

Abstracts of Theses Accepted for the Award of Post-Graduate Degree in
University of Agricultural Sciences, Dharwad

DOCTORAL PROGRAMME

AGRONOMY

Integrated Nutrient Management in Soybean (*Glycine max* (L.) Merrill.) in Vertisols of Northern Transitional Zone of Karnataka

P. SUKUMARI

1997

Major Advisor : Dr. M. N. SHEELAVANTAR

Field experiments were conducted at the Agricultural College Farm, Dharwad, during kharif seasons of 1992 and 1993 to study the effect of integrated nutrient management in soybean in vertisols of northern transitional zone of Karnataka. The treatments consisted of combinations of five proportions of MRP (Mussorie rockphosphate) and SSP (single super phosphate) with and without crop residues (maize stalks) and P - solubilizers (*Pseudomonas striata*). The experiment was laid out in factorial randomised block design with three replications.

The pooled data of two years revealed that incorporation of crop residue, inoculation of P solubilizers, combined use of crop residue and P solubilizers as well as application of different proportions of MRP + SSP in association with P - solubilizers significantly improved the growth, yield, nodulation and nutrient uptake in soybean. This was the consequent effect of significantly improved growth and yield parameters. The data further indicated that the nutrient (NPK) content and uptake by the crop in these treatments significantly increased due to enhanced nutrient availability in the soil. Nodulation (in terms of number and dry weight of nodules per plant) and rhizosphere population of P

solubilizers were also significantly influenced by the incorporation of crop residue, inoculation of P solubilizers and their combined action as well as interaction of proportions of MRP + SSP and P solubilizers.

Crop residues and P solubilizers when applied separately as well as in combination during kharif season for soybean exerted significant residual effect on the succeeding crop of wheat in rabi. Substantial increase in seed yields was realised due to improved yield parameters. Protein content of grains, protein yield of wheat, nutrient (NPK) content of plant as well as nutrient uptake by the crop were significantly improved due to better availability of N and P_2O_5 . The highest net returns from soybean-wheat sequence (Rs.29,562 ha⁻¹) was obtained with the application of 100 per cent MRP along with crop residue and P-solubilizers which was Rs.14,487 more than that obtained from the sole application of 100 per cent SSP (Rs.15,075 ha⁻¹).

The data clearly indicated that the integrated nutrient management would prove more advantageous in soybean-wheat crop sequence in vertisols of the northern transitional zone of Karnataka.

Response of *Stylosanthes* to Fertilizer, Seed, Proportion Mixtures of Grasses Under Sown and Natural Pasture Conditions

S. S. ANGADI

1997

Major Advisor : Dr. M. M. HOSAMANI

Field experiments were conducted during 1995-96 and 1996-97 to study the response of *Stylosanthes* and grasses under sown and natural pasture conditions at Kumbapur Farm, on sandy loam soils, near the main campus of the University of Agricultural Sciences, Dharwad.

In the first experiment the response of *Stylosanthes hamata* and *Stylosanthes scabra* were studied with different levels of nitrogen (0, 20, 40 kg N ha⁻¹) and phosphorus (0, 40, 80 and 120 kg P_2O_5 ha⁻¹). In the second experiment, seed proportion mixtures of *Cenchrus ciliaris* and *Chrysopogon fulvus* were tried with *hamata* and *scabra* at 25, 50, 75 and 100 per cent proportions. In natural pasture experiment, both the *Stylosanthes* species were introduced with 0, 30 kg P_2O_5 , 60 kg P_2O_5 and 30 kg N and 60 kg P_2O_5 and 30 kg N and 60

kg P_2O_5 ha⁻¹.

S. scabra recorded about 10 per cent higher green (19.70 t ha⁻¹) and dry forage yield (5.96 t ha⁻¹) than *hamata*. Application of 20 kg N and 80 kg P_2O_5 ha⁻¹ recorded significantly higher green and dry forage yield over rest of the combinations in both the cuts. With respect to quality characters *hamata* is superior over *scabra* due to higher leaf to stem ratio, N and P contents, lower crude fibre and on par crude protein yield as that of *scabra*.

The green forage yield of mixture was higher in 50:50 seed proportion mixtures over other combinations. Mixing of *Cenchrus* with *scabra* at 50 per cent proportion increased the mixture yield to an extent of 37 per cent over sole *Cenchrus*, which was on par with *hamata* and *Cenchrus* at the same

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proportion mixture. The mixture crude protein yield of grasses and *Stylosanthes* was higher at 50 per cent proportion over sole crops with superior palatability. *Cenchrus* recorded higher N, crude protein, P, K, and Ca content as compared to *Chrysopogon*.

The maximum mixture (Natural + *Stylosanthes*) yield 912.85 t ha⁻¹ was recorded with the application of 30 kg N and

60 kg P₂O₅ ha⁻¹ in association with *hamata* over rest of the combinations. Similarly, crude protein yield of mixture with the introduction of *scabra* and *hamata* was on par at 30 kg N and 60 kg P₂O₅ ha⁻¹.

In all the three experiments the soil fertility buildup was observed with respect to organic carbon, available nitrogen and phosphorus balance in soil.

