS had more morphological mutants than gamma irradiated populations, EMS at 0.3 per cent was more effective in inducing variations in both genotypes. Among gamma irradiated population 28 kR was more effective in inducing the variation in N-71. Studies on nine quantitative characters viz., plant height, number of branches, days to 50 per cent flowering, number of capitula per plant, diameter of capitula, number of seeds per capitula, internodal length, volume weight and seed yield were more. Variability studies revealed that 28 kR on N-71 was effective and 0.3 per cent EMS was effective in both genotype. Correlation and path analysis studies revealed that plant height, number of branches, number of capitula per plant, number of seeds per capitula had significant positive association and direct effect on seed yield.

PLANT BIOTECHNOLOGY

Identification of Genomic Regions Harboring QTLs for Stay - Green and Related Traits in Sorghum (*Sorghum bicolor* (L.) Moench)

SUNDARESH A

2006

MAJOR ADVISOR : Dr. M. S. KURUVINASHETTI

Stay-green feature in cereals, the ability of the plant to retain significant green leaf until complete grain maturity, is considered important as it allows proper grain fill and such genotypes are often drought tolerant. In sorghum, stay-green feature permits complete grain fill during terminal moisture stress, enables the plant to resist charcoal rot (stalk rot) disease and produces quality fodder. Being a quantitative character it is difficult to breed for this character. Present technology permits construction of detailed genetic map with the help of molecular markers and to identify genomic regions responsible for any quantitative trait. In the present investigation, a recombinant inbred population (226) derived from N 13(senescent) x E 36-1 (Stay-green) was phenotyped for one season (rabi

2005-06) and genotyped with 28 polymorphic sorghum EST-SSR markers, recently developed in our lab. The genetic data for 32 SSR markers already mapped using the same population, kindly provided by ICRISAT, India, was used to anchor the EST-SSR markers on the map. These 32 markers were distributed on LG1-0, LG2-3, LG3-5, LG4-5, LG5-1, LG6-4, LG7-2, LG8-6, LG9-3 and LG10-3. Seven QTLs were detected at a cut off LOD 2.5. Three of them were located on linkage group B. Except one QTL on linkage group D, others were found at new regions, previously not reported. Five QTLs contributed by the Stay-green parent E 36-1 accounted for 33.34 per cent of the phenotypic variation.

SEED SCIENCE AND TECHNOLOGY

Effect of Foliar Application of Micronutrients on Seed Yield and Quality of Cotton Hybrid DHH - 11

YALLAPPA

2006

MAJOR ADVISOR : Dr. M. R. ESHANNA

A field experiment was conducted at Agricultural Research Station, Dharwad during kharif 2004-2005 to find out the effect of foliar application of micronutrients on seed and seed quality cotton hybrid, DHH-11. The experiment consisted of sixteen treatments comprising of two micronutrients at various concentration and their combinations laid out in randomized block design with three replication. Number of sympodial branches were found significant due to foliar applications of MgSO₄ (1%) at 60 DAS and Boron (0.1%) at 75 DAS than control. The highest number of flowers per plant, number of bolls per plant, average boll

weight, seed cotton yield and seed yield were recorded with foliar application of MgSO₄ (%) at 60 DAS in combination with Boron (0.1%) at 75 DAS. Higher germination, shoot length, root length, vigour index, field emergence, seedling dry weight and lower electrical conductivity were observed from the seeds obtained with foliar application to female parent (CPD-423) of DHH-11 with MgSO₄ (1%) at 60 DAS and Boron (0.1%) at 75 DAS, followed by of MgSO₄ (1%) at 90 DAS in combination with Boron (0.1%) at 75 DAS. These applications not only increased the seed quality but are essential to raise a good crop.

Evaluation of Validity Period of Different Oilseed Crops Stored at Different Locations

B. DIVYA SHREE

2006

MAJOR ADVISOR : Dr. M. B. KURDIKERI

A study on evaluation of validity period of different varieties of oil seed crops stored at different locations under ambient conditions was carried out for 11 months in the Department of Seed Science and Technology, Agriculture College, University of Agricultural Sciences, Dharwad during 2005-06. The results indicated that among locations, Raichur was found to be best for storage of oilseed crops compared to Dharwad and Sirsi. Among crops, sesamum and sunflower maintained satisfactory germination upto ten months of storage, while soybean and groundnut maintained only for seven and six months respectively with better seedling vigour and with low electrical conductivity and fungal activity. Among varieties DS-1 of sesamum and KBSH-1 of sunflower, JS-9305 of soybean and GPBD-4 of groundnut stored for longer period compared to E-8 of sesamum, RFSH-1 of sunflower, JS-335 of soybean and TAG-24 of groundnut. The interaction of locations and crops revealed that sesamum seeds stored at Raichur recorded significantly higher seed quality compared to other oilseed crops stored at different locations. The interaction of crops and varieties revealed that DS-1 and E-8 of sesamum

and KBSH-1 of sunflower showed significantly higher seed quality parameters compared to both the varieties of soybean and groundnut, throughout the storage period. The interactions of locations, crops and varieties indicated that seeds of DS-1 and E-8 of sesamum and KBSH-1 of sunflower stored at Raichur recorded significantly higher germination and vigour parameters compared to other interaction combinations of crops, location and varieties. Satisfactory germination as per the Minimum Seed Standards was maintained upto eleven months in varieties DS-1 and E-8 of sesamum stored at Raichur, up to ten months at Dharwad and nine months at Sirsi. The sunflower varieties KBSH-1 and RFSH-1 stored at Raichur maintained up to eleven and ten months respectively, at Dharwad upto ten months and at Sirsi upto nine months. Whereas, soybean varieties JS-9305 and JS-335 stored at Raichur maintained satisfactory germination up to eight and seven months, upto seven and six months respectively at Dharwad and upto six and five months respectively at Sirsi. The groundnut varieties GPBD-4 and TAG-24 maintained satisfactory germination at Raichur upto seven months, at Dharwad upto seven and six months respectively, and at Sirsi only for five and four months respectively.

A Comparative Study of Nutrient Management in Paddy under SRI and Traditional Methods of Cultivation

G. JANAKI RAMA SURESH KUMAR

2006

MAJOR ADVISOR : Dr. G. S. DASOG

A field experiment was conducted at Agricultural Research Station, Gangavati, University of Agricultural Sciences, Dharwad during late rabi 2005-06 to compare the growth, yield, nutrient uptake and N dynamics of paddy under SRI (System of Rice Intensification) and traditional methods of cultivation as influenced by nutrient levels and biofertilizers. The experiment was laid out on medium deep black clay soil by adopting split plot design and the treatments were replicated thrice.

The treatments consisted of two methods of cultivation (SRI and traditional) as main plots and five fertilizer levels (100% RDF, 75% RDF, 75% RDF + biofertilizers, 50% RDF, 50% RDF + biofertilizers) as subplots. Significantly taller plants, higher number of tillers and higher dry matter production were noticed in SRI method of cultivation at all growth stages as compared to traditional method. SRI method recorded higher grain yield and yield attributes compared to traditional method of cultivation.

Abstract of Theses

Significantly higher concentration of plant N, P and K, higher uptake of N, P and K and higher available N, P and K in soils were noticed in SRI method as compared to traditional method. Higher concentration of $\text{NH}_4\text{-N}$ was registered in traditional method while higher concentration of $\text{NO}_3\text{-N}$ was registered in SRI method at all depths. Application of 75% RDF + biofertilizers resulted in significantly taller plants, higher number of tillers per hill, highest dry matter and higher grain yield and yield

attributes. Significantly higher concentration of plant N, P and K, higher uptake of N, P and K and available N, P and K in soil were recorded in treatment receiving 75% RDF + biofertilizers. The same treatment also registered significantly higher readily available $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ contents at all stages. But, the lowest values were obtained in the treatment receiving 50% RDF.

SOIL SCIENCE AND AGRICULTURE CHEMISTRY

Potassium Dynamics in Spentwash Irrigated Vertisol

MAHESH S. GOUDAR

2006

MAJOR ADVISOR : Dr. B. I. BIDARI

An investigation was undertaken to study the effect of long-term application of spentwash on Vertisol with special emphasis on potassium dynamics. The field of Ugar Sugar Works Ltd. at Ugarkhurd village, Tq. Athani, Dist. Belgaum was chosen as study site. Based on the period of spentwash irrigation the entire study area was divided into five blocks. In addition to this, spentwash samples of seven distilleries were characterized for various properties. Raw spentwash samples were acidic in reaction (3.66 - 4.48). Whereas, primary and secondary treated samples were neutral to alkaline. Colour ranged from dark reddish brown, odour was found to be jaggery and raw spent wash sample possessed higher temperature (65.70°C) than primary and secondary treated samples. The total dissolved solids and suspended solids of raw spentwash declined during lagooning. Potassium was dominant (4%) over N and P, while the concentration of micronutrient cations followed the order $\text{Fe} > \text{Mn} > \text{Zn} > \text{Cu}$. All soil pedons possessed neutral to alkaline pH with pedons I and II that received spentwash irrigation for more than 20 years recorded higher pH than other pedons. The EC of irrigated pedons ranged from 5.03 to 9.06 dS/m while in unirrigated pedon it was 0.44 to 1.67 dS/m.

Spentwash irrigated pedons showed higher ESP than unirrigated pedon. Available nutrient status of irrigated pedons was higher than that of unirrigated pedon. Potassium release parameters revealed that more than 75 per cent of total K was released at the end of fourth extraction and thereafter K release became very slow. Soils released higher quantities of non exchangeable K in the initial extractions itself. Spentwash irrigated pedons released more K than unirrigated pedon. Spentwash irrigated pedons recorded more K adsorption than unirrigated pedon. Pedons with more than 20 years of spentwash irrigation recorded K adsorption in the range of 1422.19 ppm to 1898.10 ppm. Potassium adsorption decreased with depth. There exists an equilibrium between exchangeable K and solution K with adsorption mainly controlled by diffusion process. Freundlich adsorption isotherm is the best fit for studying K-adsorption-desorption phenomenon for spentwash irrigated Vertisol. Selected ionic ratios (K/Na and K/Ca + Mg) indicated that in pedons-I and II exchange complex was saturated with K to the extent of 92.40 per cent, while in unirrigated pedon, it was 89.62 per cent less than Na.

Assessment of Salt Tolerance in Some Medicinal and Aromatic Crops

H. P. RAJESHA

2006

MAJOR ADVISOR : Dr. MANJUNATHA HEBBARA

A pot culture experiment was conducted at Agricultural Research Station, Gangavati, Karnataka on a saline vertisol to evaluate the performance of three each of medicinal (ashwagandha, stevia and coleus) and aromatic (patchouli, lemongrass and mint) crops under different levels of soil salinity (2, 4, 6, 8 and 10 dS m^{-1}) during kharif season of 2005. As soil salinity increased, plant height, number of branches/plant and biomass yield components decreased in all crops except in ashwagandha wherein these parameters were highest at 4 dS m^{-1} . Irrespective of the crop, the tissue Ca, K and S content decreased while Na and Mg content increased as soil salinity increased from 2 to 10 dS m^{-1} . Transpiration rate, stomatal conductivity, K/Na and Ca/Na ratios decreased and leaf temperature increased with increased salinity. The tissue Ca and K contents decreased significantly with increase in water soluble Ca, Mg, and Na. The relationship

between economic yield and soil salinity indicated relatively higher threshold salinity values in ashwagandha (3.47 and 4.18 for root and seed yield, respectively) compared to other crops. The threshold salinities for coleus and patchouli were 2.3 and 2.4 dS m^{-1} , respectively. No threshold salinities were observed in stevia, lemongrass and mint, as the yield-salinity relationships were either different from normal or linear. However, based on rate of yield reduction with increased salinity, lemongrass was found relatively more salt-tolerant than mint and patchouli. From this study, it can be concluded that among medicinal crops, ashwagandha followed by stevia are relatively more salt-tolerant than coleus. In case of aromatic crops, lemongrasses followed by mint are found relatively more tolerant to salinity than patchouli.

Impact of Farmers Organic Farming Practices on Soil Properties in Northern Dry Zone of Karnataka

MANJUNATHA BHANUVALLY

2006

MAJOR ADVISOR : Dr. S. K. GALI

A study was conducted in the Northern Dry Zone of Karnataka to know the effect of farmers' organic farming practices on soil properties and health in selected major cropping systems viz., cotton, sugarcane, jowar and vineyard. Farmyard manure and vermicompost were the sources of organics used by organic farmers in the study area. The quantity of organics applied to soils varied from 8.0 to 20.0 tonnes of FYM per ha per year and 1.0 to 3.0 tonnes of vermicompost per ha per year. The nutrient (N, P and K) concentration was higher in vermicomposts than in FYM. The C:N ratio of vermicomposts was also narrower (13:1 to 20:1) compared to its ratio in FYM (25:1 to 38:1). The physical properties of soils were found to be influenced favourably by the organic farming practice. A reduction in bulk density and an increase in water holding capacity and water stable aggregates was noticed in all the soils under organic farming.

