Agricultural Entomology

University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Agricultural Entomology

1. Molecular Characterization of Whitefly, *Bemisia tabaci* (Genn.) and its Transmission Efficiency of *Mungbean Yellow Mosaic Virus* in Greengram and their Management

(AMBARISH, S)

ABSTRACT

An investigation on molecular characterization of whitefly, *Bemisia tabaci*, and its transmission efficiency of MYMV, characterization of endosymbionts associated with whitefly, screening of greengram germplasms against whiteflies and evaluation of IPM modules was conducted during 2018-20. Whitefly population per trifoliate leaf ranged from 1.08 to 4.23, virus incidence of 10.32 to 68.75 per cent in the surveyed area. Phylogenetic analysis of whiteflies indicated the existence of species such as *B. tabaci*, *Aleurotrachelus trachoides, Tetraleurodes acaciae* and *Trialeurodes vaporariorum.* In *B. tabaci,* four cryptic species *viz.,* Asia I, Asia II 5, Asia II 8 and Asia II 9 were identified. Asia II 9 cryptic species of *B. tabaci* is reported for first time from India. The complete genome sequencing and phylogenetic analysis of MYMV infecting greengram indicates a new variant of MYMV infecting greengram, soybean and horsegram in India. AAP and IAP each of 10 minutes required for transmission of MYMV by whiteflies (Asia I). Single whitefly was enough to transmit MYMV. Early stages of seedlings were more susceptible to MYMV. Five genera of endosymbionts were detected in whiteflies *viz., Wolbachia, Rickettsia, Arsenophonus, Hamiltonella* and *Cardinium.* Tetracycline was more effective in inactivation of endosymbionts in whiteflies and reducing the transmission of MYMV than rifampicin and ampicillin trihydate. Among 170 germplasms, 19 were immune under field conditions. Re-evaluation of immune germplasms under breeding cage indicated none of the germplasms were immune. However, three germplasms *viz.*, RM-16-20, JNG-18 and TK-6-1 were resistant to MYMV. Maize as border crop along with one spray of NSKE 5 % and FORS@ 5 ml/liter was superior in reducing whiteflies, aphids and virus incidence with higher yield and C: B ratio. Thiamethoxam 25 WG @ 0.5 g / liter and imidacloprid 17.8 SL @ 0.3 ml / liter were effective in reducing aphids, whiteflies and virus incidence.

November, 2020

(Kalleshwaraswamy, C. M.)
Major Advisor

2. Studies on Impact of Elevated CO_2 and Temperature on Biology, Population Abundance of Aphid, *Aphis craccivora* Koch on Cowpea and Groundnut

(Girish, B. R.)

ABSTRACT

Investigations were carried out to assess the **impact of elevated CO_2 and temperature on biology, population abundance of aphid, *Aphis craccivora* Koch on cowpea and groundnut** during *Rabi* and summer seasons of 2018-2019 and 2019-2020 at College of Agriculture, Shivamogga, Karnataka by using the research facility of open top chambers (OTCs).

The biology of aphid, *A. craccivora* on cowpea and groundnut conducted for four generations, each under different environmental conditions of *e*CO_2 and temperature clearly indicated that the developmental period and adult longevity decreased, reproductive period and fecundity increased and the total life cycle was reduced under *e*CO_2 and temperature conditions as compared to the ambient condition. The population abundance of aphid, *A. craccivora* in cowpea and groundnut significantly increased in *e*CO_2 and *e*temp conditions compared to the reference plot. The biochemical constituents of leaves along with stems in both cowpea and groundnut showed higher carbon content, lower nitrogen content and more C:N ratio under *e*CO_2 and temperature conditions. Also, increased total phenols and condensed tannins and decreased soluble protein content and free amino acids were recorded under *e*CO_2 and temperature conditions. The total larval period, total developmental period, adult longevity and total life cycle of coccinellid, *M. sexmaculatus* decreased. However, the feeding efficiency of both grubs and adults increased under *e*CO_2 and temperature conditions. Likewise, the total larval period, pupal period and total developmental period of syrphid, *I. scutellaris* was found to be reduced but the larval feeding efficiency of each instar was found higher under *e*CO_2 and temperature conditions.

