ABSTRACTS OF THESES

Accepted for the award of Post-Graduate degrees by the Keladi Shivappa Nayaka, University of Agricultural and Horticultural Sciences, Shivamogga during 2025

DOCTOR OF PHILOSOPHY

A. CROP SCIENCE

GENETICS AND PLANT BREEDING

Genome-wide association studies for submergence tolerance and yield related traits in rice (*Oryza sativa* L.)

H. M. SACHIN KUMAR

MAJOR ADVISOR: Dr. B. M. DUSHYANTHA KUMAR

Rice (*Oryza sativa* L.) production is affected by flash floods in low-lying paddy-growing areas, causing submergence stress. To identify stable genetic stock of submergence tolerance, a diverse set of rice germplasm comprising 90 lines was evaluated under irrigated non-submergence and submergence conditions and also subjected to a genome-wide association study to identify the genomic regions governing submergence tolerance and yield-related traits. Towards this, germplasm lines evaluated in an augmented design at ZAHRS Shivamogga over three consecutive *kharif* seasons (2019, 2020 and 2021) showed adequate genetic variability and diversity to identify the SNPs governing the trait. The genotyping by sequencing the germplasm set resulted in the identification of 5787 SNPs and population structure analysis revealed the presence of two major subpopulations. Further, genome-wide association studies (GWAS) for yield-related traits under non-submerged conditions resulted in the identification of 11 common significant marker trait associations across the four models employed in the study. The screening of germplasm for submergence tolerance at ZAHRS Shivamogga (*kharif* 2019 & 2020) and ZAHRS Mudigere (*kharif* 2019) resulted in the identification of highly tolerant sources *viz*., Hallada batta and Natti jaddu (sub-sln) for flash flooding, while Bangaru gundu had elongation ability and hence may act as a tolerant source for deep water stagnate flooding. GWAS for submergence tolerance traits resulted in the identification of two significant SNPs, S1_19807172 and rs353008778 for survival percentage and two SNPs, rs878178297 and rs 53072485 for relative shoot length. The in-silico gene annotation of SNPs associated with submergence tolerance highlighted the SNPs role in mitigating the stress via differential regulation of stress hormones (GA, ABA, auxin and ethylene).

Studies on nutritional quality in groundnut (*Arachis hypogaea* L.) vis-à-vis genetic improvement of oil quality through marker assisted selection

SRIVIJAY

MAJOR ADVISOR: Dr. B. N. HARISH BABU

Groundnut, an important crop for its nutritional and economic value, was studied at ZAHRS, Hiriyur during the *rabi/Summer* 2022-23 season to evaluate genetic variability in 25 genotypes across four botanical groups. Significant diversity was observed for fatty acid composition, quality traits, and pod yield. Spanish bunch genotypes (Dh 256, Dh 257, HG 2023-01) matured early and had higher protein, calcium, magnesium, iron, and zinc, with moderate oil and oleic acid content. Virginia bunch types (Girnar 4, Girnar 5) showed higher oleic acid and oleic-to-linoleic ratio, with moderate levels of protein, micronutrients, oil content, and yield attributes. Analysis of Molecular Variance (AMOVA) revealed that 33.11% of the total genetic variation was due to differences between botanical groups, while 66.89% existed within the groups. Polymorphic Information Content (PIC) values ranged from 0.326 to 0.971. Eight molecular markers showed significant association with key yield and quality traits, with R^2 values ranging from 10.05 to 80.63%. Marker-Assisted Selection (MAS) was undertaken to introgress *FAD2* mutant alleles for high oleic acid content from donor lines (Girnar 4 and ICGV 16690) into Karnataka's popular cultivars TMV 2 and Dh 256 at ZAHRS, Hiriyur during *kharif*-2023. During *rabi/Summer* 2023–24, 92 true F_1 hybrids were identified from 150 F_1 seeds across four crosses (TMV 2 × Girnar 4, TMV 2 × ICGV 16690, Dh 256 × Girnar 4 and Dh 256 × ICGV 16690) using allele-specific markers. These were advanced to the F_2 generation in *kharif*-2024. Genotyping and phenotyping for the high oleate trait in high pod-yielding F_2 plants from the cross TMV 2 × Girnar 4 identified four F_2 plants as high-oleate types exhibiting >65% oleic acid. Their segregation followed a 15:1 ratio, confirmed by the chi-square test, suggesting that high oleic acid content is governed by duplicate recessive genes acting additively.

Genome-wide association studies for submergence tolerance, blast disease resistance, yield and yield related traits in rice (*Oryza sativa* L.)

N. KARTHIK MAJOR ADVISOR: Dr. B. M. DUSHYANTHA KUMAR

Rice (*Oryza sativa* L.) cultivation in low-lying areas is frequently threatened by flash and deep-water floods, resulting in submergence stress, as well as by blast disease caused by *Magnaporthe oryzae*. To identify stable genotypes and novel genomic regions linked to submergence tolerance, a diverse panel of 200 accessions from the 3K RGP was evaluated under irrigated non-submergence conditions during summer 2024 at ZAHRS, Shivamogga, and *kharif* 2024 at AHRS, Kathalagere in an augmented design. The same set was screened under controlled submergence in artificial tanks during *kharif* 2023 and summer 2024 at ZAHRS, Shivamogga. Additionally, leaf blast resistance was assessed in a uniform blast nursery and neck blast resistance was evaluated under field conditions at AHRS, Ponnampete during *kharif* 2024. Submergence screening resulted in identification of highly tolerant accessions *viz*., IRGC 125987 and IRGC 125715, which survived through an escape strategy, making them suitable for deep-water flooding. IRGC 127713 exhibited a quiescence strategy and is therefore better adapted to flash-flood conditions. Blast screening revealed IRGC 127835, IRGC 128105, and IRGC 125608 as immune to neck blast and resistant to leaf blast. To ensure robust marker-trait associations upon the assessment of sufficient variation, a genome-wide association study (GWAS) was conducted using 1,02,580 highly polymorphic SNPs for submergence tolerance, blast resistance and key yield traits. The GWAS for seedling stage survival percentage under submergence identified five stable SNPs across environments *viz*., Chr_01_42314477, Chr_02_59541834, Chr_02_180046105, Chr_05_153499239 and Chr_06_182196359. Additional analyses detected five MTAs for leaf blast, one for neck blast and 19 MTAs associated with yield traits (days to 50% flowering, number of tillers, number of productive tillers and grain length to breadth ratio). *In-silico* candidate gene analysis further highlighted putative candidate genes involved in submergence tolerance (GA, ABA, auxin and ethylene pathways), blast resistance (jasmonic and salicylic acid pathways) and yield traits.

Genome-wide association, heterosis and combining ability studies for fodder related traits in maize

THUPAKULA HARISH VIKRAM MAJOR ADVISOR: Dr. D. LAKSHMANA

Genetic architecture of fodder yield and quality traits in maize was studied by phenotypic evaluation of a diverse CIMMYT Asia Association Mapping (CAAM) panel across *rabi* 2023 and *kharif* 2024 at College of Agriculture Shivamogga. This revealed substantial genetic variability for the 17 fodder yield and related traits. Correlation analysis established strong and significant positive associations of green fodder yield with plant height, stem diameter, leaf area and dry fodder yield, identifying these traits as reliable indirect selection criteria. Genome-wide association studies using high-density SNP markers (9,55,690) and the BLINK model detected several significant marker–trait associations for key fodder traits. Consistent genomic regions were identified on chromosomes 1 for leaf area, 2 for dry fodder yield and plant height, 5 for leaf : stem ratio and 6 for stem diameter and green fodder yield. Candidate gene analysis revealed loci associated with transcriptional regulation, hormone signalling, carbohydrate metabolism and protein synthesis, highlighting the complex polygenic regulation of biomass accumulation. Crosses generated among selected inbreds in half diallel mating design, demonstrated substantial and desirable heterosis for fodder yield and quality traits, where in hybrids, VL1016214 × VL1236, VL062614 × VL1237 and VL1242 × VL1237 showed superior green fodder yield and favourable quality attributes over African Tall. Combining ability analysis indicated the predominance of non-additive gene action for most fodder traits, supporting hybrid breeding strategies. Parents VL1236, VL1242 and VL062614 were identified as good general combiners, while hybrids including VL1016214 × VL1236, VL062614 × VL1237 and VL1018667 × VL1237 exhibited superior specific combining ability. Stability analysis using multi-trait stability index, identified elite and stable hybrids, notably VL062614 × VL1237, VL1242 × VL1237 and VL108871 × VL1016214. Integrating GWAS-based marker information with heterosis exploitation and combining ability-driven hybrid development provides an effective strategy for developing high-yielding, nutritionally superior and stable fodder maize hybrids.

Development of hybrids with elevated fruit quality traits for processing purpose in tomato

C. VISHWASGOWDA MAJOR ADVISOR: Dr. R. C. JAGADEESHA

India ranks second globally in tomato production but processes only one percent of its output, primarily due to the lack of suitable processing cultivars. In this context, the present study evaluated twenty tomato genotypes for yield and processing-related fruit quality traits using randomized complete block design with two replications during summer 2024 at College of Agriculture, Shivamogga. Ten genotypes hybridized in a half-diallel mating design, generating 45 F hybrids, which, along with parents, were assessed during summer 2025. Analysis of variance indicated significant genotypic differences for all the evaluated traits. Key attributes exhibited high genetic and phenotypic variation with elevated heritability and genetic advance as a percentage of mean, suggesting additive gene action. Total soluble solids were positively correlated with lycopene content and ripening index and negatively with titratable acidity, pH and fruit size, while pericarp thickness was positively correlated with firmness, pulp recovery and fruit weight and negatively with fruit number. Higher general combining ability variances and proportional contributions for most traits, implying predominant additive gene action. Combining ability analysis, identified Kashi Vishesh, Arka Ashish, IC1, San Marzano, PKM and KP Baari as superior general combiners across traits. Crosses such as San Marzano × IC1, Kashi Vishesh × IC1 and Arka Ashish × IC1 displayed promising specific combining ability effects. The crosses Kashi Vishesh × San Marzano, Arka Vikas × IC1, San Marzano × IC1 and San Marzano × Pusa Ruby exhibited greater heterosis for most traits. Combined genetic distance outperformed both phenotypic and SSR-based genotypic distances in correlating with hybrid performance. Further, random forest model exhibited moderate to high accuracy in predicting yield and quality traits, aiding parental selection. Kashi Vishesh × San Marzano and Arka Ashish × San Marzano were superior hybrids selected through multi-trait genotype ideotype distance index for yield and fruit quality traits.

AGRONOMY

Performance of coffee grown under different shade management regimes and assessment of carbon stock and carbon footprint in central western ghats of India

RUDRAGOUDA — MAJOR ADVISOR: Dr. G. K. GIRIJESH

Shade grown coffee systems are essential to sustainable farming, offering ecological and economic benefits, particularly in biodiversity-rich regions like the Western Ghats. A study was conducted during 2022–23 in Kodagu district, Central Western Ghats, India, to assess the impact of shade management on coffee agronomy, quality, biodiversity, carbon stock and carbon footprint. Three experiments *viz*., (i) Performance of coffee under native, mixed and exotic shade tree species compared to unshaded systems, (ii) Tree diversity, biomass and carbon stock within coffee agroforestry systems, and (iii) Carbon footprint across production and processing stages were carried out. Standardized methodologies, including agronomic and physiological measurements, biodiversity indices, allometric biomass estimations and accounting greenhouse gas emissions followed ensured the robust analysis. Coffee under native shade exhibited superior growth (total nodes: 12.33, bearing nodes: 6.97 per primary branch), higher photosynthetic rates (7.6 µmol m^2s^{-1}), clean coffee yield (986.65 kg ha^{-1}) and improved quality (bean size, grade) over unshaded systems. Native and mixed shade regimes provided ecological benefit, with higher tree diversity (Shannon Index >2.0) and significant carbon stock contributions (Arabica: 353.06 Mg ha^{-1}; Robusta: 272.97 Mg ha^{-1}) and CO_2 sequestration (Arabica: 1294.57 Mg CO_{2e} ha^{-1}; Robusta: 1000.88 Mg CO_{2e} ha^{-1}). Arabica under native shade with medium management regimes achieved the lowest carbon footprint (-8792 kg CO_{2e} ha^{-1} yr^{-1}) and highest annual carbon sequestration (3.39 Mg C ha^{-1} yr^{-1}), highlighting its carbon-neutral or negative potential. Robusta under similar conditions also showed a reduced carbon footprint (-6021 kg CO_{2e} ha^{-1} yr^{-1}). Medium management regimes optimized outcomes, attaining a balanced carbon footprint (-7848 kg CO_{2e} ha^{-1} yr^{-1}). This research outcome highlights that integrating native and mixed shade species with medium management resulted in enhanced biodiversity, improved soil health and high carbon sequestration while reducing greenhouse gas emissions. These findings position Indian coffee as a climate-smart commodity with premium market potential, offering a replicable and resilient agroforestry model.

Performance evaluation of stakeless hybrid tomato to varied plant density and nutrient levels and revalidation of present fertilizer recommendation

G. D. NISARGA — MAJOR ADVISOR: Dr. G. K. GIRIJESH

Two field experiment was conducted under the title Performance Evaluation of Stakeless Hybrid Tomato to Varied Plant Density and Nutrient Levels and Revalidation of Present Fertilizer Recommendation at the College of Agriculture, Navile, Shivamogga, during the summer seasons of 2024 and 25. Experiment-1 was laid out in a split-plot design with factorial concept. The main plots comprised two tomato types (M_1: staking; M_2: stakeless); in sub plot, factor A consisted of three nutrient levels (D_1: 125:125:125 kg $N:P_2O_5:K_2O$ ha^{-1}; D_2: 187.5:187.5:187.5 kg $N:P_2O_5:K_2O$ ha^{-1} and D_3: 250:250:250 kg $N:P_2O_5:K_2O$ ha^{-1}) and factor B included three scheduling (S_1: Entire quantity during planting; S_2: 50% during planting and 50% at 25 DAT; and S_3: 50% during planting, 25% at 25 DAT and 25% at 50 DAT). Pooled results indicated that tomato types had no significant effect on fruit yield. However, M_2 registered significantly higher energy efficiency (1.03) and B:C ratio (7.48) than M_1. Among nutrient levels, D_2 recorded significantly higher fruit yield (67.89 t ha^{-1}), energy efficiency (1.04) and B:C ratio (7.09) over other levels. Fertilizer applied in three splits (S_3) resulted in maximum fruit yield (73.10 t ha^{-1}), energy efficiency (1.08) and B:C ratio (7.57). D_2S_3 recorded significantly higher fruit yield (76.83 t ha^{-1}), energy efficiency (1.14) and B:C ratio (7.96), which is on par with the D_3S_3. Experimient-2 was laid out in a split-spilt plot design. The main plots comprised two tomato types (M_1: staking; M_2: stakeless); sub-plots consisted of three spacings (S_1: 120 cm × 45 cm; S_2: 90 cm × 45 cm and S_3: 60 cm × 45 cm) and sub-sub plots included three nutrient levels (L_1: 250:250:250 kg $N:P_2O_5:K_2O$ ha^{-1}; L_2: 200:200:200 kg $N:P_2O_5:K_2O$ ha^{-1} and L_3: 150:150:150 kg $N:P_2O_5:K_2O$ ha^{-1}). Tomato types had no significant effect on fruit yield. Among spacing, S_3 recorded significantly higher fruit yield (59.64 t ha^{-1}). Among nutrient levels, L_2 recorded maximum fruit yield (60.49 t ha^{-1}) than others levels. S_3L_2 produced significantly higher fruit yield (68.66 t ha^{-1}) and was on par with S_3L_1.