A reduction in pH was observed in soils under organic farming, however there was no appreciable change in the EC of soils. Increase in organic carbon content of soils under organic farms varied widely over conventional farms. The soils under organic farms also recorded higher CEC values than those under conventional farms. The soils under organic farming recorded higher amounts of available N, P, K and S than the soils under conventional farming in all the cropping systems. A substantial increase in available status of Zn, Fe, Mn and Cu in soils of organic farms was observed. A marked increase in dehydrogenase activity was observed in the soils of organic farms in all the cropping systems. It is concluded that the soil properties get favourably influenced by organic farming practice which in turn would enhance the soil health.

Studies on Soil Properties as Influenced by Organic Farming in Northern Transitional Zone of Karnataka

R. VASUNDHARA

2006

MAJOR ADVISOR : Dr.S. K. GALI

A soil analytical survey was conducted in the Northern Transitional Zone of Karnataka (Zone-8) to study the changes in soil properties and its health as influenced by organic farming under different major cropping system such as sugarcane, maize and banana system. The soil samples were collected from fields of farmers who are practicing organic farming for more than five years along with neighbouring conventional farms under the same crop/cropping system as control. Farmyard manure, vermicompost and compost were the sources of organics used by farmers as organic source in the study area. A narrow C:N ratio and higher nutrient concentration was recorded in vermicomposts and composts than in FYM. Though the vermicomposts contained higher concentration of nutrients, compost and FYM contributed more quantity

of nutrients to soils as they were applied in large quantities. Practicing of organic farming reduced the bulk density of soil and increased the maximum water holding capacity and water stable aggregates. The soil pH was slightly reduced in soils under organic farming with no appreciable change in EC. The soils under organic farms recorded higher organic carbon, CEC and available N, P, K and S than soil under conventional farming. A substantial increase in available micronutrient status such as Zn, Fe, Mn and Cu in soils of organic farms was observed. A marked increase in dehydrogenase activity was also observed in the soils of organic farms in all the cropping system. It is evidenced from the study that, long-term (more than five years) organic farming improves soil physical, chemical and biological properties which in turn would enhance the soil health.

Response of Groundnut (*Arachis hypogea* L.) to Organics and Fertilizer Levels in Alfisols

H. R. NAGARAJA

2006

MAJOR ADVISOR : Dr. S.N. UPPERI

A field experiment was conducted at the Agricultural College Farm, Bheemarayanagudi during kharif 2005 to study the response of groundnut (*Arachis hypogea* L.) to organics and fertilizer levels in alfisol. There were 16 treatments combinations comprising four main and four sub treatments. The experiment was laid out in split plot design with three replications. Application of goat manure @ 2t ha⁻¹ recorded significantly highest pod (3211 kg ha⁻¹) and haulm yield (4867 kg ha⁻¹) compared to control (2562 and 4194 kg ha⁻¹, respectively), vermicompost (3153 and 4808 kg ha⁻¹, respectively) and FYM @ 5t ha⁻¹ (2959 and 4658 kg ha⁻¹, respectively). Application of 100 per cent RDF + 10 kg MgSO₄ recorded significantly higher pod yield (3143 kg ha⁻¹) followed by 50 per cent RDF (2940 kg ha⁻¹), while, lowest was with 50 per cent RDF (2780 kg ha⁻¹).

Application of goat manure @ 2 t ha⁻¹ recorded significantly higher uptake of NPK (213, 26.61 and 130 kg ha⁻¹, respectively) compared to vermicompost @ 2 t ha⁻¹ (207, 25.40 and 124 kg NPK ha⁻¹, respectively), FYM @ 5 t ha⁻¹ (185, 22.54 and 113 kg NPK ha⁻¹ respectively), and control (145, 15.54 and 81 kg NPK ha⁻¹, respectively). Interaction effects caused due to the application of organic manure and inorganic fertilizer levels were found to be non significant. Application of vermicompost @ 2 t ha⁻¹ recorded maximum cost of cultivation (Rs. 11,587 ha⁻¹), however significantly higher gross return (Rs. 42,576 ha⁻¹), net return (Rs. 33,788 ha⁻¹) and B:C (3.83) was with application of goat manure @ 2 t ha⁻¹. The beneficial effect of usage of both organics and inorganics is obtaining enhanced the yield and quality.

AGRICULTURE ENTOMOLOGY**Bioecology and Management of Soybean Stem Fly, *Melanagromyza sojae* (Zehnt.)**

KAVITA SAVAJJI

2006

MAJOR ADVISOR : Dr. R. H. PATIL

Studies on the survey, biology, varietal screening and management of soybean stemfly. *M. sojae* was carried out at College of agriculture, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif 2005. Results of roving survey on the pest status in two districts, (Dharwad and Belgaum) revealed that the highest per cent stem tunneling of 13.50 and 16.60 per cent was observed during vegetative and grand growth stage at Dharwad taluk of Dharwad district. Whereas, the lowest stem tunneling of 10.30 and 12.00 per cent during vegetative and grand growth stage respectively was observed in Bailhongal taluk of Belgaum district. The Biology of *M. sojae* revealed that the mean incubation, larval and pupal period were 5.10, 10.40 and 10.30 days, respectively. Adult female lived for a longer (13.40 days) period compared to male (11.20 days) with an average fecundity of 81.80 ± 5.95 eggs. The total life cycle of stem fly ranged between 31 to

57 days. Among the 27 genotypes tested, NRC-55 was categorized as resistant, NRC -51 and DSb (PR) - 101 as moderately resistant, MAS-2000-1 and MRSB-342 as susceptible genotypes. All these resistant and moderately resistant genotypes recorded lowest seedling mortality and stem tunneling compared to susceptible genotypes. With respect to yield, NRC-55 recorded highest yield (22.04 q/ha) compared to all the other genotypes. Among all the insecticides tested against stem fly, seed treatment with thiamethoxam 70 WS @ 3 g/kg seed and imidacloprid 70 WS @ 3 g/kg seed resulted in lower incidence of stem tunneling. All the soil application and seed treatment chemicals were least detrimental to the tested natural enemies. The highest grain yield was recorded in the seed treatment with thiamethoxam @ 3 g/kg seed (19.20 q/ha). Net returns was highest (Rs. 11345 / ha) in seed treatment with thiamethoxam @ 3 g/kg seed.

Biology and Management of Rice Weevil, *Sitophilus oryzae* L. in POP Sorghum

KAVITA JADHAV

2006

MAJOR ADVISOR : Dr. SHEKHARAPPA

Investigations on rice weevil, *Sitophilus oryzae* (L.) with respect to biology, reaction of genotypes, efficacy of grain protectants and organoleptic evaluations were carried out under laboratory condition at Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad during 2005-06. The biology of the rice weevil, *S. oryzae* on pop sorghum grain variety Talakal-6 revealed the larval and pupal period of 25.8 ± 3.70 and 7.4 ± 0.54 days, respectively. Total life cycle from egg to adult completed in 40.2 ± 4.69 days. Among the different grain sorghum and pop sorghum varieties screened against *S. oryzae*, maximum per cent of grain damage, per cent weight loss, population buildup and minimum per cent of germination was observed in Shiggaon

local, while Mugad local was proved relatively resistant. DSV-3 was found relatively resistant among grain sorghum varieties. The relative efficacy of different grain protectants were assessed by mixing the seeds with different plant products and inert materials in plastic jars and jutebag. The treatments sweetflag powder, neem seed kernel powder, custard seed powder and kaolinite were found more effective by protecting the grains from *S. oryzae* damage. Maximum per cent of popping was observed in sweetflag powder treatment. Whereas, treatments viz., sawdust, ash and sand were not found effective. Organoleptic evaluation of popped sorghum indicated maximum acceptance of grains treated with sweetflag powder followed by kaolinite and neem seed kernel powder.

Biorational Approaches for the Management of Brinjal Shoot and Fruit Borer

D. P. JYOTI

2006

MAJOR ADVISOR : Dr. K. BASAVANA GOUD

Investigations on the effect of organic amendments, indigenous products and new molecules to shoot and fruit borer and also their effect on sucking pests, natural enemies and effect of new molecules on *Trichogramma* adult emergence in brinjal ecosystem was carried out at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during kharif 2004-05. Studies on the effect of organic amendments and indigenous products on brinjal shoot and fruit borer revealed that soil application of neem cake 0.5 t/ha + 50% RDF followed by foliar application of 5% NSKE - 3% vermi wash - 3% garlic chilli extract - 20% fermented botanical spray was more effective in reducing the shoot (15.64%) and fruit infestation (18.49%) and recorded highest marketable fruit yield (122.20 q/ha) being on par with vermicompost 1 t/ha + 50% RDF - 5% NSKE - 3% vermi wash - 3% garlic chilli extract - 20% fermented botanical spray shoot (17.79%), fruit infestation (22.38%) and marketable fruit yield of 110.40 q per ha. Whitefly and leaf hopper

population 3 leaves was significantly lowest in neem cake 0.5t/ha + 50% RDF - 5% NSKE - 3% vermi wash - 3% garlic chilli extract - 20% fermented botanical spray (4.46) and (5.47) being on par with RPP (3.86) and (4.08), respectively. Emamectin benzoate (11.82%) and spinosad (13.75) recorded lowest shoot and fruit infestation and highest marketable fruit yield of 158.51 and 153.23 q per ha, respectively. Whitefly population was significantly lowest in diafenthiuron (3.89) followed by avermectin (5.91) and spinosad (6.70). While the leaf hopper population was lowest in avermectin (4.47) followed by spinosad (5.63) and diafenthiuron (5.88). All organic amendments, indigenous materials and new molecules under evaluation were completely safe to coccinellids, chrysopids and spiders in brinjal ecosystem. Btk (92.15%) and emamectin benzoate (88.69%) were completely safe to egg parasitoid *Trichogramma chilonis* as indicated by maximum per cent adult emergence.

Studies on Fruit Fly Trapping Systems by Using Methyl Eugenol and Protein Food Baits in Guava and Mango Orchards

P. RAVIKUMAR

2006

MAJOR ADVISOR : Dr. SHASHIDHAR VIRAKTAMATH

Investigations were carried out during the year 2005-06 at Dharwad and Mummigatti to evaluate the different quantity of methyl eugenol, frequency of charging, different colours and shapes of traps as well as protein food baits and the effect of weather on trap catches of fruit flies. Traps charged with 0.1 and 0.2 ml methyl eugenol in guava and mango respectively recorded higher trap catches. These traps could trap the fruit flies effectively upto 4 weeks and three weeks in guava and mango respectively against *Bactrocera correcta*. Whereas charging at two and four weeks intervals was effective against *B. dorsalis* and *B. zonata* respectively. Yellow coloured traps were found to be effective in guava (71.91 fruit flies/trap/week) and black colour in mango orchards (8.68 fruit flies/trap/week). Cylinder and bottle traps were efficient in guava (33.05 and 32.75 fruit flies/trap/week) ecosystem while bottle traps were efficient against mango fruit flies (7.23 fruit flies). Among various

protein food baits, fruit fly diet, mango pulp with ammonium acetate combination attracted significantly more number of female fruit flies (10.63 and 8.88 fruit flies/trap/week). Monitoring studies revealed the occurrence of all the three species (*B. correcta*, *B. dorsalis*, *B. zonata*) throughout the year. In guava, *B. correcta* had four peak catches in 2005-2006 while *B. dorsalis* had three during 2005 and one major peak catch during 2006 (April). In mango, *B. correcta* had two peaks in 2005 (July and November) and one in 2006 (May) while *B. dorsalis* had totally four peaks throughout the season (July and November of 2005 and March and May of 2006). However, *B. zonata* had only one major peak in 2005 (September) and two peaks in 2006 (April and May). In guava and mango high significant positive correlation was observed between trap catches and minimum temperature.

Evaluation of Diatomaceous Earth Against *Sitophilus oryzae* (L.) and *Callosobruchus Chinensis* (L.)

POORNIMA V. MATTI

2006

MAJOR ADVISOR : Dr. J. S. AWAKNAVAR

Investigation on effect of formulated diatomaceous earth (DE) Protect-It from USA (DE is the fossilized remains of diatoms) for the control of storage insects was carried out for the first time in India in the Department of Entomology, University of Agricultural Sciences, Dharwad, Karnataka. Admixture of DE at various concentrations with grains (0.025, 0.05, 0.1, 0.15, 0.2, 0.25 and 0.3%) under laboratory conditions on the rice weevil *Sitophilus oryzae* (L.) and bruchid, *Callosobruchus chinensis* (L.) showed 100% mortality of adults at concentration of 0.1 % and above. Investigations carried out on the effect of temperature (20, 25, 30 and 35°C) and humidity (30, 50, 70 and 90%) at each temperature. The effectiveness of DE admixed at 0.1 % showed increased mortality with increasing temperature and decreasing humidity, 100% mortality was observed in all four RHs tried with 35°C and only in lower RHs with 30°C combinations and at lower temperature 20°C only at the lowest RH

(30%) combinations. Drastic reduction of moisture content (6.8-8.2%) in DE treated grains at different temperature and humidity was noticed and higher seed germination (>90%) was also observed in DE treated grains for both the insects. Less number of eggs and less adult emergence were recorded at highest temperature with lower RH (30 and 50%) in *C. chinensis*. DE @ 0.1% and above concentration recorded higher seed germination (>89%), no seed damage and reduction in moisture content (9.0-10.5%) in both the insects. Effect of DE on reproductive performance of pulse beetle revealed that less number of eggs and less adult emergence was recorded in DE @ 0.1 % and above. Sand (20%) and ash (30%) alone were found effective by recording highest adult mortality while sweet flag rhizome powder alone at 0.5% proved to be effective recording 100% mortality, whereas neem cake has no effect on adult mortality.