November, 2020

(Pradeep, S.)
Major Advisor

Agronomy

University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Agronomy

1. **Crop diversification in maize based intercropping system for sustainable maize production in Southern Transition Zone of Karnataka**

IRFAN, M. M.

ABSTRACT

Field experiments were conducted during Kharif season of 2017 and 2018 at Bavikere, UAHS, Shivamogga. The first experiment was laid out with maize + pole bean paired row intercropping system accommodating 100 per cent population of both the component crops as additive series. Experimental design adopted was RCBD with three replications and seven treatments consisting 50, 75, 100, 125 and 150 per cent RDF of maize and pole bean to both the component crops tested against RDF of maize and pole bean applied uniformly to both the crops. Among different fertilizer levels tested, application of 150 (244.50:225:150 N, P and K kgha^{-1})per cent RDF of maize and pole bean applied to both the component crops recorded significantly higher maize grain (75.21q ha^{-1}), stover (91.88q ha^{-1}), cumulative pole bean (56.81q ha-1) and maize equivalent (149.77 q ha^{-1}) yield over 75 and 50 per cent RDF,but found on par with application of 125 and 100 per cent RDF of maize and pole bean applied to both the crops. The plots receiving 100 and 125 per cent RDF recorded higher B:C of 2.46and 2.38, respectively. Feasibility of second intercrop in maize + pole bean intercropping system was studied in second experiment with seven treatments replicated thrice under RCBD design. Intercropping system included hebbal avare, cowpea, soybean, green gram, black gram and french bean as second intercrop. Inclusion of cowpea recorded significant improvement in maize grain yield by 11.36 and maize equivalent yield by 16.22 per cent while total weed density and weed dry weight at different stages of crop were significantly lesser compared to maize + pole bean intercropping system. The above combination of crop recorded significant improvement in available nitrogen (347.01 kg ha-1), phosphorus (52.56 kg ha-1) and potassium (289.14 kg ha-1) in soil after crop harvest. Further, same treatment exhibited higher energy use efficiency, energy productivity and net energy.

February, 2020

H. K. Veeranna
Major Advisor

2. **Weed Dynamics, Growth and Yield of Pigeonpea (*Cajanus cajan* L.) as Influenced by Weed Management Approaches in North Eastern Dry Zone of Karnataka**

(YUSUFALI A. NIMBARGI)

ABSTRACT

Field experiments were conducted under rainfed conditions during *Kharif* seasons of 2018 and 2019 at ICAR KVK, Kalaburgi, University of Agricultural Sciences, Raichur. The experimental design was RCBD with three replications and eleven treatments. The first experiment was laid out with different chemical weed management approaches which were compared with cultural practices. The results showed that,among different chemical treatments,POE application of Propaquizafop 2.5% + Imazethapyr 3.75%w/wME @ 2000 ml ha^{-1} at 20-25 DAS recorded significantly highest weed control efficiency (91.36%), lowest weed index (8.78%) and higher grain yield (1317 kg ha^{-1}), stalk yield (3009 kg ha^{-1}), husk yield (1132 kg ha^{-1}) and also higher gross return (` 74961$ha^{-1}$), net return (` 43,0355 ha^{-1}) and B:C (2.35) and it was on par with Propaquizafop 2.5% + Imazethapyr 3.75%w/w ME @ 1500 ml ha^{-1} at 20-25 DAS, Imazamox 35 WG + Imazethapyr 35 WG at 100 g ha^{-1} at 20-25 and HW at 20 DAS and IC at 40 and 60 DAS.In the second experiment with three replications and seven treatments of non chemical weed management approaches, three inter crop, two mulch materials were compare with recommended practice. Among the non chemical weed management approaches, Pigeonpea mulching with residues of pigeonpea @ 2.5 t ha^{-1} recorded highest weed control efficiency (85.90 %), lower weed index,(19.86 %), highest grain yield (1022 kg ha^{-1}), stalk (2520 kg ha^{-1}) and husk yield (912 kg ha^{-1}) and also registered highest gross (63,354 ha^{-1}) , net returns (`33104 ha^{-1}) and B:C (2.09) and it was at par with the treatments like pigeonpea mulching with glyricidia @ 10 t $ha^{-1}$and pigeonpea + cowpea (1:2) and mulching at 45 DAS.

