

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

DOCTOR OF PHILOSOPHY

AGRONOMY

**Integrated Nutrient Management in Rice - Soybean Cropping System and Management of Late
Transplanted Rice under Hill zone**

K.S. CHANNABASAPPA

2001

MAJOR ADVISOR : Dr. A.S. PRABHAKAR

Two field experiments were conducted to study integrated nutrient management in Rice-Soybean Cropping System and (2) Management of rice under late planted conditions at Agricultural Research Station (Paddy), Sirsi, during Kharif, Rabi 1998-99 and 1999-2000. The design of the experiments were split plot, split-split plot, and Randomised complete block design for rice, rice-soybean and rice crop respectively.

Productivity of low land rice improved by 9.15 and 5.36 per cent with the treatments that received *C. odorata* and *C. odorata* + *S. aculeata* respectively when compared with farmyard manure, *C. odorata* a non conventional green manure can also be thought as an alternative for green manure and FYM owing to its easy availability and cheap cost. Integrated use of 100 per cent RDN with organics sustained soil fertility. Integrated use of 100 per cent RDN with FYM or *C. odorata*, 100% RDN + *C. odorata* + *S. aculeata* and 100 per cent RDN + *C. odorata* + *S. rostrata* sustained the productivity and net returns of low lands.

Significantly higher net returns of rice was obtained with treatment that received 100 per cent RDN + *C.odorata* (24110 Rs ha⁻¹) and it was on par with the treatments that received 50 per cent RDN + *C. odorata* (22780 Rs/ha), 100 per cent RDN + *C. odorata* + *S. aculeata* (23810 Rs ha⁻¹) and 100 per cent RDN + *C.odorata* + *S. rostrata* (23140 Rs/ha⁻¹) Rice-Soybean system as a whole, application of 100 per cent RDN + organics or 50 per cent RDN + *C.odorata* to rice and no fertilizer to the soybean crop resulted in higher net returns.

In the second experiment, the productivity of late planted rice improved by 16.5, 13.5, 8, 8.4, 11.6 and 11.9 per cent by adopting management techniques like Four Seedlings per hill + 33 per cent more nitrogen, 25 per cent extra population + 33 per cent more nitrogen, Four Seedlings per hill + planofix spray, Four Seedlings per hill + triaconol spray, Four Seedlings per hill + urea spray and 25 per cent extra population + urea spray respectively when compared with that of recommended practice of rice cultivation.

CROP PHYSIOLOGY

**Studies on Physiological Parameters Confering Higher Productivity In
Cotton Hybrids and their Parents**

V.H. ASHVATHAMA

2001

MAJOR ADVISOR : Dr. B.C.PATIL

A field experiment was conducted during 1998-99 and 1999-00 under rainfed conditions at the Agricultural Research Station, Dharwad to study the physiological parameters contributing towards higher productivity in cotton hybrids and their parents.

The experiment consisted of twenty four genotypes comprising of 8 hybrids (4 inter specific and 4 intra hirsutum) and 16 parents laid out in a randomized block design with three replications on medium block soil. Hybrids and their parents were assessed for morpho-physiological, biophysical, biochemical, yield and yield components.

Seed cotton yield differed significantly among the hybrids. It ranged from 1103 Kg to 2385 Kg /ha. Among interspecific hybrids, DHB-105 recorded highest seed cotton yield (1858.6 Kg/ha) and in intrahirsutum hybrids, DHH 11 recorded significantly higher yield (2385.7 Kg/ha). Higher seed cotton yield was mainly attributed to its close association with yield components like number of bolls/plant ($r = 0.744$), boll weight ($r = 0.613$), harvest index ($r = 0.682$) and other characters such as total dry matter ($r = 0.802$), absolute growth rate ($r = 0.658$), relative growth rate ($r = 0.420$), net assimilation rate ($r = 0.487$), chlorophyll ($r = 0.444$), stem nitrogen ($r = 0.390$) and nitrate reductase ($r = 0.792$).

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Heterosis for seed cotton yield was maximum in DCH-32 (84.48%), for number of bolls per plant was in DCH-32 (90.65%) and DHB-105 (78.11%) and for boll weight in RAHB-51 (29.49%). Highest heterosis for harvest index was observed in Shruthi (95.69%) and RAHB-51 (47.76%).

The interspecific crosses had higher rates of photosynthesis than intrahirsutum hybrids. Highest rates

of photosynthesis were observed at 120 DAS. It had significant association with leaf area, SLW, mesophyll CO_2 , conductance, LUE and NRase.

It is inferred that medium duration, medium number of monopodia, more number of sympodia, higher SLW, AGF, more number of bolls/plant, high boll weight, harvest index, photosynthetic rate, chlorophyll, leaf nitrogen, soluble proteins and NRase are desired for more yield.

GENETICS AND PLANT BREEDING

Identification and Development of Moisture Stress Tolerant Lines Through Pollen Selection in Sorghum

BASAVANAGOUDA S. PATIL

2001

MAJOR ADVISOR: Dr. P.M. SALIMATH

The study was carried out during 1998-99 and 1999-2000, at Main Research station, UAS, Dharwad. In the study pollen germination medium for rabi sorghum genotypes was standardized. The effect of Poly Ethylene Glycol (PEG) as an osmoticum on *in vitro* pollen germination and tube growth of fourteen genotypes grown under stress free and six from pre-flowering moisture stress environment was examined. The PEG for 50 per cent inhibition of pollen germination was highest in Sel.3, GRS-1, RSLG 241 and M 35-1. It was more for pollen grains of stressed plants than plants raised under stress free environment. Two sets of thirteen hybrids were developed through control and selective fertilization, using cytoplasmic male sterile lines 104A and 116A as female parents. The progenies were evaluated under stress and non-stress environments. The progenies obtained through selective fertilization performed better compared to that of control pollination for most of the characters including grain yield in both the environments.