AGRICULTURAL CHEMISTRY AND SOIL SCIENCE

Studies on Chemistry of Potassium in Sugarcane Soils of North Karnataka

N. S. HEBBUR

1997

Major Advisor: Dr. T. SATYANARAYANA

Ten soil pedons belonging to orders viz., Vertisol, Inceptisol and Alfisol derived from diverse parent materials from major sugarcane growing areas of North Karnataka were considered to study distribution of different forms of potassium, K content in various textural fractions, its fixation and release parameters like cumulative K, CR-K and step-K, mineralogy of clay and transformation of added K in these soils. The range in contents of various forms of K in soil samples was 0.025 to 0.620 me L⁻¹ of water soluble, 0.35 to 1.10 c mol (p⁺) kg⁻¹ of exchangeable, 150 to 1250 ppm of non-exchangeable, 0.47 to 3.25 per cent of lattice of 0.53 to 3.70 per cent of total potassium. Available K ranged from 275 to 900 kg ha⁻¹. The water soluble exchangeable, non-exchangeable and lattice potassium constituted 0.02 to 0.21, 0.64 to 4.01, 0.87 to 10.9 and 86.0 to 98.4 per cent of total K, respectively. Potassium contents in soil textural fractions viz., coarse sand, fine sand, silt and clay were in the range of 0.23 to 2.72, 0.40 to 3.23, 0.15 to 9.85 and 0.48 to 2.80 per cent, respectively. Potassium contents in soil textural fractions viz., coarse sand, fine sand,

silt and clay were in the range of 0.23 to 2.72, 0.40 to 3.23, 0.15 to 9.85 and 0.48 to 2.80 per cent, respectively in different profiles. The semi-quantitative estimate revealed the dominance of smectite in the clays of black soils and kaolinite in the clays of mixed black and red and red soils with associated minerals like mica, chlorite, kaolinite and vermiculite. The K fixation of surface soils ranged from 0.39 to 1.32 c mol (p⁺) kg⁻¹. In transformation studies, water soluble K content increased in all soils with increasing levels of added K and decreased with time of incubation. On the other hand, exchangeable K increased with time of incubation. The added K @ 1.25 and 2.50 c mol (p⁺) kg⁻¹ reacted to the tune of 223.0 to 458.7 and 448.0 to 931.2 ppm, respectively in different soils after 60 days of incubation. The cumulative K release, step K and constant rate K values ranged from 378 to 1175, 306 to 770 and 8 to 45 ppm, respectively. Considering these parameters, the soils under study may not respond to the application of potassic fertilizers.

Effect of Conjunctive Use of Canal and Ground Water on Soil Properties and Yield of Wheat in Vertisols of Ghataprabha Command

KIRANKUMAR M. ANGE GUNDI

1997

Major Advisor: Dr. P.A. SARANGMATH

A field experiment was conducted to study the "Effect of Conjunctive Use of Canal and Ground Water on Soil Properties and Yield of Wheat in Vertisols of Ghataprabha Command" during rabi season of 1995-96 and 1996-97 at Agricultural Research Station, Arabhavi and Kalloli. The experiment was laid out in randomised block design with three replications. An investigation was also undertaken to study the seasonal ground water fluctuation and quality of ground waters in Gokak and Hukkeri taluks of Belgaum district, falling under the command of Ghataprabha left bank.

Seasonal bound water table fluctuation was observed. And seasonal water samples analysed in the study area, in general, recorded higher soluble salts and SAR compared to critical limits prescribed.

Application of ground was alone significantly decreased the infiltration rate, water stable aggregates, soil available nitrogen and phosphorus and increased the bulk density, EC, soil K, Mg, Na, Cl, HCO₃, So₄, ESP and SAR when compared to only canal water application. Conjunctive use of canal ground water 4 CW : 2 GW and 5 CW : 1GW under direct mode and 1 CW : 1 GW and 2 CW : 1 GW under cyclic mode were found statistically on par with that of the treatment receiving only canal water. Uptake of N, P and K by both grain and straw of wheat was significantly higher in treatment receiving 5 CW : 1 GW and 4 CW : 2 GW (direct mode) and 1 CW : 1 GW and 2 CW : 1 GW (cyclic mode) mode of irrigations which was statistically on par with treatment receiving only canal water. Highest grain yield (28.60 and 25.59 q/ha at Arabhavi and Kalloli, respectively) and straw yield

(36.23 and 31.42 q/ha at Arabhavi and Kalloli, respectively) were obtained from treatment received only canal water. Treatments such as 5 CW : 1 GW, 4 CW : 2 GW, 1 CW : 1

GW and 2 CW : 1 GW were on par with treatment receiving only canal water in increasing grain and straw yield.

Effect of Conjunctive use of Underground and Surface Water on Soil Properties, Nutrient uptake and Yield of Wheat in Ghataprabha Command Area

SANATHKUMAR T. HUNDEKAR

1997

Major Advisor : DR. P.A. SARANGAMATH

An investigation was undertaken to study the seasonal underground water quality and water table fluctuations in Raibag and Chikodi taluks (Belgaum district) of Ghataprabha command. Further during rabi seasons of 1995-96 and 1996-97, field experiments were carried out in a farmers field at Alaknur village (Raibag taluk) to study the various modes of conjunctive use of underground and canal waters on soil properties, growth and yield of wheat.

The analysis of underground waters revealed a shift from high salt concentration in summer to lower levels in rainy season. Winter samples exhibiting intermediate properties. Majority of the samples regardless of season, belonged to C3S1 and C3S2 classes.

Among the twelve irrigation treatments adopted, namely T1 to T5 (one to five canal irrigations followed by groundwater supplementation) T6 (canal water alone), T7 (groundwater alone) and T8 to T12 (cyclic modes of canal

and groundwater usage). T7 exerted deleterious effects on soil physical properties besides increasing in soil p^H and electrical conductivity and reduction in availability of primary nutrients, and yield parameters. On the contrary, T6 was the best of the treatments in respect of both soil properties and crop growth and yield.