March, 2020

Narayan S. Mavarkar

Major Advisor

Genetics and Plant Breeding

University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Genetics and Plant Breeding

---

1. High-Frequency *in Vitro* Androgenesis for Production of Haploids and Doubled Haploids (DHs) and Evaluation of Doubled Haploid Lines in Chilli (*Capsicum annuum* L.) cv., Byadgi Dabbi.

(BHAGANNA HARALAYYA)

ABSTRACT

The chilli cv.,ByadgiDabbi is a famous and widely grown commercial dry chilli variety in Karnataka, India. It is characterised by deep red colour, highly wrinkled fruits with characteristic flavour, aroma, low pungency, high color level and oleoresin that makes it the most preferred variety for export. In a recent study, farmers, traders and consumers alike stated that yield and more specifically quality feature of Byadgichilli is deteriorating year after year because of introgression of undesirable genes from other chilli varieties/hybrids. Hence, for restoring the past glory of this variety, without sacrificing the good quality,anther culture may be applied successfully for plant breeding and genetic improvement to generate complete homozygous lines in a shorter time in comparison with the classic breeding methods. In the present study three basal induction media *viz*., Sibi, Dumas and Modified Dumas media were tested in eight replications by following standard tissue culture procedure. The embryo induction was observed in all three media. The type and color of the embryos induced were solitary and white in all three media. The growth rate was medium in all media. The highest frequency of embryo induction was observed in modified Dumas media (6.25 %) followed by Dumas media (3.38 %) and Sibi Media (2.23 %). It was observed that modified Dumas Media was superior over the original Dumas Media (45.92 %) and Sibi Media (64.32 %). The hundred DHs lines were developed and evaluated under field condition with three checks for both quantitative and qualitative characters, the diversity analysis were carried out by SSR markers. DH-22, DH-48, DH-23, DH-44, DH-41, DH-53, DH-42, DH-51, DH-7 and DH-47 were found promising for yield, colour and oleoresin content. Modified Dumas Media (DBM) was found to be most promising in inducing high frequency*in vitro*androgenesis for production of haploids and doubled haploids (DHs).

June, 2020

(H. D. Mohan Kumar)

Major Advisor

2. Genetic Variances and Association Mapping for Grain Iron and Zinc Density in Pearl Millet (*Pennisetum glaucum* (L.) R. Br.)

(MAHESH PUJAR)

ABSTRACT

Pearl millet being naturally a rich source of Fe and Zn, development of high Fe and Zn biofortified hybrids would help to reduce micronutrient malnutrition among the millet dependent regions especially among the resource-poor and farming communities in India.Bio-fortification through conventional and modern plant breeding techniques needs genetic information pertaining to Fe and Zn. Hence the present study was conducted to determine the genetic variances and association mapping for Fe and Zn in pearl millet.Six parameter generation mean analysis carried out among eight crosses evaluated across rainy-2017 and summer-2018 revealed predominant additive genetic effect for Fe whereas both additive and dominant genetic effects for Zn. Among epistatic interaction effects dominant × dominant (l) and additive × dominant (j) contributed predominantly towards the expression of Fe whereas, dominant × dominant (l) was predominant for Zn. Furthermore duplicate epistasis found predominant for both Fe and Zn insists for the practice of selection in later generation.Genome wide association study (GWAS)performed through MLM using 59,719 DArT-seq markersacross 281diverse inbreds revealed 18 SNPs for Fe (P =1.79 $\times 10^{-5}$ to 9.83×10^{-4})which explained 5.07 to 8.23% of phenotypic variation whereas,43 SNPs for Zn (P=2.24 × 10^{-5} to 9.78 $\times 10^{-4}$) explained 5.09 to 8.00% of phenotypic variation. SNPs *viz*., Pgl04_64673688, Pgl05_135500493, Pgl05_144482656 and Pgl07_101483782 were found common for Fe and Zn.The study conducted among 90 AF_1hybrids produced using 3 alloplasmic cytoplasm male sterile systems among 5 different genetic backgrounds with 6 different pollinatorsevaluated in split-split-block design revealed that there would not be any significant differences in hybrids for Fe and Znwhether we use A_1, A_4 or A_5 CMS systems. Furthermore comparison of 90AF_1 hybrids with their respective 30 BF_1 hybrids revealednon-significant difference indicatesthat there would not be any cytoplasm effect.