The evaluation of fourteen rabi sorghum genotypes for pre- and post-flowering stress environments indicated that expression of most of the characters was lowered in both pre- and post-flowering stress moisture stress. However, the genotypes E 36-1 and 100 No. recorded moderately high and consistent level of grain yield in both stress and non-stress environments. Except catalase, none of the enzymes showed polymorphism either between genotypes or due to moisture stress treatment.

Line x Tester analysis involving, 27 hybrids and 12 parents indicated the predominance of non-additive gene action for most of the characters. The crosses 116A x GRS-1, 116A x RSLG 262, 116A x RS 29, 104A x GRS-1, 104A x Chitapur local, 323A x, AJ-2113, 323A x PHR 5 and 323A x M 35-1 were identified as outstanding crosses for exploitation of morpho-physiological traits in stress environment. Association study revealed that selection could be emphasized on leaf area, panicle length, panicle width and panicle weight for improving grain yield in stress environment.

SEED SCIENCE AND TECHNOLOGY

Investigations on Seed Production and Post Harvest Techniques in Cucumber (*Cucumis sativa* L.) Cv. Polinsette

G.H. RAVIKUMAR

2001

MAJOR ADVISOR: Dr. M. SHEKHARGOUDA

Cucumber is warm season crop mainly grown in tropical and sub tropical regions. Non availability of quality seed is one of the major constraint in getting higher fruit and seed yield. The present investigations are carried out at Regional Research Station, Raichur during kharif 1999 and summer 1999-2000 to develop suitable seed production technology for cucumber.

The kharif season is better suited for fruit and seed production under Raichur conditions. The spacing of 1.50 x 0.5 m recorded higher fruit yield (154.92 q ha⁻¹) and seed yield (76.6 kg ha⁻¹) compared to 1.50 x 0.75 m spacing. Nipping at 12th node recorded higher fruit yield (139.0 q ha⁻¹). No nipping recorded higher number (119.7) per centage (170.9%) of filled seeds per fruit. All fruit retention

recorded significantly higher fruit yield (144.7 q ha⁻¹). The seed quality was not influenced due to spacing and nipping treatments. Two fruit retention recorded significantly higher germination (87.7%), root length (11.32 cm.), shoot length (14.62 cm) and vigour index (2273).

During kharif significantly higher seed yield of 72.61 and 72.26 kg was recorded with 80 P and 120 K kg ha⁻¹ respectively. The application of 120:80:50 NPK kg ha⁻¹ recorded higher seed yield. In kharif significantly higher germination percentage of 88.0, 87.9 and vigour index of 2060, 2046 were observed with the application of 120 kg

N and 80 kg K respectively. Similar trend was also noticed with summer season

The fermentation method of seed extraction recorded significantly higher germination (82.8%) compared to acid extraction and was on par with alkali extraction. Drying in oven at 40°C recorded lowest time of 18.44 hours with higher seed quality parameters.

At the end of 14 months of storage, seeds treated with thiram (2g/kg) and stored in aluminium pouch recorded germination percentage above the minimum standard of seed certification (60%).

AGRICULTURAL MICROBIOLOGY

Studies on Mineral Phosphate Solubilizing Bacteria in the Vertisols of Northern Karnataka

VIKRAM APPANNA

2001

MAJOR ADVISOR : Dr. A.R. ALAGAWADI

Investigations were carried out on the mineral phosphate solubilizing bacteria in the vertisols of Northern Karnataka and their relationship with soil physical, chemical and microbiological properties was analysed. The correlation coefficient worked for PSB population to that of soil properties indicated a strong positive correlation between PSB population and that of total bacteria, soil organic carbon and available N, whereas, other properties had no significant correlation with PSB population. In a further attempt to develop suitable strains of PSB for vertisols, 55 PSB strains from rhizosphere of various crop plants grown on vertisols were isolated, identified and screened for their efficacy to solubilize different insoluble phosphates. *Pseudomonas* and *Bacillus* were the predominant genera among the isolates. Thirty efficient PSB isolates were then analysed for production of organic acids, IAA and GA. Most of the isolates produced 2 - 4 different organic acids, as well as IAA and GA. Based on

the efficiency of mineral phosphate solubilization, IAA and GA production, 16 strains were selected for pot culture experiment with greengram and sorghum as test plants. Most of the PSB strains significantly enhanced the nodulation, growth, drymatter content and P uptake in greengram plants at 45 DAS over RP control. The growth, drymatter content, P uptake and yield of sorghum plants were also enhanced significantly over RP control by many strains. Based on the performance under pot culture conditions, seven efficient strains were selected for field performance with greengram crop. Six of them significantly increased the grain yield of greengram over RP control. However, strain 98(2) showed significantly higher grain yield over SSP control also. The transformation and expression of *pfqq* genes in *Azospirillum* was done by mobilizing the construct pMCG898 into MPS-*Azospirillum* by biparental mating and the transconjugants obtained were able to solubilize dicalcium phosphate without alteration in their N₂ fixing abilities.