The treatments in receipt of four or five canal water irrigations followed by groundwater supplementation (T4 and T5) under direct mode and those with the use of these two waters at the ratios of 1:1 or 2:1 under cyclic pattern of conjunctive usage, however, were found to be statistically not differing from the best of the treatments (T6). With respect to germination on the other hand, initial irrigation with groundwater was found harmful. Thus, it is concluded from the investigations that the conjunctive pattern in the manner as said above can be adopted without much harmful effect on soil properties and yield of wheat during the periods of canal water shortages.

AGRICULTURAL MICROBIOLOGY

Performance of Arbuscular Mycorrhizal Fungi in Chilli (*Capsicum annum* L.) and Tomato (*Lycopersicon esculentum* Mill.)

SRIHARI P. CHANDRAGHATGI

1997

Major Advisor : Dr. M. N. SREENIVASA

The efficiency of different arbuscular mycorrhizal (AM) fungi viz., *Glomus fasciculatum*, *G. macrocarpum*, *Gigaspora margarita*, *Acaulospora laevis* and *Sclerocystis dussii* was tested for chilli var. Byadagi and tomato var. L-15 under black clayey and red sandy loam soils. *Glomus macrocarpum* and *G. fasciculatum* was found to be efficient inocula for chilli and tomato respectively in improving various parameters recorded under both the soil types.

Further, pot and fields trials were conducted to know the optimum dose of the efficient AM inocula. The results of pot trials revealed 50 g and 60 g per 10 kg to be optimum dose of inocula of efficient AM fungi in black clayey and red sandy loam soils while 2 kg inoculum per one m² nursery bed was found to be optimum for field application in both the crops.

In the subsequent trials the extent of P savings was studied by inoculating the efficient AM fungus at the optimum

dose. In the pot experiment savings of 25 per cent recommended dose (PRD) of P_2O_5 was observed while results of field trials indicated that, 20 PRD of P_2O_5 can be saved in both the crops in red sandy loam, while in black clayey soils the savings were 20 PRD and 40 PRD of P_2O_5 for chilli and tomato respectively.

Further, induction of defense related enzymes was observed in the mycorrhizal tomato roots at higher P concentration suggesting their possible role in inhibiting mycorrhizal development. The shelf life of all the above mentioned AM inocula was studied at 4°C, room temperature (23-37°C) and at 45°C. The shelf life of all the inocula was found to be 10 months at 4°C and at room temperature. While at 45°C it was three months for all the inocula except for *S. dussii* for which the shelf life was four months at 45°C.

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Screening and Performance of Efficient VA Mycorrhizal Fungi for Tree Species Suitable For Agroforestry

S.B. GURUMURTHY

1997

Major Advisor : DR. M.N.SREENIVASA

A survey work was conducted to isolate the predominant spore types from the rhizosphere soil of five major tropical tree species viz., teak, silveroak, casuarina, shisham and tamarind. After isolation of predominant local isolates of VAM fungi from each tree species, they were mass multiplied in rhodes grass using sterilized sand:soil (1:1) mix.

Two predominant local isolates and four standard VAM fungi were used for screening and selection of efficient VAM fungi for all the five tree species. The results of this trial clearly brought out that the efficient VAM fungus for inoculating at nursery level is *Sclerocystis dussii* for teak, *Gigaspora margarita* for silveroak and tamarind, and *Glomus fasciculatum* for casuarina and shisham.

After selection of efficient VAM fungi for each tree species, the second experiment was carried out to determine the optimum P-dose using different levels of phosphorus (0,50,75 and 100 kg P₂O₅ per hectare as single

superphosphate). The results clearly indicated that the optimum level of phosphorus was 75 kg P₂O₅ per hectare for teak and silveroak, 50kg P₂O₅ per hectare for casuarina, shisham and tamarind which can be used to harness maximum benefits from inoculations with respective efficient VAM fungi.

After knowing efficient VAM fungi and optimum level of P-dose for each tree species in the previous trials, the third set of experiment was carried out to study the effect of dual inoculation of efficient VAM fungi and P-solubilizer, *Pseudomonas striata* using two forms of phosphorus [Rock phosphate (RP) and single superphosphate (SSP)]. The results of this study clearly brought that dual inoculation of efficient VAM fungi and P-solubilizer to be superior in improving growth, nutrition and dry matter production of all the five tree species. Among two forms of P, rock phosphate was found to be superior in improving growth, nutrition and dry matter production of all the five tree species.

CROP PHYSIOLOGY

Physiological Basis of Variation in Productivity Potential of Chilli (*Capsicum annum* L.) Genotypes

C.M.NAWALAGATTI

1998

Major Advisor : DR. M.B.CHETTI

Field experiments were conducted at the college of Agriculture Farm, University of Agricultural Sciences, Dharwad during *kharif* 1990 and 1991 to find out the physiological basis of variation in the productivity potential and the biochemical basis of murda syndrome complex in four varieties, six lines and two hybrids of chilli. Results revealed that, the morpho-physiological traits differed significantly among the lines, varieties and hybrids, with hybrids recording significantly higher dry weight of leaf, stem, reproductive parts and TDM and having significant positive correlation with yield and yield components. Similarly, the growth parameters viz., AGR, CGR, NAR, SLW, LWR, LAR, LAD and BMD also differed significantly among lines varieties and hybrids and had significant positive correlation with yield and yield components except NAR, LWR and LAR.

Fruit yield, number of fruits per plant, percent fruit set, HI, fruit girth, 100-fruit weight, number of seeds per fruit, 1000-seed weight indicated significant differences among the genotypes. The fruit yield and the yield components were

significantly higher in hybrids as compared to lines and varieties. The dry fruit yield was found to have significant negative correlation with plant height, days to 50 per cent flowering and stalk length. The capsaicin content and total colouring matter were significantly higher in varieties. Whereas, the ascorbic acid and oleoresin contents were significantly higher in hybrids.