August, 2020

(Gangaprasad, S)
Major Advisor

3. Creation of Variability by Combined Hybridization and Mutation to Identify Productive Lines in Greengram [*Vigna radiate* (L.) wilczek]

(ARUNA, K.)

ABSTRACT

Hybridization and mutation are the effective sources to create variability. Hybridization shuffles the existing variability and mutation creates new variability. Combination of hybridization and mutation is expected to create significant variation in a population that can be relied upon for crop improvement. Owing to self-pollination, greengram lacks genetic variability and necessitates creation of variability. Eighty one greengram genotypes were evaluated for yield and its component traits and *mungbean yellow mosaic virus(MYMV)* diseaseresistance. Among 13 genotypes identified as high yielding and resistant/moderately *MYMV* resistant genotypes, IPM 205-7 and Yadadri were identified as stable for yield and *MYMV* resistance based on AMMI and GGE bi-plot analysis. IPM 205-7 and Yadadri were used as male parents to cross with KKM-3 to develop F_1 hybrids. F_1seeds of both the crosses were subjected to gamma-rays induced mutation and forwarded to next generation to develop mutated populations ($C1F_2M_2$and $C1F_2M_2$). The four populations *viz.*, $C1F_2$, C2F2, $C1F_2M_2$ and $C2F_2M_2$ were investigated to identify high yielding and *MYMV* resistant genotypes. Segregation pattern of 3susceptible: 1resistant ($C1F_2M_2$ and $C2F_2M_2$)and 15susceptible: 1resistant populations ($C1F_2$) were recorded indicating that *MYMV*resistance is governed by one/two recessive genes. Twenty six plants were identified as *MYMV* resistant across four populations. Selected *MYMV* resistant genotypes were confirmed for their resistance using *MYMV* resistance linked DNA markers*viz.*, YMV-1 and $CEDG_{180}$. Plants numbered 41 and 52 ($C1F_2$); 67 ($C2F_2$); 26 and 39 ($C2F_2M_2$) were identified as top five high yielding and *MYMV* resistant plants. These plants could be evaluated further for making available for cultivation.

October, 2020

(Gangaprasad, S)
Major Advisor

Plant Pathology

University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Plant Pathology

---

1. Characterization and Virulence Profiling Of M*agnaporthe oryzae* Isolates from Diverse Rice Ecosystems of Karnataka

(AMOGHAVARSHA CHITTARAGI)

ABSTRACT

The present study was carried out during 2018-2020 with title "Characterization and virulence profiling of *Magnaportheoryzae* isolates from diverse rice ecosystems of Karnataka" The study documented the disease status, pathotype groups, genetic diversity and finally identified resistant source. The roving survey for the assessment of rice blast severity was conducted during *Kharif* -2019. Within the irrigated ecosystems, the highest PDI was observed in the Kavery (50.85) followed by Varada (45.89), Bhadra (45.82), TBP (11.13) and UKP (10.58) command areas. In case of rainfed ecosystem, the highest PDI was observed in the hilly ecosystem (53.38) and least in the coastal ecosystem (3.73). Fifty two*M. oryzae* isolates were studied for their morphological variability and themajority of the isolates were circular (n=28) followed by irregular (n=24). The equal number of isolates were raised (n=22) and flat (n=22), and few were crateriform (n=8). Fifty twoisolates were inoculated on 24 IRRI bred blast resistant lines (IRBLs) containingR-genes. The high virulence frequency (> 70%) was observed on IRBLs carrying genes *Pib*, *Pia*, *Pi5(t)*, *Pi11*, *Pi12(t)*, *Pi20(t)*, *Pii*and*Pik-h.*The52 isolates were classified into 14 pathotype groups (PG) based on the reaction pattern against IRBLs. The PG-6 and PG-7 had maximum isolates with six each followed by PG-4 and PG-9 with five and PG-1, PG-3 and PG-5 with four, PG-2, PG-8, PG-13 and PG-14 with three and PG-10, PG-11 and PG-12 with two isolates respectively. The evolutionary relationship was studied using the 5 genesequences *viz.,actin, β-tubulin, calmodulin, TEF-1α* andITS region. The 39 isolates were grouped into two clusters based on the average sequence data. Out of 1265 lines screened against rice blast, 96 were highly resistant, 359 were resistant, 310 were moderately resistant, 125 were moderately susceptible, 49 were susceptible, and 326 were highly susceptible.

