

Ph. D.

Genetics and Plant Breeding

Genetics of Nitrogen Fixation Parameters in Relation to Yield and Yield Attributes, Effect of Rhizobial Types on Inheritance of Nitrogen Fixation Parameters and Genotypic Response to Different Inoculants in Chickpea (*Cicer arietinum* L.)

C. J. DANGARIA

1992

Major Advisor : R. PARAMESWARAPPA

The investigations were carried out at UAS, Dharwad during *rabi* 1990, to derive information on genetics of nitrogen fixation parameters in relation to yield and yield attributes in chickpea. Nine genotypes selected based on their diversity for nodulation attributes through 9 x 9 F₁ and F₂ half diallel. The F₁ diallel was also studied in greenhouse under two rhizobial types. Inoculation response of nine cultivars was assessed using three rhizobial strains. Substantial variability was observed for nitrogen fixation and seed yield. Heterosis for plant nitrogen uptake stemmed up from heterosis for nitrogen fixation parameters in highly heterotic hybrids. Positive heterosis for plant nitrogen uptake was associated with increased biomass. Heterosis for seed yield was mostly due to heterosis in pods per plant. Parallel relationship between heterosis and inbreeding depression for yield and yield attributes indicated importance of non-additive gene effects. Predominantly additive gene actions were evident for nitrogen fixation parameters while both additive and non-additive gene actions were operating for

yield. Parents K-850, P-180-1, 2375 and A-1 displayed high overall gca status of which former two showed high gca effects for nitrogen fixation parameters including nitrogenase activity. Hybrids 2375 x K-850 and P-180-1 x K-850 exhibited high heterosis as well as high sca status overall traits and were suggested for further exploitation to improve yield with nitrogen fixation in chickpea. Biological yield, pods/plant and secondary branches were of primary importance for selection in F₂ population. In an experiment involving different rhizobial types, high gca status of K-850 and P-180-1 and high sca as well as heterosis status of hybrids P-180-1 x K-850 and 2375 x K-850 showed greater insensitivity across the rhizobial genotypes. Differences due to cultivars and strains were significant for majority but their interaction effects were non significant for majority of traits. K-850 and GP-6 were high nodulating cultivars while strains IC-59 and IC-2002 were significantly superior for nodulation and yield.

Agronomy

Investigations on Soil Solarization for Weed Control

P. V. HABEEBURRAHMAN

1992

Major Advisor : DR. M. M. HOSMANI

Field experiments and laboratory studies were conducted during the period April 1990 to

October 1991 at Agricultural College Farm, Dharwad to find out effects of soil solarization on control of

weeds in succeeding *Kharif* crops, on the performance and yield of *kharif* crops succeeding soil solarization, on the germination of seeds or other underground structures of different weed species buried at different depths and on the soil microbial population. The magnitude of rise in soil temperature due to transparent polyethylene 0.05 mm, transparent polyethylene 0.1 mm and black polyethylene was 10 to 13° C, 5 to 7° C and 3 to 5° C, respectively over non solarized treatments. There was significant reduction in the number and dry weight of weeds even upto the harvest of jowar and groundnut due to solarization with transparent polyethylene. Maximum extent of weed reduction was due to transparent polyethylene 0.05 mm for 40 days. Significantly higher grain yield of jowar and pod yield of groundnut were obtained due to transparent polyethylene 0.05 mm

for 40 days which were on par with weed free check and superior to normal practice of weed control. Among the weed species tried, the germination of all except *Cyperus rotundus*, *Cynodon dactylon* and *Digitaria marginata* could be significantly reduced by transparent polyethylene 0.05 mm for 40 days. The effect was more pronounced at 5 cm depth as compared to 10 cm. At 5 cm, the reduction in germination of *Ageratum conyzoides*, *Euphorbia hirta* and *Amaranthus spinosus* ranged from 54 to 84 per cent due to transparent polyethylene 0.05 mm for 40 days. The germination of all species except *C. rotundus* came down from 74% at 35° C to 0.2% at 50° C. Solarization with transparent polyethylene 0.05 mm for 40 days caused significant reduction in fungal population of soil, bacteria and actinomycetes remaining unaffected.

Horticulture

Studies on Back Pruning, Growth Retardants and Pinching in some Cultivars of Grape (*Vitis vinifera* L.)

VIVEK R. BHAT

1992

Major Advisor : N. C. HULAMANI

Studies were conducted over two seasons at vineyard of Agricultural College, Dharwad under two experiments – I. on back pruning with four dates at an interval of 15 days from March 15th on three cultivars on bower system under factorial design with the objective of finding optimum date for back pruning; II. On growth retardants and pinching with two chemicals (Cycocel – at 500, 1000 and 1500 ppm and Maleic hydrazide – at 250, 500 and 750 ppm. sprayed on Thompson Seedless vines at 5– leaf stage) and five pinching levels (5/10/15/20/all the leaves above the top cluster on bearing shoot) imposed on the same vines after fruit set with two objectives of finding ideal chemical with its effective concentration and the pinching level optimum for higher fruitfulness and productivity under factorial design. Pruning in the first fortnight of April was effective in improving the fruitfulness and productivity. April 14th pruning resulted in maximum yield of better bunch through

its effect in lowering shoot vigour, leaf production and in increasing the chlorophyll synthesis and dry matter content, in dwarfening the canes and thickening them eventually. CCC 1500 ppm was superior in checking the vigour and in enhancing the fruitfulness leading to better bunch yield and quality. MH also improved the fruitfulness and yield at its low concentration but failed to maintain the quality. Leaf nitrogen and magnesium were improved by growth retardants, leading to improved chlorophyll content and higher dry matter assimilation. Reduction in cane length and shoot vigour resulted in thicker canes and proper inception of solar light that is evident in early attainment of flowering and fruit maturity. All the bunch characters and quality were improved by CCC. Pinching the shoots at 15–20 leaves above the top cluster appeared effective for higher bunch yield with better character and berry quality.

**Studies on Standardization of Softwood Grafting Technique in Cashewnut
(*Anacardium occidentale* L.)**

D. P. SAWKE

1992

Major Advisor : DR. G. S. SULIKERI

Experiments were conducted to standardize the softwood grafting in cashewnut (*Anacardium occidentale* L.) at the Agricultural College Farm, Dharwad (Karnataka) and Sagar Farm, Nanora (Goa), representing two distinct agro-climatic situations, transitional and coastal respectively from 1988 to 1990. Soaking of the nuts with more than 8 g for 48 hours in water resulted in better germination and growth of seedlings. Foliar application of 1.5 per cent urea at fortnightly interval till grafting ensured quicker growth of seedlings for grafting. Among the rootstocks Vengurla-4 was found to be better followed by Vengurla-3 and Anakkayam-1. As regards the age of rootstock, two-three month old seedling was found better. The studies have shown that softwood grafting can be practiced round the year except cold period under coastal climatic conditions and July to October under transitional belt. The investigation has also revealed that four to four and a half month old scion having 12-15

cm length and 6-8 mm thickness with precuring treatment of 12-14 days to grafting was found to be good. When scion material is short, especially during flowering period, sub-terminal, scion with emerging panicle or even fruited scion shoot could be used as a substitute for normal terminal scion. The studies have also revealed that scion could be stored in graftable condition upto five days after separation when packed in moist sphagnum moss wrapped with polythene sheet. During grafting, it was found essential to undertake seven to eight cm long sharp cut on scion stick to maximize the success of grafting. After grafting, retention of eight to ten leaves on rootstock till graft attained a autotropic conditions was found to be beneficial. Four to five month old grafts prepared in containers have been proved to be an ideal for better field establishment. Under scarcity of water, softwood grafts could be prepared on *in situ* raised four to five month old seedling.

M. Sc. (Agri.)

Genetics and Plant Breeding

**Genetic Variability for Photosynthetic and Yield Related Traits In Chickpea
(*Cicer arietinum* L.)**

ANILKUMAR T. V.