Evaluation of Ecofriendly Techniques for the Management of Sorghum Shoot fly, *Atherigona soccata* Rondani

SHRINIVAS MUDIGOUDRA

2006

MAJOR ADVISOR : Dr. SHEKHARAPPA

Evaluation on ecofriendly techniques in sorghum with respect to management and their safety to natural enemies against shootfly, *Atherigona soccata* Rondani were carried out under field conditions at MARS, Dharwad during 2004-05. Reaction of different genotypes against the pest indicated that CSH-18 and SPH-HHHH recorded least number of eggs and per cent dead hearts. SPH -14 79 recorded highest grain yield and CSH -18 recorded highest test weight. NSKE (5%) in combination with

panchagavya (3%) was found effective against shootfly by recording least eggs (0.47/plant), per cent deadheart (21.08%) and more grain yield (14.16 q/ha). However, it was also found safe to natural enemies compared to NSKE (5%) alone. Among different indigenous technologies evaluated GCK (5%) recorded least eggs (0.83/plant), per cent deadhearts (27.68%) and higher grain yield (12.78 q/ha). But vermiwash conserved highest

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natural enemies population. Investigations on different organic treatments evaluated *Azospirillum* was found superior in reducing eggs (1.47/plantJ, per cent deadhearts (31.62%) and higher grain yield (11.20 q/ha), test weight (26.84 g) and fodder yield (4.34 t/ha). Evaluation of different

traps indicated that fish meal + monocrotophos, fish meal + dichlorovos were recorded least number of eggs (1.13, 1.20/plantl, respectively), deadhearts (40.91%, 44.44%, respectively) as compared to fish meal alone and control plots.

Performance of Pure Breeds and Hybrid of Silkworm (*Bombyx mori* L.) on Different Mulberry Cultivars

C.G. CHETAN

2006

MAJOR ADVISOR : Dr. A. NAGANAGOUD

The studies on the performance of pure breeds and hybrid of silkworm (*Bombyx mori* L.) on different mulberry cultivars was conducted at the Department of Agricultural Entomology, College of Agriculture, Raichur during July-August, September-October and January-February seasons. Significant differences were observed in larval duration, weight of mature larvae, single cocoon weight, single shell weight, shell percentage, fecundity and yield of cocoons when the silkworm breeds and hybrid reared on different mulberry varieties. However, S-1635 showed highest values for all the characters in all the seasons. In general S-1635 variety of mulberry was observed superior followed by V-I and BR-8 for feeding

silkworm race of different breeds and hybrid. The performance of pure breeds and hybrid was found to be superior during October-November rearing over other two seasons. The performance of CSR-2 breed was superior for full grown larval weight, total larval duration, fifth instar duration, silk productivity, cocoon weight, cocoon shell weight, cocoon shell ratio, cocoon filament length, pupal weight, pupal duration and moth emergence. Among the mulberry cultivars, S-1635 fed silkworms produced higher third instar larval weight, mature larval weight, silk productivity, ERR per cent, cocoon and shell weight, cocoon shell ratio, filament length, pupal duration, moth emergence, fecundity and hatching per cent.

Studies on Seasonal Incidence and Management of *Apion amplum* (Faust) (Apionidae: Coleoptera) on Greengram

A. J. UMESHA

2006

MAJOR ADVISOR : Dr. K. BASAVANA GOUD

Investigations on the seasonal incidence, monitoring by light trap, economic injury level and management of *A. amplum* by intercropping and insecticides were carried out during kharif 2005-06. Studies on the seasonal incidence of the seed weevil, *A. amplum* on greengram revealed that peak activity of the pest on greengram was noticed on the crop sown during the month of July, which recorded highest mean population of weevils (6.96 weevils/plant), highest per cent pod (63.30%) and seed damage (69.68%), whereas complete absence of the pest was noticed on the crops sown from December to April. Monitoring of *A. amplum* using modified ICRISAT light trap revealed that two peaks were observed on weevil abundance i.e., on 30th and 40th -standard weeks, which coincided with peak field incidence of the pest. Correlation between trap catches and weather parameters revealed that trap catches of *A. amplum* had significant positive correlation with minimum temperature,

morning relative humidity, evening relative humidity and also rainfall, but trap catches had highly significant negative correlation with minimum temperature. Determining of economic injury level (EIL) for seed weevil *A. amplum* on greengram revealed that EIL of seed weevil was 1.02 weevils/plant. Investigations on the management of seed weevil by intercropping revealed that greengram grown with pigeonpea and maize in the ratio of 4:2 and 2: 1, respectively minimized the activity of weevil. Significantly higher greengram equivalent yield was recorded in red gram (9.95 q/ha) and maize (9.74 q/ha) intercropping system. Evaluation of different insecticides under field conditions revealed that application of fenvalerate @ 20 kg/ha and spinosad @ 0.2 ml/l was found effective in reducing the weevil population, pod and seed damage to greengram. When the cost effectiveness was considered, fenvalerate dusting @ 20 kg/ha and chlorpyrifos @ 2 ml/l spray recorded highest C:B ratio of 1:2.23 and 1: 1.86, respectively.

Studies on Syrphid Predators of Sugarcane Woolly Aphid (*Ceratovacuna lanigera* Zehntner)

E.K. LIKHIL

2006

MAJOR ADVISOR : Dr. C. P. MALLAPUR

The role played by syrphids in the management of sugarcane Woolly aphid were studied under both laboratory and field conditions during 2005-06 at department of Agricultural entomology, College of agriculture, Dharwad and at farmer's fields. The syrphid species associated with SWA comprised of two species viz., *Eupeodes confrater* and *Dideopsis aegrota* and *E. confrater* was the major species occurring in all the locations (62.58 to 100%). Two groups of natural enemies on syrphids were identified, one larval pupal parasitoid belonging to family Ichneumonidae (*Diplazon laetatorius*) and three species of bacterial pathogens viz., *Citrobactor* sp. *Aeromonas* sp. and *Bacillus* sp. The breeding of *E. confrater* was not possible in caged condition. The predator completed three larval instars with a total larval period of 12.12 ± 0.31

(10- 14) days. Pupal period ranged from 7 to 9 days with a mean of 8.30 ± 0.89 (10-20) days and 17.6 ± 1.52 (10-22) days, respectively. A single larva of *e. confrater* consumed 442.74 sugarcane woolly aphids in its total larval period at a rate of 36.53 aphids/ individual / day. The instarwise consumption was 45.83, 133.52 and 263.39 aphids during first, second and third instar, respectively. In the absence of food, *Eupeodes* larvae. In the field study, molasses and fruit fly diet attractants recorded comparatively more syrphid larval population (1.13 and 0.92 larvae/ leaf) and registered lower mean aphid grades. All the tested chemical insecticides viz., thiamethoxam, the safest treatment was vitex + neem + lantana which recorded least reduction of syrphid population in treated plots (3.72 and 6.13%) as well as under laboratory condition (23.01% mortality).

Non Chemical Approaches for the Management of Thrips and Mites in Chilli

S. GAYATHRI DEVI

2006

MAJOR ADVISOR :Dr. R. S. GIRADDI

Field investigations were carried out to study the influence of organics, date of planting and varietal trial against leaf curl of chilli caused by thrips and mites during kharif season of 2005 at the University of Agricultural Sciences, Dharwad. Among the different planting dates, July 15th proved to be the best planting date which recorded significantly less population of mite and thrips, lowest leaf curl index and highest plant height, fruits, branches and chilli yield. Among the 12 genotypes, G-4, Pusa jwala and the hybrid, Tejaswini recorded less population of mites,

thrips and lowest leaf curl index and proved to be tolerant to the pest damage. Application of 50% N, 100% P and K, NC 250 kg/ha, 50% N, 100% P and K, VC 1.25 t/ha, 75%, N, 100% P and K, NC 250 kg/ha and 75%, 100% P and K, VC 1.25 t/ha registered significantly lower population of thrips, mites and leaf curl and yield being comparable to the standard check, RDF + RPP. Application of organics was found quite safe to coccinellid beetle and *Chrysoperla* found on the crop during experimentation.

Evaluation of Pigeonpea and Cowpea Genotypes for Bruchid Resistance (Bruchidae)

M. NAGARAJA

2006

MAJOR ADVISOR: Dr. J. S. AWAKNAVAR

Investigation on comparative evaluation of pigeonpea and cowpea genotypes against bruchid resistance and biochemical basis for bruchid resistance under laboratory condition during 2003-05 at Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad. In pigeonpea genotypes, the lowest value of per cent adult emergence, growth index value, per cent loss of germination, weight loss, highest developmental period (days), lowest protein content (mg/g), highest trypsin inhibitor (unit/mg of protein) and highest phenol content (mg/ g) genotypes showed significantly least susceptible to *C. chinensis*. these were DEPS-3, DEPS-9, PG-12, ICPL-2008-1 and WRP-230-1-1 and other genotypes were PG-27, PG-44, GPS-2003, WRP-266, ICPL-8863, ICPL-2009-1 and ICPL-99032-1 were showed more susceptible to *C. chinensis*. The lowest per cent adult emergence, germination, weight loss, lowest growth index value, highest developmental period, lowest protein content, highest trypsin content and phenol content genotypes were

ICPL-2008-1, PG-12, GS-1, DEPS-3, DEPS-9 showed relative resistance to *C. maculatus* compared to the other susceptible genotypes were ICPL-2009-1, GPS-2003, PG-44 and ICPL-87 119. The cowpea genotypes were KM -1, Goa local T -1 and TV x 944 showed least susceptible to *C. chinensis* and these having lowest per cent adult emergence, germination, weight loss, growth index value, highest developmental period, low protein, highest trypsin and phenol content. The genotypes were DCP-2, V-118, T-4, C-3 and KM-4 showed susceptible to *C. chinensis* the lowest per cent adult emergence, germination loss, weight loss, lowest growth index value, highest developmental period, low protein content, highest trypsin and phenol content genotypes were KM-1, Goa local, T-1 and TV x 944 showed relative resistance to *C. maculatus* compared to the other susceptible genotypes were CO-7, C-3, T -118 and DCP-2. The relative resistance was due to the seed physical factors and biochemical factors like protein, phenols and antimetabolites.

Development and Evaluation of Formulations of *Nomuraea rileyi* (Farlow) Samson Against *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (F.)

D. R. MALLIKARJUNA

2006

MAJOR ADVISOR: Dr. R. K. PATIL

The development and evaluation of formulations of *N. rileyi* against *H. armigera* and *S. litura* under laboratory conditions were carried out at the Biocontrol laboratory, Department of Agricultural Entomology, College of Agriculture, Dharwad, from 2004-2006. Field experiments on evaluation of *N. rileyi* formulations against chickpea pod borer was carried out at MARS, Dharwad during rabi 2005. Fifteen wettable powder and ten oils were evaluated for conidial viability, storability and per cent germination under ambient room temperature (30°C) and refrigerated conditions (4°C). Among the storage conditions *N. rileyi* conidia in WP formulation recorded 72.94 per cent germination at 4°C and 56.67 per cent at 30°C up to 180 days. Among wettable powder formulations, bentonite + glucose (7: 1) and bentonite + sucrose (7:1) recorded higher conidial germination of 77.84 and 78.66 per cent, respectively at 4°C and 64.86 and 62.31 per cent, respectively at 30°C after 180 days of storage. All the oils failed to maintain viability of conidia after 10 days of storage.

In the laboratory, the wettable powder formulations of *N. rileyi* viz., bentonite + sucrose (7: 1) and talc + sucrose (7: 1) recorded 87.00 and 75.00 per cent mortality in *S. litura* and 88.00 and 80.00 per cent in *H. armigera*, respectively. The tank mix sunflower oil and groundnut oil recorded 90.00 and 87.00 per cent mortality in *S. litura* and 89.00 and 87.00 per cent in *H. armigera*, respectively. In the field experiment, sunflower oil (tank mix) and bentonite formulation of *N. rileyi* proved better in reducing the pod damage in chickpea (9.80% and 11.79 %, respectively) which resulted in higher pod yield of 8.10 q/ha and 7.37 q/ha, respectively. However, significantly higher yield of 10.86 q/ha was obtained in chemical control (quinalphos 0.05%). With respect to cost economics the sunflower oil (tank mix) emerged as the best treatment by recording net returns of Rs. 5429 per ha with IBCR of 17.23. This was followed by quinalphos (0.05 %) with net returns of Rs. 9562/ha with IBCR of 15.98.