October, 2020

(GaneshaNaik. R)
Major Advisor

Soil Science and Agricultural Chemistry

University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in

Soil Science and Agricultural Chemistry

---

1. Dynamics of P and K in Soil as Influenced by Rice Hull Ash and Levels of P and K under Rice-Soybean Cropping System

(PURI AJIT NARAYAN)

ABSTRACT

Two field experiments were conducted on a sandy loam soil at AHRS, Bhavikere, Chikkamagaluru district of Karnataka State to know the Dynamics of P and K in the soil as influenced by Rice Hull Ash and levels of P and K under rice-soybean cropping system during 2017-18. The treatments comprised of the recommended dose of RHA (2 t ha^{-1}), FYM (7.5 t ha^{-1}) and varied levels of P and K with rice followed by soybean as test crops and tried in RCBD with eleven treatments and three replications. Results of the field experiment showed significant increase in growth and yield attributes, grain (5756.13 kg ha^{-1}) and straw yield of rice (6734.68 kg ha^{-1}) due to application of recommended dose of RHA, FYM and NPK. The content and uptake of major and micronutrients at harvest, high values of available P and K status and fractions of P and K in soil were recorded at different crop growth stages due to application of recommended dose of RHA, FYM and NPK. Significant increase in growth and yield attributes, seed (2283.94 kg ha^{-1}) and stover yield (4246.67 kg ha^{-1}) of soybean were recorded in residual treatment of recommended RHA, FYM and NPK. The content and uptake of major and micronutrients were also recorded higher in residual RHA treatments. Higher values of P and K status and fractions of P, K and C in soil were recorded with residual recommended RHA, FYM and NPK treatment at all the crop growth stages. Treatments receiving application of RHA along with RDF and FYM recorded increased soil organic carbon status after the harvest of both crops.

September, 2020

(B.C. Dhananjaya)
Major Advisor

2. Dynamics of Calcium and Magnesium in Acid Soils under Paddy Land use Cover of Coastal Karnataka

JAYAPRAKASH, S.M.

ABSTRACT

Soils of coastal Karnataka receive annual high rainfall leading to acidic soil and become problematic for crop Production. Thepresent investigation was made to study the"Dynamics of calcium and magnesium in acid soils under paddy land use cover of Coastal Karnataka". Soil samples were collected from Udupi and Dakshina Kannada districts toknow calcium and magnesium status and various forms of acidity. Field and pot culture experiments were conducted to knowthe lime recommendation and critical limits for exchangeable calcium and magnesium for paddy.

Experimental results revealed that soils are strongly acidic to moderate acidity with pH ranging from 4.11 to 5.66, organic carbon from medium to high with normal electrical conductivity and cation exchange capacity of soils ranging from 3.14 to 12.30 cmol (p^+) kg^{-1}. Analytical results showed that 58.75 per cent ofsoils were deficient in exchangeable calcium and magnesium.

Among the acidity forms, active acidity ranged from 2.19 x 10^{-6} to 8.91 x 10^{-5} mole H^+l^{-1}. Exchangeable acidity, pH dependent acidity and potential acidity ranged from 0.40 to 5.96, 3.00 to 49.87 and 4.98 to 50.82cmol (p^+) $kg^{-1}$of soil, respectively.

Different levels of agricultural lime method as per SMP and Exchangeable acidity equivalent methods, the benefit-cost ratio for treatments were considered to find suitable lime requirement method.It was concluded that lime equivalent to 50 per cent exchangeable acidity of soil was found to be better compared to all other levels of lime application for acid soils under paddy.

The results of field experiments indicated that lime application equivalent to 50 per cent exchangeable acidity of soil was found to be good for soils paddy. Pot culture experiments results indicated that 2.80 and 0.80 cmol (p^+) kg^{-1} were found as critical limits of exchangeable Ca and Mg, respectively, for the above soils.