The influence of murda syndrome complex resulted in a significant decrease of chlorophyll, total sugars, total phenols and fruit yield in all the varieties, lines and hybrids, but the extent of reduction was more in hybrids and less in GPC-69, GPC-80 among lines, and Jwala among the varieties. It is thus inferred from the present study that, the dry weight of reproductive parts, LAD, SLW, AGR, CGR, HI, number of fruits per plant, 100-fruit weight, number of seeds per fruit, 1000-seed weight, percent fruit set and fruit girth are important growth and yield parameters for enhancing productivity potential in chilli.

GENETICS AND PLANT BREEDING

Histological Basis of Genetic Male Sterility and Its Utilization in Hybrid Development in Diploid Cottons

S. T. KAJJIDONI

1997

Major Advisor : Dr. S. J. Patil

An investigation was carried out to study the histological basis of male sterility in two genetic male sterile lines of *G. arboreum* L. (DS-5 and GAKA-423) and their use in exploitation of heterosis at intra and interspecific (*G. arboreum* L. x *G. herbaceum* L.) levels in desi cotton.

A detailed comparative study on histological features of anther development in two GMS and their fertile counter part lines revealed that, the process of microsporogenesis was normal with regular meiosis until the formation of microspores. Abnormality was noticed during further development of microspores at the time of pollen grain formation in both the GMS lines.

The heterozygous condition of GMS based hybrids of *G. arboreum* L. had enhancing effect on seed cotton yield and reducing effect on ginning out turn per cent compared to conventional hybrids. Similarly among the interspecific crosses, the heterozygous condition of male sterility character had enhancing effect on anther number, leaf length and reducing effect on ginning out turn per cent.

Among crosses of *G. arboreum* L. the GMS hybrids exhibited better average heterosis than conventional hybrids. Four GMS based hybrids viz., DS-5 x 30802, DS-5xB-Desh, DS-5xNo.2708 and DS-5x No.2631 were the most promising

hybrids in respect of seed cotton yield. Among interspecific crosses, there was no significant difference for seed cotton yield between GMS based and conventional hybrids. Interspecific hybrids exhibited high average heterosis (33.68 and 34.08%) for seed cotton yield and number of bolls per plant (29.95 and 34.08%) than intraspecific hybrids involving *G. arboreum* L. in GMS and conventional cross combinations. Three interspecific cross viz., DS-5x SM-88, DS-5 x Kumpta and DS-5 x Jayadhar exhibited consistently significant better parent heterosis in both GMS based and conventional cross combinations.

The combining ability analysis of *G. arboreum* L. and interspecific crosses revealed predominance of SCA variance for all the thirteen characters under the study both GMS and conventional combinations. Importance of both the GCA and SCA variances was observed for seed cotton yield, number of bolls per plant, ginning outturn, lint index and halo length in GMS based crosses of *G. arboreum* L. The same trend was also observed in conventional crosses of *G. arboreum* L. except for lint index and halo length traits. Predominance of both GC and SCA variances was observed for plant height, number of monopodial branches, yield of seed cotton per plant, boll weight and number of seeds per boll in interspecific GMS based crosses. A similar trend was also observed for days to 50 per cent flowering, seed cotton yield per plant, number of bolls per plant and lint index in conventional crosses.

Genetics of Fruit Yield, Yield Components and Reaction to Major Biotic Stresses in Chilli (*Capsicum annum* L.)

NANDEESH V. HIREMATH

1997

MAJOR ADVISOR : Dr. S.J.PATIL

An investigation on chilli (*Capsicum annum* L.) was undertaken at the Botany Garden, University of Agricultural Sciences, Dharwad during 1994-96 with two experiments viz., 42F₂s from 7x7 diallel to estimate combining abilities and residual heterosis (Expt 1) and 75 diverse germplasm from Karnataka, Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Vietnam to work out the variability, heritability, genetic advance correlation and path analysis (Expt 2) of metric traits including fruit yield and 5 major and fruit borer. The significant differences due to genotypes for all characters in both the experiments indicated the suitability of material for the present study.

The combining ability analysis revealed that Byadgi dabbi, Lokur and Puri red parents were found as good general combiners for most of the traits. The Lokur X puri red (6x7) cross was identified as the most promising cross to obtain elite progenies for vegetable purpose with high yield and multiple resistance to all major biotic stresses. The superiority of 6x7 cross is attributed to high gca effects of both parents,

non-significant sca effects, negligible reciprocal cross differences and high per se performance along with significant residual heterosis of 123.61, 93.85 and 37.26 percent for fruit number, fruit yield/plant and plot, respectively over Byadgi kaddi as standard check. In addition, Byadgi kaddi x Puri red (3x7, Sankeshwas x Puri red (4x7) and Buton xPuri red (5x7) crosses had the potential to provide good base material for future breeding programmes.

The germplasm evaluation indicated that majority of fruit traits and yield components recorded high GCV and heritability than plant growth traits. High GCV heritability coupled with high genetic advance were recorded for number of fruits/plant, fruit yield/plant, fruit related traits like length, volume, surface area. Among biotic stresses, high GCV moderate heritability and genetic advance were recorded for fruit rot followed by murda complex, mosaic disease and fruit borer. The number of fruits/plant average fruit weight and fruit

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traits (length, diameter, volume and surface area) showed significant correlation among themselves and with fruit yield/plant. But murda complex, mosaic disease and fruit borer exhibited negative association with fruit number and fruit number exerted high direct effects followed by average fruit

weight. Therefore, the future chilli breeding programmes should include fruit length, number of fruits/plant and average fruit weight in formulating the selection criteria as they recorded high GCV, heritability, genetic advance along with significant positive correlation and high direct effects on fruit yield/plant.