Studies on Blackeye Cowpea Mosaic Viral Disease on Cowpea (*Vigna unguiculata* (L.) Walp)

K. SHILPASHREE

2006

MAJOR ADVISOR: Dr. M. S. PATIL

Roving survey during kharif 2005 for blackeye cowpea mosaic viral disease showed an incidence to an extent of 10.00 to 36.00 per cent, where as during summer 2006 incidence ranged from 18.00 to 48.00 per cent. The BICMV was readily transmitted by sap inoculation, the aphid *Aphis craccivora* Koch transmitted the virus non-persistently with transmission varied from 52.00 to 58.36 per cent and seed transmission of 18.00 to 51.00 per cent was noticed. Symptoms appeared first on cotyledonary leaves as mosaic mottling and leaf distortion followed by dark green vein banding on the succeeding trifoliate leaves. Electron microscopic studies from partially purified preparation of diseased samples showed the presence of flexuous filamentous particles. Total free phenols content was higher in BICMV resistant genotype than in susceptible genotype. In the isozyme studies, infected leaves showed greater intensities of the isoperoxidase bands in comparison with extracts of the healthy

leaf. The correlation studies of weather parameters with per cent disease incidence and aphid population revealed a significant. Positive correlation with temperature, negative non-significant correlation with relative humidity and significant negative correlation with rainfall. Highly significant positive correlation was obtained between per cent disease incidence and aphid population. Studies on integrated disease management of BICMV showed the practice of imidacloprid seed treatment followed by one spray of dimethoate at 30 days and another spray of nimbecidine at 45 days recorded the least number of vector population with reduced per cent disease incidence. Among 21 genotypes screened during kharif 2005, farmer seed, EC-29805, IC-97767 IC-202797 were resistant, GC₃ was highly susceptible. Among 25 genotypes screened during rabi-summer, 2006, DCS-6 genotype found resistant, V-118, C-152 were highly susceptible to the disease.

Management of Leaf Rust of Wheat Caused by *Puccinia recondita* f. sp. *tritici* Rob.ex. Desm.

R. K. PATIDAR

2006

MAJOR ADVISOR: Dr. I. K. KALAPPANAVAR

Evaluation of bread wheat genotypes against *Puccinia recondita* f.sp. *tritici*, crossing of susceptible lines with resistant testers, evaluation of F₁'s against leaf rust, identification of slow leaf rusting varieties, diversity assessment among wheat genotypes, management of leaf rust and impact of leaf rust on quality of wheat seed were studied during 2004-05 and 2005-06 Rabi season at Dr. Sanjay Rajaram Wheat Laboratory, Main

Agricultural Research Station, Dharwad. A unique trend of susceptibility was observed for leaf rust among bread wheat genotypes depending on the disease pressure. Nearly 2/3 genotypes under natural conditions and about ½ genotypes under leaf rust epiphytotic conditions were responded resistant reaction against leaf rust. The susceptible lines crossed with resistant testers resulted in the majority of F₁'s with resistance of resistant

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parent. However, plant height, number of productive tillers, number of seeds per spike and spike length positively correlated with leaf rust resistance. The genotype HD-2189 produced fewer rust pustules with less disease severity, low rate of infection and lower AUDPC value was identified as slow rusters and genotypes DWR-195 and DWR-162 were identified as fast rusters. The wheat genotypes showed a complex divergence among themselves. Two genotypes DL-784-3 and HP-1633 found most divergent from rest of genotypes, which showed less similarity among them. Fungicide propiconazole @ 0.1 per cent found superior against leaf rust

among fungicides, among botanicals, neem leaf extract responded best and among bioagents, *Trichoderma harzianum* performed better, while panchgavya among animal wastes and products gave better results against leaf rust of wheat. Grain quality was affected considerably by leaf rust. Propiconazole improved protein content of the seeds significantly. Whereas, neem leaf extract and *Trichoderma harzianum* improved sedimentation rate and panchgavya improved β -carotene over control significantly.

Studies on *Alternaria solani* (Ellis and Martin) Jones and Grout Causing Early Blight of Tomato

K. T. ARUNAKUMARA

2006

MAJOR ADVISOR: Dr. M. S. KULKARNI

An investigation carried out on the early blight of tomato caused by *Alternaria solani*, indicated that maximum mean severity of the disease was recorded in Belgaum district (63.71) followed by Dharwad district (58.71). The fungus grown on PDA produced dark brown mycelium, brown to olivaceous brown conidiophores, with muriform having long beak. Maximum growth was observed on PDA followed by corn meal agar. Potato dextrose broth was used to study the growth phase of *A. solani*. Maximum dry mycelial weight was recorded on 9th day of inoculation. Glucose was found to be the best carbon source and threonine was the best nitrogen source for the growth of Arabhavi and Dharwad isolates of *A. solani*. Maximum dry mycelial weight was observed at a pH range of 6.5-7.0 and least at pH 8 in both the isolates. Both the isolates of the pathogen produced maximum growth at 25-30°C temperature. Morphological

variability in colour of colony, margin of colony, topography of colony, colony growth and sporulation was observed among six isolates of *A. solani*. Two isolates namely AS1 (Arabhavi) and AS3 (Amminabhavi) produced good sporulation in PDA supplemented with 1% CaCO₃. The fungus survived in infected crop debris up to 180 days when stored under laboratory conditions and upto 120 days under refrigerated and glasshouse conditions. Among the ten fungicides, 11 botanicals and 6 bioagents evaluated in in vitro condition against *A. solani*, propiconazole (0.1%), metalaxyl MZ (0.2%), perfekt (0.3%), Clerodendron inerme (10%), *Eucalyptus globes* (10%) and *Trichoderma harzianum* gave the maximum inhibition of mycelial growth of *A. solani*. Under field conditions, propiconazole (0.1%) and pyraclostrobin (0.2%) were found to be most effective in reducing severity of the disease and increasing fruit yield over control.

PLANT PATHOLOGY

Studies on *Jatropha* Mosaic Virus Disease

K. JAYANNA

2006

MAJOR ADVISOR: Dr. A. S. BYADGI

Jatropha (*Jatropha curcas* L.) is one of the important biodiesel crops grown throughout the country. The *Jatropha* species suffer from several diseases, among them *Jatropha* mosaic virus (JMV) disease is one of the limiting factor in *Jatropha* cultivation. The survey was conducted to know the distribution of JMV in different parts of Karnataka during 2005. The results revealed that there was 2.30 per cent to 31.40 per cent disease incidence on commonly grown *J. curcas* and 6.00 per cent to 45.00 per cent on *J. gossypifolia*. The infected plants were characterized by production of mosaic, yellow mosaic, distorted leaves with reduction in leaf size, thickening of veins, puckering and crinkling of leaves. Miniature leafy enations on the axial side of leaves and severe stunted growth of the plants were also recorded. The virus causing *Jatropha* mosaic disease was neither mechanically transmissible nor through seeds, but it was transmitted through dodder, whitefly (*Bemisia tabaci*) and by grafting. The virus had

limited host range and produced mosaic, yellow mosaic and distorted leaves on *J. curcas* and mosaic and leaf curling on *J. gossypifolia* and the virus produced yellow mosaic and leaf curling symptoms on *Phaseolus vulgaris*. The biochemical analysis of diseased leaves indicated decrease in sugar with increased phenol content. The virus had severe effect on the growth parameters which was evident from the drastic reduction in plant height, inter-nodal length and petiole length in case of early infection. The yield parameters like number of fruits per plant, size of the fruit and number of seeds per capsule, seed weight and number of pollens were also affected by JMV, accounting for 78.03 per cent reduction in yield. The virus was found to affect the oil content (41.78 % reduction) drastically over healthy plants. Among the different insecticides, monocrotophos (1.5 ml/l) and confidor (0.25 ml/l) were reduced vector population and also disease incidence.

Biodegradation and Biosynthetic Capacity of Milky White Mushroom (*Calocybe indica*)

ADINATH A. KARNAWADI

2006

MAJOR ADVISOR: Dr. VEENA SAVALGI

The experiments were conducted at Department of Agricultural Microbiology, University of Agricultural Sciences, Dharwad during 2004-05 for screening and selection of different substrates viz., paddy straw, sugarcane bagasse, maize stalks, potato haulms for the production of milky white mushroom, *Calocybe indica*. Also different casing materials viz., well decomposed FYM, biogas slurry, lignite, vermicompost and sheep and goat manure in combination with garden soil (1:1 w/w) were tried for mushroom cultivation using paddy straw as a single substrate. The yield and nutrient content of mushrooms were examined. Meanwhile, biochemical changes that occurred in the substrates during the growth of mushrooms were studied. The study of chemical composition of substrates indicated the significant variation in all chemical constituents of four substrates used. The lignin, cellulose, hemicellulose, organic carbon, C:N and dry matter of substrates showed a significant reduction during growth of a fungus. But, nitrogen content was increased over a period of mushroom growth. Out of four substrates studied, paddy straw alone realized the highest bioefficiency (138.88%) and followed by maize stalks (133.16%).

Paddy straw also recorded significantly more number of buttons (6.4), minimum time for completion of the spawn run, pin head formation and days for first harvest (14.2, 7.4 and 8 days, respectively) and maximum shelf life (5.8 days). Nutritionally, mushrooms from maize stalks recorded high protein (32.43%) and carbohydrates (46.98%), which were on par with paddy straw. The mushrooms from paddy straw recorded highest fat (3.63%). Meanwhile, both moisture and crude fibre of mushrooms were shown non-significant results. As compared to other casing materials used, well decomposed FYM+garden soil (1:1 w/w) has shown significantly higher bioefficiency (137.14%) and maximum number of buttons (6.50). But, shelflife, days taken for pin head formation and first harvest were shown non-significant results. Nutritionally, mushrooms varied significantly with highest protein (30.98%) and fat (3.81%) in well decomposed FYM+garden soil (1:1 w/w) and carbohydrates in sheep and goat manure+garden soil (1:1 w/w) (47.09%). Meanwhile, moisture and crude fibre content were found to be non-significant.

AGRICULTURAL MICRO-BIOLOGY

Molecular Characterization of Insecticidal Genes in *Bacillus thuringiensis* Isolates from Western Ghats of Chikmagalur and Goa

B. K. ASHWINI

2006

MAJOR ADVISOR: Dr. J. H. KULKARNI

The present work involved characterization of insecticidal gene content of native isolates of *B. thuringiensis* from the western Ghats region of Chikmagalur and Goa. From 976 and 264 soil samples collected, 84 and 49 isolates from Chikmagalur and Goa, respectively showed the presence of crystals. The most predominant was the spherical crystals, which was present in 80 per cent of the isolates both from Chikmagalur and Goa. Only 5.2 per cent of the isolates had bipyramidal crystals. 21 isolates representing 15.7 per cent had both spherical and irregular crystals. Forty one percent of the isolates from Chikmagalur had irregular crystals, which was in contrast to the 8.1 per cent of the isolates from Goa. 87 per cent of the 85 screened for cry showed amplification of one or many cry genes. Goa isolates showed a higher percentage (88.5%) of amplification with one or more cry primer than Chikmagalur (1.12%). The presence of cry2 on the other hand was higher in Chikmagalur (5.95%)

than Goa (2.04%). Overall, the most abundant gene was cry33 (27.81%), which was followed by cry46 (23.30%) and cry20 (22.55%) and cry6 (21.05%). Isolate 1711/1 had six cry genes viz., cry4, cry6, cry20, cry28, cry33 and cry46. Similarly, 17007/5 also had six cry genes (cry6, cry12, cry20, cry24, cry33 and cry46). Isolates 1606/2, 2422/c, 1764/2, 1949/c, 1210/a, 1946/c harbored five cry genes each. All of them possessed cry33. The RFLP pattern of the cry46 that amplified well in 1711/1, 2377/a, 1708/3 and 1652/1 obtained with *HindIII*, *KpnI* PstI, XbaI and XhoI, were different from the expected RFLP indicating that the cry46 present in the above isolates should be different than the one whose sequence is available in the nucleotide sequence databank. None of the native isolates amplified for cry3, cry7, cry8, cry9, cry10, cry11, cry12, cry13, cry14, cry15, cry16, cry17, cry18, cry21, cry22, cry25, cry26, cry27, cry36, cry42 and vip.

AGRICULTURAL ECONOMICS

Economics of Production and Marketing of Patchouli in North Karnataka

C. RAGHU

2006

MAJOR ADVISOR: Dr. SURESH S. PATIL

Medicinal and aromatic plant cultivation is emerging as one of the major high value commercial crops in India with great potential for exports. Patchouli is an important aromatic plant cultivated on a large scale in Karnataka, Gujarat, Andhra Pradesh, Kerala and other states, patchouli is in great demand within the country and abroad. North Canara and Haveri districts were purposively selected for the study, as these districts have highest area under patchouli crop in the state. Sirsi, Siddapur and Yellapur taluks in North Canara and Hangal, Hirekerur and Byadagi taluks in Haveri districts were purposively selected because patchouli crop was almost entirely concentrated in these taluks. Although, the cost of establishment is high, the return from the investment in patchouli cultivation are attractive. The values of B:C ratio (2.45 in Uttara Kannada and 2.44 in Haveri districts), net present value (Rs. 156975.27 in Uttara Kannada and Rs. 148407.19 in Haveri districts) and internal rate of

returns (88.93% in Uttara Kannada and 87.30% in Haveri districts) are fairly high reflecting greater financial viability of investment in patchouli cultivation. Since, it is a new crop, which was introduced recently farmers face certain problems especially in production and marketing. Major problems faced by the farmers in the production of patchouli were water logging in rainy season, frequent irrigation and nematode attack. Other problems were post-harvest drying, need of well-drained soil to grow the crop infestation of plants with wilt caused by fungus, lack of proper package of practice, need of technical assistance and leaf blight. Three problems were expressed by the farmers in the marketing of patchouli. They were nonavailability of method/instrument to assess the quality of patchouli herbage at farm level. Secondly, cheating the farmers by the agents of the company. Third was lack of market information.