1992

Major Advisor : P. M. SALIMATH

A field experiment was conducted during *rabi* 1990 at the Agricultural Research Station, Dharwad to estimate the genetic variation for photosynthetic and yield related traits of chickpea at different stages of crop growth, their nature of association with seed yield as well as among themselves and to quantify the genetic diversity. The trial was conducted with 54 advanced generation breeding lines of chickpea laid out in a randomised complete

block design with two replications. The traits related to chlorophyll content at 60 and 75 DAS and leaf area parameters (LAI at 60 and 75 DAS and LAD) showed high genetic variation followed by high heritability and genetic advance expected over means of the respective traits. Number of pods, leaf area parameters and total dry matter at 75 DAS not only had high positive correlation with seed yield but they also showed strong positive

correlations among themselves. These all together form an important group of characters for indirect selection for yield improvement. Pod number, LAD (60–75 DAS) and total chlorophyll at 75 DAS showed high positive direct effects on seed yield. Most of the other traits contributed substantially through these traits towards seed yield. The D^2 values ranged widely to denote enormous diversity in the material under study. The 54 genotypes fell

into nine clusters of which the cluster V accounted for 34 of them. The grouping pattern showed that it is not possible to generalise the diversity of segregants with a common parentage as low. Based on the cluster means and diversity, different genotypes were identified as potential sources of genes for different characters. Canonical analysis strictly followed the grouping pattern as obtained by the D^2 analysis.

Standardization of Tissue Culture Procedures for Some Maintainer (B) Lines of *Kharif Sorghum (Sorghum bicolor (L.) Moench)*

SUMANGALA BHAT

1992 Major Advisor : M. S. KURUVINASHETTI

Standardization of the protocols for the induction and maintenance of callus and regeneration of plantlets from some maintainer lines (SB 101B, SB 323B and 296B) of *kharif* sorghum were investigated. Callus was induced on Murashige and Skoog's (MS) medium supplemented with different levels (1, 2, 4 and 8 mg/l) of 2, 4-D from young seedlings, mature and developing embryos, inflorescence and leaf sheath explants. The average frequency of induction of callus was 69.7, 63.2 and 49.7 per cent, respectively for SB 101B, SB 323B and 296B. Genotypic differences were observed with respect to frequency of callus induction, type of callus and regeneration of plants. Among the explants, immature inflorescence (4–5 cm) responded better than the others. Further, as a single inflorescence could provide 75–100 explants, it was considered to be the best material to start cultures. The calli from inflorescence and 14–18 days old embryos and leaf sheaths were white, hard and nodular. Calli from seedlings and mature embryos were unorganized and they could not be

maintained further. The optimum level of 2, 4-D for callus induction was 2 mg/l. In genotype SB 323B, both the explants and the calli produced dark brown pigments inhibiting the growth of callus. This problem was largely overcome by using activated charcoal (0.5 g/l) in the medium. Regeneration of plantlets from 4–6 months old callus of SB 101 B and SB 323 B occurred on hormone-free MS medium. Addition of 0.5 mg/l of benzyladenine improved the frequency of regeneration. Plants were not obtained from 296B callus. However, its maintainer line, 296A, responded well indicating cytoplasmic effects. The plantlets produced were mostly normal, except for a few albinos and with abnormal morphology. Microtome sections of the regenerating calli showed that plantlet formation was through somatic embryogenesis. Profuse rooting of the plantlets occurred on MS basal medium itself, but the addition of activated charcoal (0.5 g/l) reduced the number of roots per plantlets.

Heterosis and Combining Ability of Induced Mutant Restorer Lines in Sunflower (*Helianthus annuus L.*)

R. K. SUGOOR

1992

Major Advisor : DR. K. GIRIRAJ

RHA-298 is a high yielding, good combiner and rust resistant line. But it is late in maturity. With a view to induce variability for earliness, RHA-298 was treated with 0.3 per cent and 0.4

per cent EMS chemical. The individual plants of M^2 generation and control (untreated) plants were crossed with CMS-234 A and CMS-851 A. A

total of 50 hybrids along with control (check) hybrids were evaluated in L x T mating design during summer-92 season to assess the magnitude of heterosis and combining ability. The study in M_2 and M_3 generation revealed wide variability for all the characters studied. In general 0.3 per cent of EMS was more effective than 0.4 per cent enlarging variability for days to flowering, plant height, head diameter and stem girth. The study on heterosis over mid parent, higher parent and control (untreated) F_3 s revealed that the derived hybrids had high heterotic effect for seed yield, leaf area, head diameter, plant height and stem girth. The magnitude of average heterosis was to the extent of 266 per

cent of seed yield followed by head diameter (67%) and test weight (50%). Days to flowering recorded negative heterosis (-6.7% to -11.8%) which implied earliness in derived hybrids. Studies on combining ability analysis showed that seed yield and component characters were governed by non-additive gene action. Two lines, viz. P_{14} and P_{15} were good combiners for days to flowering. P_{14} and P_{15} recorded significant gca effects for most of the yield attributing characters and considered as good general combiners. The two derived crosses, viz. CMS-234 A x P_{15} and CMS-851 A x P_{14} recorded high sca effects and high *per se* performance for seed yield and oil content.

Tissue Culture Studies in Rabi Sorghum (*Sorghum bicolor* (L.) Moench)

VISHWANATH M. PATIL

1992 Major Advisor : M. S. KURUVINASHETTI

Protocols for callus induction from different explants, its maintenance and regeneration of plants from the established callus were standardized for four rabi cultivars, viz. M 35-1, SPV-86, GRS-1 and A-1. Explants from mature and immature embryos, seedlings raised *in vitro*, young leaf sheaths and inflorescences were cultured on Murashige and Skoog's (MS) medium with varying concentrations of 2, 4-D (1, 2, 4 and 8 mg l⁻¹). Generally, 2 mg l⁻¹ of 2, 4-D was found to be the best, irrespective of the source of explants or cultivars. Blackening of medium was observed in some of the cultivars with higher concentration of 2, 4-D, resulting in the reduction of the growth of callus. This problem was overcome by adding 0.5 g l⁻¹ of activated charcoal to the medium. Immature inflorescence (10-25 mm) was the best source of explants for callus induction (58.3%) in all the cultivars. Irrespective of the source of explants used, M 35-1 was the most responsive cultivar (51.2%). The results indicated that the frequency of callus induction was dependent

on genotype. The callus cultivars were satisfactorily maintained on MS medium supplemented with 2 mg l⁻¹ of benzyladenine (BA). Organized and unorganized calli occurred together in most cultures. However, the callus cultivars initiated from mature embryos and young seedlings were mushy and completely unorganized. Wherever possible, 10-12 weeks old organized callus masses were employed for regeneration of plantlets. Of the three media combinations tried, MS with 0.5 mg l⁻¹ of BA gave the highest frequency (82.5%) of regeneration, across all the four genotypes. But, regeneration of plants did not occur in any of the callus cultures initiated from mature embryos and young seedling tissues. The shoots produced healthy roots on MS medium with higher amount (80 g l⁻¹) of sucrose than with 40 g l⁻¹, normally employed for callus induction and plant regeneration. Microtome sections of the regenerating callus showed that plantlets occurred through somatic embryogenesis.

Agronomy

Response of *Bidi* Tobacco (*Nicotiana tabacum* L.) to Sucker and Fertilizer Levels

S. M. SANGAVE

1992

Major Advisor : M. D. KACHAPUR

A field experiment was conducted to know the response of *Bidi* tobacco to levels of sucker and fertilizer in the northern transitional zone during *kharif* 1990–91 under protective irrigation on medium black soil at Agricultural Research Station, Nippani. There were 15 treatment combinations comprising five levels of suckers (topping the main shoot at 18th leaf without retaining suckers, topping the main shoot at 16th leaf with one top sucker, topping the main shoot at 16th leaf with two top suckers, topping the main shoot at 16th leaf with three top suckers and topping the main shoot at 16th leaf with four top suckers each top sucker was topped at 8th leaf) and three levels of fertilizers (recommended dose of fertilizer, 175 : 60 : 40 N, P₂O₅ and K₂O kg per ha, 1½ RDF and 2 RDF). The leaf length and breadth are higher when all the suckers were removed. Levels of fertilizer had no significant

influence on these characters. In general, leaf thickness decreased with increase in sucker levels, but increased with increase in fertilizer level. Among all the treatment combinations higher leaf thickness was noticed with RDF and without sucker. However, these variations did not alter *anqad* tobacco yield significantly. Application of RDF and retaining two top suckers recorded higher yield (2490.7 kg/ha). Nicotine and nitrogen contents of sucker and composite leaf samples significantly decreased with increased sucker level, while nicotine content increased in mainleaf sample with increase in fertilizer level. Reducing sugars, potash and ash decreased significantly with increase in sucker level, whereas chloride in composite leaf sample and potash and ash increased with increase in fertilizer level. Treatment combination of no sucker level and RDF registered higher benefit : cost ratio (5.19).