October, 2020

(H. M. Chidanandappa)
Major Advisor

3. Studies on Influence of Fly Ash on Properties of Acid Soil under Rice Crop in Southern Transition Zone of Karnataka

(BHAVYA, V. P)

ABSTRACT

A field experiment was carried out during 2019 at Agricultural and Horticultural Research Station, Bavikere, UAHS, Shivamogga to study the effect of different levels of fly ash on properties of acid soil and productivity of paddy. The four levels of fly ash @ 10, 20, 30 and 40 t ha^{-1} with and without PGPR were tried in a randomized complete block design (RCBD) with ten treatments. Among the different levels of fly ash application, treatment that received fly ash @ 40 t ha^{-1} along with PGPR and FYM recorded significantly higher plant growth attributes *viz.*, plant height, number of tillers per hill and dry matter accumulation and yield attributes like *viz.*, number of panicles per hill (21.08), number of grains per panicle (97.15), grain yield (60.54 q ha^{-1}) and straw yield (73.4 q ha^{-1}). Application of fly ash at 40 t ha^{-1} with PGPR significantly increased the nutrient content and uptake by paddy.Lower values of soil bulk density (1.45 Mg m^{-3}) and improvedsoil porosity(59.42 %) and water holding capacityof acid soil (35.05%) was recorded due to fly ash application along with FYM and RDF. Fly ash integrated with PGPR and FYM significantly increased the major and micronutrients status in acid soiland enzymes activities such as urease, dehydrogenase and alkaline phosphatase activity. Results of laboratory incubation study revealed that higher saloid-P, calcium-P and available phosphorus was obtained when higher dose of fly ash was applied @ 80 t ha^{-1} along with PGPR and there was a maximum reduction of P fixation in the acid soil compared to without application of fly ash.

November, 2020

(G. N. Thippeshappa)
Major Advisor

4. Assessment of Soil Carbon Fractions under Different Land-Use Systems and Micro-Level Land Resource Inventory of Nandipura Mini-Watershed of Muguli Sub-Watershed of Tarikere Taluk of Chikkamagaluru District

(JAHNAVI KATTI)

ABSTRACT

A study was carried out in Nandipura mini-watershed of Tarikere taluk, Chikkamagaluru district on micro level land resource inventory and assessment of carbon fractions under different land-use systems. Sixteen soil pedons were selected based on soil heterogeneity and topography. These soil pedonswere studied for their morphological characteristics, physical and chemical properties. Soil reaction was varied from 5.48 to 8.22 and was non-saline in nature with low to high organic carbon content. Free calcium carbonate equivalent varied between 1.50 to 11.25 per cent. Among the pedons, exchangeable cations concentration was in the order of Ca^{2+}> Mg^{2+}> Na^{+}> K^{+} on the exchange complex. Whereas, cation exchange capacity ranging from 8.80 to 30.60 cmol (p^{+}) kg^{-1}. Soil pedons 2, 5, 7, 8, 10, 11, 13 and 14 were classified as *Typic Haplustepts*, soil pedons 1, 3, 12 and 15 were classified as *Typic Haplusterts*, pedons 4, 6 and 9 were classified as *Typic Rhodustalfs* and pedons 16 was classified as *Inceptic Haplustalfs*. The mini-watershed area was low to medium in available nutrients (nitrogen, phosphorus and sulphur)while available boron content was low to medium andavailable potassium was medium to high in status. The soils of the study area were sufficient in exchangeable calcium, magnesium, DTPA extractable iron, copper and manganese, whereas it was deficient in majority of the area (63.03%)with respect to DTPA extractable zinc. The mapping units belonged to land capability class II and III with two sub-classes *viz.*, IIes, IIIe and IIIes.Soil-site suitability was moderately to marginallysuitable for arecanut, banana and coconut, highly to moderately suitable for bajra, groundnut, pomegranate and ragi and marginally suitable for maize, mango and sorghum. Carbon fractions under different land-use systems showed significantly higher PDOC, PPOC, CWEC, SMBC, TOC, TIC, TC, carbon stock, HA and FA content under the horticultural land-use system.

November, 2020

(K. T. Gurumurthy)

Major Advisor