Agronomic interventions for enhancing production potential of aerobic rice in southern transition zone of Karnataka

M. RAGHUVEER — MAJOR ADVISOR: Dr. C. J. SRIDHARA

Aerobic rice productivity is often constrained by nutrient deficiencies, heavy weed infestation and inefficient water management, highlighting the need for improved agronomic strategies. This study was carried out at the College of Agriculture, Shivamogga, through two field experiments conducted during *kharif* 2023 and 2024 and summer 2024 and 2025. The first experiment, laid out in a Factorial Randomized Block Design, examined the combined effects of three nutrient levels and four weed management practices on aerobic rice. Weed density was minimum under Pyrazosulfuron ethyl 10% WP @100 g ha^{-1} followed by sunhemp, which lowered the total weed population to 32.92 m^{-2} at 60 DAS compared with 181.36 m^{-2} in the weedy check, giving a weed control efficiency of 77.7%. Grain yield increased with higher nutrient application, with 125:62.5:62.5 kg $N:P_2O_5:K_2O$ ha^{-1} producing 4114 kg ha^{-1}. The interaction of 125:62.5:62.5 kg $N:P_2O_5:K_2O$ ha^{-1} combined with pyrazosulfuron ethyl+sunhemp produced the highest grain yield (4908 kg ha^{-1}), straw yield (6952 kg ha^{-1}), net returns (`67,763 ha^{-1}) and benefit-cost ratio (2.59). The second experiment, conducted in a split-plot design, evaluated four irrigation schedules based on cumulative pan evaporation ratios and three aerobic rice genotypes. Irrigation at 1.2 CPE improved crop

growth rate (12.86 g m^{-2} day^{-1}) and root volume (76.68 cm^3), resulting in the highest grain yield (4498 kg ha^{-1}). However, maximum water-use efficiency (87.42 kg ha^{-1} cm^{-1}) was achieved at 0.6 CPE. Among genotypes, KMP-175 consistently outperformed IET-1444 and Sahyadri Kempumukthi, exhibiting superior physiological vigor, larger root volume (61.03 cm^3) and a grain yield 4168 kg ha^{-1}. Collectively, the results indicate that 125:62.5:62.5 kg N:P_2O_5:K_2O ha^{-1}, pyrazosulfuron ethyl 10% WP @100 g ha^{-1} +sunhemp, irrigation at 1.2 CPE and the genotype KMP-175 constitute the most effective combination for optimizing productivity, profitability and water-use efficiency in aerobic rice systems.

Assessment of *in-situ* green manure intercrops in maize-maize sequence under varied nitrogen levels on maize productivity and soil carbon sequestration

V. S. VIDYA — MAJOR ADVISOR: Dr. H. K. VEERANNA

A field experiment was conducted at College of Agriculture, Navile, KSNUAHS, Shivamogga, during *kharif* and *rabi* seasons of 2023 and 2024 in sandy loam soil. The experiment was laid out in split plot design where main plots consisting three nitrogen levels *viz*., 75%, 100% and 125% Recommended Dose of Nitrogen – RDN and sub plots consisting four green manure intercropping systems (sole maize, maize + fodder cowpea, maize + horse gram and maize + sunhemp) forming 12 treatment combinations which were replicated thrice. Results revealed that higher growth and yield parameters were recorded at 125% RDN among nitrogen levels while, under green manure intercropping systems maize + sunhemp recorded higher growth and yield parameters. Maize grain yield under 125 per cent RDN was 11.61 and 5.25 per cent higher than 75 per cent and 100 per cent RDN, respectively. Maize + sunhemp recorded 7.80 per cent higher maize grain yield than sole maize. Interaction of nitrogen levels and green manure intercropping system showed that maize + sunhemp with 125 per cent RDN recorded 13.12 per cent higher grain yield over sole maize with 100 per cent RDN. Yield improvement over the seasons was greater in green manured plots across all nitrogen levels. While, it was lowest under sole maize. Further, higher soil nutrient status, total soil carbon stock and carbon sequestration (2.08 Mg ha^{-1} yr^{-1}), soil beneficial microbial population and enzymatic activity were higher in maize + sunhemp, followed by maize + cowpea. However, higher nutrient uptake, net returns (`98,846 ha^{-1}), B:C (2.42) and sustainable yield index (0.95) were recorded in maize + sunhemp with 125 per cent RDN. Green manure-based intercropping can thus be a viable strategy for improving soil properties, carbon sequestration and sustaining productivity under intensive maize-based systems across variable nitrogen regimes.

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

Pedometric based land resource appraisal and soil organic carbon modelling in a prioritized sub-watershed of upper Tungabhadra catchment using geospatial techniques

S. ANAND — MAJOR ADVISOR: Dr. K. T. GURUMURTHY

An investigation was carried out during 2022-24 to prioritize the sub-watersheds of Kaggi Kusi watershed using morphometric analysis and holistically appraise the land resources as well as to model soil organic carbon in the prioritized sub-watershed using pedometric and geospatial techniques. The results of the morphometric analysis revealed that, Kalahalla, Udava and Nandi sub-watersheds of Kaggi Kusi watershed were at very high risk of soil erosion due to their morphometric characteristics. Based on these results Nandi sub-watershed was prioritized for taking up further studies. The characterization studies indicated that the soils of Nandi sub-watershed belonged to soil orders *Inceptisols* and *Alfisols*. The surface soils of the sub-watershed had moderately acidic to strongly alkaline pH, low soluble salt content (non-saline), low to high soil organic carbon, low to medium available nitrogen, low to high available phosphorus and medium to high available potassium. It had low to high available sulphur and low to medium available boron. The soils had sufficient exchangeable calcium and magnesium as well as available micro nutrients (Iron, manganese and copper) except zinc, which was found deficient in certain areas of the sub-watershed. Based on the performance metrics, random forest model was found to be effective in predicting soil organic carbon content using the selected covariates. The predicted annual average soil loss in the sub-watershed was found to be 62.15 t ha^{-1} yr^{-1} and was highest in closed scrublands followed by open scrublands. The sub-watershed belonged to land capability class II, III and IV with two subclasses *viz.,* 'e' and 'es'. The sub-watershed was moderate to marginally suitable for pomegranate and maize, although was not suitable to marginally suitable for mango and jamun, while was highly suitable to marginally suitable for amla, brinjal, chilli, groundnut, guava, finger millet, red gram, sorghum, soybean and sunflower.

Phosphorous dynamics in coastal alluvial soil of Karnataka under paddy-groundnut cropping system as influenced by organic manures enriched with rock phosphate

ARUN C. KANAGALABAVI — MAJOR ADVISOR: Dr. S. M. JAYAPRAKASH

Two field experiments were conducted at ZAHRS Brahmavar, KSNUAHS, Shivamogga in order to know the phosphorous dynamics in coastal alluvial soil of Karnataka under paddy-groundnut cropping system as influenced by organic manures enriched with rock phosphate (RP) during *kharif* and *rabi* season of 2023-24. The experiment was laid out in RCBD with eight treatments replicated thrice. The treatments comprised of varied levels of phosphorous in combination of chemical fertilizers and three different rock phosphate enriched organic manures *viz.,* Farm yard manure (FYM), leaf litter compost and *salvinia molesta* compost. The data revealed that combined application of 75% RDP + 25% RP enriched *Salvinia molesta* compost recorded significantly higher grain (5370.20 kg ha^{-1}) and stover (7600.44 kg ha^{-1}) yield. While, P uptake of 27.39 kg ha^{-1} in grain and 21.35 kg ha^{-1} in straw was observed. Residual effect of

applied RP-enriched organic manures in groundnut also showed positive results on both crop yield and soil available nutrient status. Treatment with 75% RDP + 25% RP enriched *Salvinia molesta* compost recorded significantly higher pod (1590.19 kg ha^{-1}) and haulm yield (2824.20 kg ha^{-1}), P uptake of 2.89 kg ha^{-1} in grain and 8.97 kg ha^{-1} in haulm was observed. Analysis of post-harvest soil showed improved nutrient availability, with notable increase in organic carbon, available N, P, K and other plant nutrients. Application of RP enriched *Salvania molesta* compost and leaf litter compost significantly increased the biological activities and reduced the P fixation capacity of the coastal alluvial soil. Path coefficient analysis revealed that among the different P fractions, organic bound P and saloid-bound P fractions contributed most to the pod yield, straw yield and labile phosphorous pool in soil after harvest of the crop. Whereas the non-labile P fraction was primarily composed of iron and aluminum bound P fractions.

Assessment of soil ecological functions and processes along rural-urban gradient in Shivamogga district

SUDARSHAN VARMA — MAJOR ADVISOR: Dr. M. S. NAGARAJA

A study was undertaken to evaluate the effects of urbanization on land-use patterns, biomass and nutrient turnovers, soil ecological functions and processes. Land-use and land-cover (LULC) analysis across urban peri-urban and rural zones revealed significant soil sealing variations. Urban zones recorded the highest proportion of sealed areas (65.59%), while peri-urban zones showed moderate sealing (19.26%) and rural zones recorded lowest soil sealing (5.76%). Biomass and nutrient turnover differed across land-use types. Among the land use systems, organic matter recycling was significantly higher in arecanut plantations (10.50-10.65 Mg ha^{-1} yr^{-1}) followed by Forest/ forest plantations (9.01-9.38 Mg ha^{-1} yr^{-1}). Across the gradient, urban zone exhibited lesser biomass and nutrient turnovers, while rural zone recorded higher turnovers. Soil ecological functions in terms of physical, chemical and biological properties varied significantly along the gradient as influenced by the extent of soil sealing. Urban soils exhibited higher bulk density (1.42 Mg m^{-3}) and lower porosity (35.75%). Soil organic carbon (SOC) was highest in forest/forest plantations (6.83 g kg^{-1}) and lowest in sealed areas (2.72 g kg^{-1}). Soil nutrient status, carbon and nitrogen fractions were also greatly altered by the intensity of urbanization. Microbial populations and enzymatic activities were higher in rural soils than urban soils indicating greater biological activity. Soil Quality Index (SQI) was lowest in sealed areas of urban zone (0.20) and highest in forest and agricultural soils of rural zone (0.64). The study highlights the adverse impacts of urbanization on soil ecological functions and underscores the need for sustainable land management to mitigate soil degradation, enhance productivity and promote ecological resilience in urbanizing landscapes.

Assessment of spatio-temporal variability of salinity in coastal soils of Udupi district using geospatial technology

SHRIDHAR — MAJOR ADVISOR: Dr. D. RAVIKUMAR

A study was conducted in 2022 to assess the spatial and temporal variation of soil salinity and irrigation water quality during pre and post-monsoon seasons in the coastal region of Brahmavara Taluk, Udupi District. A total of 772 surface soil and 102 irrigation water samples were collected (soil: 386 pre and 386 post-monsoon; water: 51 pre and 51 post-monsoon) and analyzed for salinity and water quality parameters. Results revealed that 10.62, 5.71 and 12.69 per cent of soils in the pre-monsoon and 8.81, 6.22 and 7.77 per cent in the post-monsoon season had ECe of 4–8, 8–16 and >16 dS m^{-1}, respectively, indicating moderate to very strong salinity levels. Among water samples, 29.41 and 33.34 per cent (pre-monsoon) and 35.29 and 29.42 per cent (post-monsoon) had EC_{iw} values 0.75–2.25 and >2.25 dS m^{-1}, classifying them as highly saline and unsuitable for irrigation. A decline in soil ECe and EC_{iw} post-monsoon suggests a dilution effect. According to CSSRI, Karnal, 11.76 and 17.65 per cent of water samples in pre-monsoon and 19.61 and 13.73 per cent in post-monsoon belonged to saline and high SAR saline classes. As per USSL classification, 13.72 and 17.65 per cent (pre-monsoon) and 15.69 and 11.76 per cent (post-monsoon) of water samples fall under C4S1 and C4S2 classes. Only 3.92 per cent in pre-monsoon fall under C4S3. Correlation analysis between NDSI and ECe values showed significant positive relationships ($r = 0.7746^*$ pre-, $r = 0.7593^*$ post-monsoon; $p < 0.05$). A pot culture experiment conducted at ZAHRS, Brahmavara using paddy variety MO-4 under different seawater-induced soil salinity levels showed that T_1 (recommended fertilizer + FYM) recorded significantly better growth, yield, nutrient uptake and improved post-harvest soil properties, highlighting the potential of integrated nutrient management to mitigate seawater-induced salinity stress and sustain paddy production.

Quantitative assessment of morphometric variables and land resource appraisal of priority areas in lower Tungabhadra catchment of Krishna basin

N. SUSHMA — MAJOR ADVISOR: Dr. GANAPATHI

An investigation was carried out during 2023–25 to prioritize the fifteen sub-watersheds of the Vedavathy watershed through morphometric analysis and to comprehensively assess their land resources, total carbon stock, soil loss and crop suitability. These evaluations were performed using geospatial techniques along with the Analytical Hierarchy Process (AHP). The results of the morphometric analysis indicated, that SWS-1 (Birur) was the most vulnerable to soil erosion, while SWS-10 (Mangenahalli) is the most sustainable. This prioritization was based on the compound factor (CF), which ranged from 3.31 to 10.66, with the highest priority assigned to the sub-watersheds having the lowest CF values. But Vitalapura sub-watershed was chosen for detailed studies due to its diverse landuse systems and geomorphological features. Characterization studies revealed that the soils of the Vitalapura sub-watershed belonged to the *Alfisol* and *Inceptisol* orders. The surface soils of had slightly acidic to slightly alkaline pH (5.27 - 7.80) and non-saline, low to medium soil organic carbon (2.30 - 7.40 g kg^{-1}), low available nitrogen (194.72 - 243.20 kg ha^{-1}),

medium available phosphorus (24.16 – 56.31 kg ha^{-1}) and potassium (158.93 – 325.19 kg ha^{-1}). It had low to medium available sulphur and boron. The soils had sufficient exchangeable calcium and magnesium as well as micro nutrients (manganese and copper) except zinc and iron which was found deficient in certain areas. Carbon stock was found higher in forest land use (208.29 Mg C ha^{-1}) followed by coconut plantation (138.66 Mg C ha^{-1}) and agriculture land use (78.04 Mg C ha^{-1}). The predicted average soil loss of the sub-watershed area was found 27.62 t^{-1} ha^{-1} yr^{-1}. The crop suitability analysis showed that the sub-watershed was highly to moderately suitable for maize, sorghum, finger millet, minor millets, soybean, redgram, pomegranate, chilli, arecanut, cardamom and sunflower. Highly to marginally suitable for sapota, onion and coconut crops

PLANT PATHOLOGY

Investigations on guava wilt complex incited by *Meloidogyne enterolobii* yang and eisen back and *Fusarium oxysporum* f. sp. *psidii* Prasad, Mehta and Lal

H. D. MANTHESHA

MAJOR ADVISOR: Dr. R. GANESHA NAIK

Guava wilt is a complex disease incited by *Meloidogyne enterolobii* and *Fusarium oxysporum* f. sp. *psidii*, which significantly affects guava production and causes severe yield losses. Roving survey carried out during (2022 and 2023) revealed, highest mean PDI (19.71 and 16.96%) in Chikkaballapura with mean Root Knot Index (RKI) 3.01 and 2.68. Whereas, least PDI (6.87 and 14.17%) was recorded in Chitradurga with RKI 1.37 and 2.24, respectively. During the survey, 15 isolates of both pathogens were isolated from infected samples across the surveyed locations. Cultural, morphological and physiological characteristics of *Fusarium* revealed that PDA was the best medium, with pH of 6.5 and temperature of 25°C found optimum for growth and sporulation. All *Fusarium* isolates showed variation with respect to morphology of macro and microconidia. Molecular characterization of isolates of both pathogens using the primers D2D3 and ITS1/ITS4 confirmed as *Meloidogyne enterolobii* and *Fusarium oxysporum* f. sp. *psidii*, respectively. Also further, confirmation was achieved using specific primers, SCAR-Me for *M. enterolobii* and Tef1, â-tubulin and FOP for *F. oxysporum* f. sp. *psidii*, targeting specific genes. Sequence of five representative isolates of both pathogens were deposited in NCBI Gen Bank and their accession numbers were obtained. Interaction studies revealed that, the inoculation of *Meloidogyne juveniles* two weeks before *Fusarium*, recorded least shoot, root growth and highest wilt incidence. *In vitro* studies of fluopyram and *Psuedomonas fluorescens* was effective against *Meloidogyne* causing the maximum juvenile mortality, while hexaconazole 5 EC and *Trichoderma harzianum* showed highest efficacy against *Fusarium*. 'Module C' which included soil application of fluopyram (6 ml/l) followed by drenching of hexaconazole (2 ml/l) after one month of fluopyram application was found superior with least per cent wilted branches of 16.73 and 10.42 in 2023 and 2024, respectively with highest per cent reduction of root and soil nematode population.