Economic Evaluation of Vanilla Cultivation in Uttara Kannada District of Karnataka

D. B. RAJESH

2006

MAJOR ADVISOR: Dr. M. G. KERUTAGI

Vanilla is an important orchid commercial spice crop. It is commercially cultivated as an intercrop under arecanut garden and also as pure crop under artificial shade. The study was undertaken in Uttara Kannada district because it is having highest area under vanilla cultivation in Northern Karnataka. In Uttara Kannada, Sirsi and Yellapur taluks were selected, respectively primary data was collected from the farmers growing vanilla. The secondary data was collected from spice board and other agencies. The present study covered 80 farmers who were grouped into farmers growing vanilla as an intercrop, pure crop. In vanilla grown as intercrop, the net present value of the cash inflow per ha was Rs. 1856659.40 on small farm and Rs. 2448524.8 on large farm. B:C ratio was 10.71 on small farm and 13.71 on large farm. The internal rate of return was 58 per cent on small and 65 per cent on large farm. The break

even point for small farm was 145.52 and 127.98 kg for the large farm. In vanilla grown as pure crop, the net present value per ha was Rs. 4942593.61 on small farm and Rs. 5373993.35 on large farm. The major problem faced by the farmers in the production of vanilla was incidence of pest and diseases. The main diseases which infected the vines are fungal and viral diseases and the beetle pest damaged the leaves and flowers. Non-availability of skilled labours for pollination is another important problem faced by farmers. Some of the farmers expressed that the investment is very high when it is taken as a pure crop. The processing of vanilla bean is not standardized at the farmer level low price to poor processed bean. The marketing structure for vanilla is poorly developed. Finally vanilla cultivation is profitable.

Traditional and Sri Methods of Paddy Cultivation - A Comparative Economic Analysis

P. SIVANAGARAJU

2006

MAJOR ADVISOR: Dr. H. BASAVARAJA

The present study was conducted to ascertain the economics and sources contributing to the productivity differences besides examining technical and allocative efficiency of both traditional and SRI methods of

paddy cultivation in Prakasam and Guntur districts of Andhra Pradesh. The per hectare cost of cultivation of paddy was Rs. 26,655 and Rs. 28,088 for farmers following traditional method and SRI method,

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respectively. The variable costs constituted the major portion of the total cost of cultivation forming about 84.46 per cent and 84.89 per cent in traditional and SRI methods, respectively. The net returns was found to be higher in SRI method of paddy cultivation, which was estimated to be Rs.28,877. Constant returns to scale was noticed in both traditional and SRI paddy productions. The elasticity of production for seeds, labour, fertilizer and farmyard manure were positive and significant in both the methods of paddy production. MVP- MFC ratios in traditional paddy indicated that there was scope for increased use of seeds, fertilizers and FYM. In SRI paddy, there was scope for increased use of all the inputs except land. The average technical efficiency was slightly high in SRI

method (79.80%) than in traditional method (73.40%). However, SRI paddy farmers were found to operate at high economic efficiency level (50%) when compared to traditional paddy farmers (41.90%). There was a structural break in the paddy production with the introduction of SRI method. The higher productivity in SRI paddy production was because of the shift in the intercept. The total productivity difference between the SRI and traditional methods of paddy cultivation was estimated to be 33.72 per cent. The difference in technology was found to be the major contributor (31.61%) to the yield differences between SRI paddy and traditional paddy.

Production and Marketing of Sapota in Northern Karnataka - An Economic Analysis

V. A. RAMACHANDRA

2006

MAJOR ADVISOR: Dr. M. G. KERUTAGI

The objective of the study was to analyse the production and marketing of sapota in Northern Karnataka. Random sampling procedure was adopted in selection of the study area, districts (2) and respondents (90). The results revealed that the Belgaum and Dharwad districts were found to be having negative growth rate in area and production (-3.07 and -9.18% and 3.73 and -4.77%, respectively). While the productivity of both the districts was negative viz., -6.30 and -8.20 respectively. On the contrary, a lower but positive and significant growth rate was observed in sapota area for the state as a whole, whereas the production and yield showed negative trend (-1.98 and -6.24 respectively). The per ha establishment cost of sapota was found to be Rs. 118666.56 and Rs.113927.38 in Belgaum and Dharwad districts respectively. The maintenance cost worked out to be as Rs. 16952.38 and Rs. 15662.10 in Belgaum and Dharwad districts respectively. The average per ha yield in

Belgaum district was 11.09 tonnes and in Dharwad district was 11.56 tonnes. Net returns were Rs. 57679.27 from Belgaum district and Rs. 50149.26 from Dharwad district. Financial analysis revealed that of 9.5 per cent discount rate, the sapota enterprise has maximum NPV (Rs.136720.87 & I 6S4:3R.6R), BC (3.10 & 3.61), PBP (6.03 & 5.79 years) and If R (18% & 21%) in Belgaum and Dharwad district respectively. Two marketing channels were identified in which the producer's share in consumer's rupee was highest in channel-I (73.68%) and it was 57.89 per cent in channel-II. Higher incidence of diseases, scarcity of water, distant markets and high commission charges were the main problems confronting the cultivators. Adoption of recommended cultivation practices, provision of adequate credit would help in expanding the area and also in increasing the productivity of sapota.

AGRICULTURE BUSINESS MANAGEMENT

Captive Market in Agricbusiness: A Case of Grainages in Kolar District of Karnataka

C. M. ASHARANI

2006

MAJOR ADVISOR: Dr. H. S. VIJAYAKUMAR

India ranks second in the world raw silk production. Karnataka produces more than 60 percent of total silk production in the country. Grainages are the vital centers of silkworm seed production. Marketing of DFLs is the major constraint in the grainage enterprise. Analysis of Captive Market for Silkworm Seeds in Kolar district is made on the components of terms of contracts, pattern of supply, pricing and purchasers satisfaction. Private and government grainages of Kolar, Shidlaghatta and Chintamani taluks were selected and primary data were collected from 30 private and five government grainages for the period of 25 years to evaluate costs, returns and marketing of DFLs. Different analytical tools like tabular, break-even and ratio analysis were used to evaluate these aspects. The prices of DFLs were increased in both private and public sectors. The

production of DFLs in private sector overtook that of the government sector in recent years. The cost of production of DFLs was higher in case of government sector as compared to private sector because of high installed capacity of grainages are much higher than actual production in government sector. The private grainages have been functioning efficiently with well-established cliental relationship, market driven strategies for sale of DFLs and quality seed production. The operation of captive market will reduce the cost of production of DFLs and avoid risk involved in marketing of DFLs. Awareness must be created among the farmers and grainage owners about the captive market for the silkworm seeds. Seed cocoon price must be stabilized by strengthening government rules and also by training grainers to produce quality seeds.

Pre and Post WTO Era: Changes in Pulses Economy in Karnataka

N. BINDUKUMAR

2006

MAJOR ADVISOR: Dr. R. A. YELEDHALLI

Economic integration and trade liberalization will have great impact on the national economy in general and agricultural sector in particular. This will be a good opportunity to expand markets and receive modern and advanced technologies from developed countries. The liberalization of the Indian economy has provided enormous opportunities for agricultural exports in the new economic policy. Adjustments in the exchange rate of the rupee were effected to bring it line with the equilibrium in order to improve the country's international trade. India's redgram exports were negligible in the pre WTO period. But, after GATT accord and consequent upon setting up of the WTO redgram exports have increased considerably. In economies of production, cost of plant protection chemical occupied a maximum share in the increase in cost of cultivation of redgram. Lagged price, the area allocated for redgram in

the previous year and rainfall were the chief determinants of the area allocation in the current year of redgram crop in Karnataka. Rainfall in the state has well proved to be an important variable determining the productivity of redgram. UAE, Malaysia and USA are the stable markets for Indian redgram exports, UAE has really been a growing market for Indian redgram exports. The co-integration analysis showed integration between domestic and world prices. That means there exists the long run equilibrium relationship between domestic and international prices. The redgram in the state had been perfectly competitive and also enjoys comparative advantage in the production. Karnataka enjoys an edge of competitiveness in redgram trade. Hence, all efforts should be made to increase the production and productivity of the redgram, state should devise incentives policies that shows the direction in enhancing the exports of redgram for sustainable trade in the International market.

Export Performance and Competitiveness of Ginger from India

W. J. THANUJA

2006

MAJOR ADVISOR : Dr. K. H. S. S. KHAN

India is rightly called as "spice bowl of the world" for its production of variety and superior quality of spices. In the area of export ginger occupies fifth position in terms of quality and sixth position in export earnings among the spices. The main competitors to India are China, Indonesia and Thailand. The main importers are Pakistan, Saudi Arabia, USA and Netherlands. A study conducted to analyze export performance and competitiveness of ginger from India with the objectives like trends in domestic and International prices of ginger, direction of trade of ginger export and impact of withdrawal of freight subsidies on export. Karnataka, Kerala, and Tamil Nadu markets were selected to study the market integration and export of ginger from Cochin port. The required data collected for the period of 20 years. The objectives are analyzed with trend, nominal protection coefficient, and markov chain

and growth rate analysis. The international prices of Cochin ginger were found to be decreased in I and III phase and increasing in II Phase. An average NPC value over 20 years for the domestic market price was 0.70 indicated moderate competitiveness in the international market. Pakistan and Saudi Arabia were found to be highly loyal markets for Indian ginger indicated by the retention of their previous shares of exports from India. The growth rate between pre and post-WTO period in terms of area and production were positive. The export growth between pre and post WTO period in terms of quantity and values were found to be declining and negative. The correlation analysis revealed that the selected markets in three states were well integrated and the pair of Bangalore-Trivendrum market was highly integrated.

AGRICULTURE EXTENSION EDUCATION

Study on Management Orientation and Economic Performance of Chrysanthemum Growers in North Karnataka

S. PRABHU

2006

MAJOR ADVISOR: Dr. S. N. HANCHINAL

The present study on management orientation and economic performance of chrysanthemum growers was carried out during 2005-06 in selected taluks of Gadag and Haveri districts. By following simple random sampling of 120 chrysanthemum growers were selected and data were collected by personal interview method. The important findings of the study were that 43.33 per cent of chrysanthemum growers had low management orientation, 57.50 per cent belonged to low planning orientation, 40.00 per cent of them had low production orientation, followed by 45.83 per cent had medium market orientation and nearly half of them (45.83%) had medium economic performance. Near about half of chrysanthemum growers (45.83%) belonged to high self-confidence, followed by high cosmopolitanism (45.00%), high innovativeness (40.00%), and high-risk orientation (35.83%). In case of extension activities, 60.00 per cent of respondents had participated in Krishimela,

followed by training programmes (37.00%), whereas 70.00 per cent were occasionally contacted extension workers like private agency consultant. Cent per cent of chrysanthemum growers possessed knowledge on season of sowing, spacing followed, pinching terminal portion of plant buds, major pests and diseases, time of harvest yield per acre, followed by quantity of seeds (96.66%). Recommended control measures of pest and disease are known to respondents were 76.66 and 71.66 per cent, respectively. The major constraints faced by the respondents found that, cent per cent of them expressed shortage of irrigation water, followed by greater price fluctuations (88.33%), pest and disease problems (81.66%) and non-availability of skilled labours (68.33%). Majority of respondents expressed suggestions like sufficient water through irrigation (93.33%), followed by high price for the produce (92.50%), reduce the cost of the fertilizers (65.00%), provision for the sorting the flowers (40.00%) and provision of technical guidance (23.33%).

A Study on Decision Making Pattern of Urban Working and Non Working Women in Home Activities in Dharwad District of Karnataka State

RANGALATA KHANDAI

2006

MAJOR ADVISOR : Dr. UMA S. HIREMATH

The present study on decision making pattern of urban working and non-working women in home activities in Dharwad district of Karnataka State was undertaken in the year 2005-06 with a sample size of 140 including 70 women working in different government and non-government organizations and remaining 70 non-working women. The data was collected on employment details of working women, socio-personal characteristics, decision making pattern, constraints faced and stress management techniques adopted by the respondents with the help of pre-tested structured interview schedule. Majority of the working women belonged to government organizations and supporting staff category. A large percentage of the working and non-working women were taking joint decisions in childrens affairs, personal affairs and household affairs but in aspects like religious practices, expenditure aspect, purchasing

of items and hygiene practices they were taking independent decisions. Major constraints faced by the working women were feeling tired due to long hours of work, neglecting of duties of children, non-cooperation from family members, no social visits and insufficient time for leisure and sleep, personal care and entertainment, traveling problem, while lack of time for attending social gatherings, marriage ceremonies, birthday parties, communication facilities, over burden of work, no link with the people, feeling fatigued after work and insecurity were the constraints faced by the non-working women. Regarding stress management techniques, both working and non-working women were adopting the techniques like relaxation, correct posture, balanced diet, body therapy, meditation, psychotherapy, working in groups, altering situation, planning, reducing responsibilities to manage their physical and mental stress.