HORTICULTURE

Genetic Analysis and Economic Usage of Compound Inflorescence in Tomato

GIRISH S. PATIL

1997

MAJOR ADVISOR : Dr. B. B. MADALAGERI

Four experiments were undertaken in tomato during the year 1995-97 on characterization of compound inflorescence genotypes, inheritance of compound inflorescence (CI), heterosis and combining ability, isolation of segregants suited to fresh market or processing, at the College of Agriculture, Dharwad.

Studies on characterization revealed that CI of all five genotypes had the basis structure of compound dichasium while, simple inflorescence (SI) genotypes had unbranched monochasium. Further, two CI phenotypes were observed for flowering habits : terminal flowering and non-terminal flowering. Characterization of compound inflorescence vs. simple inflorescence indicated higher flower number in CI genotypes. Higher flower number (166) in CC-NT was associated with non-terminal flowering habit.

Inheritance of basic structure of inflorescence was controlled by recessive epistasis (9:3:4 ratio of unbranched monochasium : compound monochasium : compound dichasium), type of inflorescence by monogene (3:1 ratio of SI : CI) and flowering habit also by monogene (3:1 ratio of terminal flowering : non-terminal flowering).

Additive variance was higher than the dominance variance for seventeen of the nineteen characters indicating preponderance of additivity in these cases. For number of fruits per plant and number of fruits per truss dominance variance was higher than additive variance thus evidencing the dominant role of non additivity.

Out of 28 hybrids, there were two significantly positive heterotic hybrids namely SP 28-2-2 x CC-SF and SP 28-2-2 x CC-BF over mid parent/best parent and three L-15 x SP 28-2-2, SP 28-2-2 x CC-SF x CC-SF and SP 28-2-2 x CC-BF over commercial check-Punjab Chhuhara, worth of commercial exploitation.

When subjected F2 population for selection to processing requirements L-15 x CC-OF/96/13-8 and L-15 x SP 28-2-2 (96/14-7) were found worth while for commercial exploitation (need to be developed into pure lines). But these require manual harvesting. However, suitability to mechanical harvesting and having desirable processing traits point out to SP 28-2-2 x CC-BF/96/21/5 as a best segregant. Alternatively, suitability to fresh market indicated CC-SF x CC-BF/96/3-8 as a best segregant worth of commercial exploitation.

Genetic Variability and Genetics of Quantitative and Quality Characters in Green Chilli (*Capsicum annuum* L.) Genotypes

N. BASAVARAJA

1998

Major Advisor : DR. N.C.HULAMANI

Studies on variability, path coefficient analysis, correlation, heterosis, combining ability and fruit bearing pattern were studied at the Agricultural Research Station, Hanumanamatti, of University of Agricultural Sciences, Dharwad during Kharif 1993-94 and 1995.

Eighty eight genotypes were tested for the range of variability and the results revealed significant differences for all the 17 characters studied. The phenotypic and genotypic coefficient of variation were low for plant spread, pedicel length, days to 50 per cent flowering and stem diameter. Yield per plant recorded low GCV(15.32%). Remaining characters showed moderate phenotypic and genotypic coefficient of variation.

Heritability estimates were high for days to 50 flowering (88.9%), fruit length (88.76%), seed weight (87.25%), fruit weight (86.76%), pericarp weight (86.63%), plant height (83.28% and number of seeds per fruit (83.07%) indicating moderate to high response to selection for these attributes.

Fruit yield per plant showed positive and significant genotypic association with stem height, stem diameter, secondary branches per plant and plant spread. Genotypic path analysis for green fruit yield per plant revealed that number of seeds per fruit was the major component contributing for the yield. It showed high direct effect (0.8864) and also indirect effect through pericarp weight and plant height.

The studies on combining ability and heterosis revealed

preponderance of non additive gene action for most of the characters as indicated by higher magnitude of SCA variance than GCA variance. Crosses showing useful significant heterosis over better parent for yield per plant were Sindhur x SIC-10-166b, Sindhur x G-3, Sindhur x Bydagi and 90/MC-11 x SIC-10-166b.

The overall assessment of gca effects of the parents revealed that none of the parents was the best general combiner for all characters. However, the female line Sindhur was good general combiner for plant height, fruit length, fruit weight and pericarp weight. Among the 12 male lines SIC-10-

159 was good general combiner for plant height, number of primary and secondary branches per plant and other fruit characters. The parent SIC-10-166b had positive values of gca effects for yield in addition to fruit weight and pericarp weight. These parents would be of great practical utility in any breeding programme in evolving high yielding varieties with desirable characters for green chillies.

The study on fruit bearing pattern in chilli revealed that early borne flowers in first flush had better setting opportunity than the flowers borne latter.

AGRICULTURAL ECONOMICS

Performance of Canal Irrigation System In Tungabhadra Project - An Economic Analysis

L. B. HUGAR

1997

MAJOR ADVISOR : Dr. K. N. RANGANATHA SASTRY

The performance of the canal irrigation system was evaluated at system level as well as at different regions (Head, Middle and Tail) of the Left Bank Low Level Canal (LBLEC) system during the year 1993-94. The estimated water budget revealed that the supply of water resource was less than (22.89%) its demand in the command area as a whole as per the existing area and water use level. The violation of localised cropping pattern especially in paddy both in kharif (132.11%) and rabi/summer season (entire area of 27,348 hectares) coupled with higher levels of water use (27% to 34%) have contributed for wide gap in supply and demand for water. Further, the distribution of water was not only unequal over the regions but also varied from farmer to farmer. Similarly, the reliability and timeliness of water supply was not ensured especially at tail region. In the case of cost and productivity of water, it was found profitable to invest in irrigation systems since the net returns per unit of water supply were at higher

levels inspite of the increasing trend of cost on water distribution. Though irrigated water was found to be fairly stable over the years, it varied substantially at tail regions. The rise in the depth of ground water table and increase in the extent of salt affected soils may affect the stability in the irrigated area in the coming years. The projections indicated that by 2047 A.D. the whole command area would be under water logging with complete salt affected soils. The fee collection performance, maintenance efficiency and performance of the existing organisational structure was observed to be poor. The increase in the distance of location of farm and the number of farmers intervening have resulted in decrease in the extend of water supply at farm level. The turn ('vant') system of rotational water distribution by ensuring fairly adequate supply of water with moderate use of water and other inputs, was found superior over other systems.