AGRICULTURAL ENTOMOLOGY

Studies on insecticide resistance and development of IPM modules against *Spodoptera litura* (F.) (LEPIDOPTERA: NOCTUIDAE) in tobacco crop ecosystem

SADASHIVA TIPPIMATH

MAJOR ADVISOR: Dr. K. RAJASHEKHARAPPA

A study was conducted on insecticide usage patterns and the status of insecticide resistance in *Spodoptera litura* (Fab.) (Lepidoptera: Noctuidae) in central and southern India during 2021–2023. Survey data revealed that farmers used nineteen different insecticides to manage *S. litura* on various crops. Among the different insecticides, the highest usage was recorded for emamectin benzoate 5 SG (46.67%), followed by chlorpyrifos 20 EC (44.44%), chlorantraniliprole 18.5 SC (41.11%), and lambda-cyhalothrin 5 EC (34.44%). Furthermore, the average number of insecticide applications was highest (5.7 per cropping season) in Belagavi, with a spray interval of 10.2 days, followed by Kolhapur. The lowest number of applications was recorded in Kurnool and Chittoor (1.5 and 1.3 sprays, respectively). Approximately 46.67% of farmers approached pesticide dealer shops, while the majority (78.89%) did not pay attention to container label information. Nearly 91.11% of farmers sprayed during the morning hours, while 76.67% sprayed only after observing initial symptoms. Among the farmers surveyed, 84.44% relied solely on insecticides, while 5.56% adopted IPM practices to manage *S. litura*. The study revealed that the toxicity response of the insecticides against *S. litura*, in descending order, was: emamectin benzoate > chlorantraniliprole > flubendiamide > lambda-cyhalothrin > chlorpyrifos. The highest specific activity of carboxylesterase (63.35 µmol) was observed in the Belagavi population and glutathione S-transferase activity was the highest (131.51 nmol) in the Kolhapur population, followed by Belagavi. However, MFO activity was highest in the Belagavi and Kolhapur populations (5.34 and 5.33 nmol, respectively). Molecular study revealed no significant diversity within the populations with respect to *mt COI*. Among the various modules, IPM performed better against *S. litura*, followed by the chemical module. Similarly, the highest green and cured leaf yields were recorded in the IPM module, with a 1:2.20 cost-benefit ratio, followed by the chemical module, with a 1:2.0 cost-benefit ratio.

Species diversity of eriophyoid mites associated with different crop ecosystems in selected agro-climatic zones of Karnataka

P. DYAMANAGOUDA MAJOR ADVISOR: Dr. K. RAJASHEKHARAPPA

In recent times eriophyoid (superfamily) mites are important mite pests causing significant yield loss in various crops. Survey were conducted from November 2022 to August 2024 across different agro-climatic zones of Karnataka to document the diversity of eriophyoid mites in various agro-ecosystems. A total of 52 eriophyoid mite species were recorded from diverse hosts, ranging from agricultural crops to forest plantations. Seven species were reported for the first time in India. *Aceria ficaria* Ueckermann on *Ficus leaves*, *Abacarus horseshoex* Liu & Xue, *A. fuzhoubambusae* Liu & Xue, and *Knorella gigantochloae* Keifer on *Bamboo leaves, Vittacus bougainvilleae (*Keifer) on leaves of *Bougainvillea spectabilis*, *Calacarus flagelliseta* Flechtmann, Moraes & Barbosa on leaves *Carica papaya*, and *Jutarus benjaminae* Bocezk & Chandrapatya on leaves *Ficus benjamina*. Two species, *Calacarus sp1.* On leaves of *Ocimum tenuiflorum* and *Floracarus sp1.* on leaves of *Gymnema sylvestre*, appear to be new to science. Additionally, two economically important mite pests were identified *viz., Aculops lycopersici* (Tryon), which caused severe damage on both tomato leaves and fruits and *Aceria boisi* (Gerber), which formed galls on cinnamon leaves, reducing their marketability. Two species, *Acalitus adoratus* Keifer and *Eriophyes lantanae* (Mohanasundaram) were observed on *Chromolaena odorata* and *Lantana camara*. The genera, *Knorella* and *Jutarus* were recorded for the first time in India. Phylogenetic analysis was conducted separately for the D1D2 and 28s9 genes to understand the relationships among selected eriophyoid mites. Fifteen new sequences were submitted to the NCBI database. This study emphasizes the importance of systematic surveys in documenting eriophyoid mite diversity, identifying potential pest threats and exploring biocontrol possibilities, ultimately contributing to food and biosecurity.

Diversity, distribution and development of ipm modules for the management of thrips with special reference to invasive thrips, *Thrips parvispinus* (KARNY) (THYSANOPTERA: THRIPIDAE) in chilli

ASLAM MAJOR ADVISOR: Dr. B. K. SHIVANNA

The chilli thrips were highly menace to the crop across the major chilli growing regions of Karnataka. In the current investigation, an attempt was made to know the *Thrips parvispinus* documentation, diversity, distribution, identification, population dynamics and to evaluate pest management modules against *T. parvispinus* in chilli crop during *kharif* 2023 and 2024 at College of Agriculture, Navile, Shivamogga. Result revealed that, during the survey, seven thrips species were recorded as infesting chilli crop *viz., T. parvispinus*, T. *palmi*, *T. hawaiiensis*, *T. florum, Frankliniella schultzei*, *F. occidentalis* and *Megalurothrips usitatus*. *T. parvispinus* was highest in Bellary and lowest in Shivamogga districts. Natural enemies (coccinellids and spiders) were recorded. Morphologically identified chilli thrips. Diversity indices showed that low species richness with high relative abundance, shannon wiener diversity index indicated that low diversity of thrips, simpsons dominance index showed high dominance of *T. parvispinus*. Distribution maps showed that *T. parvispinus* distributed across all the surveyed regions. Population dynamic of *T. parvispinus* recorded the highest thrips incidence was observed during first week of October (40th and 41st SMW). Correlation study indicated that the incidence of thrips was high significant positive correlation with the maximum temperature and bright sunshine hours but significant negative correlation with rainfall. Regression study showed, the influence of weather parameters on thrips was 93.90 and 71.30 per cent. During both seasons management modules revealed that maximum suppression of *T. parvispinus* population was found in IPM module (Neem cake + Bajra border crop + Seedling root deep with imidacloprid 17.8 SL + Silver mulch + Blue sticky trap + *Pseudomonas flurescence* + Fipronil 5% SC) recorded 7.35 thrips per three terminal twigs followed by chemical and bio-intensive modules. IPM module showed least effective against natural enemies and most effective against leaf (21.86%), flower (18.24%) and fruit damage (10.54%) and recorded higher chilli yield (11.31 q/ha) and cost benefit ratio (1:2.92) followed by chemical and bio-intensive modules.

Toxic effects of pesticides on the physiology and behaviour of domesticated species of honey bees

CHAITANYA B. POLICE PATIL MAJOR ADVISOR: Dr. SHARANABASAPPA

In India, *Apis cerana* and *Apis mellifera* are the principle domesticated honey bee species supporting crop pollination and apiculture. However, widespread use of pesticides in modern agriculture poses a serious threat to their survival and colony health. An experiment was conducted at the College of Agriculture, Shivamogga and College of Forestry, Ponnampet to comparatively evaluate the responses of *A. cerana* and *A. mellifera* to different classes of pesticides widely used in Indian agriculture. Acute toxicity was assessed by topical and residue contact bioassays against fifteen pesticides. Broflanilide, imidacloprid, indoxacarb, thiamethoxam, spinetoram and chlorpyriphos emerged as highly toxic to both the species. Whereas, chlorantraniliprole, mancozeb, hexaconazole and glyphosate recorded LC_{50} values exceeding 5000 ppm, indicating their relative safety to honey bees. *Apis cerana* exhibited greater susceptibility than *A. mellifera*. Age-dependent studies revealed younger and older workers were significantly more vulnerable to pesticide exposure than middle-aged bees. Highly toxic pesticides caused severe immuno-suppression characterized by sharp reductions in total haemocyte counts, depletion of frontline immune cells *viz.,* plasmatocytes and granulocytes with a concomitant increase in prohaemocytes within 1 h of exposure, while safer pesticides maintained haemocyte profiles close to untreated controls. Behavioural impairment was confirmed through mark-release-recapture studies which revealed complete homing failure of foragers exposed to highly toxic pesticides even at sublethal doses.

Colony confinement studies indicated that confinement beyond four days adversely affected foraging activity, worker survival and hive microclimate, although colonies exhibited recovery after release when confined with extra space. To the best of our knowledge, this investigation represents the first study from India to comprehensively evaluate pesticide-induced physiological and behavioural toxicity in both *A. cerana* and *A. mellifera* and the first global report on broflanilide-induced immunotoxicity and homing failure in honey bees. The findings strongly advocate restricting highly toxic pesticides during flowering, promoting safer alternatives and incorporating sublethal endpoints in pesticide risk assessment for sustainable pollinator conservation.

SILVICULTURE AND AGROFORESTRY

Assessment of carbon footprint in robusta-based coffee agroforests of Kodagu

A.B. SANGEETHA

MAJOR ADVISOR: Dr. N. SATISH

In the context of climate change, a comprehensive assessment of the carbon footprint in the coffee production systems was essential for advancing sustainable agricultural practices and mitigating environmental impact. Hence, the present study was conducted during 2022 – 2024 to assess the carbon footprint, biomass and carbon stock of the Robusta-based coffee agroforests of Kodagu by classifying the study area based on land holding size (small: <10 ha. and Large: >10 ha), land tenure (Redeemed and Unredeemed) and ownership (Private and Corporate) and also estimated the number of trees required to offset the emitted greenhouse gases. The results revealed that small land holdings and unredeemed tenured farmers had the least carbon footprint of 1.44 Mg CO_2e ha^{-1} yr^{-1} whereas, corporate owned coffee agroforests had the highest carbon footprint of 2.25 Mg CO_2e ha^{-1} yr^{-1}. Large land holdings, redeemed tenured farmers and private owned coffee agroforests had the carbon footprint of 1.75 Mg CO_2e ha^{-1} yr^{-1}, 1.81 Mg CO_2e ha^{-1} yr^{-1} and 1.47 Mg CO_2e ha^{-1} yr^{-1} respectively. The total biomass was recorded highest in corporate owned coffee agroforest (208.45 Mg ha^{-1}) and small farmers land holdings recorded the lowest (92.90 Mg ha^{-1}). The carbon stock of Robusta-based coffee agroforests ranged from the highest of 231.86 Mg C ha^{-1} (corporate owned) to the lowest of 152.57 Mg C ha^{-1} (small holdings). The number of trees required to offset the emitted greenhouse gases emphasized the pivotal role of coffee agroforests of Kodagu as a dual-functioning entity in carbon dynamics. This study demonstrated that the Robusta-based coffee agroforests of Kodagu are carbon-negative with the carbon stock present and carbon sequestration in the area surpassing the carbon footprint generated highlighting their potential as a significant tool in climate change mitigation.

MASTER OF SCIENCE

A. CROP SCIENCE

GENETICS AND PLANT BREEDING

Genetic and submergence studies on backcross derived lines of rice (*Oryza sativa* L.)

V. S. BHOOMIKA — MAJOR ADVISOR: Dr. B. N. HARISH BABU

Sahyadri Kempumukthi, a National check for red rice, is the popular variety in hilly and transitional zones of Karnataka replacing Jyothi, cultivated on 1.20 lakh hectares. It is susceptible to submergence stress. To introgress Submergence tolerance into Sahyadri Kempumukthi, a backcross breeding programme was carried out to transfer *SUB 1* gene from Swarna Sub 1. The present study was conducted to screen, 40 backcross derived lines (BC_1F_3) of cross Sahyadri Kempumukthi×Swarna Sub-1, along with four checks in randomized complete block design for yield attributing traits and also screened for submergence tolerance in CRD design at ZAHRS, Shivamogga during *kharif* 2024. Top performing 20 lines selected based on high yield attributing traits were evaluated for six quality parameters *viz.,* protein, carbohydrate, Zn, Fe, Cu and Mn. The analysis of variance revealed significant variation among14 traits in rice, supported by standardized range and coefficients of variation. Correlation study revealed the highest significant positive association of the test weight, spikelet fertility, number of productive tillers with grain yield indicating the effectiveness of indirect selection for these traits in improvement of grain yield in rice. Twenty promising lines were found to be better performing than parents with yield range of 60 to 87 q/ha.Five Submergence tolerant lines of BC_1F_4 were identified through screening and confirmed with three *SUB 1* genic SSR markers. Three SSR genic markers *viz.,* Sub 1A203, Sub 1BC2 and SUB1C173. The Backcross lines K×S-6-2-1 and K×S-11-4-2, showed superior grain yield of 85.38 and 86.45 q/ha, respectively.While K×S -6-2-1 and K×S-12-4-1were better performing for yield, submergence tolerance and nutritional quality making these promising lines precious for selection. Therefore, these lines are needed to be forwarded to further generations and evaluated under diverse environments to assess their stability and may be proposed for further varietal release programmes

Genetic characterization in diverse germplasm of cowpea [*Vignaunguiculata* (L.) Walp.] for agro morphological traits

B. K. MANJUNATH — MAJOR ADVISOR: Dr. D. LAKSHMANA

A field experiment was conducted at College of Agriculture, Navile, Shivamogga during *kharif* 2024 to assess the genetic characterization and to evaluate genetic variability, diversity, character association and path analysis of 62 cowpea genotypes. The study assessed 24 qualitative and quantitative traits for morphological characterization of which two traits were common across all genotypes, while the remaining were distinct and unique among them. In addition, 11 yield related traits were considered for genetic analysis. The presence of significant variation among genotypes indicated ample genetic variability. High phenotypic and genotypic coefficients of variation were recorded for plant height, number of secondary branches per plant, number of clusters per plant, 100seed weight and seed yield per plant. High heritability coupled with high genetic advance as a percentage of mean was observed for plant height, number of secondary branches per plant, number of clusters per plant, 100 seed weight and seed yield per plant suggesting the predominance of additive gene action and the potential for improvement through direct selection.MahalanobisD² analysis grouped the genotypes into six clusters, with the greatest intercluster divergence observed between Clusters V and VI (962.37), followed by Clusters IV and V (930.17) highlighting their potential in heterosis breeding. Cluster mean performance indicated that Cluster IV was superior for seed yield (25.79 g), Cluster V for earliness and branching, and Cluster VI for bold seeds and higher seed number per pod underscoring their breeding utility. Correlation analysis revealed significant positive associations of seed yield with clusters per plant, pods per cluster, seeds per pod, secondary branches and 100seed weight. Path coefficient analysis further identified 100seed weight, clusters per plant and secondary branches per plant as the major contributors to seed yield. Based on mean performance, the genotypes PMCP-1131, IC-202854, IC-402164 and NBC-42 were identified as high-yielding and can be exploited as promising parents in cowpea improvement programmes.

Genetic studies on low nitrogen stress tolerance in maize (*Zea mays* L.)

PRATIKSHA KARANJI — MAJOR ADVISOR: Dr. SHASHIKALA S. KOLAKAR

Understanding the low- nitrogen stress tolerance, genetic variability, trait associations, and genetic diversity in maize is essential for breeding high-yielding and stress-tolerant cultivars. In the present study, 40 inbred maize lines along with two checks were evaluated under optimal and low nitrogen in field conditions using a factorial block design at the College of Agriculture, Shivamogga, Karnataka, during *rabi* 2024 for eighteen yield and yield-associated traits. Analysis of variance revealed significant differences among genotypes for all traits, confirming the presence of broad genetic variability. High genotypic and phenotypic coefficients of variation were observed for anthesis–silking interval, ear girth, kernel rows per ear, and grain yield, while days to 50 *per cent* anthesis and silking showed comparatively low variability. Most traits exhibited moderate to high heritability coupled with high genetic advance as *per cent* of mean for grain yield, plant height, and ear girth, indicating predominant additive gene action and reliable response to selection. Grain yield per plant showed positive and significant correlations with kernel rows per ear, and kernels per row, under both nitrogen regimes. Path coefficient analysis identified

kernels per row and kernel rows per ear as the major direct contributors to grain yield, while delayed flowering and a prolonged anthesis–silking interval exerted negative indirect effects, particularly under nitrogen stress. Integration of stress susceptibility index (SSI) and stress tolerance index (STI) identified genotypes VL21945, VL187123, VL18953, VL181580, and VL143906 as the most promising, exhibiting low SSI and high STI values, signifying superior stability and adaptability under nitrogen-limited conditions. Overall, the study highlights the importance of reproductive and kernel traits for improving maize yield and nitrogen-use efficiency and identified promising genotypes for developing nitrogen-efficient, high-yielding hybrids suitable for diverse agro-ecological environments.

Stability analysis for yield and yield attributing traits in pigeonpea *Cajanus cajan* (L.) Millsp.]