HORTICULTURE

Standardization of Propagation and Post-Harvest Techniques in Custard Apple (*Annona squamosa* L.)

PRAVEEN JHOLGIKER

2001 MAJOR ADVISOR: Dr. B. SATHYANARAYANA REDDY

Experiments on standardization of propagation and post - harvest techniques were carried at two locations, viz., Kittur Rani Channamma College of Horticulture, Arabhavi and Department of Horticulture, University of Agricultural Sciences, Dharwad during 1998 to 2001.

In propagation studies, the seed treatment with GA₃ 200 ppm under misthouse ecosystem was found to be the

most feasible one which resulted in very high per cent germination(88%) in seeds of 60 days after extraction from fruit. A meager per cent rooting of 18.33 was obtained in cuttings of dormant season on treatment with IBA 5000 ppm + NAA 5000 ppm under misthouse environment.

Very high graft success of 95.0 and 90.0 per cent was recorded for veneer and wedge methods of grafting, respectively. Further, grafting in the months of February

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and March recorded a high per cent graft-take (>90%) during both the years (1999-2000 and 2000-2001) of experimentation. Studies on storage of scions pointed out that scions of *A. squamosa* L. produced healthy grafts upto seven days of storage. Propagation under misthouse and modified propagation chamber yielded a high graft success of 96.67 and 93.33 per cent, respectively. The rootstock of *A. squamosa* L. was suitable and compatible for different *Annona* spp. except for *A. muricata*.

Post-harvest studies revealed that corrugated paper board box is idea for storage, transportation and marketing of custard apple fruits. Further, post-harvest treatment with coating material of Sago, Arrowroot and waxol at 10 per cent and storage in zero energy cool chamber improved shelf life by 9 to 11 days without any adverse effect on quality of fruits.

HUMAN DEVELOPMENT

Indigenous Knowledge Systems Used for Health Care of People in Shikaripur Taluk of Shimoga District with Special Reference to Women and Children

C. ANUPAMA

2001

MAJOR ADVISOR: Dr. K. SAROJA

This study was carried out during 1998-2000 in Shikaripur taluk. The sample of the study were 15 indigenous medicinal practitioners, 10 traditional birth attendants, 39 patients and 150 general public in the Shikaripur taluk.

The results showed that the system of indigenous medicine is fairly prevalent in the study area. Patients and even the general public were found to possess varying degrees of the knowledge of indigenous medicines. Even the market survey carried out showed the easy availability of indigenous medicines.

Majority of the indigenous medicinal practitioners were found to be popular in the study area. Most of them were males from upper class and caste, fairly educated and belonging to the older age group of above 60 years. Majority acquired their knowledge through their parents as a family tradition.

Majority of their patients were women and children, living below the poverty line and with low educational

level. Half of the women patients visited the practitioners for their reproductive health problems. This implies that the indigenous medicinal system caters to the needs of poor rural masses and especially women and children. Majority of the child patients were treated for health problems like sore ear, jaundice, diarrhoea etc. Majority of the patients were observed to be either fully cured or on the verge of getting cured.

Birth attendants were poor, illiterate, old women from backward castes. As such the general public and their clients took their services for granted and paid them very meagerly. Thus due to the low status of their job and public disinterest, *Dais'* knowledge of indigenous medicines was found to be fast declining.

From the market survey, 150 samples of the indigenous medicines were collected, authenticated and classified according to their successful use in the treatment of various diseases. The results imply the necessity of reviving and strengthening the indigenous medicinal system.

Master of Science

CROP PHYSIOLOGY

Effect of Nutrients on Rust Resistance in Soybean

HEMA MORAB

2001

MAJOR ADVISOR: Dr. R.V. KOTI

A field experiment was conducted during kharif, 2000 to study the effect of nutrients on rust resistance in soybean at Agricultural College Farm, University of Agricultural Sciences, Dharwad. The experiment consisted of one genotype, JS-335 susceptible to rust and nine foliar application treatments viz., control (unsprayed), fungicide (Hexaconazole 0.1%), manganese sulphate (0.3%), ferrous sulphate (0.5%), zinc sulphate (0.2%), boric acid (0.2%), copper sulphate (0.2%), elemental sulphur (0.1%) and magnesium sulphate (0.5%). The experiment was laid out in a randomised block design with three replications and the treatments were imposed at 35 and 50 DAS.

The rust infestation and severity increased as the crop advanced towards maturity. All the morphological characters were decreased due to the rust. Whereas, the biochemical parameters viz., total chlorophyll, chlorophyll 'b', phenol contents and peroxidase activity were enhanced along with the disease severity from 45-60 DAS. There was a significant reduction in number of

leaves and leaf area due to disease infestation. The growth parameters like CGR, AGR were maximum between 45-60 DAS than at 60-75 DAS. However, these growth parameters and morphological characters were maximum in the fungicide treatment followed by the application of $MnSO_4$ and boric acid.

The maximum control of disease was found in fungicide treatment with PDI of 7.5 as compared to control (89.6). The secondary nutrients (sulphur and magnesium) and micronutrients (iron, zinc, copper, manganese and boron) also found to offer resistance to the disease with PDI ranging from 33.7 ($MnSO_4$) to 79.9 ($FeSO_4$). Foliar application of fungicide recorded significantly higher number of pods per plant, seeds per plant, 100-seed weight and seed yield followed by $MnSO_4$ and boric acid. The cost:benefit ratio of $MnSO_4$ (0.3%) sprayed twice at 35 and 50 DAS was almost on par with that of fungicide treatment and hence the spray of $MnSO_4$ can be recommended for the control of soybean rust.