A Comparative Profile Analysis of Rural Youth in Rainfed and Irrigated Tracts of Bagalkot District

SANGAMESH P. SAJJAN

2006

MAJOR ADVISOR : Dr. L. MANJUNATH

Youth are the most potent segment of the population of the country. The youth of today are the hopes of tomorrow. They are the backbone of the country. The Socio economic development and prosperity of rural areas depends to a considerable extent, on the type of youth living in rural areas, because the rural youth have abilities to orient themselves to go along the main stream of the development process. Hence, the study was conducted in Bagalkot during 2005-06. Two taluks were selected namely Badami (rainfed) and Jamakhandi (irrigated) from which eight villages were selected by random sampling method. From

these villages, fifteen respondents were selected. Thus, total sample size was 120. Both in rainfed and irrigated tracts, majority of the respondents had favourable attitude, towards agriculture (63.33% and 66.66%). Majority of the respondents had medium level of aspirations towards better living in rainfed and irrigated tracts (66.66% and 69.99%). Majority of the respondents in rainfed tract had high level of education (60.00%) and medium nuclear family (51.66%), medium annual income (54.99%), small land holdings (45.00%) and low extension participation (46.32%). Whereas in irrigated tract, majority of the respondents had high level of

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education (82.00%), joint family (53.33%), medium annual income (58.33%), semi medium land holding (38.33%) and high extension participation (83.31%). Attitude of respondents was significantly associated with education, land holding, mass media in rainfed tract while, education, land holding, annual income, local institutional participation

and extension participation showed significant relationship with attitude in irrigated tract. Aspiration was significantly associated with education, annual income, land holding, local institutional participation and mass media showed significant relationship with aspiration level of the respondents.

Study on Aspirations of Rural Youth and Their Attitude Towards Rural Developmental Activities in Dharwad District of Karnataka State

V. L. BHANU

2006

MAJOR ADVISOR : DR. K. V. NATIKAR

Youth are the most potent segment of the population of a country. They have been playing quite a significant role in almost every country of the world as they possess the zeal and vigour necessary to create opportunities for national development. The study was conducted in Dharwad, Hubli, Khalaghatagi and Kundagol taluks of Dharwad district during 2005-06. Three villages from each taluk were selected based on the presence of active youth club. From each village 10 respondents were selected based on their membership in the youth club to make the sample size of 120 respondents. The important findings of the study were 26.67 per cent of rural youth aspired for education upto SSLC followed by 25.00 per cent aspired for education upto degree. Majority of the rural youth (60.83%) aspired to take up farming as their occupation. Further majority of rural youth ranked agriculture (crop production) as 1st in the order of preference to different enterprises. And a large percentage (65.00%) of

the respondents had medium general aspirations. A majority of the rural youth (72.50%) had favourable attitude towards rural developmental activities. Positive and significant relationship was observed between dependent variables like educational aspirations, occupational aspirations, enterprise aspiration and general aspirations of rural youth with independent variables like education, mass media utilization, annual income, extension contact, economic motivation and achievement motivation. Whereas, negative and significant relationship was observed between educational aspirations of rural youth and age. Cent per cent of the respondents expressed that rural developmental activities are 'Risky and time consuming' and 'No reorganization or awards for participation' as the important constraints and 'Daily wages have to be given to the every individual. who participate in the activity' as their suggestion for better participation of rural youth in rural developmental activities.

Effect of Nitrogen on growth, Yield and Oil Content of Patchouli (*Pogostemon patchouli* Pellet) Under Mixed Tree Plantation

AJIT M. KULKARNI

2006

MAJOR ADVISOR: Dr. S. K. PATIL

A field experiment was laid out in a randomized block design with nine treatments and three replications at College of Forestry, Sirsi, to study the effect of nitrogen on growth, yield and oil content of patchouli (*Pogostemon patchouli* Pellet) under mixed tree plantation. Results revealed that, in general, application of 66.66 and 83.33 kg N/ha in three equal splits recorded the maximum value for all the growth parameters in first and second crop respectively. In first crop, the maximum fresh and dry herbage yield per hectare of 9.95 and 1.74 tonnes, respectively was recorded in treatment involving application of 66.66 kg N/ha in three equal splits. Whereas in second crop coinciding with rainy season, the treatment involving application of 83.33 kg N/ha in three equal splits produced the higher fresh and dry herbage yield per hectare of 6.62 and

1.21 tonnes, respectively. The maximum cumulative fresh and dry herbage yield per hectare and net returns (15.09 t, 2.77 t and Rs. 48,610/year/ha, respectively) were recorded in treatment involving application of 66.66 kg N/ha in three equal splits. Oil content (%) of herbage did not differ significantly from control due to the nitrogen application. The cumulative oil yield per hectare was maximum (81.07 kg) in treatment involving application of 66.66 kg N/ha in three equal splits. N concentration (%) in plant tissue was increased with levels of N applied. There was an increase in available NPK in soil due to their external application. Finally it is concluded that the application of 66.66 kg N/ha in three equal splits to first crop and 83.33 kg N/ha in three equal splits to second crop is advisable for cultivation of patchouli under mixed tree plantation.

Studies on Reducing Tree Crop Competition in Teak Based Agroforestry System

P. PURUSHOTHAMA

2006

MAJOR ADVISOR: Dr. S. L. MADIWALAR

Upland paddy cultivation is a predominant system in the hill zone (9) of Karnataka. Teak has been introduced to this unique agroclimatic situation and teak based agroforestry system has gained popularity in the recent past. With the increase in growth/age of teak trees, there is greater suppression of associated field crops. This competitive effect can be further increased in the absence of tree management. The present study was under taken to find out suitable methods to reduce tree crop competition in teak based agroforestry system. The growth and yield parameters of paddy viz. plant height, number of tillers, dry weight, number of panicles, straw and grain yield were significantly higher due to thinning over no thinning. Among the competition reducing methods, higher grain yield was noticed in treatment receiving trenching (2819 kg/ha). Combination of thinning + trenching recorded higher grain yield (3642 kg/ha). Basal area and main stem volume per plant of teak was

significantly higher due to thinning. Branch pruning showed same trend on growth parameter of teak. Combination of thinning with branch pruning as well as root barrier had higher main stem volume. Net returns were significantly higher due to thinning (Rs. 31,186/ha). The higher net returns were recorded in treatment receiving trenching (Rs. 31,444/ha) followed by root barrier (Rs.28,607/ha). Combination of thinning with trenching recorded higher net returns (Rs.38,309/ha) than rest of the combinations. Soil moisture content, light transmission ratio (LTR) and relative crop yield were significantly higher due to thinning and competition reducing methods. Among the competition reducing methods trenching + branch pruning recorded higher soil moisture content (13.71%). Higher LTR was noticed in branch pruning treatment (69.34%). Relative crop yield was higher in treatment receiving trenching (72.27%), combination of thinning with trenching recorded higher relative crop yield compared to rest of the treatments.

Disease Situation in Different Agroforestry Systems in Hilly Tract (Zone- 9) of Karnataka

G. SREEDHARA

2006

MAJOR ADVISOR : Dr. S. T. NAIK

Survey for diseases in agroforestry systems was undertaken in nine taluks. During rainy season in sole crop and at 3m distance from base of trees, maximum incidence and PDI of blast of paddy was recorded at Tyagali with *Acacia auriculiformis* and minimum with Teak in Burunkae. While at 6m distance, maximum was noticed with Mango at Kalghatgi taluk and minimum was recorded with teak in Burunkae. In sole cotton and at 3m distance from base of trees, maximum incidence and PDI of angular leaf spot was documented at Linganamath with teak and minimum was recorded at Singanahalli. The observations recorded at 6m distance also had similar trend. In sole maize and at 3m distance from base of *Acacia mangium*, maximum incidence and PDI of leaf blight was recorded at Gudnapur and no disease was recorded at Devikoppa. Similar trend was noticed at 6m distance from base of tree rows. During post rainy season in sole crop, at 3m and 6m distance from base of trees, the maximum

incidence recorded was in leaf curl of Black gram at Mundgod. Sunhemp crop at Sirsi, maize at Ajagav and horscgram at Hangal were free from any diseases. There was low incidence in free species. The maximum incidence of Kole roga was noticed in home gardens with a single component and minimum with four or five components. In Agrisilviculture system, highest maximum temperature, RH, at both 3m and 6m from base of tree rows was recorded in bund planting type of agroforestry system. Results of the correlation matrix between PDI of blast of paddy and the weather parameters indicated that, maximum relative humidity and rainfall had positive association with PDI of blast. Results obtained on path coefficient analyses for sole crop, at 3m and 6m from base of trees suggested that maximum relative humidity and rainfall had positive effects suggesting that these will help in disease development.

Seed Source Variation for seed and Seedling Attributes in *Jatropha curcas* L.

K. B. SRIDHAR

2006

MAJOR ADVISOR : Dr. H. SHIVANNA

The Investigation on Seed Source Variation for seed and seedling attributes in *Jatropha curcas* L. was conducted at the College of Forestry, Sirsi. The study was laid out by following completely randomized design with ten treatments (seed sources) and three replications. In large seed source seed length, seed width and test weight were 18.59 mm, 9.57 mm and 846 gm respectively in Banavasi seed source which was found to be superior from rest of the seed sources. For the same parameter in small seed source it recorded 14.89 mm, 7.88 mm and test weight of 610 mm respectively. However, Gouribidanur seed source recorded the least for the seed parameters. Maximum germination was recorded for large and small seeds in Banavasi seed source (95.23% and 71.42%) respectively and the least was recorded in Gouribidanur seed source (61.90% and 38.09%). At 120 Days after germination, maximum seedling height for

large and small seeds was recorded in Banavasi source (59.39 cm and 28.97 cm) respectively. Similar trend was noticed for collar diameter and number of leaves per seedling also. The shoot length and root length traits for large and small seed was higher in Banavasi source (53 cm and 24.30 cm) respectively at 120 Days after germination and lowest was for Gouribidanur source (40.20 cm and 13.80 cm). The highest shoot biomass (116.5 g and 44.50g) was recorded for Tiptur source followed by Tumkur source. Banavasi seed source outperformed the other seed sources in the study by recording highest oil content (55.50%), followed by Tiptur (54.25%), Doddaballapur (51.58%) and Shivamoga (50.50%) source. Thus Banavasi, Shivamogga and Tiptur seed source were found most promising. The breeding zones may be set up in these areas and the best genotypes selected from them for further breeding work.

Survey, Epidemiology and Management of Leaf Spot and Blight Disease of *Pongamia pinnata* (L.) Pierre - A Potential Bio-Fuel Yields

C. M. SIDDARAJU

2006

MAJOR ADVISOR: Dr. V. SURYANARAYANA

Pongamia pinnata (L.) Pierre. is a bio-fuel yielding tree having a potential role in medicinal, industrial and agriculture sectors. *Fusicladium* leaf spot and blight disease is the major constraint in raising quality planting stock. Hence, the study on "Survey, epidemiology and management of leaf spot and blight disease of *Pongamia pinnata* (L.) Pierre. " was taken up. Survey for *Fusicladium* leaf spot and blight disease of *Pongamia* in 14 forest nurseries falling under bio-climatic dry zone of Karnataka revealed highest incidence and PDI of 91.04 per cent and 57.20 per cent respectively were recorded in Hirekerur nursery of Haveri district. The lowest disease incidence and PDI of 63.50 per cent and 36.70 per cent respectively were registered in Mundargi nursery of Gadag district. Epidemiological studies revealed high per cent disease index from October to December, 2005 (56.90-73.72%) and least during June (23.15 %).

Study on disease progression at fortnight intervals showed a maximum 'r' value during second fortnight of October (0.0188) and least during second fortnight of May (0.0005). Per cent defoliation and seedling mortality due to disease was highest in December (34.96 % and 12.5 % respectively). In, *in-vitro* evaluation of fungicides, plant extracts and bio-agents against *Fusicladium pongamiae*, Penconazole, Carbendazim and Propiconazole resulted cent per cent growth inhibition. Among plant extracts and bio-agents, fresh leaf extract of *Prosopis juliflora* and the Strain EPBC-71 of *Bacillus subtilis* showed a maximum growth inhibition and zone of inhibition (78.22 % and 16.50mm respectively). In field evaluations, Carbendazim sprays at fortnight interval showed least increase in PDI (51.21 to 61.74) and rate of disease progression (0.0042 to 0.0031) after 90 days of spray. Increased height and collar in the treatment (Carbendazim @ 0.1%) and reduction in leaf defoliation (14.67%) was also observed.