Response of Cotton Cv. Abadhita (*Gossypium hirsutum* L.) to Soil and Foliar Application of Micronutrients Under Rainfed Conditions

R. BASAVARAJAPPA

1992

Major Advisor : V. R. KORADDI

A field experiment was conducted on medium black soil at Agril. Research Station, Dharwad, during the year 1991–92 to study the response of cotton to soil and foliar application of micronutrients under rainfed conditions. Treatments consisted of five micronutrients, viz. Cu, Mn, Fe, Zn and B applied to soil @ 20 kg/ha (except Borax @ 10 kg/ha) individually and in combination. Foliar applications @ 5 kg/ha (except Borax at 2.5 kg/ha) in two equal splits were made at 60 and 90 DAS. Water spray and control were also included making a total of 14 treatments. A common dose of 40 : 20:20 kg/ha NPK was applied to soil before sowing of the crop. Cotton variety Abadhita (*G. hirsutum*) was planted on 14.7.1991. Significant differences were observed for plant height at 45, 75 and 105

DAS and number of leaves for all stages. Non-significant differences were observed for monopodial and sympodial branches at 135 DAS. Dry weights of individual plant parts and TDM per plant responded significantly to micronutrients. Significantly higher number of harvested bolls/plant, seeds/boll and yield/plant (g) were recorded, the highest being in FeSO₄ (foliar) (12.33, 30.06 and 49.33 respectively). Foliar application of FeSO₄ gave the highest yield of seed cotton (2446 kg/ha) followed by ZnSO₄ (foliar) (2405 kg/ha) and CuSO₄ (foliar) (2337 kg/ha) as against 1544 kg of control. All the micronutrient treatments gave higher yields than control (1544 kg/ha) and water spray (1546 kg/ha) ranging from 2003 kg/ha to 2446 kg/ha. Non-significant difference was observed for seed index; however MnSO₄

(foliar) recorded the highest seed weight of 9.13 g. Fibre length, uniformity ratio and micronaire were found non-significant. Significant differences in maturity coefficient were recorded in FeSO₄ (foliar) and FeSO₄ (soil). Significantly highest bundle strength

was recorded in both MnSO_4 (foliar) and MnSO_4 (soil). Significantly higher uptake of N, P_2O_5 and K_2O was recorded by the application of micronutrients, the highest being in FeSO_4 (foliar) for all the three nutrients.

Studies on Intercropping of Sesame (*Sesamum Indicum* L.) with Pulses and Oilseeds

J. A. HOSMATH

1992

Major Advisor : V. C. PATIL

A field experiment was conducted to identify suitable companion crops for intercropping in sesame in black clay soil of Agricultural College Farm, Dharwad, during *Kharif* 1990. Sesame (E-8) was intercropped with groundnut (DH 3-30), Soybean (Monetta), greengram (Pusa baisaki) and frenchbean (selection-9) in 3 : 1 row proportion. Sole sesame recorded significantly higher seed yield (7.7 q/ha) than intercropped sesame (6.4 q/ha). In intercropping, sesame seed yield was reduced on account of replacement population. The reduction in sesame seed yield was lower when intercropped with greengram (9%) and frenchbean (12%), whereas, reduction by 21 and 27 per cent occurred with soybean and groundnut, respectively. Sole sesame recorded higher leaf area index and dry matter production than intercropped sesame. Plant height, number of primary branches, leaf area index, dry matter production and number of capsules per plant of sesame were higher when intercropped with greengram and frenchbean. In intercropping, the decrease in leaf area index of sesame was compensated for

by the component crops. The combined-leaf area index was significantly higher when sesame was intercropped with frenchbean (5.58) and greengram (5.26) than with groundnut (4.86) and soybean (4.56). Significantly higher sesame equivalent yield was obtained when intercropped with groundnut (12.6 q/ha) as compared with frenchbean (11.3 q/ha), greengram (8.8 q/ha) and soybean (8.4 q/ha). Land equivalent ratio (LER), System productivity index (SPI) and Area Time Equivalent Ratio (ATER) values were significantly higher when sesame was intercropped with greengram (1.27, 9.8 and 1.15 respectively) followed by frenchbean, groundnut and soybean. Intercropping of groundnut with sesame gave higher gross and net income (Rs. 19,574 and Rs. 17,378 per ha, respectively) followed by sesame + frenchbean (Rs. 17,613 and Rs. 15,628, respectively) and sesame + greengram (Rs. 13,881 and Rs. 12,576 per ha, respectively). Higher benefit : cost ratio (9.64) was observed with sesame + greengram intercropping system.

Studies on the Production Potential of Lentil (*Lens culinaris* Medic.) Varieties as Influenced by Plant Densities In Vertisols

Y. S. PATIL

1992

Major Advisor : M. N. SHEELAVANTAR

An experiment was conducted in vertisols of Agricultural College Farm, Dharwad during *rabi* season of the year 1990–91 to find a suitable variety and optimum plant population for lentil cultivation. The results revealed that the variety L-4076 produced significantly higher seed yield (11.94 q/ha) when compared to K-75 (9.33 q/ha).

and L-639 (9.18 q/ha) which was 22 and 23 per cent higher respectively. Row spacings also influenced the seed yield significantly. The crop under 15 cm row spacing produced significantly higher seed yield (11.25 q/ha) and it was 9 and 20 per cent higher, respectively than the crops under 30 cm (10.19 q/ha) and 45 cm (9.00 q/ha) row spacing.

The variety L-4076 in association with 15 cm row spacing produced the highest seed yield (13 q/ha). All varieties produced maximum seed yield per ha. Under narrow row spacing, while all the varieties produced maximum seed yield per plant under wider row spacing. The higher seed yield of L-4076 under narrow row spacing was traced back to higher dry matter production per unit area coupled with higher CGR. Varieties and row spacings

had significant influence on protein content and yield. The variety L-4076 recorded significantly higher protein content (26.84%) than L-639 (25.92%) and was on par with K-75 (26.52%). The variety L-4076 recorded significantly higher protein yield (3.20 q/ha) than K-75 (2.47 q/ha) and L-639 (2.38 q/ha). The seed protein content increased from (26.14%) at 15 cm row spacing to (26.83%) at 45 cm row spacing.

Soil Science

Studies on the Evaluation of Suitable Chemical Extractant for Available Copper in Vertisols of Upper Krishna Project Area

SHANMUKH K. PATIL

1992

Major Advisor : T. SATYANARAYANA

An investigation was carried out to study the evaluation of suitable chemical extractant for available copper, relationship between available copper as extracted by different extractants such as DTPA-CaCl₂-TEA (pH 7.3), EDTA-(NH₄)₂ CO₃ (pH 8.6), $\frac{1}{2}$ N NH₄ OAC (pH 4.8), 0.1 N HCl and soil properties and critical level for available copper in vertisols of Upper Krishna Project area. Wheat was taken as test crop. The available copper extracted by different extractants were in the order of 0.1 N HCl > EDTA-(NH₄)₂ CO₃ (pH 8.6) > DTPA-CaCl₂-TEA (pH 7.3) > $\frac{1}{2}$ N NH₄ OAC (pH 4.8). Maximum area under Kagalgomb and Tumkur soil series were found to be deficient in available copper content. Results indicated that pH, organic carbon and clay content were the dominant factors associated with the extraction of copper by various chemical extractants. In addition to these, DTPA-

CaCl₂-TEA and $\frac{1}{2}$ N NH₄ OAC extractants were found to be influenced by CaCO₃, MnO₂ and CEC of soil. The DTPA-CaCl₂-TEA (pH 7.3) was found to be suitable chemical extractant to predict the available copper status of vertisols of Upper Krishna Project area, as reflected by its high correlation coefficient value with Bray's percent dry matter yield ($r = 0.926^{**}$), Bray's percent dry matter uptake ($r = 0.909^{**}$) and plant copper content ($r = 0.965^{**}$). A significant increase in the dry matter content of wheat was observed with the application of CuSO₄ 5H₂O @ 5 mg Cu/kg soil. The critical level for available copper as extracted by DTPA-CaCl₂-TEA, EDTA-(NH₄)₂ CO₃, $\frac{1}{2}$ N NH₄ OAC and 0.1 N HCl were 0.64, 1.48, 0.34 and 3.11 ppm respectively, which demarcated the responsive soils from non-responsive ones.