Physiological and Histochemical Changes Associated with the Male Sterility in Brinjal Using plant Growth Regulators

SREENIVASA V. CHINTAL

2001

MAJOR ADVISOR: Dr. NALINI PRABHAKAR

A field experiment was conducted at College of Agriculture, University of Agricultural Sciences, Dharwad during kharif, 2000 to study the physiological and histochemical changes associated with the male sterility in brinjal using plant growth regulators.

The plant height increased significantly due to NAA and decreased with MH and 2,4-D. The application of NAA increased the leaf area significantly however, MH and 2,4-D treatment decreased the leaf area. Number of branches per plant increased significantly due to MH over

control. Length of peduncle, length of pedicel, number of flowers per inflorescence, size of corolla, size of stamen, and number of stamen did not vary significantly with the application of plant growth regulators. Application of MH @ 200 ppm sprayed at 10 days before bud initiation + at bud initiation stage resulted in poor pollen germination as compared to 2,4-D and NAA.

Application of plant growth regulators induced pollen sterility to varying degrees depending on the nature of plant growth regulator, concentration and the stage of

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spray. Application of MH @ 200 ppm concentration sprayed at 10 days before bud initiation + at bud initiation stage resulted in higher pollen sterility (70.10%). Maximum pollen sterility was reached at 29 days after flowering and the sterility per cent started declining thereafter. Absolute fertility restoration was observed after 45 days after flowering.

Fruit length and diameter were significantly reduced by 2,4-D treatments. MH and NAA treatments did not alter fruit length and diameter significantly.

In MH treated anthers, shriveling of anther, anther locule, microspores, degeneration of anther wall, clumping of meiocytes and early degeneration of tapetum were the salient features observed. In control plants, all these features were noticed to be normal. Histochemical localization of polysaccharides, proteins and RNA exhibited low concentration in MH treated plants. Enzymatic localization of succinate dehydrogenase, esterase and peroxidase in pollen grains of MH treated plants was low to very low. On the contrary, in control plants pollen grains recorded very rich activity of these enzymes.

GENETICS AND PLANT BREEDING

Genetic Analysis of Height Isogenics in Wheat Under Rainfed Conditions

R. KRISHNA MOHAN

2001

MAJOR ADVISOR: Dr. R.R. HANCHINAL

A study was undertaken with 15 pairs of height isogenic lines (9 pairs of bread wheat and 6 pairs of durum wheat) to elucidate information on field emergence and root characteristics, morpho-physiological association of tall types over their dwarf counterparts. And also to find the genotype x environment (GxE) interaction, phenotypic stability over locations with respect to yield, yield attributes and grain quality parameters. Evaluation was done at Dharwad, Annigeri and Bagalkot during rabi 1999-2000. Observations were recorded on yield, yield components, physiological and grains quality parameters.

Variability parameters generally exhibited high values for GCV, PCV, GA and GAM for all the characters under study.

In character association study, spike length, grains per spike, spikelets per spike, plant height showed positive association with grain yield under stress environments. Effects of genotypes and environments were significant for all the 18 characters under study, thereby indicating presence of large genetic variability in the material.

The stability analysis based on stability parameters revealed that the accessions 2 (Nesser dwarf), 3 (Pavon dwarf) and 18 (Nesser tall) as the most adaptable genotypes over environments showing stability for more number of traits including yield.

But it may be noted here that root length and field emergence did not displayed significant difference between tall and their dwarf isogenic lines.

Evaluation and Characterization of Indigenous Rice (*Oryza sativa* L.) Germplasm Collection Under Upland Ecosystem

NIRALA RAMCHIARY

2001

MAJOR ADVISOR: Dr. R.R. HANCHINAL

A field experiment was conducted at Agricultural Research Station, Mugad, during kharif 2000 to estimate genetic variability for qualitative and quantitative traits and genetic divergence among 132 indigenous rice germplasm collections of western Ghats of Karnataka. Observations were recorded at different crop growth stages both for qualitative and quantitative characters. Significant genotypic

differences were observed for all the traits under study thereby indicating presence of large genetic variability in the material.

High genotypic co-efficient of variation, high heritability as well as high expected genetic advances were observed for flag leaf angle, flag leaf length, plant height, number of

panicles per meter, L:B ratio, 1000 grain weight, root length, root number per plant, root dry weight, grain yield per plot, straw yield per plot and harvest index.

In character association study, harvest index, straw yield per plot, 1000-grain weight, filled grains per panicle, main panicle weight, panicle length, number of panicles per meter, plant height and flag leaf length, showed significant positive association with grain yield per plot. L:B ratio, harvest index and straw yield per plot exhibited high positive direct effect on grain yield per plot.

The D² analysis revealed distribution of 132 rice genotypes into 16 clusters. Cluster IX with Raja Khaima

and cluster XIII with three genotypes viz., Padmarekha, Mysore malige and M.S. were strikingly diverse with rest of the clusters.

Based on mean performance of the genotypes, 23 genotypes (Medum sali, Basumati, Mysore mallige, Bangargund, Mullu kalavi, Bidar local-1, Halkalasali, Udursali, Antar sali, Somasali, Karigajavile, Konnur local, Dambor sali, Black paddy, Ofle farm batta, M-141, Alur sanna, Soratiga, Ambemohr, Bile dodiga, Jaddo batta, Gopal dodiga and Woner-1) were identified as potential genotypes for specific agromorphological traits. It has been suggested to use these genotypes in future breeding programme for improvement of specific traits in rice.