M. S. SHASHANK

MAJOR ADVISOR: Dr. SHASHIKALA S. KOLAKAR

Pigeonpea [*Cajanus cajan* (L.)Millsp.] is a crucial leguminous crop cultivated for its economic yield and nutritional quality. In the present study, thirteen pigeonpea genotypes, including three standard checks, were evaluated for stability of yield and related traits across four diverse environments during *kharif* 2024. Comprehensive multilocation testing was conducted at AHRS Kathalgere, COA Shivamogga, ZAHRS Hiriyur and AHRS Bavikere to assess the effects of genotype, environment and genotype × environment interaction on key traits such as days to fifty*per cent* flowering, days to maturity, plant height, number of primary branches, number of secondary branches, number of pods per plant, pod length, number seeds per pod, seed yield per plant, seed yield per plot, 100 seed weight, seed yield per hectare, protein content and chlorophyll pigments.AMMI analysis revealed significant genotype × environment interactions for most yield-contributing traits, except chlorophyll pigments, with PC1 and PC2 explaining the majority of interaction variance. Biplot interpretation and AMMI Stability Value (ASV) allowed identification of stable and high-yielding genotypes. Genotypes ICPL-22260 and ICPL-22254 demonstrated superior yield and stability across locations, while ICPL-22257 ensured early maturity. Specific adaptation was recorded for ICPL-22259 and ICPL-22258 in targeted environments, confirming their potential for high protein and bold seed weight in rainfed agro-ecologies.Traits including number of pods per plant, pod length and number of seeds per pod had strong positive associations and direct effects on yield, while extended maturity duration showed a negative impact, emphasizing the need for environment-specific selection. Locations Kathalgere and Bavikere favoured yield stability, while Shivamogga supported bold-seeded types and Kathalgere for high protein. The study highlights the critical importance of multilocation trials for genotype evaluation and breeding of pigeonpea varieties with broad adaptability and high nutritional quality.

Screening for salt tolerance in advanced breeding lines of groundnut (*Arachis hypogaea* L.)

K. SHIVARAJ

MAJOR ADVISOR: Dr. B. N. HARISH BABU

Groundnut (*Arachis hypogaea* L.) is an economically important oilseed crop highly sensitive to salinity, especially during early seedling stages. Salinity stress adversely affects germination, root and shoot growth and seedling vigour, leading to poor establishment and reduced yield. The present investigation aimed to evaluate 200 advanced breeding lines of groundnut, along with four checks, under hydroponic conditions at 0 mM and 120 mM NaCl to identify salt-tolerant genotypes and understand trait associations contributing to yield. Significant genotypic variability was observed across all traits, indicating ample scope for selection. Tolerant lines such as NRCG-10273, NRCG-10340, NRCG-14493 and NRCG-11120 maintained higher germination, root and shoot length, seedling vigour and biomass under stress, whereas checks (TMV-2, GPBD-4, Dh-256) showed severe reductions. The Salinity Tolerance Index (STI) effectively classified genotypes into tolerant, moderately tolerant and susceptible groups. Analysis of variance confirmed substantial genetic variability for yield and yield-related traits, with high heritability and genetic advance in pod yield, kernel yield, shelling percentage and test weight, revealing strong additive gene action.Correlation and path analyses identified pod yield per plant, kernel yield per plant, shelling percentage and test weight as the most reliable selection criteria for yield improvement, while seedling vigour index, root traits and biomass proved useful for screening salinity tolerance. The integration of hydroponic screening with field-based genetic evaluation demonstrated that combining yield components with physiological tolerance traits can enhance breeding efficiency.Overall, the study identified promising donor genotypes for salinity tolerance and provided a scientific basis for developing high-yielding, salt-resilient groundnut cultivars suited for sustainable production in salt-affected environments.

Genetic diversity and variability studies in soybean (*Glycine max* (L.) Merrill)

SHREYA SHASHIDHAR NAIK

MAJOR ADVISOR: Dr. B. MANJUNATHA

A field experiment was conducted during *rabi* 2024 at Agricultural and Horticultural Research Station, Kathalagere to evaluate genetic variability, diversity and character association among 112 soybean germplasm lines along with three checks using an augmented design. Analysis of variance revealed highly significant differences among genotypes for all traits indicating substantial genetic variability. High genotypic coefficient of variation (GCV) and phenotypic coefficients of variation (PCV) were observed for number of branches per plant, number of pods per plant, number of seeds per pod, seed yield per plant and seed yield (kg/ha), suggesting ample scope for selection. High heritability coupled with high genetic advance as a percent of mean was observed for number of branches, number of pods per plant, 100-seed weight, seed yield per plant and seed yield (kg/ha), indicating that effective selection can be made for these traits.Character association studies revealed that plant height, number of branches per plant, number of pods per plant, number of seeds per pod, 100-seed weight and seed yield (kg/ha) were positively and significantly correlated with seed yield per plant**.** Positive direct effect was exhibited

by number of pods per plant (0.360), number of seeds per pod (0.148), 100-seed weight (0.110) and seed yield kg per hectare (0.345) on seed yield per plant, suggesting their importance in selection for yield improvement. K-means clustering grouped the genotypes into six clusters, with the highest inter-cluster distance observed between clusters VI and I (6.11) followed by cluster VI and V (5.11) indicating wide genetic diversity. Lines such as I-812, I-4, EC-0280134, IC-0501833 and IC-0501882 were identified as promising for both high yield and protein content, making these lines valuable for crop improvement programs

Genetic analysis of grain yield and yield component traits in red rice genotypes under coastal saline condition

D. SUBHASHINI — MAJOR ADVISOR: Dr. SHRIDEVI A. JAKKERAL

The present investigation was conducted to evaluate salinity tolerance in fifty-two red rice genotypes including checks *viz.,* Pokkali, Karikagga and MO 4 were screened for salinity tolerance in a randomized complete block design (RCBD) with two replications during *kharif*2024, the study was conducted at a farmer's field under natural coastal saline condition at Barkur village in Udupi district.Most of the plants of highly sensitive genotypes were died in visual scoring of genotypes for salt injury based on Standard Evaluation System at seedling stage. Analysis of variance revealed highly significant differences among genotypes for all the traits studied. Values for genotypic and phenotypic coefficients of variation, heritability coupled with genetic advance as a percent of the mean ranged from moderate to high for number of productive tillers per plant, number of filled grains per panicle and test weight. Character association study and path analysis revealed that traits like plant height, panicle length, tillers per plant and test weight had a significant impact on grain yield under saline condition. The Mahalanobis' D^2 analysis grouped the genotypes intofive clusters. The maximum inter cluster distance was notices between cluster IV and V. Studies on plant nutrient uptake of nitrogen, phosphorus, potassium and sodium (kg/ha) revealed that increase in the uptake of Na^+ concentration exhibited detrimental effect on plant growth. Additionally, soil analysis for carbonate, bicarbonate, EC, pH, nitrogen, potassium and chloride ions indicated that there is a significant amount of carbonate and bicarbonate in the soil which contribute to increased salinity stress in the soil. The present study showed that the genotypes BMR-M-4, BMR-M-5, BMR-M-6, Lavanya, Jyotsna,Misebhatta and Peetasale are salinity tolerant genotypes at 8dS/m and could be further used in salinity tolerance breeding program.

Genetic variability and submergence tolerance studies among advanced breeding lines of rice (*Oryza sativa* L.)

J. B. VIKAS — MAJOR ADVISOR: Dr. B. M. DUSHYANTHA KUMAR

Rice (*Oryza sativa* L.) is an important cereal crop with high agricultural importance.The present study was conducted during *kharif*2024 with sixteen advanced breeding lines (Six lines of the cross Tunga × KHP-13 and Ten lines of the cross KPR-1 × KHP-13) under randomized complete block design with two replications. The analysis of variance revealed significant variation among all advanced breeding lines for 16 traits studied. Genetic variability studies revealed moderate to low estimates for phenotypic and genotypic coefficient of variation for all the studied traits. Number of tillers per plant, number of productive tillers per plant, number of grains per panicle, number of filled grains per panicle and length to breadth ratio showed high heritability coupled with high genetic advance as *per cent* of mean. Correlation analysis revealed that grain yield per plant exhibited significant positive association with number of filled grains per panicle, number of grains per panicle, number of productive tillers per plant, number of tillers per plant and spikelet fertility, while days to fifty *per cent* flowering, days to maturity, plant height, panicle length, length-to-breadth ratio and test weight exhibited non-significant correlations with yield. Path coefficient analysis revealed that the number of grains per panicle exerted the highest positive direct effect on grain yield, while number of tillers showed negative direct effect. All the sixteen advanced breeding lines were screened for submergence tolerance wherein none of them were found tolerant to submergence. The line KPR-1×KHP-13-7-3-9-1-5 showed superior grain yield, while Tunga×KHP-13-4-8-3-14-20 recorded the high protein content and KPR-1×KHP-13-16-11-17-1-44 showed maximum germination percentage, Tunga×KHP-13 -3-5-2-13-19 achieved the maximum seedling vigour index I and KPR-1×KHP-13-11-5-8-13-28 showed the maximum seedling vigour index II. Further, these promising lines can be utilized for crop improvement programme.

AGRONOMY

Herbicide options for management of *Wedeliasps.* and other weed species in arecanut garden of coastal Karnataka

OMKAR GANAPATHI NAIK — MAJOR ADVISOR: Dr. N. E. NAVEEN

A field experiment was conducted during *rabi* 2023-24 at farmer's field in coastal Karnataka, to study the "Herbicide Options for Management of *Wedeliasps.*and Other Weed Species in Arecanut Garden of Coastal Karnataka." The experiment was laid out in RCBD design including ten treatments consisting of eight post-emergent (PoE) herbicides, which are replicated thrice.The investigation revealed that the post-emergent application of 2,4 D sodium salt 80% WP @ 1250 g *a.i*. ha^{-1} at the 5-6 leaf stage showed a significantly lower weed density of *Wedelia*species (1.67, 2.00, 3.00, and 8.67 m^{-2}), whereas glyphosate 41% SL IPA salt showed significantly lower total weed density (7.67,12.67,31.33,and 41.67m^{-2}), lower total weed drymatter production (9.37, 23.60, 37.83, and 47.27 g m^{-2}) and higher weed control efficiency (96.97, 95.16, 89.51 and 86.81%), respectively at 15, 30, 45 and 60 days after treatment incorporation (DATI). It was found to be on par with the post-emergent application of glyphosate 71% SG (ammonium salt) @ *a.i*. 2.13 kg ha^{-1}. Among the different post emergent herbicides glyphosate 41% SL IPA salt @ 1230 g *a.i*. ha^{-1} at the 5-6 leaf stage recorded highest bacterial (31.33 cfu×$10^{-6}g^{-1}$),

fungi (23.33 cfu×$10^{-4}$$g^{-1}$) and actinomycetes (7.33 cfu×10^{-3} g^{-1}) population recorded at 30 days after treatment imposition. In comparison, the application of saflufenacil 70% WG @ 52.5 g *a.i*. ha^{-1} as post-emergent at 5-6 leaf stage of weeds significantly resulted in the lowest bacterial (24.67 cfu×$10^{-6}$$g^{-1}$), fungi (18.33 cfu×$10^{-4}$$g^{-1}$) and actinomycetes (4.33 cfu×10^{-3} g^{-1}) population recorded at 30 days after treatment imposition. Further, the application of glyphosate 41% SL IPA salt @ 1.230 kg ha^{-1}*a.i.* ha^{-1} has recorded a 63.66 per cent lower weeding cost of 3100 ₹ ha^{-1} compared to the farmer's practice (₹ 8530 ha^{-1}).

Effect of different levels of nitrogen and potassium on fodder maize (*Zea mays* L.) productivity under irrigated condition in coastal Karnataka during late *rabi* season

R. ROHAN

MAJOR ADVISOR: Dr. M. JADEYEGOWDA

A field experiment titled "Effect of Different Levels of Nitrogen and Potassium on Fodder Maize (*Zea mays* L.) Productivity under Irrigated Conditions in Coastal Karnataka during Late *rabi*Season" was conducted during the late *rabi* season of 2023 at the Zonal Agricultural and Horticultural Research Station in Brahmavara, Shivamogga. The experiment was designed as a randomized complete block design (factorial concept) with nine treatment combinations. These included three levels of nitrogen: N_1 (100%, *i.e.*, 90 kg N ha^{-1}), N_2 (125%, *i.e.*, 112.5 kg N ha^{-1}), and N_3 (150%, *i.e.*, 135 kg N ha^{-1}); and three levels of potassium: K_1 (100%, *i.e.*, 30 kg K_2O ha^{-1}), K_2 (125%, *i.e.*, 37.5 kg K_2O ha^{-1}), and K_3 (150%, *i.e.*, 45 kg K_2O ha^{-1}), each replicated three times. The results of the experiment indicated that among the different nitrogen levels, the application of 150% nitrogen resulted in significantly higher plant height (316.07 cm), number of leaves (15.94 per plant), leaf area (4636.98 cm^2), total dry matter accumulation (131.29 g $plant^{-1}$), green fodder yield (438.03 q ha^{-1}), and lower Neutral Detergent Fiber (NDF) (59.58%) and Acid Detergent Fiber (ADF) (29.75%) compared to 125% and 100% of recommended nitrogen dosage. Similarly, among the different levels of potassium, the application of 150% potassium resulted in significantly taller plants (295.26 cm), a higher number of leaves (15.30 per plant), larger leaf area (4645.87 cm^2), total dry matter accumulation (123.12 g $plant^{-1}$), green fodder yield (420.74 q ha^{-1}), and lower NDF (60.45%) and ADF (30.43%) compared to 125% and 100% of recommended potassium dosage. The total nutrient uptake of nitrogen, phosphorus, potassium, and quality parameters was significantly higher with 150% nitrogen and potassium than 100%. In conclusion, applying 150% N and K provides maximum green fodder yield during fodder scarcity in the late *rabi* season in coastal Karnataka.

Evaluation of nano dap on growth and yield of finger millet (*Eleusine coracana* L.)

S. K. AKASHA

MAJOR ADVISOR: Dr. O. KUMAR

A field experiment was conducted at College of Agriculture, KSNUAHS, Navile, Shivamogga during *rabi* 2023. The experiment was laid out in RCBD with twelve treatments and replicated thrice. The treatments comprised of absolute control (T_1), Recommended dose of fertilizer (T_2), Two levels of recommended dose of N and P (75 and 100 per cent) were tested in combination with two levels (2ml and 4ml kg^{-1} of seeds) through two different methods of nano DAP application *i.e.* seed treatment and seedling dip (T_3 toT_{10}), 75 per cent recommended N & P + seed treatment 2 ml kg^{-1} of seeds + Foliar spray of nano DAP@ 2 ml 1^{-1} at tillering stage (T_{11}), 75 per cent recommended N & P + seed treatment 4 ml kg^{-1} of seeds + Foliar spray of nano DAP @ 4 ml 1^{-1} at tillering stage (T_{12}). These treatments were tested against recommended dose of fertilizer (T_2), 100 per cent K is applied to all treatment except absolute control. The results revealed that application of 100 per cent recommended dose of fertilizers along with seed treatment 4 ml kg^{-1} of seed (T_6) will recorded higher plant height (95.07 cm), no of leaves per hill (49.10), dry matter production (14.81 g $hill^{-1}$), number of tillers $hill^{-1}$ (8.87), root volume (13.96 cm^3), grain yield (3639.32 kg ha^{-1}) and straw yield (6460.86 kg ha^{-1}), total NPK uptake (100.05, 26.75 and 73.84 kg ha^{-1} respectively), gross return (₹ 13,0198 ha^{-1}), net return (₹ 76.602 ha^{-1}) and B:C ratio of 2.46 which was statistically on par with the treatment T_{12}. Treatment T_6 recorded 9.72 per cent higher grain yield as compared to recommended dose of fertilizers (T_2).

Effect of micronutrients on growth and yield of transplanted rice

M. A. ANJIMA

MAJOR ADVISOR: Dr. RUDRAGOUDA F. CHANNAGOUDA

A field experiment entitled "Effect of Micronutrients on Growth and Yield of Transplanted Rice" was conducted during late-*kharif* 2024 at College of Agriculture, Navile, Shivamogga, Karnataka. The treatment details included different micronutrients ($ZnSO_4$, $MnSO_4$, $CuSO_4$ and $FeSO_4$) in combination with RDF. The results of the experiment showed that among the different treatments, RDF (100:50:50 kg ha^{-1} NPK) + $ZnSO_4$ (20 kg ha^{-1}) + $MnSO_4$ (2.5 kg ha^{-1})+ $CuSO_4$ (1.5 kg ha^{-1})+ $FeSO_4$ (5 kg ha^{-1})- T_7 showed significantly higher values of plant height (107.00 cm), leaf area (1100.00 cm^2 $hill^{-1}$), dry matter accumulation (59.79 g $hill^{-1}$), number of productive tillers per hill (20.90), panicle weight (2.67g $panicle^{-1}$), number of grains per panicle(188.49), grain yield (6476.6 kg ha^{-1}) and straw yield (8047.1 kg ha^{-1}). However, it was on par with application of 100:50:50 kg ha^{-1} NPK + $ZnSO_4$ (20 kg ha^{-1}) + $MnSO_4$ (2.5 kg ha^{-1})+ $FeSO_4$ (5 kg ha^{-1})-T_5. Highest uptake of nitrogen(172.12 kg ha^{-1}), phosphorous (45.08 kg ha^{-1}), potassium (141.75 kg ha^{-1}), zinc (663 g ha^{-1}), iron (2410 g ha^{-1}), copper (205.16 g ha^{-1}) and manganese (1139 g ha^{-1}) were also recorded in T_7over RDF alone and was on par with T_5. Similarly, highest available micronutrients such as available zinc, iron, copper and manganese (1.68, 29.72, 2.41 and 17.45mg kg^{-1}, respectively) were noticed in the soil after harvest in T_7 followed by T_5. Maximum net returns (₹ 98,433 ha^{-1}) and B: C ratio (2.93) were also recorded in T_7 over RDF alone (₹ 44,792 ha^{-1}, 2.59).