Influence of Tree Plantations on Soil Properties

GIRISH C. HOSUR

1992

Major Advisor : G. S. DASOG

The influence of tree species on red soils (Inceptisols) of Main Research Station, Dharwad was conducted to understand the changes in morphological, physical and chemical properties of soils; and quantifying the amount of litterfall and composition

of litter so as to make an evaluation of the nutrients returned to soil through litterfall. Six tree plantations, viz. *Tectona grandis*, *Dalbergia sissoo*, *Acacia catechu*, *Dendrocalamus strictus*, *Eucalyptus tereticornis* and *Casurina equisetifolia* were selected. Bulk

density was lower, aggregate stability and terminal infiltration rates were higher in the soils under the plantations than under unplanted controls. These properties were better developed under eucalyptus and bamboo. Among the chemical properties evaluated, pH decreased and organic carbon, exchangeable acidity, CEC and exchangeable bases increased under plantations compared to control sites. The soils from tree plantations were generally observed to be higher in nutrient status as compared to control sites. Eucalyptus depleted the soil nitrogen to a greater extent while sissoo improved the soil nitrogen over control sites. Litterfall by the tree

species studied varied from 4099 kg ha⁻¹ in teak to 8313 kg ha⁻¹ in eucalyptus. Contribution of leaf litter to the total litterfall was more than other plant parts. Plant parts showed variations in nutrient concentrations though generally the concentrations of Ca, K and N were higher than other nutrients. Sissoo returned highest N, P, K and Ca among the six plantations while teak returned least nutrients among the six plantations. The nutrient return followed by order Ca K N in sissoo and catechu; Ca N K in teak and casuarina and K Ca N in bambo and eucalyptus. The return of P and Mg were lower in all the cases.

Forms and Adsorption Characteristics of Sulphur In Some Soils

P. VEERAMALLAPPA

1992

Major Advisor : S. G. PATIL

Studies on different forms of sulphur and its adsorption characteristics were carried out in surface and sub-surface soils of black (Yediapur and Kagalgumbi), red (Ranebennur and Budhigumpa) and laterites (Khanapur, Bidar, Sirsi and Golikotta). The effect of SO_4^{2-} concentration, pH, organic matter, iron oxides and other anions on SO_4^{2-} adsorption were investigated. As in most of the soils, more than 90% of the total sulphur was in organic form while very small fraction of it was in adsorbed and readily soluble forms. Total, organic and adsorbed S was perceptibly higher in laterites compared to red and black soils, whereas the readily soluble S was more in black soils than in red and lateritic soils. However, surface soils recorded more of total and organic S while, sub-surface recorded more of readily soluble and adsorbed S.

The adsorption of SO_4^{2-} increased as SO_4^{2-} concentration in the solution increased and adsorption increased rapidly as the pH decreased in red and lateritic soils. However, the black soils showed only net desorption but no adsorption at all concentration and pH ranges tried. The removal of organic matter and iron oxides from red and lateritic soils caused the loss of large proportion of adsorption capability, while it contributed very little to SO_4^{2-} adsorption in black soils. The SO_4^{2-} adsorption is influenced by other anions. The inorganic anion NO_3^- and PO_4^{3-} and organic anions, viz. Citric, oxalic and tannic acid reduced the SO_4^{2-} adsorption significantly. However, PO_4^{3-} was more effective amongst all these followed by citric, oxalic, tannic acid and least NO_3^- .

Influence of Farm Yard Manure on Phosphorus Availability in Vertisol to Sunflower (*Helianthus annuus* L.)

S. M. WARAD

1992

Major Advisor : H. M. MANJUNATHAIAH

The investigation was carried out during *rabi* 1991 on Typic chromustert of Regional Research Station, Raichur. The treatments consisted of three levels of FYM and four levels of DAP. Different

levels of FYM and DAP were mixed well and applied on band placement at the time of sowing. The objectives of the investigation were to study the effect of different levels of DAP and DAP

mixed FYM levels on the release and utilization of phosphorus at different stages of crop growth, the concentration and uptake of nutrients by crop and seed, stalk yield and oil content of crop. Increased levels of FYM application significantly increased the available phosphorus and was highest (16.95 kg ha⁻¹) with 816 kg FYM ha⁻¹. Application of 75 kg P₂O₅ ha⁻¹ gave highest available phosphorus at all growth stages. The highest available phosphorus at bud formation (21.0 kg ha⁻¹), peak flowering stage (20.2 kg ha⁻¹) and at harvest (19.2 kg ha⁻¹) was noticed with application of 816 kg FYM + 75

P₂O₅ ha⁻¹. Uptake of N, P, K and Fe by plants was highest with 816 kg FYM ha⁻¹. Uptake of N, P, K, Ca, Mg, Mn and Cu by both plants and seeds was highest with application of recommended dose of phosphorus. Different FYM levels did not cause significant effect on growth, yield attributes, stalk and seed yield and oil content while they were significantly differed and highest with application of 75 kg P₂O₅ ha⁻¹ alone and also with combined application of 816 kg FYM and this treatment gave highest net profit (Rs. 10,285) and maximum B : C ratio (2.39).

Agricultural Entomology

Ecological Studies on Millipedes with Special Reference to *Phyllogonostreptus nigrolabiatus* (Newport)

C. M. RAFEE

1992

Major Advisor : H. R. RANGASWAMY

The survey, population dynamics, seasonal occurrence, behaviour, off-season survival, host preference and the effect of temperature on survival and feeding of millipedes in general and *P. nigrolabiatus* in particular were studied during 1990–91. Survey work undertaken for collection and identification of millipede fauna in different regions revealed the presence of six species, namely *P. nigrolabiatus*, *Streptogonopus jerdani* (Pocock), *Polydrepanum* sp., *Ktenostreptus lankaensis* (Humb.), *Chondromorpha severini* Silvestri and *Chondromorpha mammifera* (Humb.) and their population per square meter varied from 1 to 12. Seasonal occurrence studies in four different soil habitats at the University Farm, Dharwad revealed that the millipede activity was confined to five months from May to September. The seasonal mean of 6.3, 5.9, 4.6 and 3.7 per square metre in the population was recorded in the garden, black, red and grassland soils, respectively from May to October, 1991. Studies on off-season

survival indicated the presence of diapausing millipedes in all the soil habitats but at different depths in different soils. The diapausing millipede population was in the order of garden soil > black soil > red soil > grassland soils. Maize, cowpea, sunflower, cotton and chilli supported the maximum population of millipedes among cereals, pulses, oilseeds, fibre crop and vegetables, respectively. Further, maize, field bean, sunflower, cotton and chilli seedlings were damaged most among cereals, pulses, oilseeds, fibre crop and vegetables, respectively indicating their preference, while, millipedes preferred maize, cowpea and groundnut seeds among cereals, pulses and oilseeds, respectively. The maximum damage to seeds was observed at 48 to 72 hours after sowing and no damage was observed to castor, chilli and tomato seeds. The ideal temperature for survival and feeding was found to be between 22 to 27° C under laboratory conditions.

Bioecology and Management of Tobacco Aphid, *Myzus persicae* (Sulzer)

N. B. SHANTAPPANAVAR

1992

Major Advisor : I. G. HIREMATH

Studies on the biology of tobacco aphid, bioefficacy of insecticides against aphids and their natural enemies, persistency of insecticides on tobacco against the aphid and sensitivity of colour morphs to insecticides were carried out in the laboratory at University of Agricultural Sciences, Dharwad and Agricultural Research Station, Nipani, during 1990 to 1992. Two colour morphs were noticed in aphids. There were four nymphal instars, occupying a total period of 5.5 to 6.5 days in green morphs whereas red morphs occupied 5 to 6 days. The red morph produced more nymphs (82.33) than green morph (72.4) over 14.27 and 13.73 reproductive days, respectively. Green morph completed its life cycle at a shorter duration (21.4 days) than red morph (22.3 days). Among four dosages of imidocloprid studied, 75 and 100 g a.i per ha offered best control and allowed lowest aphid population. It enhanced the yield to reach highest

1055 and 1125 kg per ha, respectively. Acephate spray yielded 833.33 kg/ha tobacco leaves. Imidocloprid at 75 and 100 g a. i per ha were more toxic to natural enemies, viz. coccinellid beetle, lacewing bug, and syrphid fly. However morgocide OK (3.2 kg/ha), neem (160 g a.i/ha) and cascade (80 g a.i/ha) were harmless to natural enemies. Persistent toxicity of imidacloprid to tobacco aphid lasted for 30 and 31 days at 75 and 100 g a.i/ha respectively as compared to 24 days in the case of acephate. However, an elapsed period of 23.5, 24.5 and 18.5 at 75 and 100 g a.i per ha of imidacloprid and acephate treatment, respectively was necessary to cause loss in the effectiveness by 50 per cent. The red and green morphs of aphids failed to differ in their sensitivity to imidacloprid. However, in the case of acephate, red morph exhibited slight tolerance capacity compared to green morph.