Genetic Variability for Early Vigour, Root and Nodulation Traits in Chickpea (*Cicer arietinum* L.)

H.B. MALLIKARJUN

2001

MAJOR ADVISOR : Dr. V.S. HEGDE

The experiment was conducted during rabi 2000-01 at College of Agriculture, Dharwad, involving 36 diverse genotypes with the objectives of studying the variability, heritability and genetic advance for early vigour, root and nodulation traits, association pattern among early vigour, root and nodulation traits and their relationship with yield and its components, to study the genetic diversity for early vigour, root and nodulation traits and to identify the suitable genotypes for early vigour, deep and dense root system and high nodulation.

The genotypes showed significant variability for all the traits under study except number of primary branches at 25 DAS. High variability (PCV and GCV), heritability and genetic advance was observed for leaf area, shoot dry weight at 50 per cent flowering, root dry weight, nodule number per plant, nodule dry weight per plant, average nodule dry weight, secondary branches per plant, seeds per plant, seed yield per plant and 100-seed weight.

Seed yield showed strong positive association with shoot length at 25 DAS, secondary branches at harvest, number of pods per plant, number of seeds per plant and 100-seed weight. Hundred seed weight showed strong positive correlations with shoot length at 25 DAS, shoot

dry weight at 25 DAS, root length and root dry weight, nodule number per plant, nodule dry weight 100-seed weight and shoot dry weight at 25 DAS reveals that the dry matter accumulated early in the season in partitioned into seed resulting in large seed size. Hundred seed weight was also observed to have a strong positive association with seed yield. Hence, seed size can be used in indirect selection not only for the improvement of seed yield, but also the traits related to early vigour and high nodulation.

Mahalanobis's D²-statistic was used to classify 36 genotypes into similarity groups. Nodule dry weight per plant, days to 50 per cent flowering and physiological maturity contributed maximum to genetic divergence. Maximum divergence was observed between genotypes ICC 10448 and ICCV 42. Thirty six genotypes could be classified into seven clusters. Cluster V (L 550) and cluster VII (ICCV 42) were found to be highly divergent.

The study also involved identification of genotypes for early vigour, root and nodulation traits. The genotypes identified for early vigour (GCP 107, Sushillaxmi, ICC 4958), deep and dense root system (ICC 4958) and high nodulation (K 850 and ICCV 42) can be used as donors in the chickpea improvement programme.

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PLANT BIOTECHNOLOGY

Regeneration and Transformation Studies In Pigeonpea (*Cajanus cajan* L.) cv. ICPL-8863 (Maruti)

MAMATHA V. HOOLI

2001

MAJOR ADVISOR : M.S. KURUVINASHETTI

Investigations were carried out to standardize protocols for regeneration and transformation in pigeonpea cv. Maruti. For regeneration, direct organogenesis was carried out using different cytokinins and auxins at different levels on different explants of pigeonpea. Among the different explants viz, cotyledonary node with cotyledon (CNC), cotyledonary node with part of the cotyledon (CNP), cotyledonary node (CN), epicotyl and leaf; shoots and shoot buds were seen only in CNC, CNP and CN. Epicotyls bulged and showed compact, green and non-morphogenic callus at the cut ends while leaf explants only bulged and curled.

In experiments with BAP, 1 mg/l BAP (1.708), CNC (1.8) and the treatment combination CNC with 1 mg/l BAP (2.875) were found to be the best with respect to shoots/explant and for shoot buds/explant, CNP (9.681), 2mg/l BAP (17.08) and the treatment combination CNP with 2 mg /BAP (20.0) were best among explants, level of BAP and their combinations respectively. In experiments with kinetin, CN produced an average of 2.25 shoots/explant

and an average of 9.317 shoot buds/explant with 2 mg/l kinetin. In TDZ experiments, CN gave best response producing, on an average, 0.625 shoots/ explant and 1.425 shoot buds / explant at 0.1 mg/ l TDZ.

Considering all the experiments, it was found that for number of shoots/ explant, CN (1.154), BAP (1.352) and the treatment combination with BAP (1.8) were better than the rest and for shoot buds/explant, CNP (5.419), BAP (8.410) and the treatment combination CNP with BAP (9.681) were ideal. Elongation of shoots was observed on auxin supplemented MS medium. Thus regeneration through direct organogenesis was successfully obtained.

For transformation protocol, Agrobacterium mediated transformation was tried out. Kanamycin sensitivity of explants was seen at elongation stage at 100 mg/l and above and at rooting stage at 50 mg/l and above of kanamycin in the medium. The strains of *Agrobacterium tumefaciens* used in the study were sensitive to cefotaxime at the level of 100 mg/l and above. After co-cultivation, shoot buds were seen on explants when protocol II was followed, but they did not elongate further.