Effect of foliar application of nutrients using agricultural drone on growth and yield of soybean (*Glycine max* (L) Merrill)

K. R. BINDU

MAJOR ADVISOR: Dr. N. E. NAVEEN

A field experiment was conducted during *kharif* 2024 at Agricultural and Horticultural Research Station, Honnavile, Shivamogga, to study the "Effect of Foliar Application of Nutrients Using Agricultural Drone on Growth and Yield of Soybean (*Glycine max* (L) Merrill)". The experiment was laid out in a Restricted RCBD with eight treatments and three replications. Treatments included an absolute control and plots receiving the recommended dose of fertilizer (RDF: 25:27:21 NPK kg ha^{-1}) at 100% and 75% levels, combined with pulse magic (3 g l^{-1} and 6 g l^{-1}) and potassium sulphate (K_2SO_4 at 0.5% and 1%). Foliar sprays were given at 35 and 55 days after sowing (DAS) using a drone at 50 l ha^{-1}. Among treatments, T_6 (100% RDF + pulse magic 6 g l^{-1} + 10 ml K_2SO_4 1%) recorded significantly higher plant height (49.29 cm), number of branches (9.67$plant^{-1}$), leaf area (424.17 cm^2 $plant^{-1}$), dry matter accumulation (22.23 g $plant^{-1}$) at 90 DAS and number of functional nodules (41.66 $plant^{-1}$) at 45 DAS. Similarly, higher nutrient uptake (121.58, 23.51, 102.13and 19.83 kg ha^{-1} nitrogen, phosphorus, potassium and sulphur, respectively) at 70 DAS was noticed in the same treatment. Significantly higher number of pods (666.89 m^{-2}), seed yield (2147 kg ha^{-1}), haulm yield (2998 kg ha^{-1}), protein content (41.51%), protein and oil yield (890.90 and 452.16 kg ha^{-1} respectively) were recorded in T_6. Further, the net returns (₹ 73,236ha^{-1}) and B:C (2.74) were also recorded higher in the same treatment. This treatment was statistically on par with T_8 (75% RDF + pulse magic 6 g l^{-1}+ 10 ml K_2SO_4 1%), indicating that fertilizer input can be reduced without compromising yield and highlighting the importance of foliar nutrients application.

Comparative evaluation of different cereal based cropping systems under irrigated condition in southern transition zone of Karnataka

M. N. CHETHAN

MAJOR ADVISOR: Dr. H. G. SANNATHIMMAPPA

A field experiment entitled "Comparative Evaluation of Cereal Based Cropping Systems under Irrigated Condition in Southern Transition Zone of Karnataka" was conducted during *kharif* and Summer2024-25 at Agricultural and Horticultural Research Station, Kathalagere. The experiment was laid out in a randomized complete block design with seven treatments and three replications. The treatments comprised of seven cropping systems which were evaluated as paddy - paddy, maize - maize, paddy - soybean, maize - soybean, maize + soybean (4:1) - cowpea, maize + greengram (4:1) - sunhemp and finger millet + field bean (4:1) - groundnut. Among these, maize - maize system recorded significantly higher rice equivalent yield, maize equivalent yield, finger millet equivalent yield and system productivity (13342, 13030, 7290 kg ha^{-1} and 55.59 kg ha^{-1} day^{-1}, respectively) as compared to other cropping systems. Significantly higheravailable nitrogen, potassium and zinc were recorded in finger millet + field bean (4:1) - groundnut (338.25, 190.89 kg ha^{-1} and 19.70 mg kg^{-1}, respectively) when compared to other cropping systems. Whereas,available phosphorus was significantly higher in maize + soybean (4:1) - cowpea (62.49 kg ha^{-1}) while higher available sulphur was found in maize + green gram (4:1) – sunhemp (19.70 mg kg^{-1}) cropping systems. However, soil microbial properties such as bacteria, fungi and actinomycetes population were recorded significantly higher in finger millet + field bean (4:1) - groundnut (65.11×10^5 CFU , 21.71×10^3 CFU and 11.54×10^2 CFU g^{-1} soil, respectively) when compared to other cropping systems.The maize - maize cropping system recorded significantly highercarbon sustainability index (11.21), carbon efficiency ratio (12.21) and net returns (2,03,720 ₹ ha^{-1}),while higher benefit–cost ratio (2.65) was observed in finger millet + field bean (4:1) – groundnut.

Effect of nano fertilizers on growth, yield and quality of maize (*Zea mays* L.)

MALLIKARJUN

MAJOR ADVISOR: Dr. M. JADEYEGOWDA

A field experiment entitled "Effect of nano fertilizers on growth, yield and quality of maize (*Zea mays* L.)" was conducted during late *kharif* 2024 at College of Agriculture, Navile, Shivamogga. The experiment was laid out in randomized complete block design with thirteen treatments replicated thrice. The treatments consist of package of practice (POP) along with foliar spray of nano urea, nano DAP and nano zinc at 2 ml l^{-1} and 4 ml l^{-1} applied at 30 DAS, 45 DAS and at both 30 and 45 DAS. The results revealed that treatment received foliar spray of 4 mll^{-1} nano DAP + 4 ml l^{-1}nano Zn at 30 and 45 DAS showed significantly higher the values of plant height (202.79 cm), number of leaves (12.51), leaf area (2291.32cm^2 $plant^{-1}$), total dry matter production (430.52g $plant^{-1}$), leaf area index (2.87), crop growth rate (51.84 gm^{-2} day^{-1}), absolute growth rate (6.99 g day^{-1}), number of grains per cob (666.94), number of grains per row (43.40), cob length (23.38 cm), cob weight (216.58 g), grain yield (7637 kg ha^{-1}), stover yield (9549 kg ha^{-1}), N:P:K uptake (213.55:44.09:104.19 kg ha^{-1}), protein content (11.18%), starch content (74.88%), gross returns (₹ 1,68,206 ha^{-1}), net return (₹ 96,937ha^{-1}) and benefit cost ratio (2.37). The lowest yield (6434 kg ha^{-1}) was observed in the package of practice. The treatment receiving foliar application of nano fertilizers recorded an 18.61 per cent increase in grain yield and 16.18 per cent increase in stover yield over the package of practice (POP). It can be concluded that foliar spray of 4 ml l^{-1}nano DAP + 4 ml l^{-1}nano Zn at 30 and 45 DAS in combination with package of practice improves growth, yield, nutrient uptake and quality of maize.

Effect of nipping and growth retardants for management of tendril formation in cowpea (*Vigna unguiculata*) for higher productivity

NABUMA USTAD MAJOR ADVISOR: Dr. M. SHIVAPRASAD

A field experiment entitled "Effect of nipping and growth retardants for management of tendril formation in cowpea (*Vigna unguiculata*) for higher productivity" was conducted during late *kharif* 2024 at Main Agricultural and Horticultural Research Station, Iruvakki, Shivamogga. The experiment was laid out in Factorial Randomized Complete Block Design with fifteen treatment combinations consisting of three nipping stages *viz*., No nipping, nipping at tendril initiation at 30 DAS and nipping at two weeks after tendril initiation at 45 DAS with five growth retardant treatments *viz*., water spray, Chlormequatchloride at 500 and 1000 ppm, Maleic hydrazide at 500 and 1000 ppm replicated thrice. The results revealed that nipping at tendril initiation along with foliar application of Chlormequat chloride at 1000 ppm significantly minimized number of tendrils per plant (1.80), mean length of tendril (31.23 cm) and plant height (78.56 cm) at harvest. It also significantly increased number of branches (25.90 plant^{-1}), leaf area (2144.57 cm^2 plant^{-1}), dry matter accumulation (44.58 g plant^{-1}), leaf area index (3.83), pod weight (43.87 g), number of pods (16.18plant^{-1}), number of seeds (16.42 pod^{-1}), seed yield (1548 kg ha^{-1}). The above treatment has effect of 22.8 percent increase over no nipping along with water spray) and haulm yield (3440 kg ha^{-1}). Also recorded highest B:C (2.16) and ICBR (2.68^1 ha^{-1}), followed by nipping at tendril initiation along with Chlormequat chloride at 500 ppm. The lowest was observed in no nipping along with water spray. The tendril formation has shown negative correlation with yield whereas growth retardants and nutrient uptake had shown positive correlation with yield of cowpea. It can be concluded that nipping at tendril initiation with foliar application of Chlormequat chloride at 1000 ppm is recommended to manage tendrils, enhance productivity and manage excessive vegetative growth sustainably in cowpea.

Performance of new paddy var. Sahyadri Sindhura under different spacing and fertilizer levels

N. R. SATHVIKAINDU MAJOR ADVISOR: Dr. H. K. VEERANNA

A field experiment on Performance of New Paddy var. Sahyadri Sindhura under different spacing and fertilizerLevels was carried out at College of Agriculture, Navile, Shivamogga during *kharif* 2024. The experiment was laid out in Randomized Complete Block Design under factorial concept with nine treatment combinations consist of three levels of spacing such as (20 cm ×10 cm, 25 cm ×10 cm and 30 cm ×10 cm) and three levels of fertilizers (75 % RDF 75:37.5:37.5 N:P_2O_5:K_2O kg ha^{-1},100% RDF 100:50:50 N:P_2O_5:K_2O kg ha^{-1} and 125% RDF 125:62.5:62.5 N:P_2O_5:K_2O kg ha^{-1}) replicated thrice. The results revealed that paddy at 20 cm ×10 cm spacing with 125 per cent RDF application showed significantly taller plants (119.84 cm). Whereas, 30 cm ×10 cm with 125 per cent RDF application recorded more number of leaves hill^{-1} (77.18), number of tillers hill^{-1} (24.41), dry matter accumulation (59.00 g hill^{-1}), productive tillers hill^{-1} (22.83), panicle weight (2.83 g), grain yield (6124 kg ha^{-1}) and straw yield (7368 kg ha^{-1}).Total major soil available nutrients and total plant nutrient uptake *viz*., nitrogen, phosphorus and potassium were recorded significantly highest at 30 cm ×10 cm with 125 per cent RDF. Superior grains with higher protein (9.87 g per 100 g), ash (1.80 g per 100 g),iron (35.86 ppm) and zinc (30.45 ppm) content were also obtained in treatment combination of 30 cm ×10 cm with 125 per cent RDF. Higher net returns (₹ 65,826 ha^{-1}) and B-C ratio (2.30) were obtained at 30 cm ×10 cm spacing with125 per cent RDF.

Effect of biochar application on growth and yield of groundnut (*Arachis hypogea* L.)

SHAKUNTALA B. GONABAI MAJOR ADVISOR: Dr. C. SUNIL

A field experiment was conducted at Zonal Agricultural and Horticultural Research Station, Navile, Shivamogga during *kharif*-2024, on "Effect of Biochar Application on Growth and Yield of Groundnut (*Arachis hypogea* L)". The experiment was laid out in Randomized Complete Block Design with ten treatments and replicated thrice. The treatments comprised of 2.5 t ha^{-1} biochar + 75 per cent recommended dose of fertilizer (T_1), 2.5 t ha^{-1} biochar + 100 per cent recommended dose of fertilizer (T_2), 2.5 t ha^{-1} biochar + 125 per cent recommended dose of fertilizer (T_3), 5 t ha^{-1} biochar + 75 per cent recommended dose of fertilizer (T_4), 5 t ha^{-1} biochar + 100 per cent recommended dose of fertilizer (T_5), 5 t ha^{-1} biochar + 125 per cent recommended dose of fertilizer (T_6), 7.5 t ha^{-1} biochar + 75 per cent recommended dose of fertilizer (T_7), 7.5 t ha^{-1} biochar + 100 per cent recommended dose of fertilizer (T_8), 7.5 t ha^{-1} biochar + 125 per cent recommended dose of fertilizer (T_9) and control (Package of practice) (T_{10}). The results revealed that application of 7.5 t ha^{-1}biochar along with 125 per cent recommended dose of fertilizer was recorded significantly higher plant height (55.63cm at harvest), number of branches (13.37), dry matter accumulation (22.70 g plant^{-1}), days to 50 per cent flowering (39.54), pod yield per plant(19.67 g plant^{-1}), pod yield (3604.00 kg ha^{-1}), kernel yield (2754.00 kg ha^{-1}), haulm yield (4300.00 kg ha^{-1}), peg to pod ratio (0.76), protein and oil content (25.18 and 50.00%, respectively), which was statistically on par with the T_6. Compared to T_{10} 13.65 per cent increase in pod yield was realized with T_9. In contrast to this higher net returns (₹ 1,20,149 ha^{-1}) and B: C ratio (2.65) was recorded in T_6.

Evaluation of different soybean varieties to different farming practices

SOUMYA M. KURIYAVAR MAJOR ADVISOR: Dr. BASAVALINGAIAH

A field experiment was conducted during *rabi* 2024-25 in the College of Agriculture, Navile, Shivamogga. The investigation was laid out using split plot design where main plot consists of three farming practices *viz*., conventional farming, organic farming and natural farming and sub plots consists of soybean varieties *viz*., MAUS-2, KB-79, KHSb-2 and JS 335 resulting twelve treatment combinations replicated thrice. The results revealed that conventional farming recorded significantly superior seed yield (18.7 q ha^{-1}) over organic farming (16.6q ha^{-1}) and natural farming (15.1q ha^{-1}). Conventional farming recorded 12.65 per cent and 23.84 per cent higher yield than organic farming and natural farming, respectively. Among the varieties tested, MAUS-2 recorded significantly higher growth and yield parameters compared to KB-79, KHSb-2 and JS 335 varieties.Conventional farming recorded significantly higher protein content (34.47%) and oil content (18.97%) whereas, organic and natural farming were statistically on par with each other. Further, Organic farming recorded significantly higher soil organic carbon content (0.60%) and available nutrient status in soil than other farming practices, but they remained non-significant with respect to different soybean varieties. Soil microbial population were significantly higher in bacteria, fungi and actinomycetes population (73.74 x 10^{-6} CFU $g^{-1}$of soil, 17.41 x 10^{-4} CFU $g^{-1}$of soil and 17.06 x 10^{-2} CFU $g^{-1}$of soil, respectively) in organic farming which was statistically on par with natural farming in bacterial and actinomycetes population (67.40 x 10^{-6} CFU $g^{-1}$of soil and 14.16 x 10^{-2}CFU $g^{-1}$of soil, respectively). Net returns (₹ 61,455 ha^{-1}) and B:C ratio (3.98) received from natural farming was significantly higher than conventional farming and organic farming. Among the varieties, MAUS-2 recorded significantly higher net returns and B:C ratio as compared to other varieties.

Effect of nano dap on growth, yield and quality of field bean (*Lablab purpureus* (L.) Sweet) under southern transitional zone of Karnataka

SUMUKHA N. MAVARKAR MAJOR ADVISOR: Dr. A.Y. HUGAR

A field experiment was conducted to study the effect of nano DAP on growth, yield and quality of field bean (*Lablab purpureus* (L.) Sweet) at the College of Agriculture, Navile, Shivamogga, on sandy loam soil during the late *kharif* season of 2024. The investigation was laid out in a randomized complete block design with ten treatments and replicated thrice. Treatments comprised 100 and 75 per cent recommended dose of fertilizers (RDF) + FYM @ 7.5 t ha^{-1} along with foliar spray of nano DAP @ 2 and 4 ml l^{-1}applied at 30 DAS or 30 and 60 DAS. The results revealed that 100 per cent RDF + foliar spray of nano DAP @ 4 ml l^{-1} at 30 and 60 DAS (T_8) recorded significantly higher growth attributes *viz*., plant height (93.67 cm), number of branches $plant^{-1}$ (8.45), leaf area (972 cm^2 $plant^{-1}$), LAI (1.44) and total dry matter production (33.39 g $plant^{-1}$) at harvest. Yield parameters were also superior in T_8 with more number of pods $plant^{-1}$ (26.56), dry pod weight (16.40 g $plant^{-1}$), 100-seed weight (14.70 g), haulm yield (2035 kg ha^{-1}) and seed yield (1234 kg ha^{-1}) with an increment of 25 per cent over 100 per cent RDF alone (T_2). Among quality traits, crude protein content (24.92%) and ash content (5.47%) were also enhanced. In T_8 seed yield was statistically on par with 75 per cent RDF + nano DAP @ 4 ml l^{-1} at 30 and 60 DAS (T_{10}) and 100 per cent RDF + nano DAP @ 2 ml l^{-1} at 30 and 60 DAS (T_{10}). However, $T_{10}$with reduced fertilizer recorded the highest benefit-cost ratio (2.94). Thus, foliar application of nano DAP @ 4 ml l^{-1} at 30 and 60 DAS along with RDF + FYM improved growth, nutrient uptake, yield and quality of field bean.