Studies on the Biology and Management of *Heliothis armigera* (Hubner) Infesting Sunflower

SUDHIR A. NAIK

1992

Major Advisor : K. A. KULKARNI

The investigations on biology of *Heliothis armigera* (Hubner) on sunflower, crop loss estimation due to *H. armigera* (Hbn.) management of *H. armigera* (Hbn.) by insecticides infesting sunflower and persistence of HNPV on sunflower have revealed the following: Majority of eggs possessed 23 ribs. The egg, larval and pupal period lasted for 3-4, 16-23, 12-16 days in November-December, 1990 and 3-5, 14-23, 14-17 days in December-January, 1990-91. There were six larval instars. The longevity of adult female with food, ranged from 7-13 days and of male 5-11 days. In the absence of food, the longevity of adult female ranged from 3-5 days and of male 2-3 days. The total life cycle lasted for 32-46 days in November-December, 1990 and 33-48 days in December-January, 1990-91. The natural enemies recorded were (1) *Campdoltis chloridiae* Uchida (2) *Eriborus* spp. and (3) White muscardine, *Beauvaria bassiana* (Bals.) vuill. The

crop loss estimation revealed highly significant positive correlation between number of larvae per plant and weight loss in grains per capitulum. ($r = 0.97$). From the regression equation, $Y = 1.197 + 1.0195^*$ it was evident that per unit increase in larval population resulted in weight loss of 1.0195 of grains per capitulum. The economic injury level (ETL) was 1.03 larvae per plant. In the management studies, it was found that the endosulfan spray application yielded maximum benefit of Rs. 9.50 per every rupee investment, followed by NPV @ 400 LE per ha + endosulfan spray amounted to Rs. 3.77. The persistence of HNPV revealed that the HNPV persisted over the span of 12 days. The cumulative mortality was highest (93.33%) in the larvae released on the day of NPV spray, followed by 66.7 per cent in the larvae released on third day of NPV spray.

Off-Seasonal Behaviour and Management of Cotton Shoot Weevil, *Alcidodes affaber* Aurivillius (Coleoptera : Curculionidae)

V. RAJENDRA KUMAR

1992

Major Advisor : V. P. DESHPANDE

Investigations on off-seasonal behaviour and management of *Alcidodes affaber* Aurivillius on cotton were undertaken at Dharwad, during 1991-92. The incidence of adult diapause was observed from December to April. Increased number of adults were found from January to April on July and August sown crops. The diapausing adults attained peak during February. The number of males were 1.31 for every female. The increase in maximum temperature enhanced diapause incidence, while rise in rainfall suppressed the diapause activity. The larval-pupal parasitoid, *Goryphus* sp. (Hymenoptera : Ichneumonidae) was responsible for inflicting 70 per cent mortality during December. Anatomical

studies were made on reproductive organs of both active and diapausing adults which exhibited significant difference in the size and colour of ovary and testis lobe. Studies with variable temperature and humidity indicated that 25 and 30° C with 80 and 90 per cent relative humidity were found to be congenial for reproductive development. The pre-oviposition period and oviposition period occupied nine days and 30 days, respectively with fecundity rate of 32 eggs at 25° C and 80 per cent relative humidity. Injecting Dichlorvos (19 and 21% a.i) and Methomyl (0.024%) into the stem through syringe resulted in highest mortality of grubs in the tunnel.

Horticulture

Studies on Evaluation of Elite Tamarind (*Tamarindus Indica* L.) Types for Quality, Yield and Multiplication by Air-layering

A. P. CHALLAPILLI

1992

Major Advisor : N. C. HULAMANI

An attempt was made to evaluate 24 tamarind trees of seedling origin with respect to physico-chemical and yield characters and also to study multiplication of tamarind by air-layering with pre-girdling plus etiolation and different concentrations of rooting hormones to find out suitable treatment combination to improve rooting of layers and post separation establishment of layer. The fruit yield per tree, among the 24 varieties, varied from 147 to 504 kg. The highest yield per tree (504 kg) was recorded for tree number 5, followed by tree number 33 (474 kg). The higher fruit weight (25.2 g) was recorded in tree number 33 having fruits of semi-curved type. The tree number 33 recorded higher fruit volume with shell intact as well as without

shell. The highest titratable acidity (% Tartaric acid) was recorded (14.9%) in tree number 39. The ascorbic acid (2.64 mg/g) was found higher in tree number 33 and the lowest in tree number 9 which had semicurved fruits. In air-layers of tamarind, pre-girdling plus etiolation for 30 days along with IBA at 500 ppm recorded maximum percentage of rooting. Average number of primary roots and the number of layers rooted were superior in pre-girdling and etiolation for 30 days with IBA at 500 ppm concentration to other treatments. The interaction effect of pre-girdling plus etiolation for 30 days with IBA at 1000 ppm gave maximum (95%) survival ability over rest of treatments.

Studies on the Evaluation of Ber (*Zizyphus mauritiana* Lam.) Cultivars and Their Pruning Time

UDAYANARAYANA

1992

Major Advisor : N. C. HULAMANI

The investigations on the performance of six cultivars of ber namely, Umran, Chhuhava, Kadaka, Gola, Seb and Sanaur-2 for their physico-chemical characters, keeping quality and pest and disease incidence, were carried out at two locations, viz. Regional Research Station, Bijapur and Agricultural Research Station, Gangavathi, during the year 1991-92. A study on the effect of pruning time on vegetative growth, flowering and fruit set in four ber cultivars was also initiated during the year 1992, at the Silver Jubilee Orchard of University of Agricultural Sciences, Dharwad. The results obtained showed that Sanaur-2 and Chhuhava were high yielders, while Umran and Kadaka topped the other in fruit size and fruit weight. The pulp to stone ratio was highest in cultivar Gola. Total

soluble solids and total sugars were high in Chhuhava and Umran. Cultivar Umran had maximum ascorbic acid content with least acidity. Gola recorded higher acidity and least Brix to acid ratio. The cultivar Sanaur-2 revealed the least PLW (%) after 10 days of storage indicating its superiority over other cultivars with respect to keeping quality. Incidence of powdery mildew and fruit borer was maximum in cultivar Umran and Kadaka at Bijapur. Among the three different time of pruning imposed on four different cultivars at Dharwad conditions, pruning during first fortnight of April was observed better with respect to growth, flowering and fruit set. Among the cultivars, Umran and Kadaka showed better response to pruning in April.

Studies on Softwood Grafting in Sapota (*Manilkara achras* (Mill.) Fosberg)

PAMPANNA Y.

1992

Major Advisor : G. S. SULIKERI

Studies on germination of rootstock seeds, growth of seedlings (rootstocks) and softwood grafting in sapota were conducted at the Agricultural College, Dharwad during 1991-92. Under field conditions, Pre-soaking of rayan seeds in Gibberellic acid at 400 ppm for 24 hours gave the highest germination and resulted in the better growth of seedlings. Pre-soaking of sapota (cv. Kalipatti) seeds, after cracking the seed coat, in GA 300 ppm for 24 hours gave the highest germination. The seedlings obtained from GA 400 ppm pre-soaked seeds were taller with more number of leaves. Under laboratory conditions, pre-soaking of sapota (cv. Kalipatti) seeds, after cracking the seed coat, in GA + ethrel each at 400 ppm gave the highest germination. Gibberellic acid 400 ppm pre-soaked seeds took minimum time to initiate the germination. Emergence rate index and Bartlett's rate index for earliness of germination was highest with GA + ethrel each at 400 ppm pre-soaked seeds. The seedlings raised from the GA 400 ppm

pre-soaked seeds recorded significantly higher shoot length, number of leaves, root length, fresh and dry weight of shoot, root and seedling. The seedling vigour index was significantly superior with GA + ethrel each at 400 ppm. Soil application of neem cake @ 25 g per seedling per month plus a foliar spray of GA 100 ppm at monthly interval for a period of three months was found to be effective in improving the growth of potted rayan rootstock seedlings and reducing the period required to attain graftable size. Softwood grafting of sapota during May was proved to be superior, followed by April, in respect of graft-take as well as growth of grafts. There was not much difference between two types of seedlings (rootstocks) used, viz. new seedlings and invigorated seedlings, with respect to graft-take and growth of grafts. Softwood grafting of sapota with young scions (about 3 month) was resulted in the higher graft-take and the better growth of grafts.