SEED SCIENCE AND TECHNOLOGY

Effect of Gypsum, NAA, Harvesting Stages and Post Harvest Ripening Periods on Seed Yield and Quality in Brinjal cv. Composite-2

THERAKAM SURESH BABU

2001

MAJOR ADVISOR: DR. M.B. KURDIKERI

A field experiment was conducted to ascertain the effect of gypsum and NAA on crop growth, fruit yield, seed yield and quality in brinjal Cv. Composite-2 at University of Agricultural Sciences, Dharwad during kharif 2000. The experiment comprised of four levels of gypsum as soil application of NAA viz., 0.10 and 20 ppm spray at initiation of flowering. Among the treatment combinations, soil application of gypsum @ 150 kg per ha and foliar spray of NAA (20 ppm) resulted in maximum plant height at 120 DAT (102.03 cm), fruit size (21.44 cm), number of fruits per plant (25.67), fruit yield (35.86 t/ha), number of seeds per fruit (411.77 seed yield (774.07 kg/ha) and seed recovery percentage (2.42). Similarly this treatment combination recorded maximum seed quality parameters viz., 1000 seed

weight (4.34 g), germination (94.90%), vigour index (1202), seedling dry weight (7.498 mg) and field emergence (88.94%) while electrical conductivity of seed leachates was minimum (0.891 dSm⁻¹).

A Study was conducted to ascertain the effect of fruit harvesting stages (purple, half yellow and full yellow colour) and post harvest ripening periods (0, 2, 4, 6, 8 and 10 days) on seed yield and quality in brinjal. Fruits harvested at full yellow colour stage and kept upto six days of post harvest ripening period recorded highest seed weight per fruit (1.28 g), seed recovery percentage (2.16), 1000 seed weight (3.71 g), and field emergence (85.55%) while, electrical conductivity was lowest (1.341 dSm⁻¹)

AGRICULTURAL ENTOMOLOGY

Evaluation of Indigenous Technology for Management of *Helicoverpa armigera* (Hubner.) and *Spodoptera litura* (Fab.)

ABHAY BHASKAR BARAPATRE

2001

MAJOR ADVISOR : Dr. S. LINGAPPA

Investigations on the utilization of indigenous practices for pest management against two lepidopterous pest viz., *Helicoverpa armigera* (Hub.) and *Spodoptera litura* (Fab.) was carried out during 2000-2001 in the Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad.

In the laboratory, preliminary study revealed that the cow urine (5%) + half dose of insecticides viz., endosulfan (0.035%) and quinalphos (0.025%) were effective by causing highest per cent mortality against both the test insects. The next best treatments were mixture of pongamia (5%) + aloe (2.7%) + NSKE (5%) + cow urine (13%) followed by NSKE (5%) against *S. litura*, and pongamia + aloe + NSKE + cow urine and NSKE against *H. armigera*.

Among the indigenous practices tasted, extracts from pongamia + aloe + NSKE + cow urine, agave + chilli and NSKE exhibited significant superior antifeedant activity against *S. litura* and extracts of pongamia + aloe + NSKE +

cow urine, NSKE, vitex + aloe against *H. armigera*

Indigenous practices found to have moderate effect in reducing the larval number and increasing grain yield in field. Pongamia (10%) + aloe (5%) + NSKE (10%) + cow urine (30%) performed better among indigenous practices against *S. litura* on groundnut, but standard check, quinalphos was significantly superior over all other treatments.

The cost benefit ratio (1:11.18) was highest in the case of the NSKE (8%) among indigenous practices.

In management of *H. armigera* under chickpea ecosystem all indigenous practices performed poor at the end of third spray. Vitex (20%) + aloe (2%) and pongamia + aloe + NSKE + cow urine were comparatively better to other indigenous practices and were on par with quinalphos. Although the yield was highest in pongamia + aloe + NSKE + cow urine, but the C:B ratio was highest in the case of NSKE (8%) and vitex + aloe.

PLANT PATHOLOGY

Studies on Mosaic Disease of Tomato (*Lycopersicon esculentum* mill.)

N. RAJA KUMAR

2001

MAJOR ADVISOR : Dr. A.S. BYADGI

The production of tomato, an important vegetable crop in Karnataka, is limited by the attack of pests and diseases. Among the viral diseases, mosaic, in addition to leaf curl is an important problem in tomato production.

The survey undertaken in parts of Belgaum, Dharwad, Gadag and Haveri districts indicated presence of mosaic in all the places surveyed ranging from 9.4 per cent (Annigeri) to 44.3 per cent (Kagwad).

The infected plants were characterised by production of light and darkgreen mosaic on leaves and

down ward curling. The virus was readily transmissible through sap and aphids but not through seed, dodder and whiteflies.

The virus had a TIP of 55 to 60 °C, DEP of 10^{-8} to 10^{-4} and LIV of 144 hours at room temperature ($27 \pm 1^\circ\text{C}$). The virus had a limited host range and produced necrotic local lesions on *Chenopodium amaranticolor*, light and dark green mosaic mottling on *Nicotiana tabacum*, *Nicotiana glauca*, *Solanum tuberosum* and *Datura metel*, mottling and crinkling of leaves in *Capsicum annuum* and black necrotic local lesions on *Cajanus cajan*, *Dolichus lablab*

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and *Vigna sinensis*. These studies indicated association of PVY with tomato mosaic disease. Which was confirmed by electron microscopic studies as few long flexuous virus particles, approximately 650-750 nm in size resembling Potyvirus were observed in infected leaves. However ELISA results indicated association of two viruses i.e., PVY and CMV with mosaic disease. Hence, it was concluded that the tomato mosaic in this tract is caused by a mixed infection of PVY and CMV.

Among the different insecticides, viricides and plant extracts tested monocrotophos (0.01%) and dimethoate (0.175%) were effective in controlling aphids and keeping mosaic incidence low.

Among 225 lines screened against the disease none of the lines were found to be immune. Only six lines were resistant and remaining all were either susceptible or highly susceptible.