Influence of mulching and fertilizer levels on micro meteorological parameters, growth and yield of field pea (*Pisums ativum arvense*)

SUSHMA MAJOR ADVISOR: Dr. S. SRIDHARA

An experiment was conducted during *rabi* 2024-25 at Centre for Climate Resilient Agriculture, College of Agriculture, Shivamogga, to study the "Influence of Mulching and Fertilizer Levels on Micro Meteorological Parameters, Growth and Yield of Field Pea (*Pisumsativum arvense*)". The experiment was laid out in factorial randomized complete block design (RCBD) with three replications. The experiment consisted of four mulching materials (no mulch, pongamia leaf, maize cob husk and areca husk mulch) applied at the rate of 5 t $ha^{-1}$and three fertilizer levels (75, 100 and 125% of Recommended Dose of Fertilizer). The results revealed that pongamia leaf mulch recorded significantly higher plant height (56.32 cm), leaf area (6994.08 cm^2plant^{-1}), total dry matter (36.66 g $plant^{-1}$), seed (71.7 q ha^{-1}) and biological yield (142.69 q ha^{-1}) at harvest, maintained lower soil and canopy temperature and also higher soil moisturecompared to other mulches. Among the fertilizer levels 125 % RDF recorded significantly higher plant height (59.38 cm), leaf area (7244 cm^2plant^{-1}), total dry matter (39.03 g $plant^{-1}$), seed (81.51 q ha^{-1}) and biological yield (153.45 q ha^{-1}) at harvest, maintained lower soil and canopy temperature and also higher soil moisture. The interaction effects were found non-significant. However, pongamia leaf mulch at the rate of 5 t ha^{-1} with 125% RDF recorded significantly higher growth and yield parameters. The correlation analysis between micro meteorological parameters and yield of field pea at different phenological stages were analysed, the soil temperature and canopy temperature were negatively correlated and soil moisture and canopy air temperature difference were positively correlated.

Effect of nano dap on growth and yield of blackgram (*Vigna mungo* L. Hepper)

VIJETA PARASAPPA MALAGOND — MAJOR ADVISOR: Dr. C. J. SRIDHARA

A field experiment entitled "Effect of Nano DAP on Growth and Yield of Blackgram (*Vigna mungo* L. Hepper)" was conducted during *kharif* 2024 at the College of Agriculture, Navile, Shivamogga. The experiment was laid out in Randomized Complete Block Design (RCBD) with eight treatments replicated thrice. Treatments included an absolute control, recommended dose of fertilizers and others included combination of basal application of recommended nitrogen and phosphorus through conventional urea and DAP, respectively at 75 per cent and 100 per cent in combination with methods of nano DAP application (seed priming @ 3 ml l^{-1} and foliar spray @ 4 ml l^{-1} at 30 DAS). Among the treatments, 100 per cent recommended nitrogen and phosphorus along with nano DAP seed priming @ 3 ml l^{-1} followed by foliar spray of nano DAP @ 4 ml l^{-1} at 30 DAS has recorded significantly higher plant height (49.49 cm), number of branches (11.56), leaf area per plant (683.20 cm^2), dry matter production (21.84 g $plant^{-1}$) at harvest and number of effective root nodules at 45 DAS (30.87). This treatment also produced superior yield attributes at harvest *viz*., number of pods per plant (40.87), seed yield per plant (12.03 g), pod length (5.17 cm) and pod weight per plant (17.36 g) resulting in the highest seed yield (1111 kg ha^{-1}) and haulm yield (2431 kg ha^{-1}). It also recorded higher crude protein content (25.75%) and total nutrient uptake (N: 91.23, P: 13.58 and K: 69.65 kg ha^{-1}). The seed yield increment achieved by this treatment over RDF treatment was 20.24 per cent, with the highest net returns (47,086 ₹ ha^{-1}) and B:C (2.30). The lowest growth and yield parameters were recorded in absolute control.

Effect of biostimulants on field bean (*Lablab purpureus* (L.) Sweet) under rainfed condition of southern transitional zone of Karnataka

H. D.YASHAVANTH — MAJOR ADVISOR: Dr. NARAYANA S. MAVARKAR

A field experiment was conducted at College of Agriculture, Shivamogga Navile, during *kharif* 2024, on "Effect of Biostimulants on Field bean (*Lablab purpureus* (L.) Sweet) under Rainfed Condition of Southern Transitional Zone of Karnataka" The experiment was laid out in Randomized Complete Block Design with 11 treatments and replicated thrice.Treatments include *viz*., control and RDF along with foliar spray of DAP (2%) , humicacid @ 2 and 4mll^{-1}, sea weed extract @ 2 and 4mll^{-1}, humic acid @ 2mll^{-1}+ sea weed extract @ 2mll^{-1}, humic acid @ 2mll^{-1}+sea weed extract @ 4mll^{-1}, humic acid @ 4mll^{-1} +sea weed extract @ 2mll^{-1}, humic acid @ 4mll^{-1}+seaweed extract @ 4mll^{-1} and DAP (2%) +humic acid @ 2mll^{-1}+seaweed extract @ 2mll^{-1} at 30 and 45 DAS. The results revealed that foliar spray of 2% DAP+humic acid @ 2mll^{-1}+seaweed extract @ 2mll^{-1}at 30 and 45 DAS recorded significantly higher plant height (93.40 cm), number of branches $plant^{-1}$(8.01),total dry matter production $plant^{-1}$ (36.14g), number of pods $plant^{-1}$(27.15), pod weight $plant^{-1}$(18.46g), seed pod^{-1} (4.38), seed yield (1191kg ha^{-1}) and haulm yield (2204 kg ha^{-1}) at harvest and similarly, higher total nutrient uptake of nitrogen (77.36 $kgha^{-1}$), phosphorus (18.81kg ha^{-1}) and potassium (64.17$kgha^{-1}$) and higher gross returns (₹ 1,19,100ha^{-1}), net returns (₹ 76,985ha^{-1}) and benefit-cost ratio (2.83) recorded by the same treatment. However these were on par with foliar spray of humic acid @4mll^{-1}+sea weed extract @ 4mll^{-1}at 30 and 45DAS. It was found that there was a 35% increase ein seed yield over the control (RDF alone).

Performance of FCV tobacco VAR. FCS-4 as influenced by spacing and fertilizer levels

DEEPA PATIL — MAJOR ADVISOR: Dr. T. M. SOUMYA

A field experiment on Performance of FCV tobacco var. FCS-4 as influenced by spacing and fertilizer levels was conducted during late *kharif* of 2024 at All India Network Project on Tobacco, Zonal Agricultural and Horticultural Research Station, Navile, Shivamogga. The experiment was laid out in Randomized Complete Block Design with factorial concept. There were twelve treatment combinations consisting of four spacing (90 cm × 45 cm, 90 cm × 60 cm, 90 cm × 75 cm and 75 cm × 75 cm) and three levels of fertilizers (100 per cent RDF 40:30:80 N:P_2O_5:K_2O kg ha^{-1}, 125 per cent RDF 50:37.5:100 N:P_2O_5:K_2O kg ha^{-1} and 150 per cent 60:45:120 N:P_2O_5;K_2O kg ha^{-1}) which were replicated thrice.The outcome revealed that, among different spacing 90 cm × 45 cm recorded significantly higher plant height (131.9 cm) at final harvest, Whereas, 90 cm × 75 cm recorded significantly higher cumulative number of leavesharvested per plant (20.0),leaf area per plant (62.0dm^2 $plant^{-1}$), specific leaf weight (11.0 mg cm^2) at 45 days after planting. Green leaf yield (10889kg ha^{-1}) and cured leaf yield (1348 kg ha^{-1}) were significantly higher at 90 cm × 60 cm. The application of 150 per cent RDF recorded significantly higher plant height (129.8 cm), cumulative number of leaves harvested per plant (20.0), leaf area per plant (57.8 dm^2 $plant^{-1}$), specific leaf weight (10.6 mg cm^2), green leaf yield(10886kg ha^{-1}) and cured leaf yield (1290 kg ha^{-1}). Quality attributes, *viz*., nitrogen, potassium, nicotine, reducing sugars and chloride in leaf were within the acceptable limits. Among the interaction 90 cm × 60 cm with 150 per cent of RDF recorded significantly higher net return (188833 ha^{-1}) and B:C (2.11).

Evaluation of early post emergent and post emergent herbicides for weed control in groundnut and their effect on succeeding crop

RAMANAGOUDA — MAJOR ADVISOR: Dr. A. H. KUMAR NAIK

A field experiment on evaluation of early post emergent and post emergent herbicides for weed control in groundnut and their effect on succeeding crop was conducted at field unit of AICRP on groundnut, ZAHRS, Babbur farm, Hiriyur during *kharif*, 2024. The experiment was laid out in RCBD design with nine treatments replicated thrice. The treatments consists of different pre-emergent, early post emergent and post emergent herbicides compared to manual weeding and weedy check treatments. Among all the treatments, manual

weeding at 20 and 40 DAS (T_9) recorded significant weed control which resulted in higher pod yield (2904 kg ha^{-1}). Among different herbicidal treatments, treatment receiving pre-emergent application of Diclosulam @ 26 g *a.i*. ha^{-1} followed by post-emergent application of Fenoxaprop-p-ethyl @ 78 g ha^{-1} at 25 DAS (T_2) recorded significantly lower total number of weeds (21.33 m^{-2}at 60 DAS), weed dry matter (9.8 g m^{-2} at 60 DAS),higher pod yield (2833 kg ha^{-1}), net returns (₹ 1,17,894 ha^{-1}) and B:C ratio (2.59) which was statistically on par with treatment with early post-emergence application of Fluazifop-p-butyl 13.4% + Fomesafen 11.1% SL (RM) @ 230 g *a.i.* ha^{-1} at 2-3 leaf stage of weeds (T_3) which recorded lower total number of weeds (25.33 m^{-2} at 60 DAS), weed dry matter (10.9 g m^{-2} at 60 DAS), pod yield of 2765 kg ha^{-1},net returns (₹ 1,11,654 ha^{-1}), and B:C ratio (2.55). these herbicides have shown no residual toxicity to succeeding crop soybean which recorded higher germination percentage under all the herbicidal treatments. Thus, application of early post-emergence herbicide Fluazifop-p-butyl 13.4% + Fomesafen 11.1% SL having two different active ingredients resulted in broad spectrum weed control similar to sequential application of pre-emergent application followed by post-emergent application.

SOIL SCIENCE

Status and distribution of boron in soils under arecanut plantations of chitradurga district, Karnataka

M. S. AHALYA — MAJOR ADVISOR: Dr. PARASHURAM CHANDRAVANSHI

An investigation was carried out to study the different forms of boron and their relation with other properties of soils in soils under arecanut plantations of Chitradurga district, Karnataka, during 2024-25 in the department of Soil Science, College of Agriculture, Shivamogga, KSNUAHS, Shivamogga. 120 soil samples at two depths (0-30 and 30-60 cm) were collected and analyzed for physico-chemical properties, available macro and micronutrients and different fractions of boron. Results indicated that soil texture varied from sandy loam to clay loam. Soil pH ranged from 6.89 to 8.74 and 7.11 to 8.96, electrical conductivity varied from 0.41 to 1.37 and 0.27 to 1.07 dS m^{-1}, organic carbon ranged from 3.36 to 6.90 and 1.67 to 5.92 g kg^{-1} in surface and sub-surface layers, respectively. Available N, P_2O_5 and K_2O ranged from 250.88 to 528.85, 16.00 to 52.94, 142.60 to 325.92 and 200.70 to 416.46, 13.76 to 45.53, 99.82 to 176.96 kg ha^{-1} in surface and sub-surface layers, respectively. The soils were sufficient in exchangeable calcium and magnesium. DTPA extractable Fe, Zn and Mn were found to be deficient and DTPA extractable Cu was found to be sufficient in the majority of the surface and subsurface samples. Available B ranged from 0.40 to 1.01 mg kg^{-1} (surface) and 0.29 to 0.77 mg kg^{-1} (sub-surface). Among the boron fractions, residual boron contributed around 94.74 per cent in soils and other fractions followed the order of organically bound > oxide bound > specifically adsorbed > readily soluble boron.

Effect of foliar fertilization of water extract k from organic residues on nutrient content, quality and productivity of tomato (*Lycopersicon esculentum* L.)

R. AKASH — MAJOR ADVISOR: Dr. G. N. THIPPESHAPPA

Organic wastes from agriculture are rich source of many nutrients which are not exploited properly for plant nutrition purpose. In this context, the water-soluble K was extracted (Ws-K) from banana pseudostem (1:100 residue to water ratio for 20 min shaking) and used as foliar spray on tomato crop under pot culture experiment at College of Agriculture,Navile, KSNUAHS, Shivamogga, during *rabi* 2024-25. The experiment was laid out in completely randomized design with eleven treatments and three replications *viz*., absolute control, 100 per cent recommended dose of fertilizers (RDF) andfoliar spray of Ws-K from 1 to 4 per cent in combination with soil application of 100 and 75 per cent recommended dose of potassium. The results revealed that, application of 100 per cent RDF along with foliar spray of 4 per cent Ws-K from banana pseudostem recorded significantly higher plant growth parameters like plant height, number of branches per plant and number of leaves per plant. Similarly yield parameters *viz.,* number of flowers per plant (39.33), number of fruits per plant (34.33), individual fruit weight (70.74 g), fruit diameter (5.67 cm), fruit yield per plant (2.43 kg $plant^{-1}$) and quality parameters *viz.,* TSS (4.77 ^{0}Brix), lycopene content (4.27 mg $100g^{-1}$), ascorbic acid content (33.68 mg 100 g^{-1}) and shelf life (19.50 days) were registered highest under the same treatment. Total nutrient content and uptake were also highest in the same treatment. The percentage yield increase was found to be 10.83 per cent over the RDF (2.19 kg $plant^{-1}$) application. The research findings suggested that foliar spray of 4 per cent water-soluble K extracted from banana pseudostemcould be used as a potential source of potassium for increasing K nutrition, enhancing vegetative growth, fruit yield, quality parameters and nutrient content and uptake by tomato crop.

Influence of liming materials on productivity of Mangaluru melon (*Cucumis melo* var. *acidulous*) in coastal Karnataka

B. AKASH — MAJOR ADVISOR: Dr. S. M. JAYAPRAKASH

A field experiment was conducted during *rabi* 2024 in farmer's field of Nailady village, Brahmavar taluk, Udupi district, to evaluate the impact of different liming materials and magnesium sulphate on Mangaluru Melon (*Cucumis melo* var. *acidulous*) performance in acidic soils of coastal Karnataka. The study arranged in a Randomized Complete Block Design with ten treatments replicated thrice *viz.,* Package of Practice (POP) (T_1), lime equivalent to 50 and 100 per cent exchangeable acidity (T_2 and T_5), lime equivalent to 50 and 100 per cent exchangeable acidity with magnesium sulphate at 10 and 20 kg ha^{-1} (T_3, T_4, T_6, T_7) and dolomite equivalent to 50 per cent and 100 per cent exchangeable acidity (T_8 and T_9). The results showed that treatment T_4 (POP + lime equivalent to 50 per cent exchangeable acidity + 20 kg magnesium sulphate) exhibited the highest performance across all parameters. This included superior vine length (201.30 cm), number of leaves (44.33), number of branches (6), fruit length (21.73 cm), fruit diameter (14.27 cm), individual fruit weight (1.25 kg) and a yield of 21.70 t ha^{-1}.

Furthermore, T_4 showed enhanced shelf life (111 days) and ascorbic acid content (27.43 mg $100g^{-1}$). This synergistic effect of magnesium sulphate and lime also improved soil pH and the availability of N, P, K, Ca, Mg and S. Conversely, the farmer's practice (T_{10}) recorded the lowest values, highlighting the detrimental effects of untreated soil acidity. Treatments with dolomite (T_8 and T_9) offered moderate improvements but were less effective than lime combined with magnesium sulphate. The study concludes that lime application equivalent to 50 per cent exchangeable acidity along with 20 kg ha^{-1} magnesium sulphate significantly boosts the growth, yield and nutritional quality of Mangaluru Melon, establishing it as an effective soil management strategy for acidic soils of coastal Karnataka.