Studies on the Performance of Turmeric (*Curcuma longa* L.) Cultivars

Gopalkrishna Hegde

1992

Major Advisor : G. S. SULIKERI

An experiment was conducted at the plantation crop unit of the Agricultural College, Dharwad during 1991-92 with the main objective of evaluating 16 cultivars of turmeric collected from various places for observing morphological features, rhizome yield and curcumin content. Six cultivars namely Cuddapah, Bidar, Amalapuram, CO-1, Rajapuri and BSR-1 showed better performance compared to other cultivars with regard to rhizome yield and rhizome characters. Whereas Moovattupuzha and CLS No. (11)A were found to have higher curcumin content (6.40% and 6.36%, respectively) though their fresh yield were low (3.73 and 12.37 t/ha) as against higher yields in Cuddapah (22.19 t/ha), Rajapuri (21.89 t/ha) and Amalapuram (21.69 t/ha). All the growth and yield attributes had positive

corelation with rhizome yield. The better performed cultivars had significantly different magnitude of morphological parameters like plant height, number of tillers, leaves and leaf area. Amalapuram and Cuddapah were tallest (24.76 cm and 23.36 cm, respectively) while Moovattupuzha was dwarfest (13.5 cm). BSR-1 had maximum tillers (5.7 per plant) and Bidar was on par with that of Cuddapah in respect of number of leaves. CO-1 could produce maximum leaf area. Cured rhizome yield was maximum with Amalapuram (5.63 t/ha) due to its higher fresh yield and higher curing percentage (26.3). None of the cultivar under study was free from leaf diseases. The cultivar Cuddapah was marked for highest N and K uptake while Bidar for P uptake.

Biology and Productivity of Drumstick (*Moringa oleifera* Lamk.)

C. N. HANCHINAMANI

1992

Major Advisor : B. B. MADALAGERI

Investigations on biology, varietal performance and nutrition of drumstick varieties, Local, selections 5/9 and 6/4 were carried out at the New orchard of the University of Agricultural sciences, Dharwad during the year 1991-92. The studies on floral biology in Local and 6/4 revealed that Local cultivar shed maximum flowers as compared to selection 6/4. The selection 6/4 registered highest pods per plant at its fifth year. It was found that most of the pollens in Local cultivar appeared to be sterile. The peak period of anthesis was at 4.30 p.m. in both cultivars. Stigmatic receptivity was maximum in 6/4 on the day of anthesis as compared to Local. The selection 6/4 was adjusted to self pollination but the Local was adjusted to cross pollination. Among insect pollinators, bumble bees were found prominent. The average heat units required for the

pod development from set to maturity is 590.34° Cd. The different varieties studied showed significant differences with respect to yield expressed both in terms of number and weight of pods per tree. Significant differences were also observed between the varieties with respect to pod length, pod girth and individual pod weight. Cultivar 6/4 is dwarf and had the habit of bearing more number of branches. The number of pods per plant was correlated significantly with number of branches the tree produced. Selection 6/4 was found to be superior to other two cultivars with respect to high score of taste panel which is an added attribute. The optimum fertilizer dose appeared to be 200 : 100 : 100 g/NPK plant since the increase in pod yield in terms of either number or weight beyond this dose was non significant.

Effect of Plant Population and Nitrogen Levels on Growth and Flower Yield of *Jasminum grandiflorum* L.

S. K. KULKARNI

1992

Major Advisor : A. A. PATIL

A field trial on the plant population and nitrogen levels on growth and yield of *Jasminum grandiflorum* L. was conducted at the New Orchard of University of Agricultural Sciences, Dharwad during 1990-91. The treatment included combinations of three levels of spacing (2 x 1, 2 x 2 and 2 x 3 m) and three levels of nitrogen (0, 200 and 400 kg/ha). The study revealed that increased N application from 0 to 400 kg per hectare increased the growth as well as yield parameters. The nitrogen dose of 400 kg per hectare and spacing of 2 x 1 m (5000 plants/ha) recorded the higher number of sprouts, secondary laterals, productive shoots, number of

leaves, leaf area, leaf area index and leaf area duration per unit area which resulted in maximum flower yield per hectare (13351.08 kg/ha). A maximum net profit of Rs. 3,35,069.24 per hectare was obtained at a planting density of 5000 plants per hectare (2 x 1 m) and nitrogen level of 400 kg N per hectare whereas the lowest net profit of Rs. 60,108.91 was obtained at a plant population of 1667 plants per hectare (2 x 3 m) with no application of nitrogen. Among the environmental factors, heat units and diurnal temperature range were found to play an important role in influencing the flowering behaviour.

Use of Growth Retardants In Potato (*Solanum tuberosum* L.) Production

VASANT. M. GANIGER

1993

Major Advisor : B. B. MADALAGERI

Experiments were conducted to know the efficacy of new growth retardants to check excessive vegetative growth and improve the yield of potato under rainfed culture at College of Agriculture, Dharwad during 1991-92. The *Kharif* experiment on vertisol consisted of a split plot experiment with 3 main treatments of crop growth stage for spray application, viz. 45 days after planting (DAP), 60 DAP and 45 + 60 DAP and 13 sub treatment of different growth retardants at 3 concentrations, viz. Mepiquat chloride (MC) at 100, 125 and 150 ppm, CCC at 250, 500 and 750 ppm and TIBA at 100, 200 and 300 ppm along with mechanical deoliation (leaving 30 cm growth above ground level) treatments at 45 DAP, 60 DAP and 45 + 60 DAP) with an untreated control. The best treatments of this experiment were verified in *rabi* field experiment on ineptisol under irrigated condition and a pot experiment in greenhouse condition. The results of the *Kharif* experiment revealed that the optimum stage for application of growth retardants was

found to be 45 DAP which effectively controlled the vegetative growth without any formative effect on the yield. Application of growth retardants like MC at 100 to 150 ppm and CC at 75.0 ppm have significantly improved the yield of potato (23.0 to 24.0 t/ha). These treatments were repeated in *rabi* experiment and was found that there was a significant difference in the yield of treated plants (8.0 t/ha) against only 5.6 t/ha in control. The pot culture experiment confirmed this fact. The superiority of either CCC at 75.0 ppm or MC at 150 ppm over control was further confirmed by pooled analysis of yield per plant (about 500 g/plant against only 250 g/plant of untreated control). The storage behaviour of tubers obtained from treated plants did not show any significant deviation from control with respect to physiological loss in weight, per cent rot and sprouting. The quality of tubers from treated plants showed improvement with respect to specific gravity, reducing sugar, and non reducing sugar.