FOODS AND NUTRITION

Effect of Processing and Preservation on b-Carotene Content of Selected Fruits and Vegetables

A. S. SEEMA

1997

MAJOR ADVISOR : Dr. RAMA K. NAIK

The effect of processing and preservation on b-carotene content was studied in selected fruits and vegetables. Preliminary survey results revealed that sun drying and pickling were the common methods of preserving vegetables and fruits. Open column chromatographic estimates of b-carotene (μ /100g) content revealed that carrot contained highest (14,918.66) followed by green leafy vegetables (1,545.33 - 6,832.64), fruits (2,569.21 - 3,437.14), capsicum (856.65) and yam (820.76). Sulphited fruits, green leafy vegetables (GLV) and capsicum retained higher amounts of b-carotene. Blanched polyvinyl chloride cup packed vegetables and fruits recorded higher values for b-carotene as compared to low density polyethylene (LDPE) bag packed. Sulphited, shade dried GLV recorded significantly high b-carotene content after

processing and consistently during storage. Significant reduction in b-carotene content of canned products was noticed with advancement of storage period (12 months). Brix preservation resulted in better retention of b-carotene and acceptable products. Frozen storage of vegetables and fruits resulted in 53.07 to 90.58 per cent loss of b-carotene content. However, sulphiting of vegetables and fruits enhanced the retention of b-carotene. Higher sensory scores were recorded for blanched LDPE packed carrot, yam, sulphited LDPE packed capsicum and papaya. The b-carotene values, moisture content and rehydration ratio of GLV reduced with increasing storage period. Blanched and sulphited GLV showed lower moisture and higher rehydration ratio, respectively during storage. Rehydrated Harvi, Pundi and Golli

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were highly acceptable even at 12 months of storage irrespective of the drying method. Among the processing methods, canning of carrot and mango and shade drying of Honagone retained highest amount of b-carotene and were also

acceptable. Sulphiting of fruits and vegetables was advantageous over blanching in retention of b-carotene. Packing of fruits and vegetables in LDPE aided in better retention of b-carotene as compared to PVC package.

MASTERS OF SCIENCE

AGRONOMY

Integrated Nutrient Management in Rabi Maize (*Zea mays* L.) Under Irrigated Condition

T. MADEGOWDA

1997

MAJOR ADVISOR : A. D. JANAWADE

A field experiment was carried out during rabi season of 1995-96 at Agricultural Research Station, Kalloli (Belgaum district) on clay soils to study the integrated nutrient management in rabi maize under irrigated condition. The experiment was laid out in factorial RBD with three replications. The treatments comprised of three nitrogen levels ($N_1=150$ kg N, $N_2=225$ kg N, $N_3=300$ kg N ha^{-1}) and five organics ($O_1=no$ organics, $O_2=12.5$ t FYM, $O_3=25.0$ t FYM, $O_4=2.5$ t vermicompost and $O_5=5.0$ t vermicompost ha^{-1}).

The results indicated that application of 300 kg N recorded significantly highest grain yield (66.34 q ha^{-1}) and yield components compared to 150 kg N which was on par with 225 kg N. The growth components like plant height, leaf area duration and total dry matter production per plant were also higher in 300 kg N application treatment. Similar trend was observed in protein and nutrient content (NPK) also. Application of FYM @ 25.0 t ha^{-1} recorded significantly highest grain yield (69.47 q ha^{-1}). The combined application of 300 kg N and 25.0 t FYM recorded significantly highest grain yield (71.89 q ha^{-1}). Yield reduction was observed due to combined

replication of 300 kg N along with vermicompost either @ 2.5 or 5.0 t ha^{-1} .

Significantly highest uptake of NPK by maize crop was observed due to combined application of 300 kg N and vermicompost @ 5.0 t ha^{-1} . Available soil N was significantly highest (363.11 kg ha^{-1}) due to combined application of 300 kg N and vermicompost @ 5.0 t ha^{-1} . Application of 300 kg N resulted in significant increase in available phosphorus content of the soil (48.67 kg ha^{-1}), whereas, available potassium did not differ significantly due to variation in nitrogen levels. Application of vermicompost @ 5.0 t ha^{-1} recorded significantly highest available phosphorus and potassium content of the soil (48.67 kg and 486.66 kg ha^{-1} respectively).

Application of recommended dose of nitrogen (150 kg) recorded lowest cost of cultivation (Rs. 5704 ha^{-1}) and highest B:C ratio (3.14). Significantly highest net returns were realised with combined application of 225 kg N and 5.0 t vermicompost ha^{-1} (Rs. 22,337 ha^{-1}).

Effect of Post-Emergence Herbicides on Control of Weeds in Soybean (*Glycine max* (L.) Merrill)

GADEPPAGOUDAR SOMANAGOUDA

1997

MAJOR ADVISOR : V. S. GIDNAVAR

A field experiment was conducted at the Main Research Station, University of Agricultural Sciences, Dharwad during kharif season of 1996 to study the effect of post-emergence herbicides on control of weeds in soybean under rainfed conditions.