Characterization of soil properties under conventional system and alternate wetting and drying method of paddy cultivation

P. V. MEGHA

MAJOR ADVISOR: Dr. SARVAJNA B. SALIMATH

A study on characterization of soil properties under the conventional system and Alternate Wetting and Drying (AWD) method of paddy cultivation was conducted during 2024 – 25 in the Department of Soil Science, College of Agriculture, KSNUAHS, Shivamogga. The survey was conducted in Harihar and adjoining Ranebennur taluks to compare the effectiveness of AWD with conventional method of paddy cultivation on soil physical and chemical properties. 100 soil samples each were collected and analyzed for physical and chemical properties. It was observed that the soil textures under both systems ranged from sandy clay loam to clay and there was a marginal decrease in bulk density in AWD method when compared with the conventional system (1.27 to 1.35 Mg m^{-3}) and increased soil pH (7.14 to 6.95), electrical conductivity (0.64 to0.39 dS m^{-1}) and soil organic carbon (7.23 to 5.10 g kg^{-1}). Under AWD method, there was an increased availability of nitrogen and potassium (415.53 and 284.72 kg ha^{-1}, respectively), while available phosphorus and sulphur (41.53 kg ha^{-1} and 8.58 mg kg^{-1}, respectively) declined, compared to conventional system. There was an increase in exchangeable calcium and magnesium (18.54 and6.57 cmol (pz) kg^{-1} respectively) in AWD compared to conventional system. Under AWD method, DTPA-extractable zinc, iron, manganese and available boron also increased, whereas DTPA-extractable copper decreased. Farmer surveys (75 respondents per system) showed that adoption of RNR-15048 predominated and AWD fields required lesser irrigation days (21), used lower agrochemicals and achieved higher yield (74.10 q ha^{-1}) compared to conventional system. From the studies, it was observed that AWD proved to be a sustainable alternative method to conventional system since there was water saving, increased fertiliser use efficiency, decreased pesticide application, better soil health and ultimately not compromising the yield.

Influence of NPK levels on productivity of finger millet + soybean (4:2) intercropping system under *Alfisol*

H. R. PRIYANKA

MAJOR ADVISOR: Dr. GANAPATHI

A field experiment was conducted during *kharif* 2024 at College of Agriculture, Navile, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences (KSNUAHS), Shivamogga, Karnataka to study the effect of different NPK nutrient levels on crop growth, yield, yield attributes and soil fertility under finger millet + soybean (4:2) intercropping system. The experiment was laid out in Factorial-RCBD with twelve treatment combinations comprising three cropping systems [Finger millet sole crop (CS), Soybean sole crop (CS,), Finger millet + Soybean (4:2) intercropping (CS*f*)] and four nutrient management levels [Control (NM), 75% RDF (NM,), 100% RDF (NM*f*) and 125% RDF (NM,,)] along with recommended dose of FYM with three replications. Among different treatments, sole finger millet under 125% of RDF(CSNM,,) recorded significantly higher plant height (91.61 cm), number of tillers per plant (3.80), number of ear heads per plant (4.27), number of fingers per ear head (5.07), grain and straw yield of 32.43 q ha^{-1} and 50.83 q ha^{-1}, respectively. However, among different intercropping systems, finger millet + soybean (4:2) under 75% RDF (CS_3NM_2) recorded significantly higher finger millet equivalent yield (38.24 q ha^{-1}), higher B:C-ratio (2.83), land equivalent ratio (1.71), area time equivalent ratio (1.58) and monetary advantage index (₹ 84671.09 ha^{-1}), indicating better economic returns and input efficiency. Post-harvest soil analysis revealed that available nitrogen (359.34 kg ha^{-1}), phosphorus (159.45 kg ha^{-1}) and potassium (236.37 kg ha^{-1}) were highest in treatments intercropped with 125% RDF, which were statistically on par with 100% RDF finger millet + soybean (4:2) intercropping treatment. Thus, finger millet + soybean (4:2) intercropping with 75% RDF was most efficient in enhancing productivity, profitability and soil fertility.

Influence of different sources of phosphorus on soil nutrient availability, growth and yield of chrysanthemum (*Dendranthema grandiflorum* L.)

SANGAMESH Y. VAGGAR

MAJOR ADVISOR: Dr. M. S. NAGARAJA

Phosphorus management is very important for flower crops. A field experiment was conducted in an acid soil to evaluate the effect of different phosphorus sources on soil properties, growth and yield of Chrysanthemum (*Dendranthema grandiflorum* L.). Three different sources at two levels (RDP at 100 and 50%) with ten treatments in three replications were arranged in simple RCBD. Phosphorus was applied through fertilizer (T_3 to T_6) phosphorus-enriched compost (PEC- T_7 and T_8); and P-rich organic manure (PROM- T_9 and T_{10}); and they were compared with absolute control (T_1) and FYM alone (T_2). Recommended doses of nitrogen and potassium were applied to T_3 to T_{10}; and recommended dose of FYM was applied to T_5 to T_{10} treatments. The results revealed that use of organic-P sources significantly improved growth, yield and soil attributes. Available nitrogen, phosphorus and potassium were higher in all the fertilized plots. Application of PROM and PEC recorded higher available phosphorus than conventional P-fertilized (T_3 to T_6) treatments. The secondary nutrients were also higher in plots applied with FYM. Notably, higher exchangeable-Ca was recorded in PEC and PROM treatments. Sustained phosphorus (Brays-P) release was also observed in the above treatments. All the growth attributes recorded were higher in fertilized treatments. Among them, treatments with PROM and PEC recorded better growth. Application of PROM and PEC reduced

the number of days for bud initiation and for 50 per cent flowering. The maximum flower yields were recorded in PROM and PEC treatments. Notably, supplementation of RDP at 50 per cent through PEC (T_8) and PROM (T_{10}) recorded on par yields with T_5 treatment (100% RDP). Similarly, growth and soil parameters were also found on par with each other. Thus, the study indicated that the chrysanthemum flower yields can be enhanced with the application of PROM and PEC. Interestingly, the present yield levels can also be achieved even at 50 per cent of RDP through PROM or PEC application.

Studies on soil carbon dynamics in different land use cover in southern transition zone of Karnataka

SHAFAISAL SHAFEEK MUJAWAR

MAJOR ADVISOR: Dr. D. RAVIKUMAR

The research was carried out to study the carbon dynamics of soils under different land use covers in the southern transition zone of Karnataka within Tarikere taluk of Chikkamagaluru district. A total of 100 surface soil samples (0–20 cm) were collected from five major land use covers, *viz*., natural forest, arecanut, paddy, maize and barren land and analyzed for physico-chemical properties and available nutrients. To assess the depth-wise distribution of soil carbon fractions, 50 additional samples were collected from two benchmark sites under each land use cover at five different depths (0–20, 20–40, 40–60, 60–80 and 80–100 cm). The results of the surface soil samples revealed that soil texture varied from sandy loam to clay loam. The soil pH varied from slightly acidic to moderately alkaline (5.50 to 8.17), while soils were non-saline in nature. Soil organic carbon varied from low to high (3.22 to 8.97 g kg^{-1}) and cation exchange capacity ranged from 6.18 to 27.82 cmol (pz) kg^{-1}. Available nitrogen and phosphorus ranged from low to medium (149.63 to 432.41 kg ha^{-1} and 8.97 to 41.03 kg ha^{-1}, respectively) and available potassium ranged from low to high (85.93 to 421.38 kg ha^{-1}). DTPA-extractable micronutrients were within the sufficient range, although a few samples exhibited zinc deficiency. Thedepth-wise distribution of soil carbon fractions, total organic carbon was highest in natural forest soils, followed by arecanut and paddy, while maize recorded the lowest in their respective depths. Total carbon followed a similar trend, whereas total inorganic carbon was relatively higher in paddy soils. All carbon fractions decreased with increasing soil depth in all land use covers, indicating greater accumulation in the surface layers. Overall, land use cover is a key driver of the distribution and dynamics of soil carbon fractions.

Assessment of carbon fractions in soils under agriculture, horticulture and silviculture systems of Koranahalli subwatershed in Chikkamagaluru district, Karnataka

SHIVANAND K. NANDAGANV

MAJOR ADVISOR: Dr. R. JAYAPRAKASH

The present study was conducted to assess the distribution of carbon fractions under different land use systems in the Koranahalli subwatershed, which is characterized by diverse topography, soil types, and cropping patterns. A total of 100 surface soil samples (0–20 cm) were collected from five major land use systems*viz.,*coconut, mango, finger millet, arecanut and teakand analysed for physical and chemical properties. To study depth-wise variations in carbon fractions, 50 additional samples were collected from two benchmark spots under each land use system atfive depths with uniform interval (0–20, 20–40, 40–60, 60–80, and 80–100 cm).The results showed that soils exhibited textural variation from sandy loam to sandy clay loam, with bulk density ranging from 1.17 to 1.49 Mg m^{-3}. Soil pH varied from slightly acidic to moderately alkaline (5.58 to 8.34), while electrical conductivity remained within permissible limits across all the systems. Soil organic carbon varied from low to high (4.98 to 8.97 g kg^{-1}), Available nitrogen varied from low to medium (172.32 to 387.52 kg ha^{-1}). Available phosphorus, potassium and sulphur were varied low to high (17.42 to 64.36 kg ha^{-1}, 124.83 to 392.15 kg ha^{-1} and 9.30 to 27.22 mg kg^{-1}, respectively). DTPA-extractable Fe, Mn, Zn and Cu were found to be sufficient in majority of the soil samples. Depth-wise analysis revealed that total organic carbon (TOC) was highest in teak soils, followed by arecanut and coconut and lowest in finger millet soils. Total carbon followed a similar trend, whereastotal inorganic carbon (TIC) was comparatively higher in finger millet soils. All carbon fractions decreased with increasing depth, indicating greater accumulation in the surface layers. The study suggests that land use systems play a crucial role in enhancing soil carbon addition and improving soil health.

Effect of p levels and foliar application of phosphate and phosphite on productivity of soybean (*Glycine max* L.) and P status in *Alfisols*

P. P. LOKESH

MAJOR ADVISOR: Dr. B. C. DHANANJAYA

A field experiment was conducted to evaluate the foliar application of phosphorus (as phosphate and phosphite) on the productivity of soybean (*Glycine max* L.) and P status in *Alfisols* during summer season of 2025 at College of Agriculture, Navile, KSNUAHS, Shivamogga. The experiment was laid out in RCBD comprising 11 treatments, replicated thrice. The treatments comprised of varying levels of P (75% and 100% of RDP) and combinations of potassium phosphate and potassium phosphite at 1% and 2% concentrations applied at 30 DAS. Among the different treatments, treatment T_4 (100% RDP + 1% KH, $PO_{,,}$ foliar spray) emerged as the most effective, significantly enhancing plant growth and yield parameters. The treatment T_4 (100% RDP + 1% KH, $PO_{,,}$ foliar spray) recorded significantly higher plant height of 47.33 cm, number of branches per plant (7.73), pods per plant (32.20), seeds per pod (2.86), seed yield of 23.04 q ha^{-1} and stover yield of 30.76 q ha^{-1}. The crude protein (28.27%), oil content (20.74%) and phytate P (81.47 mg $100g^{-1}$) content of soybean seeds were also higher in the treatment T_4. Post-harvest soil analysis showed significantly higher available P status *i.e.,* 138.05 kg ha^{-1} in the same treatment. With respect to distribution of P fractions, saloid bound-P (43.20 mg kg^{-1}), organic P (112.05 mg kg^{-1}) and total-P (398.85 mg kg^{-1}) were significantly higher in the treatment T_4. Whereas, Al bound-P (82.92 mg kg^{-1}) and Fe bound-P (66.3 mg kg^{-1}) were highest in treatment T_7 receiving 100% RDP + 2% KH_2PO_3. This study highlights the potential of integrating soil and foliar phosphorus management, particularly with 1% phosphate sprays, as an effective strategy to enhance soybean yield and phosphorus availability in *Alfisols*.

ENTOMOLOGY

Studies on insect pests of ginger with special reference to *Conogethes punctiferalis* GUENEE (Lepidoptera: Crambidae) and its management

B. ANILKUMAR

MAJOR ADVISOR: Dr. S. PRADEEP

The present study on insect pests of ginger, farmers' knowledge and shoot borer management was conducted at College of Agriculture, Shivamogga, Karnataka during 2024–25. A roving survey was conducted across five taluks of Shivamogga district namely, Shivamogga, Shikaripura, Sagara, Soraba, Hosanagara, in which seven major insect pests were recorded. Among them, ginger shoot borer (*Conogethes punctiferalis*) was predominant, followed by rhizome fly, leaf roller, thrips, leaf beetles, weevils and leaf-eating caterpillars. Several minor pests and five natural enemies, mainly coccinellids, spiders, chrysopids and larval parasitoids, were also documented. Survey on farmers knoweldge revealed high reliance on chemical control, with 28 to 78% farmers using insecticides (chlorpyrifos 20 EC being most common) and 10 to 86% using fungicides.Pesticide practices were largely unscientific, with poor safety measures, blanket spraying schedules and minimal adoption of cultural methods (6%) or IPM (34%).Studies on the biology of *Conogethes punctiferalis* on ginger revealed that eggs were oval, translucent, with incubation period of 3.72 days.The average duration of larva on ginger was 21.25 days, while average pupal period was 7.75 days. The average pre-oviposition period, oviposition period and post-oviposition period of adult female was 3.00 days, 2.40 days, 2.60days, respectively.The total developmental period of male and female moth was 42.50 and 43.50 days, respectively.The bio-efficacy trial against ginger shoot borer revealed that spinetoram 11.7% SC @100 ml/acre was the most effective insecticide, reducing damage by 60.61% over the untreated control and recording the lowest mean damage across both sprays. Lambda-cyhalothrin 5% EC @ 80 ml/acre provided superior long-term control, while cartap hydrochloride 4% G @ 10,000 g/acre, chlorantraniliprole 0.4% G @ 4,000 g/acre, imidacloprid 70% WG @ 400 g/acre and azadirachtin 1% EC @ 400 ml/acre were moderately effective in managing ginger shoot borer.

Population dynamics and management of pest complex in field bean, *Lablab purpureus* (L.)

R. BHANUPRIYA

MAJOR ADVISOR: Dr. B. C. HANUMANTHASWAMY

The investigation on population dynamics and management of pest complex in field bean, *Lablab purpureus* (L.) was undertaken at College of Agriculture, Shivamogga during *kharif* 2024 and *rabi* 2024-25. Eighteen different insect pests were recorded on field bean crop which includes, Sucking pests – Aphids (*Aphis craccivora*), Thrips (*Thrips florum* and *Thrips parvispinus*) and Leafhopper (*Empoascakerri*), Pod bugs - Pod sucking bug (*Riptortus pedestris* and *Riptortus linearis*), Tur pod bug (*Clavigralla gibbosa* and *Clavigralla horrens*), Green stink bug (*Nezara viridula*) and *Lablab* bug (*Coptosoma cribraria*), Pod borers - Gram pod borer (*Helicoverpa armigera*), Spotted pod borer (*Maruca vitrata*), Field bean pod borer (*Adisura atkinsoni*) and Plume moth (*Exelastis atomosa*) and Defoliators - Bihar hairy caterpillar (*Spilarctia obliqua*), Leaf webber (*Omiodes indicata*), Tobacco caterpillar (*Spodoptera litura*). The peak incidence of sucking pests, pod bugs, pod borers and defoliators were observed between 56 to 77, 77 to 91, 63 to 77 and 49 to 70 days after sowing (DAS), respectively in *kharif* and 49 to 70, 70 to 84, 56 to 77 and 42 to 63 DAS in *rabi* season respectively. The activities of Predators *viz*., Lady bird beetle (*Cheilomenessex maculata, Coccinella transversalis),* Green lacewing bug (*Crysoperla carnea)*, Assas in bug (*Rhynocoris iracundus),* Predatory stink bug (*Eocanthecona furcellata)* and Parasitoids (*Telenomus remus*, *Cotesia* sp. *Aphidius Colemani* and *Trichogramma chilonis)* were also noticed between 42 to 77 DAS during *kharif* and 49 to 77 DAS in *rabi*, which was coincided with peak activity of pest. Among the modules evaluated for the management of insect pest complex, lowest pest infestation and highest per cent reduction over control were recorded in IPM module with green pod yield of 33.84 q/ha in *kharif* and 27.34 q/ha in *rabi* followed by Farmer's or Chemical module and Biorational module in both the seasons. Further, IPM module registered the highest C:B ratio (*kharif*-1:3.22; *rabi*-1:3.52).