Plant Pathology

Further Studies on Leaf Blight of Arecanut (*Areca catechu* L.) Caused by *Phyllosticta arecae* Hohné)

BHARATI S. HEBBAR

1992

Major Advisor : K. H. ANAHOSUR

Leaf blight of arecanut caused by *Phyllosticta arecae* was severe during rainy season in parts of Uttara Kannada and Shimoga districts. The survey revealed maximum disease in Honnavar and Chennagiri talukas. The pathogen isolated from gardens of eight villages, viz. Halawalli (Ankola), Idagunji (Honnavar), Gore (Kumta), Ikkeri (Sagar), Mandagadde (Thirthahalli), Hegganur (Siddapur), Kalve (Sirsi) and Manchikeri (Yellapur) were named as A, B, C, D, E, F, G and H isolates respectively. The variability among them was assessed on the basis of morphological, cultural, physiological, nutritional and pathogenic characters. The isolates were classified into three groups on the basis of cultural and morphological characters; Group I – A, B and C; Group II – D, E, F and G; and Group III – H. Cultural, physiological and nutritional studies revealed considerable variation among the isolates. Sensitivity to copper sulphate

indicated that isolates A, B and C were tolerant to the chemical, D, E, F and G were moderately sensitive and H was highly sensitive. The conidia of isolates were uninucleate in nature. On the basis of pathogenicity, isolates were grouped as highly virulent (A, B, C and G) which were distributed in Ankola, Honnavar, Kumta and Sirsi; moderately virulent (D, E and F) from Sagar, Thirthahalli and Siddapur and least virulent (H) from Yellapur. Thus, there were three strains of *P. arecae*. Toxin studies indicated that A, C and G isolates produced more toxic metabolites. The pathogen was host specific in nature. Ascospores germinated when treated with 0.5 N HCl (for 3 min.), red soil extract, FYM extract and also when passed through the snail gut. Carbendazim (500 ppm), Bitertanol (500 ppm) and Mancozeb (2000 ppm) were found to inhibit the growth of the fungus.

Studies on Slow Rusting Mechanism in Cowpea

M. R. CHANDRA MOULI

1992

Major Advisor : G. M. PADAGANUR

The investigation on rust of cowpea caused by *Uromyces phaseoli* Var. *vignae* (Barcl.) Arth. with particular reference to slow rusting mechanism was carried out during 1991–92 at Main Research Station, Dharwad, Karnataka. Slow rusting mechanism was identified by using two epidemiological concepts, viz. rate of development of disease (r) and area under disease progress curves (AUDPC). The cowpea varieties, viz. V-16, V-70, TUX-944, V-37, V-118 and V-240 were identified as slow rusters where as the varieties C-152 and HG-172 as fast rusters. The intermediate ones were the varieties, viz. NPRC-1, NPRC-3, COVU-58, APC-36 and S-488. The varieties Chiroli and CO-4 were found to possess absolute resistance to rust. The study

also indicated that latent period, pustule density, size of the pustule and uredospores per pustule are important components of slow rusting mechanism in cowpea. The study conducted to know the congenial conditions for uredospore germination revealed that a temperature of 20° C with 100 per cent relative humidity and complete darkness is ideal for cowpea rust uredospore germination. The study also indicated that there is certain amount of uredospore germination inhibition due to light. Among the five fungicides evaluated *in vivo* on five varieties of cowpea, it was found, that tridemorph (0.05%) was found to be very effective in reducing the disease incidence and in preventing loss, followed by diclobutrazol (0.1%), propiconazol (0.1%), chlorothalonil

Abstract of Theses

(0.2%) and mancozeb (0.2%). Among varieties, least disease was in the variety V-118 followed by V-240, S-488, C-152 and HG-171 in ascending order for disease severity. But in terms of yield S-

488 was best with tridemorph (0.05%) treatment. For a given variety average 'r' values and AUDPC values were least in tridemorph (0.05%) treated plots.

Studies on Late Leaf Spot of Groundnut Caused by *Phaeoisariopsis personata* (Berk. and Curt.) V. Arx.

SUDHEENDRA ASHTAPUTRE

1992

Major Advisor : SRIKANT KULKARNI

An investigation was undertaken and a survey was conducted to know the incidence and intensity of late leaf spot of groundnut caused by *Phaeoisariopsis personata* (Berk. and Curt.) V. Arx. in two districts of Northern Karnataka. Severity of the disease was high in Ramdurg and Dharwad talukas. Hence, these localities were considered as "hot spots" for late leaf spot infection. The yield loss was more in disease affected plots when compared to chlorothalonil sprayed plots. It was found that four sprays of chlorothalonil were found to be economical which reduced the disease intensity realising higher pod yield. Early sown crop escaped from the late leaf spot whereas, late sown crop suffered from the disease. Maximum germination of conidia of *P. personata* was noticed in two per cent glucose, sucrose and one per cent

sucrose solutions when incubated at 27° C. The conidia remained viable in the host debris for 105 days under natural conditions, for 181 days at 6° C and 151 days under laboratory and glasshouse conditions. Increase in total sugar content and decrease in total phenol content was observed in diseased leaf in comparison with healthy leaf. Fungicides viz. mancozeb, carbendazim, bitertanol and chlorothalonil reduced disease effectively and yield was also increased when compared to plant extracts like sorghum, coconut, parthenium and neem leaf extracts. However, neem leaf extract was found to increase the yield than the other leaf extracts studied. Among 12 leading groundnut genotypes screened, only two genotypes, viz. PI 393516 and ICGV - 872664 were found moderately resistant to the disease.

Seed Technology

Effect of Different Extraction and Drying Methods on Seed Quality in Storage of Tomato (*Lycopersicon esculentum* Mill.)

G. A. PATIL

1992

Major Advisor : S. D. SHASHIDHARA

The investigations on tomato seed extraction were carried out at the Department of Seed technology, Dharwad, during 1991-92. Experiment I consisted of 7 extraction methods, viz. fermentation, mechanical, acid (HCl and H₂SO₄), alkali (NaOH and NaHCO₃) and control. Among the methods, acid extracted seeds required less time (11 hours) and less number of washings (4) with high seed recovery

(5.29 g/kg of fruit). Further, the seeds were of golden yellow colour. Longest time required was in fermentation method of extraction, while mechanically extracted seeds recorded lowest seed recovery (5.07 g/kg of fruit) and NaHCO₃ method was the costliest (Rs. 147.75/q of fruit). HCl and H₂SO₄ extracted seeds were significantly higher in germination (89.5 and 89.6%) field emergence (79.8 and

79.3%) and other quality parameters and NaOH extracted seeds were on par with acid extracted seeds. In storage also, similar trend was observed. Experiment II was divided into two parts. In first part the seeds were dried at different air temperatures (30, 35, 40 and 45° C) in mechanical drier. The best drying temperature which recorded maximum seed quality parameters was compared with different drying methods, viz. sun, shade and dehumidified air drying. Results of drying showed that drying of

tomato (cvL-15) seed took place in falling rate period. Total drying time decreased with increase in drying temperature. Seeds dried at 35° C recorded highest germination (93.8%), field emergence (89.9%) and other seed quality parameters. In storage also similar trend was observed. In interaction effect, acid extraction followed by NaOH extracted seeds dried at 35° C or in sun recorded the highest seed quality parameters. Similar trend was observed in storage also.

M. Sc.

Agricultural Economics

Hybrid Cotton Seeds Production and Marketing in Maharashtra : An Economic Analysis

A. B. MANE

1992

Major Advisor : G. K. HIREMATH

The Maharashtra State Seeds Corporation undertakes seed production programme on contract farmers' fields of various crops. Hybrid cotton is widely grown in the state. The seed production programme of NHH-44 and PKV Hy-2 is concentrated in Parbhani district. Two talukas ranking first and second in area under seed were selected for the study conducted during the year 1990-91. For the study of NHH-44 and PKV Hy-2, 80 and 60 sample seed growers were surveyed. The tabular presentation and production function were used as analytical tools. The findings showed that the production cost per hectare was found to be Rs. 67,061 in NHH-44 and Rs. 62,629 in PKV Hy-2 while the net return was higher in NHH-44 (Rs. 30,458) than in PKV Hy-2 (Rs. 28,148). The per hectare yields of seed obtained were 878 kg and 662 kg in NHH-44 and PKV Hy-2 respectively. Further, the study revealed that the hybrid cotton seed production was highly labour intensive. The man-days required were 3123 and 2866 per hectare for NHH-44 and PKV Hy-2 respectively. The application of NPK

fertilizers was more than warranted. The total quantity of NPK was 524 kg/ha against the recommended quantity of 200 kg. About 65 per cent of seed growers expressed that they had used pesticides indiscriminately for seed production programme. The ratios of MVP to price of land, NPK and irrigation were 0.86, -0.67 and -41.09 respectively which showed reduction of use of these inputs in PKV Hy-2. While the ratios of land, NPK, irrigation and plant protection chemicals were 5.97, 1.25, 10.38 and 3.34 which indicated necessity of increasing the quantities of these inputs in NHH-44 hybrid. The producer's share in consumer's rupee was 59.49 per cent in NHH-44 whereas it was 64.56 per cent in PKV Hy-2. Non-availability of labourers, lack of effective control measures, isolation problems, inadequate and untimely availability of capital besides high risk in production were the main problems confronting the growers. Adoption of recommended package of practices, timely input supply through Corporation, crop loan and insurance and transportation facilities would help to expand the seed programme.