Weed population as well as dry weight of weeds were significantly reduced at all the growth stages by weed control treatments. Among the weed control treatments, fenoxprop-p-ethyl + lactofen (70+120) g a.i. per ha recorded significantly lower weed dry weight (3.16 q/ha) and higher weed control efficiency (81.19%) whereas, unweeded control noticed significantly higher weed dry weight (16.78 q/ha) and lower WCE. The reduced weed dry weight in weed control treatments may be attributed to a lower number of weeds. Significantly higher seed yield was recorded in weed free check (1800 kg/ha) which was on par with fenoxprop-p-ethyl+lactofen (70+120)

g a.i. per ha (1600 kg/ha) whereas, unweeded control recorded the lowest seed yield 817 kg/ha).

Significantly higher yield components viz., number of pods per plant, number of grains per plant, grain weight per plant and test weight were recorded in weed free check which were on par with fenoxprop-p-ethyl + lactofen (70+120) g a.i. per ha whereas, unweeded control recorded the lowest yield components. All the weed control treatments recorded significantly higher nutrient uptake by the crop while, the uptake by weeds was significantly lower in unweeded control. Uptake of nutrients by crop was significantly lower in unweeded control, while the nutrients removed by weeds was significantly higher.

From the investigation, it could be inferred that post-emergence application on fenoxprop-p-ethyl + lactofen (70+120) g a.i. per ha is as efficient as weed free check in control of weeds in soybean in the transitional areas.

Weed Control in Cotton (*Gossypium hirsutum* L.) in Black Soils of Northern Transitional Tract of Karnataka

S. V. KELAGINAMANI

1997

MAJOR ADVISOR : S. I. HALIKATTI

A field experiment was conducted at the Main Research Station, University of Agricultural Sciences Dharwad, during kharif season of 1996 to study the new herbicide acetochlor in comparison with other herbicides in cotton on black soils. Weed population as well as dry weight of weeds were significantly reduced at all the growth stages by weed control treatments. At harvest, among the weed control treatments, farmer's practice recorded lower weed dry weight (4.93 q/ha) and higher weed control efficiency whereas, unweeded check had significantly higher weed dry weight (30.20 q/ha) and lower WCE. The reduced weed dry weight in weed control treatments may be attributed to lower number of weeds.

Significantly higher seed cotton yield was noticed in weed free check (23.21 q/ha) which was on par with acetochlor @ 0.90 (22.15 q/ha) and 1.35 kg a.i./ha (21.95 q/ha), alachlor

@ 2.00 and 2.50 kg a.i./ha and farmers's practice while, unweeded check recorded the lowest seed cotton yield (6.60 q/ha). Significantly higher yield components viz., number of bolls per plant, mean boll weight, seed index, ginning percentage, seed cotton yield per plant were recorded in weed free which was closely followed by acetochlor @ 0.90 kg a.i./ha whereas, unweeded check recorded the lowest yield components. Seed cotton yield is positively correlated with yield components and negatively with weed index and weed weight at harvest.

All the weed control treatments recorded significantly higher nutrient uptake by the crop and lower uptake by weeds while, unweeded check recorded the highest nutrient uptake by weeds and lowest by crop. From the investigation, it could be inferred that pre-emergence application of acetochlor @ 0.90 or 1.35 kg a.i./ha is the best to control the weeds in cotton on black soils.

Weed Management in Soybean (*Glycine max* (L.) Merrill) in Black Soils of Northern Transitional Tract of Karnataka

T. T. BANDIWADDAR

1997

MAJOR ADVISOR : Dr. C. J. ITNAL

A field experiment was conducted on black soils at the Main Research Station, University of Agricultural Sciences, Dharwad, during kharif 1996 to study the weed management practices in soybean under rainfed conditions. Observations on weeds, crop growth, yield components, nitrogen, phosphorus and potassium uptake by crop and weeds were studied.

Weed population as well as dry weight of weeds were significantly reduced at all the growth stages by weed control treatments. Cultural method of weed control consisting of two intercultivations + two hand weedings had the lowest weed dry weight (8.18 kg/ha) and higher weed control efficiency (91.26%). Among the herbicides treatments, alachlor (2.0 kg a.i./ha) in pre-emergence had lower weed dry weight (10.18 kg/ha) and higher weed control efficiency (86.45%) whereas, in weedy check, the weed dry weight was 20.95 kg/ha.

Significant yield reduction was observed due to the adverse effects of weeds on soybean. All weed control treatments recorded significantly higher nitrogen, phosphorus and potassium uptake by crop compared to weedy check. The superior yield and yield components were recorded in weed free check compared to all the treatments. The higher yield of soybean was recorded in the treatment of two intercultivations + two hand weeding (30 + 45 DAS) (2026.66 kg/ha). Among the herbicides, alachlor + two hand weedings (30 + 45 DAS) (2026.66 kg/ha). Among the herbicides, alachlor (pre-em.) @ 2.0 kg a.i./ha exhibited the maximum yield (1810 kg/ha).

Based on the investigation, it can be inferred that two intercultivations + two hand weedings at 30 and 45 DAS can be advocated for satisfactory weed control in soybean or wherever manual weeding is not possible, application of alachlor (2.0 kg a.i./ha) or pendimethrin (1.0 kg a.i./ha) could be recommended for satisfactory weed control in soybean.

Integrated Nutrient Management in Sunflower (*Helianthus annuus* L.)