AGRICULTURAL ECONOMICS

A Study on Sustainability of Dry Farming on Small and Marginal Farms In Bijapur District of Karnataka

M.S.RAGHAVENDRA

2001

MAJOR ADVISOR : Dr. L.B.KUNNAL

Rainfed agriculture occupies a large chunk of arable land in Karnataka. Nearly 80 per cent of the cultivated land in the state experiences drought with average annual rainfall of 500 mm or less. 66.62 per cent of farmers own less than 2 hectare of land (small and marginal). These farmers are unable to make both ends meet with the income from cropping alone. The situation is further worsened due to repeated failure of monsoons. The present study was undertaken in Bijapur district (Northern dry zone of Karnataka), to find out the possible ways to make dry farming on small and marginal farms a sustainable one.

A multistage sampling procedure was adopted for the selection of sample farmers. The data collected from these farmers was subjected to tabular analysis.

Majorities of the small (56.67%) and marginal (66.67%) farmers in the study area were illiterate and they mainly grew bajra crop in kharif and jowar crop in rabi season.

Asset (resource) position of both the small and marginal farmers was very poor. The total average value of asset of small farmers was Rs.1,44,762.67 and that of marginal farmers was Rs.75,878.17. The land formed the major asset of these farmers and they hired implements and draft power.

Small and marginal farmers are heavily depending on moneylenders for their financial needs and they have

huge amount of overdues (Rs.28,993.54 in case of small and Rs. 15,979.40 in case of marginal farmers) with financial institutions. Debt-equity ratio was 0.24 in case of small farmers and 0.38 in case of marginal farmers indicating very heartening performance of farming.

Small and marginal farmers could not use the recommended levels of inputs in cultivation of crops because of their poor resource base, which led to poor yields on their farms.

Most of the small (60%) and marginal (75%) farmers practiced only crop production and small per cent of the farmers diversified their production activity.

The total average annual income of the small and marginal farmers was Rs. 32,248.96 and Rs. 28,197.83 respectively, of this income 54.78 per cent in case of small farmers and 60.79 per cent in case of marginal farmers was earned from agriculture and allied activities. Incomes earned by the small and marginal farmers from crop enterprise are very low (6.43% and 3.16%). Male members of the farm households migrated to the border states (Maharashtra and Goa) in off season to earn livelihood.

The farmers who reared livestock along with crop enterprise could earn a reasonable level of profits. Hence small and marginal farmers in dry farming areas should in variably go for livestock enterprises along with their crop production activities. Based on the findings sustainable farming systems have been suggested.

FORESTRY

Studies on Sandal Spike with Special Reference to Disease Resistance

B.SHAFIULLAH

2001

MAJOR ADVISOR : Dr. S.T. NAIK

The Sandal tree (*Santalum album* L.), the source of East Indian Oil underpins the Indian culture. Sandal spike disease is one of the important constraints in the production of sandal. Survey for spike disease conducted during 1999-2000 in Mysore division of Karnataka and Dharmapuri division of Tamil Nadu indicated that the highest disease incidence was recorded in Chamundi Hills (53%), least disease incidence was recorded in Harur SF (3.8%).

Among all species grown in association with sandal in different forests, the association of Witches' broom affected *Zizyphus oenoplea* was common wherever the sandal spike disease was observed.

Among the identified insects, *Moonia* sp., and *Coelidia indica* were reported as insect vectors for spike

disease. Correlation studies showed that there is a positive correlation between population of *coelidia indica* and spike disease incidence. Regression equation ($Y = 3.232 + 1.62X$) fit for this relation suggested that for every 1 per cent increase in population of *Coelidia indica* it resulted in 1.62 per cent increase in spike disease incidence.

In vitro studies carried out to test the disease resistance indicated that treatments viz., MS + 2,4 -D 1mg l MS + 2,4 -D 2 mg l resulted in callus induction of 25.75 per cent and 10.5 per cent respectively. As per the results, the extracted toxin like substance contained highest amount of total sugars (48.07 µg/l) and least amount of orthodihydroxy phenols of 4.07µg/l. *In vitro* testing of disease resistance indicated that callus remained healthy in low concentration levels of toxin (up to 0.2 %).

Studies on Rust of Teak Caused by *Olivea tectonae* (Racib.) Thirum

V. MAHESWARAPPA

2001

MAJOR ADVISOR : Dr. S.T. NAIK

Tecton grandis is an aristocrat of timber species which integrated into agricultural system for multifarious uses and land care benefits. Among various biotic factors foliar rust caused by *Olivea tectonae* (Racib) Thirum is important

Survey conducted for rust disease in teak indicated that plantations under bioclimatic zone VI had higher incidence (100%). There areas received moderate rainfall with more number of rainy days thus suffered high disease incidence.

The pathogen was identified morphologically as orange yellow, hypophyllous and subepidermal measuring 0.2 mm X 0.1 mm maximum number of uredospores (17,980 uredospores/cm²) were observed in highly infected leaves. The higher germination of uredospores was observed in May, 2000 (58.47%). Rust severity, rate of disease development and maximum defoliation was higher in 3-6 year teak (67.50%, 0.153 and 25.60% respectively).

The logistic model was found to be more

appropriate prediction of disease development as it gave linear relation with environmental factors.

The simple correlation worked out for disease severity for 1-2 year and 3-6 year teak indicated that, rainfall and wind speed had positive significant influence in disease. The path coefficient analyses suggested that maximum temperature, minimum temperature and wind speed had positive direct effect on rust severity.