Pattern and Flow of Institutional Credit to Agriculture In Karnataka : An Inter-District Analysis

HARISH R. RAO

1992

Major Advisor : H. S. VIJAYAKUMAR

The nature and extent of imbalances in the flow of institutional credit to agriculture among the districts in Karnataka were studied. The study was based on the data pertaining to all the 20 districts for 15 years (1975-76 to 1989-90). To compute the average compound growth rates of different variables, exponential form of regression equation was used. Cluster analysis of variables was adopted to assess the nature of association between the flow of institutional credit and the economic indicators viz. productivities of crops, gross cropped area, gross irrigated area and contribution of agriculture sector in districts' income. To examine the disparity in distribution of credit among the districts, Gini concentration ratios were computed. Belgaum district followed by Dakshina Kannada, Bellary and Raichur received higher amount of total credit disbursements by commercial banks and RRBs during 1989-90. Uttara Kannada, Bidar and Bijapur districts received lower amounts and Gulbarga and Raichur districts registered the highest growth rates (1980 to 1989-90). During 1989-90,

Belgaum district followed by Dharwad, Dakshina Kannada and Bijapur received higher amount of credit disbursed by Co-operatives. In the case of disbursements both by commercial banks and RRBs., jointly and Co-operatives, districts with heavy rainfall and or irrigation potential recorded lower growth rates. In those districts where foodgrain production forms the core of agricultural activity, close association of productivity of total foodgrains with the credit disbursements were found. In Belgaum, Chitradurga, Dakshina Kannada, Kolar, Shimoga, Tumkur and Uttara Kannada districts, higher degree of association of the growth in the GCA with the growth in the flow of institutional credit was observed. GIA was one of the determinants of flow of institutional credit. Decreasing Gini concentration ratios in the flow of agricultural credit in the cases of commercial banks and RRBs (0.4966 to 0.2840), Co-operatives (0.4271 to 0.3985) and total credit to agriculture (0.4641 to 0.3953) indicated that inequalities in the distribution of credit decreased during the study period.

Agricultural Extension

A Study on Role Performance, Time Spent on Them and Socio-Economic Characteristics of Rural Girls of Dharwad District, Karnataka

SUNANDA D. SITOLE

1992

Major Advisor : B. SUNDARA SWAMY

The study was conducted involving 160 randomly selected rural girls from Dharwad district to find out the different activities performed by them and to determine the time spent on each activity. An attempt was also made to know their leisure time activities, interest pattern and value orientation on different issues. The results of the study indicated that more than 50 per cent of rural girls performed home activities like sweeping, cooking, fetching water and washing clothes. The farm

activities performed by the rural girls were weeding, harvesting, cleaning land and grain storage. Comparatively less percentage of girls performed transplanting, sowing and winnowing regularly. Feeding cattle, milking, cleaning cattle sheds and feeding were animal husbandry activities performed by rural girls. Time spent by upper caste girls was more for performing home and animal husbandry activities as compared to lower caste girls. It was reverse in case of farm activities. Majority of the rural girls

were under the age group of 18 years and belonged to nuclear and medium sized, low income families. More than half of them were found to have low mass media participation and high social participation. Taking rest, knitting and embroidery, gardening and making decorative things were indicated as leisure time activities by a significant number of rural girls. Knitting and embroidery, listening to radio, travelling and gardening were the important activities in which girls were very much interested. A large majority of rural girls expressed high value

orientation towards family planning, girls education and scientific farming. Whereas large majority of the girls expressed low value-orientation towards work. Age, size of family, land holding and family income were found to have non-significant relationship with their value-orientation. Whereas education, mass-media participation and social participation exhibited significant relationship with their value-orientation. Lack of entertainment, traditions and customs, heavy work load were the important problems faced by majority of rural girls.

A Study on Socio-Economic Profile, Aspirations and Work Satisfaction of Women Workers of Cotton Ginning and Pressing Factorles, Hubli-Dharwad, Karnataka

NAGARATNA BIRADAR

1992

Major Advisor : B. SUNDARA SWAMY

Women workers are more in cotton ginning and pressing factories and are working under very bad conditions. Hence, it was essential for intensive and detailed studies to get facts as to their conditions and problems in order to implement remedies to improve their working conditions. In the present study, an attempt was made to the personal and socio-economic characteristics of women workers of cotton ginning and pressing factories, activities performed by them, their aspirations, work satisfaction, health problems and other problems encountered in performing their job. The study was conducted during the year 1992 in the Dharwad-Hubli twin city. Two factories from each town were selected, where 40 women workers were selected randomly to constitute a sample of 160 women workers. The data were collected by using pre-tested scheduled

by personal interview method. Majority of the women workers were illiterate, married, landless, middle aged, from lower castes, had nuclear and large size family, living in debt and in mud wall and thatched house and had very low level of mass media utilization. Putting and moving hands in cotton platform was the major activity performed at factory by women workers. Majority of the respondents had medium level of aspirations and medium work satisfaction. Caste was significantly associated with aspiration and work satisfaction. Family size, number of earning members and annual income exhibited positive and significant relationship with aspiration. More often the women suffered from cough and sore throat with fever. Dust and noise and heavy work were the major problems encountered by women factory workers.

A Study on Innovative Proneness and Silk Rearing Practices Followed by Sericulturists of Chitradurga District

RAGHUPRASAD K. P.

1992

Major Advisor : B. SUNDARA SWAMY

The study conducted in the year 1992 involving 150 sericulturists of Chitradurga district to know their innovative-proneness, silkworm rearing practices followed, economic grain obtained and

their socio-economic characteristics revealed that the level of innovative proneness of majority (58.00 per cent) of the respondents was low. All the respondents adopted the practices like disinfection

of rearing house, method of hatching eggs, proper care of worms during moulting as recommended. Also they possessed correct knowledge about identification of worms preparing for moult and identification of ripe worms. But method of bed cleaning as recommended was not followed by 74 per cent of the respondents followed by number of times of feeding (55 per cent), frequency of bed cleaning (33 per cent) and space of worms (26 per cent). About 40 per cent of the respondents were not knowing the correct symptoms of major diseases of silkworms. Demonstrator of the sericulture department was the most (53 per cent) contacted information source. Majority (85 per cent) of the sericulturists were middle aged, educated upto high school and Pre-University level

(41 per cent), from forward caste (64.00 per cent) had joint and large size family (91 per cent and 48 per cent, respectively) and possessed large holding (86 per cent). Further, they had medium level of cosmopolitaness, low level of social participation. Fifty per cent of the respondents each belonged to medium risk and market orientation categories. Family size, size of land holding and market orientation of the respondents were significantly associated with their innovative proneness. Forty one per cent of the respondents' annual income was less than Rs. 15,000. Distant market place (46 per cent), non-availability of labour (42 per cent), non-availability of eggs in time (26 per cent) were the important problems encountered by the sericulturists.

A Study on the Adoption Pattern of Groundnut Cultivation Practices Among Beneficiaries and Non-Beneficiaries of National Oilseed Development Project in Dharwad District

S. B. KOPPAD

1992

Major Advisor : L. MANJUNATH

This study was conducted during 1990-91 to know the adoption pattern of groundnut cultivation practices among beneficiaries and non-beneficiaries of NODP in Dharwad district. The independent variables were quantified by the scales and scoring procedures developed by earlier researchers. All the respondents both among beneficiaries and non-beneficiaries of NODP had followed the recommended sowing time, gypsum application and time of harvest of groundnut. There was no considerable variation in the overall adoption pattern of individual recommended practices. The variables such as land holding, annual income, material possession, live stock possession, scientific orientation, change proneness, and management orientation have greater influence

on adoption of recommended practices of groundnut in both the category of respondents. Agricultural Assistant was found to be the first and foremost consulted source of information. The least consulted sources of information were magazines and extension literature. High cost and non-availability of recommended varieties were the reasons for not using certified seeds. Lack of knowledge and non-availability of chemicals were attributed for non-adoption of seed treatment and *Rhizobium* inoculation. The most important problems encountered by both the group of farmers in groundnut cultivation were inadequate, erratic and untimely rainfall, costly inputs, price fluctuation, non-availability of quality seeds in time, storage and labour problems.