Influence of Manure and Fertilizer on Early Seedling Growth and Camptothecin Content of *Nothapodytes nimmoniana* (GRAH.) Mabbar - An Important Anti Cancer Drug Yielding Tree

TULSI DAS

2006

MAJOR ADVISOR : Dr. R. VASUDEVA

Nothapodytes nimmoniana is the one of the important medicinal plants that yield an active principle in the wood, camptothecin (CPT). CPT is known as a potent drug that breaks single-stranded DNA in the mammalian systems and is found to be useful in the treatment of mammalian tumours. Studies on nursery techniques are important to domesticate this species such that wood becomes an important industrial

raw material. Three separate experiments were conducted at the College of Forestry, Sirsi to understand the influence of manure, fertilizer and of the shade on the initial growth of the seedlings. Wild collected seeds were germinated and seedlings were raised in poly-ethylene bags (30 cm x 20 cm). Completely Randomized Design was adopted in the study. Application of manure significantly influenced the growth, vigour and biomass of

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seedlings. At the end of one year, maximum height (31.37 cm) was obtained when 10 g of pig manure was supplied in two equal split applications (T_3). Fresh shoot weight (11.43g), total dry weight per plant (15.51g) was also highest with T_3 . Maximum growth in collar diameter (9.76 mm), number of leaves per plant (8.2), total leaf area per seedling, was obtained when 10 g of pig manure was supplied in only one application. Influence of fertilizers on the seedling traits was also significant. Maximum height growth (27.73 cm), fresh weight (33.7 g) and total dry weight (13.84g)

were found with the application of T_4 (0.46:0.616:0 g of NPK per plant). Different levels of shade significantly influenced the seedling growth. Maximum height growth (19.41 cm), basal diameter (6.92 mm) and number of leaves per plant (8.07) were observed when the seedlings grown under maximum shade (i.e. by providing 75% shade). Total biomass was however, maximum (11.41 g) when 50% shade was provided. Interestingly, leaf CPT content of seedlings treated with fertilizers showed significant differences and maximum leaf CPT was found with the application of 2 g DAP per plant.

AGRICULTURAL ENGINEERING

Prioritization of Subwatersheds Based on Geomorphological Characteristics of Ag2 Watershed in Krishna River Subcatchment (Karnataka)

N. ASHOKKUMAR

2006

MAJOR ADVISOR: Dr. B. MAHESHWARA BABU

Quantitative analysis of morphological parameters of 11 subwatersheds of Ag2 watershed was carried out, which are important from hydrological studies point of view. The priority fixation of subwatersheds in Ag2 watershed is needed because it is difficult to implement soil conservation measures in entire subwatersheds at the same time for the shortage of time and manpower. The priority fixation was done using seven morphological parameters viz. form factor, drainage texture, time of concentration, bifurcation ratio, relief ratio, average slope and drainage density of subwatersheds separately. The value of different factors was ranked in descending order. Priority was given based on the rank number (lowest to highest). Finally an overall priority index was preferred which

was an average of rating values of all individual parameters so that effect of any particular parameter showing diversion to other normal values, may be diluted. The number of subwatersheds under very high priority, high priority and lower priority were found 4, 6 and 1 respectively. From the hypsometric analysis, the hypsometric integral of Ag2k, Ag2m, Ag2n, Ag2p, Ag2q, Ag2s, Ag2t and Ag2w were found to be 0.413, 0.50, 0.532, 0.485, 0.461, 0.531, 0.55 and 0.469. These eight subwatersheds were susceptible to less erosion. The hypsometric integral of Ag2r, Ag2u and Ag2v were found to be 0.628, 0.918 and 0.772. These three subwatersheds were susceptible to severe erosion.

Integrated Nutrient Management for Growth, Flowering, and Xanthophyll Yield of Marigold (*Tagetes erecta* L.)

B.M. SHUBHA

2006

MAJOR ADVISOR: Dr. B. HEMLA NAIK

Marigold is one of the important commercial flower crops of India, which ranks first among the loose flowers. It is not only grown as a cut flower and in landscaping but also as a source of natural carotenoid pigment, 'xanthophyll'. It is used in poultry industries to intensify yellow-orange colour of egg yolk and broiler skin. Marigold xanthophyll is gaining lot of importance in the international market. The study was conducted to find out the best integrated nutrient approach with organic manures, biofertilizers along with 75% recommended dose phosphorus (RDP) and nitrogen (RDN) for higher growth, flower and xanthophyll yield in Alfisol at Floriculture Unit, Department of Horticulture, MARS, UAS, Dharwad, during Rabi, 2005-06. The vegetative parameters viz., plant height, plant spread, number of primary and secondary branches per plant, number of leaves per plant, total dry matter production were recorded maximum in

treatment T_8 (i.e., vermicompost (12.5 % N) + poultry manure (12.5 % N) + 200 g of *Azospirillum* along with 75% RDN/ha) at 30, 60, 90 and 120 days after transplanting. The same treatment T_8 found to be early for flower bud initiation, 50% flowering and maximum flowering duration. Similarly the floral characters, viz., flower diameter, number of petals per flower, were also maximum in the same treatment. Besides the above, yield components like number of flowers per plant, flower yield, petal meal yield, xanthophyll yield per hectare with maximum net returns and B: C ratio, uptake of N and P were also maximum in the treatment combination of vermicompost (12.5 % N) + poultry manure (12.5 % N) + *Azospirillum* along with 75% RDN/ha. Overall the above treatment was significantly superior to all other treatment combinations tried.

HORTICULTURE

Evaluation of Promising Hybrids of Gladiolus

L. RASHMI

2006

MAJOR ADVISOR: Dr.A. A. PATIL

The present investigations on 10 hybrids and one check variety of *Gladiolus hybridus* were carried out to know their performance and to findout their suitability for cut flower production under transitional tract of Karnataka. There were significant variations for all the characters among the genotypes studied. Dharwad 10, Dharwad -1, Dharwad - 3, Dharwad - 7 and Dharwad -5 showed superior performance over other hybrids and also check variety with respect to number of days taken for first floret to open, spike length, number of florets per spike, rachis length and dormancy period etc. Spike characters are important with regard to cut flower production in gladiolus especially when we consider quality. The hybrids under study have shown significant differences with respect to spike length, spike girth, rachis length and weight of the spike.

Spike length showed a significant positive correlation with average weight of corm (planted), plant height, girth of spike, weight of the spike, rachis length, number of florets per spike and number of cormels per plant at genotypic level. The highest direct effect on spike length was observed in case of number of days taken for first floret to open, number of florets per spike average weight of corm planted, length of the rachis and number of cormels per plant. The present study revealed that the improvement in gladiolus for qualitative and quantitative characters can be done by direct selection for desired characters like average weight of corm (planted), number of florets per spike, marketable spike per plant, number of cormels per plant and number of days taken for first floret to open.

Heterosis and Combining Ability Studies in Okra (*Abelmoschus esculentus* L. Moench)

H. B. ANIL

2006

MAJOR ADVISOR : Dr. M. G. PATIL

The study was undertaken to elicit the information on heterosis, combining ability and nature of association of component characters

with yield and its components in okra. Line x tester method was used for crossing eight lines with four testers. Thirty two F_1 s hybrid along with

Abstract of Theses

their parents and three commercial checks were planted in randomized block design during summer 2006 on red sandy loam soil at Department of Horticulture, College of Agriculture, Raichur. Hybrids showed significant differences for most of the characters studied. Significant *per se* performance and standard heterosis in desirable direction were recorded in several crosses. The crosses Arka Anamika x Punjab Padmini, Arka Anamika x Pusa Sawani, Arka Anamika x HRB-55 and Arka Abhay x Pusa Sawani exhibited maximum heterosis for yield over all the parents and checks. These were found suitable for commercial exploitation. The combining ability studies indicated both additive and non-additive type of gene actions in determining the expression of characters. The line Arka

Anamika and tester Pusa sawani are good general combiners for many characters. The cross Arka Abhay x Pusa Sawani and HRB-9-2 x Punjab Padmini were good specific cross combination for yield component. The simple correlation studies showed that direct positive correlation of number of fruits per plant, average fruit weight, number of leaves per plant and negative correlation for days to fifty per cent flowering with total yield per plant indicating that direct selection for these characters will improve the yield per plant. The study of path analysis have showed that number of fruits per plant had high positive direct effect on total yield per plant and indirect effect through number of nodes per plant which indicates the direct selection of this trait will improve the yield.

Hormonal Regulation of Growth and Yield in Jasmine (*Jasminum auriculatum* Vahl.)

P. SRIDHAR

2006

MAJOR ADVISOR : Dr. S. G. ANGADI

Jasmine is one of the important commercial flower crops grown for its white fragrant flowers largely used for garland and floral decoration. The jasmine belongs to family 'Oleaceae'. A study on the effects of four growth regulators viz., NAA, cycocel, gibberellic acid and ethrel each at two concentrations was carried out on *Jasminum auriculatum* Vahl. in the Floriculture Unit of the Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad during 2005-06. The main objective was to evaluate their effects on growth, flowering and yield of *Jasminum auriculatum* Vahl. GA₃ at both the concentrations significantly increased primary and secondary lateral shoot length, GA₃ gave more number of internodes and enhanced the internodal length. GA₃ increased the length and width of the leaves with an associated increase in the total leaf area and slightly reduced number of leaves. Cycocel and

ethrel were equally effective in increasing the number of productive shoots closely followed by NAA. Reduced number of productive shoots was observed under high concentration of gibberellic acid. Cycocel at 500 ppm induced early flowering and registered longer duration of flowering. Cycocel at 500 ppm recorded highest yield in terms of both weight and number of flowers, whereas both the concentrations of GA₃ registered lowest values. Cycocel at 500 ppm recorded highest length of flower bud and increased the weight of hundred flower buds, whereas both the concentrations of GA₃ recorded lowest length of flower bud and reduced the weight of hundred flower buds. Cycocel at 500 ppm increased chlorophyll 'a' content whereas ethrel at 100 ppm increased chlorophyll 'b' content. The total chlorophyll content was maximum with cycocel at 500 ppm.

Micropropagation of Ginger (*Zingiber officinale* Rosc.)

RAJANI C. HIREMATH

2006

MAJOR ADVISOR: Dr. S. S. PATIL

An investigation on micropropagation of zinger (*Zingiber officinale* Rosc.) was carried out during 2004-06 at the Tissue Culture Laboratory of Department of Horticulture, College of Agriculture, University of Agricultural Sciences, Dharwad. In the present investigation five sub experiments were carried out by following CRD design and 't' test in order to find out best surface sterilizer, explant, shooting media, rooting media and hardening material. Regarding the suitability of explants, shoot tip was the best for culture establishment by producing more number of adventitious shoots in a shorter period of time i.e., early emergence of primordial than the axillary bud. The study on surface sterilization revealed that explants treated with 0.1 per cent mercuric chloride for 12 minutes, showed the highest aseptic culture establishment. Among the two different explants viz., shoot tips axillary buds treated, shoot tips gave maximum survival percentage and healthy culture establishment. Early response

for sprouting and better culture establishment of shoot tip were observed on Murashige and Skoog (MS medium). Among the cytokinins, BAP and kinetin at different concentrations, 2.0 mg/l BAP. Produced more number of multiple shoots. Media with the highest cytokinin concentration showed the maximum number of multiple shoots and lowest length of shoots. On cytokinin free medium single shoot with maximum length were produced. Among the auxins used in the rooting experiment the maximum number of roots, with less number of day taken for initiation were observed on 1 mg/l IBA supplemented medium. NAA was found less effective than IBA. On auxin free medium maximum root length was produced. Peat medium gave highest survival percentage at 15 and 30 days after transfer to hardening media and better vigour of the plantlets were observed in peat media, followed by vermiculture and sand media.

Propagation Studies in Aonla (*Phyllanthus emblica* L.)

D. GOVINDA NAYAKA

2006

MAJOR ADVISOR: Dr. A. N. MOKASHI

Studies on seed germination, softwood grafting and micro propagation were carried at Department of Horticulture, University of Agricultural Sciences, Dharwad during 2005-2006. In seed germination studies, the seeds scarified with concentrated sulphuric acid for 30 seconds were found to be the best one with very high per cent germination (80.39), taking least number of days for 50 per cent germination (12.27) and highest vigour index (1223). Propagation studies revealed that, season of grafting had profound influence on graft success. Maximum success per cent of 87.50 was recorded in November grafting followed by 66.69 per cent in case of December. Least success was recorded during June grafting (16.52%). Influences of rootstock age on success of grafts were significant.

The higher per cent successful grafts (62.88) were observed in eight months old rootstocks followed by four months (56.25%) old rootstocks. In the studies on micropropagation, nodal segments from mature tree as explants were used with use of growth regulators (Kinetin and GA₃) at various concentrations for shoot proliferation. MS medium supplement with Kinetin at 2.0 mg/l with GA₃ 0.5 mg/l resulted in more number of shoots (3.28) and less number of days taken for bud initiation (7.07). All the concentrations of IBA and NAA used individually for *in vitro* rooting of micro shoots failed to induce rooting. However combination of IBA (2.0 mg/l) and NAA (2.0 mg/l) has resulted in callus induction at cut end of *in vitro* shoots.