SURESH V. DODAMANI

1997

MAJOR ADVISOR : DR. R.A. SETTY

A field experiment was conducted at the Agricultural College farm Raichur during *rabi*/summer 1996, under irrigated condition, to study the effect of organic manures, biofertilizers and inorganic fertilizers on the growth and yield of sunflower. There were seventeen treatments with three replications laid

out in randomised block design. The soil type was alfisol and the genotype was CMS 234 B.

Better vegetative growth in terms of increased plant height, leaf area and dry matter accumulation were recorded

Abstract of Theses

with the application of phosphorus solubilising micro organism (PSM) @ 375 g/ha + FYM @ 8 t/ha + 100% RDF. Yield components viz., head diameter (13.46cm), number of seeds per head (456.20) and thousand seed weight (54.81g) were also higher in this treatment. This treatment recorded highest seed yield of 1143 kg/ha and stalk yield of 1865 kg/ha with higher oil content of 41.9 per cent. The yield increase in this treatment was 22.50 percent over the application of 100% RDF. This was followed by PSM @ 375 g/ha+vermicopost@2t/ha+100% RDF (1084kg/ha).

The uptake of N,P and K was maximum (125.29 N,

49.56 P and 109.16 K kg/ha) in the treatment receiving PSM @ 375 g/ha + vermicompost @ 2t/ha+100% RDF. Maximum net return (Rs. 5308/ha) was obtained in the treatment receiving PSM @ 375 g/ha+FYM @ 8t/ha+100%RDF. This was followed by PSM @ 375 g/ha+100% RDF (Rs 4822), PSM 375 g/ha+75% RDF (Rs. 4711) compared to 100% RDF (Rs 4770).

Application of PSM and FYM with 50 percent RDF produced on per yield as compared to application of 100 percent RDF. The results indicate that 50 percent of chemical fertilizer could be saved by using PSM and FYM without significant reduction in the seed yield.

Studies on Integrated Nutrient Management in Summer Groundnut (*Arachis hypogaea* L.)

BASAVANAGOWDA S. PATIL

1997

MAJOR ADVISOR : DR.V.B.NADAGOUDA

A field experiment was conducted on red sandy loam soils, at the College of Agriculture, Raichur, during summer season of 1997 to study the effect of integrated nutrient management in summer groundnut. The experiment was laidout in a randomised block design with 16 treatments and replicated three times. The maximum pod yield (30.04 q/ha) and haulm yield (36.09 q/ha) was recorded in treatment receiving vermicompost 2.5 t/ha+fly ash 30 t/ha + RDF and lowest pod yield of 20.66q/ha was recorded in RDF alone treatment.

Among different treatments, higher oil content (48.81%) was recorded in treatment receiving vermicompost 2.5 t/ha+sulphur 40 kg/ha+RDF, while the highest oil yield (10.83 q/ha) was observed in vermicompost 2.5 t/ha+fly ash 30t/ha+RDF treatment. Whereas, treatment receiving RDF alone recorded the lowest oil content (45.53%) and oil yield (6.40 q/ha) respectively. Maximum uptake of N,P,K,S and Zn (215.81,

22.08, 130.14, 30.84 and .198 kg/ha, respectively) was recorded in treatment receiving vermicompost 2.5 t/ha + fly ash 30 t/ha + RDF while, RDF treatment recorded the lowest uptake of N,P,K,S and Zn (119.77, 11.21, 61.47, 17.22 and 0.097 kg/ha, respectively). The treatment receiving vermicompost 2.5t/ha + fly ash 30 t/ha+RDF recorded highest cost of cultivation (Rs. 17,084) while, RDF and fly ash 30 t/ha+RDF treatments recorded the lowest cost of cultivation (Rs 9,112 and Rs. 10,922, respectively). The maximum net returns were obtained from treatments receiving FYM 10 t/ha+ fly ash 20t/ha+RDF followed by green leaf manure 5 t/ha+fly ash 30 t/ha+RDF (Rs. 38,036 and 36,252, respectively). The treatments receiving FYM 10 t/ha + fly ash 30 t/ha + RDF, vermicompost 2.5 t/ha + fly ash 30 t/ha+RDF and green leaf manure 5 t/ha + fly ash 30 t/ha+ RDF, respectively gave 36.35 and 28 percent additional income over RDF.

Response of Wheat Varieties to Integrated Nutrient Management in Saline Soils of Tungabhadra Project Area

D.A. BIRADAR

1997

Major Advisor : DR. C.J.ITNAL

An investigation to study the response of wheat varieties to integrated nutrient management in saline soils was conducted during rabi 1996-97 at Agricultural Research Station, Gangavati, with two wheat varieties KRL 1-4 and DWR-162, two forms of organic sources (FYM @ 10Mg/ha, green manure (Dhaincha) @ 12.5 Mg/ha and a control) and four levels of fertilizers (100 Kg N + 75 ha). The treatments were laidout in a split-split plot design replicated three times.

The improved salt resistant variety KRL 1-4 recorded significantly higher grain yield (2663.69 Kg/ha) over DWR-162 (2050.03 Kg/ha). The KRL 1-4 produced 23.04% higher yield over DWR-162 in salt affected soil. The higher yield with

KRL 1-4 was the consequence of higher number of effective tillers/m row length, higher dry matter accumulation in earhead, 1000 grain weight, harvest index, higher stomatal conductance and nutrient uptake. All these parameters were positively correlated with yield. Straw yield was higher in DWR-162 than KRL 1-4.

Significant response of the applied organic and inorganic sources of nutrients was observed. Application of FYM and green manure (Dhaincha) recorded 23.01% and 11.7 % higher grain yield over control, respectively. Reduced soil pH, ECe and increased available N,P and organic carbon content in soil was the result of addition of organic manures.