In the rust management under field conditions in two locations (Mundgod and Murakatti), Tridemorph (T2) showed less disease intensity followed by Nimbicide 3ml/l compared to control. Rate of disease development, AUDPC and per cent defoliation after 30 days of first and second spray suggested that there was low spread of disease and low AUDPC values in T2 at both the locations compared to control. The highest volume increment was observed in T2 (54.21%).

Sources from Gundvamoli, Vimoli and Kulagi were free from rust and healthy leaves of these clones contained higher phenols (1.483 mg/g).

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AGRICULTURAL ENGINEERING

Hydrological Investigations of Singnodi (Ag 2m) Watershed in Krishna River Basin

A.V. KAREGOUDAR

2001

MAJOR ADVISOR : S.S. KUMATHE

The Singnodi (Ag 2m) watershed, one of the high priority watershed in the Krishna river basin in Raichur taluk was studied during the years 1998-2000 and was found to be a fourth order watershed having a dendritic drainage network, elongated in shape (stream length ratio (R_L)= 1.22 to 1.36, stream area ratio (R_A) = 2.43 to 2.62 and bifurcation ratio (R_B)=3.1 to 3.50) resulting in time to peak of 5.32 hr and time of concentration of 7.00hr. Linsley *et al.* (1958) and James *et al.* (1987) models were found to be able to predict the time to peak with a relative error of

27.63 and 45.11% respectively. The watershed has an *archean* age geologic structure, soils with poor internal drainage, flat gradients (Main channel slope= 1 in 294.11 and Relief Ratio = 1 in 285.71) and semi-arid climate. It was found that 64.6% of the total watershed area comes under the land capability classification of III and , necessitating intensive use of erosion control practices to control soil erosion if crops are grown in a regular rotation and 23.27% of land comes under class IVa and is more suitable for pasture.

HORTICULTURE

Studies on Wedge Grafting in Tamarind (*Tamarindus indica* L.)

V.SATHISH KUMAR

2001

MAJOR ADVISOR : Dr. A.N. MOKASHI

In view of the established superiority of vegetatively propagated planting material over the use of seedlings, especially in heterozygous perennial crops like tamarind, studies on wedge grafting in tamarind (*Tamarindus indica* L.) were carried out.

Among different provenances studied for their growth and graftability, P_8 (Tadas) followed by P_1 (Bailhongal/Hosur) P_4 (Garag-Dharwad) recorded maximum germination per cent, while P_6 and P_7 has taken minimum period (15 days) for fifty per cent germination. P_8 has given highest per cent of graftable seedlings among all the provenances. Further, P_8 recorded highest graft success (95.01%) followed by P_1 and P_3 (Bailhongal -Murgod) 30 days after grafting, while it was P_1 (39.03%) and P_3 (34.93%) which recorded higher graft success 90 days after grafting. However, P_7 (Dharwad) put forth good vegetative growth on the graft.

The age of the rootstock was found to have no significant effect on graft success at all the stages of

observation except 30 DAG. However, numerically highest graft success (51.96%) was observed with 8 month old rootstocks, followed by 7 months (45%) and 4 months (44.56%) old rootstocks. With regard to sprout length, 90 days after grafting significantly longer sprouts (7.08 cm) were recorded in 10 month old rootstock followed by 9 months old rootstock, while all other age groups were found on par with each other. Rootstock girth was also found to have no influence on graft success and development. However, highest graft success was noticed with the 0, 4-0.6 cm girth group.

It was interesting note that the season of grafting had the profound influence on grafting success. Grafting done during February recorded as high as 92.49 per cent success followed by 58.57 per cent in case of January 30 DAG. However, 90 DAG fairly higher per cent (48.61%) of graft success was recorded in January grafted stocks than February (38.79%). Incidentally least success of only 12.03 per cent was recorded in December grafting.

Stability Analysis in Tomato (*Lycopersicon esculentum* MILL.) Varieties and Hybrids

J.S.ARAVINDAKUMAR

2001

MAJOR ADVISOR : Dr. RAVINDRA MULGE

Studies were carried out with eleven genotypes of tomato for their stability under eight environments during Kharif 2000-2001 and Rabi 2000-2001 at Kittur Rani Channamma College of Horticulture, Arabhavi. Genotypes were assessed for stability and desirability for fourteen characters, viz., days to 50 per cent flowering, plant height, number of primary branches, average fruit weight, fruit volume, fruit polar diameter, fruit equatorial diameter, flesh thickness, number of locules, TSS, number of fruits per plant, yield per plant, early yield per plot and total yield per plot using regression coefficient (b_i) and deviation from regression (S^2_{di}).

The genotype \times environment interaction was significant for all the fourteen characters studied. The hybrids F₁-124, Shivaji and BSS-211 were found stable

and predictable with higher mean values for total yield per plot due to their non-significant regression coefficients (b_i) approaching unity and non-significant deviations from regression (S^2_{di}). The hybrids S-72 and Rashmi were unstable with higher mean values for total yield per plot and were suited for favourable environments. The variety Megha was found stable with superior *per se* performance for early yield per plot and days to 50 per cent flowering.

Correlation study among growth, yield and quality parameters in tomato over three sets revealed that, the positive and significant association of total yield per plot with plant height, number of primary branches, average fruit weight, number of fruits per plant and yield per plant was consistent over environments.