FLORICULTURE AND LANDSCAPE GARDENING

Propagation Studies in Carnation (*Dianthus caryophyllus* L.) by Stem Cuttings under Mist Ecosystem

MAHESH V. NAIK

2006

MAJOR ADVISOR: Dr. P. M. GANGADHARAPPA

An investigation on induction of rooting in carnation stem cuttings under mist using different rooting media and growth regulator formulations was conducted during 2001-02. The study revealed that among the different rooting media tried, rooting and establishment of carnation cuttings were best in sand medium followed by sand + coir pith (1:1) and vermicompost. The performance of other rooting media such as soil, human hair and sphagnum moss was in the next order. The performance of sphagnum moss along with sand and vermicompost (1:1:1) was very poor in carnation cuttings. Among the different growth regulator formulations tried on rooting and establishment of carnation cuttings under

pre-standardised rooting media (sand + coir pith in 1:1 proportion), IAA 100 ppm + NAA 100 ppm formulation helped in induction of rooting by over 88.89 per cent as against 66.67 per cent in NAA at 500 ppm. Using IAA and NAA, singly or in combination at 100 or 200 ppm was also effective in promoting better root characters. However, use of higher concentration especially at 400 and 500 ppm was not promotive. It could be summarised that the rooting in carnation can be enhanced by pre-treatment of cuttings with IAA 100 ppm + NAA 100 ppm and planting in either sand or sand + coir pith (1:1) media and placing them under mist to accomplish higher turnover of planting material.

Variability Studies in Dahlia (*Dahlia variabilis* L.)

G. H. BASAVARAJU

2006

MAJOR ADVISOR: Dr. BALAJI S. KULKARNI

An investigation with twenty accessions of dahlia was carried out to generate information on genetic variability, character association and path coefficient analysis at Department of Floriculture and Landscaping, Kittur Rani Channamma College of Horticulture, Arabhavi during March to July, 2006. Analysis of variance revealed that significant differences among accessions for growth, flowering, yield and quality parameters. The phenotypic and genotypic coefficient of variations were recorded high for the traits like individual flower weight, individual tuber weight, number of flowers per plant, flower diameter and length of petals, indicating existence of wide range of genetic variability among the evaluated germplasms. Hence, there is a good scope for further improvement of these characters. High heritability estimates coupled with high genetic advance over percent of mean were observed for the traits like number of flowers per plant, individual flower weight, individual

tuber weight, number of petals per flower, flower diameter, length of petals, days to first flowering and number of branches, indicating the predominance of additive gene component. Therefore, simple selection for these characters would be rewarding. Correlation studies revealed significant and positive association of yield with plant height, number of branches, plant spread, number of leaves, duration of crop and number of tubers per plant, suggesting the possibility of simultaneous selection for these traits. High direct effect of path analysis for flower yield recorded for plant height, number of branches, number of leaves and days to 50 percent flowering indicated the possibility of increasing flower yield by selecting the accession considering these characters directly. Per se performance suggested that ACD-16, ACD-14, ACD-5 and ACD-20 were found promising for flower yield.

Response of Rose Cultivars to Bending and Pruning Under Shadehouse

AMITH GAURAV SOANS

2006

MAJOR ADVISOR : Dr. B. S. REDDY

Experiment was carried out to study the response of eight rose cultivars to bending and pruning under shadehouse conditions at Kittur Rani Channamma College of Horticulture, Arabhavi in the year 2006. Cultivar Diplomat recorded the highest number of new sprouts, shoots whereas, Grand Gala and First Red recorded the highest shoot length and girth. Bending resulted in better vegetative growth over pruning and control. Bending in Grand gala produced the highest number of sprouts, increased shoot length and girth. Grand Gala and Konfetti showed early flower bud development. Pruning in Skyline and Tineke resulted in early

sprouting. Cultivar Diplomat recorded the highest flower yield when subjected to bending. Quality parameters like stalk length, flower bud length and vase life were superior in the cultivar Grand Gala. Cultivar Samurai had maximum flower diameter and number of petals. The yield of marketable flowers was higher in the cultivar Diplomat. In general, bending operation in rose performed better with respect to yield and quality flower production. Among the cultivars studied, Diplomat was better in flower production, whereas Grand Gala produced quality flowers.

POMOLOGY

Response of Jamun to Arbuscular Mycorrhizal Fungi (AM Fungi) and Bioformulations on Germination, Growth of Rootstocks, Graft -Take and Tolerance to Induced Moisture Stress

NONGTHOMBAM DEVACHANDRA

2006

MAJOR ADVISOR : Dr. P. B. PATIL

An investigation was carried out to study the response of jamun to different AM fungi and bioformulations on germination, growth, graft-take and tolerance to induced moisture stress at the Department of Pomology, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Agricultural Sciences, Dharwad, during 2005-2006. The inoculation of seeds with *Glomus fasciculatum* and *Glomus intraradices* recorded significantly maximum germination (89.00% each). The vegetative parameters, viz., plant height, stem diameter, number of leaves,

root parameters and biomass production were significantly enhanced by *G. fasciculatum*, *G. intraradices*, *G. monosporum*, and *Sclerocystis dussii*. These four AM fungi enhanced the rootstock growth to attain stem girth of graftable size in third month itself after sowing when compared to control. Higher relative mycorrhizal dependency was recorded in *G. fasciculatum* with respect to germination (10.11%), stem diameter (28.08%), number of leaves (27.10%), root volume (40.98%), rootstock dry weight (50.81%) and nitrogen content (34.08%). *G. fasciculatum* inoculated grafts.

OLERICULTURE

Studies on Heterosis and Combining Ability in Capsicum (*Capsicum annuum* L.)

CHANDRAKANT KAMBLE

2006

MAJOR ADVISOR: Dr. RAVINDRA MULGE

The investigation on heterosis and combining ability was carried out in capsicum at K.R.C. College of Horticulture, Arabhavi. Forty five F1 hybrids developed by crossing 15 lines with three testers were evaluated along with parents in RBD with three replications and data was subjected to line x tester analysis. The magnitude of heterosis over commercial check (Golden Summer) was high in desirable direction for number of fruits per plant (173.77%), early yield per plant (75.56%), total yield per plant (69.59%) and fruit yield per hectare (69.40%). The cross KCP02 x CW exhibited maximum and significant standard heterosis (69.59%) for total yield per plant followed by KCP12 x CW (67.70%), KCP04 x BGM (62.42%), KCP13 x BGM (61.94%) and KCP01 x BL (61.59%). The cross KCP11 x CW exhibited maximum and significant standard heterosis (75.56%) for early yield per plant followed by KCP12 x CW (46.12%). The best parent KCP03 had given highest yield (21.62 t/ha) among the

lines and testers and was superior to commercial check. The crosses KCP01 x BL and KCP12 x CW were identified as good specific combiners for total yield per plant. The lines KCP01, KCP02, KCP04, KCP05, KCP11, KCP12, KCP13 and KCP15 were identified as good general combiners for total yield per plant. Among the lines, KCP01, KCP03, KCP04, KCP05, KCP07, KCP11, KCP12 and KCP15 and among testers, BL were identified as good general combiners over all the 31 characters based on comprehensive study considering gca effects. Non additive gene action was predominant for days to 50 per cent flowering, stem girth at 30 DAT, plant height at 60 DAT, fruit skin thickness, fruit polar diameter, plant height at first branching and stem girth at 60 DAT. Additive gene action was predominant for number of ridges per fruit, ascorbic acid content, total chlorophyll content, average fruit weight and fruit stalk length.

Genetics of Growth, Yield and Quality Parameters in Pumpkin (*Cucurbita moschata* Duch. Ex. Poir.)

N. L. CHANDRAKUMAR

2006

MAJOR ADVISOR : Dr. M. B. MADALAGERI

The studies were undertaken to assess the nature of gene effects on important growth, yield and quality parameters in three crosses of Cross-I (Arka Chandan x IC 276312), Cross-II (Arka Chandan x CO-2) and Cross-III (BLG-I x CO-2) of pumpkin. A generation mean analysis design was followed by developing six genotypes of each cross to estimate the gene effects. All these six generations were field evaluated in randomised complete block design with three replications during kharif 2005 at Department of Olericulture, Kittur Rani Channamma College of Horticulture, Arabhavi, Karnataka. Analysis of variance revealed significant differences among the treatments for all the parameters in all the crosses except in Cross II and III number of fruits per vine. The estimates of population means and variances for different traits revealed higher variance and coefficient of variance in F₂ generation for most of the traits. The heterobeltiosis was significant in desired direction for most of growth, yield and quality parameters. The significant inbreeding depression was observed for most of growth (except leaf size), yield and quality traits. Inbreeding depression was not observed for flowering traits. The estimates of heritability and genetic advance over mean were moderate to high for

most of the traits studied. Scaling test revealed the presence of epistasis for all the traits studied except for number of fruits per vine (Cross I and II). Estimates of gene effects revealed the significance of additive (d) and / or dominance (h) gene effects in most of the traits except for number of traits per vine. The estimates of non-allelic interactions for most of the traits revealed the significance of additive x dominance (f) and dominance x dominance effects with duplicate type of epistasis except for number of leaves (Cross I), days to first flowering (for all the crosses), days to first female flowering (Cross I), node number for first female flower production (Cross I and III), number of fruits per vine (Cross II), cavity size (Cross I and II) and seed weight (cross III), where complementary type of epistasis was observed. The breeding methods like simple selection, reciprocal recurrent selection, heterosis breeding would be fruitful for improvement of the growth, yield and quality parameters in pumpkin. The correlation studies revealed positive and significant association of pumpkin yield with vine length number of primary branches, number of traits per vine, average fruit weight, trait diameter, trait length and flesh thickness.

Effect of Organic and Inorganic Fertilizers on Growth and Yield of Coleus (*Coleus forskohlii* Briq.)

SADASHIV V. NADUKERI

2006

MAJOR ADVISOR : Dr. K. N. KATTIMANI

A field experiment was conducted at the Department of Medicinal and Aromatic Plants, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Agricultural Sciences, Dharwad during 2005-2006 to study the effect of organic and inorganic fertilizers on growth and yield of coleus (*Coleus forskohlii* Briq.). Significant increase in the growth parameters viz., plant height (66.49 cm), number of branches per plant (85.95), number of leaves per plant (848.61), East-West (80.14 cm) and North-South plant spread (74.54 cm), dry matter accumulation in leaves (76.32 g/plant), stem (271.46 g/plant) and total dry matter accumulation (370.24 g/plant) and physiological parameters viz., leaf area (6746.46 cm²), leaf area index (7.49), absolute growth rate (3.394 g/plant/day), crop growth rate (0.943 g/m²/day), relative growth rate (0.0460

g/g/week) and net assimilation rate (0.00214 g/m²/day) were recorded when the crop was supplied with 75 per cent RDF + 10 t FYM + Vermicompost 5 t per ha. Application of 75 per cent RDF + 10 t FYM + Vermicompost 5 t per ha recorded significantly highest number of tubers (26.58/plant), length of tuber (23.16 cm), diameter of tuber (2.25 cm), fresh tuber (250.5 q/ha) and dry tuber (32.81 q/ha) yield as compared to other treatments. The highest gross returns (Rs. 1,31,240/ha) and net returns (Rs. 98,680/ha) were recorded with application of 75 per cent RDF + 10 t FYM + Vermicompost 5 t per ha as compared to other treatments. The lowest gross returns (Rs. 93,360/ha) and net returns (Rs. 62,467/ha) were recorded with application of 10 t FYM + Vermicompost 2.5 t per ha.

Nutritional Status and Dietary Guidelines of Predialytic and Hemodialytic Patients

SWETA SUMAN

2006

MAJOR ADVISOR : Dr. USHA MALAGI

An investigation was undertaken with an objective to assess the nutritional status of renal patients and document the related complications and suggest suitable dietary guidelines. Predialytic (n=20) and hemodialytic (n=25) patients were selected from Karnataka Institute of Medical Sciences, Hubli, Karnataka. The personal information, prevalent vices, exercise behaviour, dietary modifications and clinical and health status of the subjects were recorded by using pre-tested questionnaire. Etiology of the chronic renal disease, complications and biochemical parameters were documented from the case files. The nutritional status of the patients was assessed by dietary, anthropometric and biochemical methods. Chronic glomerulonephritis (40% in each) followed by diabetes mellitus (30% in predialytics and 32% in dialytics) were the most common etiology for chronic renal failure. Pallor of eyes was the most prevailing sign and the most common complication was anaemia (100%). The dialytics had higher mean values for all the anthropometric measurements compared

to predialytics however, both groups had mean values lower than NCHS standards. The mean nutrient intake viz., energy, protein, fats, carbohydrates, fiber, minerals, electrolytes and vitamins were significantly higher in dialytics compared to predialytics. When the subjects were divided based on adequacy of nutrients, higher percentage of predialytics had low adequacy compared to dialytics for energy, carbohydrates, fats, sodium and potassium except for protein. When the biochemical parameters were considered, higher percentage of dialytics had acceptable levels for serum albumin and serum total protein compared to predialytics except for hemoglobin. Suitable dietary guidelines were formulated for dialytics and predialytics based on associated conditions such as hypertension and diabetes mellitus and patient's glomerular filtration rate. Low protein, sodium and potassium and high carbohydrate diets were formulated for predialytics and high protein, low sodium and potassium for dialytics, making variations according to individual requirements.