Studies on insect pest spectrum of robusta coffee with special reference to seasonality and management of shot hole borer, *Xylosandrus compactus* (EICHHOFF)

H. K. BHARATH GOWDA

MAJOR ADVISOR: Dr. M. H. SUCHITHRAKUMARI

Coffee is a popular beverage crop worldwide and also called as King of beverage crop. Karnataka is the largest producer of coffee in India, but its production is severely affected by insect and non – insect pests, particularly shot hole borer is also a serious pest of Robusta coffee which attack tertiary twigs, young primaries and suckers.The severity of *Xylosandrus compactus* infestation is more in Robusta coffee plantations of Chikkamagaluru district and Kodagu district. The present investigation was to identify the insect pests associated with Robusta coffee and study the seasonality of the shot hole borer which was conducted in Robusta coffee plantation of Zonal Agricultural and Horticultural Research Station, Mudigere and farmers plot. The study revealed that five major insect pests, namely shot hole borer, berry borer, red borer, hairy caterpillar and mealy bugs were observed. The shot hole borer was found infesting coffee shoots throughout the year, with the population peaking during January (3.5 adults/shoot) and reaching the lowest during July (0.5 adults/shoot). Correlation analysis showed that the shot hole borer population had a highly significant positive correlation with maximum temperature and sunshine hours, while rainfall, minimum temperature, and relative humidity exhibited negative correlations. Field evaluation of insecticides and biopesticides against shot hole borer conducted in farmers plot at Gonibeedu, Mudigere revealed that chlorpyriphos 20% EC (3 ml/l) recorded the lowest shoot damage and was most effective, followed by acetamiprid 20% SP (0.2 g/l) and spinetoram 11.7% SC (0.4 ml/l). Among biopesticides, *Beauveria bassiana* 5% SC performed better than *Metarhizium anisopliae* 1% WP. On the whole, it can concluded that integration of effective insecticidal management practices with seasonal monitoring plays a vital role in reducing shot hole borer infestation and ensuring sustainable production of Robusta coffee in Karnataka.

Interactions of novel insecticides with entomopathogenic nematode, *Heterorhabditis indica* (Poinar) on fall armyworm, *Spodoptera frugiperda* (J.E. Smith)

K. BOOMIKA MAJOR ADVISOR: Dr. SHARANABASAPPA S. DESHMUKH

The fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)is a highly polyphagous invasive pest causing severe damage to many crops especially maize. Among several management strategies, Entomopathogenic nematodes (EPNs) are the biocontrol agent withan ability to infect, kill and reproduce inside *S. frugiperda* larva and also it can be tank mixed with insecticides. The present study evaluated the biocontrol potential of *Heterorhabditis indica*, the effects of novel insecticides on *H. indica* and their combined efficacy against *S. frugiperda* larvae under laboratory conditions. The infective juveniles of *H. indica* exhibited high virulence against all tested larval instars of *S. frugiperda*, with efficacy influenced by both concentration and time of exposure. The tested insecticides,emamectin benzoate 5 SC and broflanilide 20 SC were classified as slightly toxic to *H. indica*, causing 32.57 and 35.67% mortality of *H. indica* with insecticidal effects (E%) of 62.63 and 59.52, respectively. In contrast, chlorantraniliprole18.5 SC and spinetoram11.71 SC were found non-toxic, caused lower mortalities (10.19 and 9.67%) with E% values of 25.53 and 29.80, respectively. Results revealed that when insecticide treated infective juveniles were applied to *S. frugiperda*, the larval mortalities ranged from 49.26 to 73.70%, compared to 88.89% mortality caused by untreated nematodes. The application of combinations of chlorantraniliprole or spinetoram with *H. indica* at 1/4thand 1/8threcommended field doses resulted in higher larval mortality in *S. frugiperda* compared to the application of either the insecticide or *H. indica* alone,exhibiting both additive and synergistic interactions depending on exposure time and larval stage.Overall, the study concluded that *H. indica* was virulent against *S.frugiperda* larvae at different concentrations. EPNs can be effectively integrated with chlorantraniliprole and spinetoram at lower doses to manage fall armyworm and can minimize negative impacts on nematode viability.

Studies on lepidopteran pest complex of cashew inflorescence and their management

M. V. NIRANJANA MAJOR ADVISOR: Dr. R. GIRISH

Studies on lepidopteranpest complex of cashew inflorescence and their management was conducted in the cashew plantations at Zonal Agricultural and Horticultural Research Station of Chikkamagaluru (Mudigere and Bhavikere), Udupi (Bramavara) and Shivamogga (Navile) districts of Karnataka during the year 2024-25. Observations on cashew pest infesting inflorescence recorded were shoot tip and inflorescence caterpillar, leaf and blossom webber and apple and nut borer. Seasonal activity of these caterpillars showed peak activity of shoot tip and inflorescence caterpillar during October month with a damage of 22.53 per cent, leaf and blossom webber during November with damage of 4.26 per cent and apple and nut borer showed peak activity during April and May month with damage of 25.25 and 25.72 per cent. The correlation studies with abiotic factors showed non-significant in reduction of pest damage. Screening of cashew varieties showed that the Ullal 1 variety recorded less pest infeststion compared to all other varieties screened. Biochemical constituents showed none of the varieties were found resistance to the pest damage, while higher phenols, vitamin C, tanin and titratable acidity recorded in least pest damage and varieties having higher total sugars recorded higher pest damage. Phenols, vitamin C, tannin and titratable acidity showed negative correlation with incidence of shoot tip and inflorescence caterpillar, leaf and blossom webber & apple and nut borer, While positive correlation was observed for total sugars. Efficacy of newer insecticides molecules against apple and nut borer damage showed that Fluxamaetamide 10 EC @0.3ml/L, Chlorantranilliprole 18.5 EC @0.3 ml/L, Broflanillide 20 SC @0.3 ml/L and Lambda cyhalothrin 5 EC @1ml/ L with minimum mean infestation of 60.72, 59.06, 59.05 and 58.62 per cent reduction over control respectively.

Studies on the biology, life table parameters and management of arecanut mites

PARVATI B. MORABAD MAJOR ADVISOR: Dr. K. RAJASHEKARAPPA

Studies on the biology, life table parameters and management of arecanut mites were carried out at the Acarology Laboratory, Zonal Agricultural and Horticultural Research Station, Navile, KSNUAHS, Shivamogga, during 2024-25. Field observations revealed the occurrence of *Raoiella indica* Hirst, *Oligonychu stylus* Baker and Pritchard and *Tetranychus fijiensis* Hirston arecanut, showing distinct seasonal fluctuations influenced by weather conditions. Mite populations reached their peak during May-June 2025 under hot and dry conditions. Correlation analysis showed a positive association with maximum temperature and a negative correlation with rainfall and relative humidity, indicating that warm and dry weather favoured mite multiplication.The predatory mite *Amblyseius largoensis* was the most dominant natural enemy, followed by *Scolothrips asura* and *Stethorus keralicus*, suggesting their role in natural regulation of mite populations. The biology of *T. fijiensis* and *O.tylus* under laboratory condition showed that the total duration from egg to adult was 27.50 ± 1.22 days in females and 21.53 ± 0.35 days in males of *T. fijiensis* and 28.82 ± 0.20 days in females and 18.93 ± 0.37 days in males of *O. tylus*, with mean fecundity of 49.50 ± 3.11 eggs/female in *T.fijiensis* and 50.62 ± 1.13 eggs per female in *O. tylus*. The intrinsic rate of increase (r_o) was 0.1648 ± 0.0067 day^{-1} for *T. fijiensis* and 0.1694 ± 0.0048 day^{-1} for *O. tylus* and the net reproductive rate (R_ϵ) was 26.42 ± 3.25 offspring/female and 33.35 ± 3.14 offspring/female, in *T. fijiensis* and *O. tylus*, respectively. Indicating high reproductive potential. Field evaluation of eight acaricides against *O. tylus* and *T. fijiensis* results revealed that Spiromesifen 22.9 SC @ 0.8 ml/lit. was most effective in reducing total mite population of both the species recorded 5.68 and 3.22 mean number of mite per 2 cm^2 leaflet, respectively, followed by Fenpyroximate 5 SC @ 1.5 ml/lit.and Fenazaquin 10 EC @ 1.8 ml/lit.

Studies on the relative toxicity of acaricides against *tetranychus urticae* koch (ACARI: TETRANYCHIDAE) and its predator, *Neoseiulus longispinosus* evans on tomato

S. SHANTHAKUMAR MAJOR ADVISOR: Dr. K. RAJASHEKARAPPA

Tomato is one of the most important vegetable crop worldwide, but its production is severely affected by insect and non-insect pests, particularly the two-spotted spider mite (*Tetranychus urticae* Koch, Acari: Tetranychidae). In order to control this pest chemical pesticides (acaricides) remain the principal control measure.However, their indiscriminate use leads to resistance and adverse impacts on natural enemies, particularly the predatory mite,*Neoseiulus longispinosus* Evans (Acari: Phytoseiidae). With this background present investigation assessed the relative and residual toxicity against *T. urticae* and *N. longispinosus*. Results revealed that diafenthiuron was the most effective compound, with LC_{50} value of 40.55 ppm for eggs and 4.59 ppm for adult female followed by fenazaquin with LC_{50}values of 58.84 and 47.58 ppm for eggs and adult female, respectively. Whereas, propargite showed moderate toxicity with LC_{50}value of 225.41 ppm for eggs and 278 ppm for adult female, but sulphur and horticultural mineral oil were found to be least effective. Fenazaquin exhibited the highest residual toxicity against *T. urticae* with LT_{50} value of 14.75 days and PT value of 1442.10, followed by propargite (LT_{50}= 13.13 days; PT = 991.04) and diafenthiuron (LT_{50}= 10.57 days; PT = 1102.14).Sulphur and horticultural mineral oil reduced its efficacy with least LT_{50}values of 1.86 and 1.54 days and PT values of 219.15 and 316.48, respectively. For predatory mite, N.*longispinosus* fenazaquin remained the most persistent with LT_{50}value of 9.17 days, while sulphur and horticultural mineral oil were safer with least LT_{50} and PT values.Overall, we can conclude that diafenthiuron and fenazaquin were the most effective acaricides against *T. urticae* management, but their high persistence necessitates judicious use and rotation with acaricides of different modes of action to delay resistance and safeguard predatory mites.

Studies on agriculture drone based insecticides spray for management of rice pests during *rabi* season

A.G. VASANTHALAKSHMI MAJOR ADVISOR: Dr. REVANNAREVANNAVAR

The research entitled “Studies on agriculture drone based insecticides spray for management of rice pests during *rabi* season”was conducted at Zonal Agricultural and Horticultural Research Station (ZAHRS), Brahmavar (Udupi district) during 2024-25.Thrips incidence (*Stenochaetothrips biformis*) was noticed from 15 days after sowing (DAS) whereas leaf folder(*Cnaphalocrocis medinalis*), green leafhopper (*Nephotettix virescens* and *N. nigropictus*), white leafhopper (*Cofana* sp.), blue beetle and hispa were observed from 30 DAS. Thedead heart caused by yellow stem borer (*Scirpophaga incertulas*) and grasshoppers (*Oxyahylahyla, Acridaexaltata*) was noticed from 45 DAS.The maximum incidence of blue beetles, hispa, leaf folder and yellow stem borer was recorded at 60 DAS. Gundhibug (*Leptocorisa lepida*), green leafhopper, white leafhopper, grasshopper and white ears caused by yellow stem borer were noticed from 75 DAS. The white ears symptom and gundhi bug infestation was the highest at 90 DAS. The natural enemies like dragon flies (*Orthetrum sabina* and *Pantala flavescens*), damselflies (*Ischnura aurora* and *Ceriagrion*sp.),coccinellids (*Micraspistenuilinea* and *Brumoides lineatus*), rove beetles and spiders (*Tetragnatha keyserling*) were also noticed during the experimental period.Among insecticide treatments, chlorantraniliprole 18.5% SC @ 0.4 ml/l sprayed through drone was the most effective against stem borer and leaf folder followed by cartap hydrochloride 50 WP @ 1.5 g/l, whereas flupyrimin 10% W/W SC @ 2.6 ml/l was superior against gundhi bug, green leafhopper and white leafhopper. The drone sprayer was the most efficient insecticide sprayer than knapsack sprayer for the pest reduction, saved water and time 91.87% and 75%, respectively. The drone can spray up to 8 hectares per day, whereas knapsack sprayers can spray 2 hectares per day. The net return (₹ 79715/ha) and B:C ratio (2.92) was also higher than knapsack- sprayer (2.23). The higher dosages of insecticide treatments did not cause any phytotoxic effect.

Taxonomy and genetic diversity of *Achaea janata* (L.) (Lepidoptera: Erebidae) from Karnataka

G. YOGITHA MAJOR ADVISOR: Dr. B. C. HANUMANTHASWAMY

The castor semilooper, *Achaea janata* (Linnaeus) (Lepidoptera: Erebidae), is a major defoliator pest of castor and several other crops across tropical and subtropical regions of India. It is known to possess several colour morphs in the larval and adult stage, making it difficult for identification.The present study was carried out to understand the morphological variation and genetic diversity of *A. janata* populations collected across Karnataka. Among all the collected samples, six colour morphs in the larval stage and two morphs in adults were documented. Larval description was made based on external morphology, chaetotaxyand arrangement of crochets. Adult description was made based on the external morphology, male and female genitalia structures, all the samples collected were identified as *Achaea janata*. The mitochondrial cytochrome oxidase I (*mtCOI*) gene was used for molecular identification and analysis of genetic diversity for 13 sequences. The nucleotide composition revealed a high A+T bias (69.71%) and substitution analysis showed a predominance of transitions over transversions. The amino acid profile indicated leucine as the most abundant (24.42%), while cysteine was absent in all sequences. Pairwise genetic distances ranged from 0.0000 to 0.01227, suggesting low genetic divergence among 13 population sequences. Phylogenetic analysis although grouped the Karnataka populations into four clades with high bootstrap support, it is not conclusive that all the clades are regionally aligned. Haplotype analysis yielded 11 haplotypes from 32 sequences, of which eight were from Karnataka, showing higher haplotype diversity (0.80769) compared to populations outside Karnataka. This study provides the first comprehensive taxonomic and molecular data on *A. janata* populations from Karnataka, which highlights the morphological polymorphism and low genetic divergence.

PLANT PATHOLOGY

Studies on early blight of tomato incited by *Alternaria solani* in central dry and southern transition zones of Karnataka

BEERAPPA R. PUJERI — MAJOR ADVISOR: Dr. G. N. HOSAGOUDAR

Arecanut (*Areca catechu* L.) is an important plantation crop grown across India. Among the different states, Karnataka contributing nearly 70 per cent of national production. Recent outbreaks of leaf spot disease caused by different species of *Colletotrichum* have become a major constraint in arecanut production, especially in hilly and coastal regions. Present investigation (2024-25) with respect to isolation, characterization and identification of pathogen along with assessing fungicidal sensitivity test to assess cross resistance, *invitro* and *invivo*. Result revealed the prevalence of different species of *Colletotrichum* across the surveyed area. Pathogenicity of the pathogen confirmed through detached leaf assays method, whereas molecular studies using ITS and species-specific primers *viz*., identified *C. gloeosporioides* as predominant species associated with leaf spot disease. *In vitro* assessment of fungicides revealed that triazoles *viz.,*Tebuconazole, Propiconazole, Hexaconazole were highly effective at 150 ppm achieving more than 85 per cent mycelial inhibition, with no cross-resistance mechanism by the pathogen. Carbendazim showed initial effectiveness, while strobilurins (Azoxystrobin, Trifloxystrobin) exhibited moderate activity, indicating emerging resistance with those fungicides. Multi-siteaction fungicides (Bordeaux mixture, Mancozeb, Copper oxychloride, Copper hydroxide) were generally less effective, however Propineb showed comparatively higher inhibition. Post-exposure assays revealed reduced efficacy of combi-fungicides prior fungicide treatments. In planta studies confirmed the superiority of systemic triazoles and combi-fungicides in disease management, wherein with Tebuconazole + Trifloxystrobin giving maximum suppression of leaf spot compared to others. The study highlights predominance of *C. gloeosporioides* in diseased garden variability in fungicide responses and rising resistance risk in strobilurins. Systemic triazoles and combi-fungicides proved most effective, while contact fungicides remain valuable for resistance management. Integrated use of fungicides, with long term monitoring, resistant variety development and eco-friendly alternatives, is essential for sustainable arecanut leaf spot management.

Fungicidal cross resistance against *pyricularia oryzae* an incitant of blast of rice

M. HARISH REDDY — MAJOR ADVISOR: Dr. B. GANGADHARA NAIK

Rice (*Oryza sativa* L.) is an important staple food for majority of the population across the globe. Rice suffers from many diseases and among them,blast disease caused by *Pyricularia oryzae* is exerting the major threat in rice cultivation. During the study emphasis was given for the collection, isolation, characterization and identification of pathogen along with assessing fungicidal sensitivity to assess possible cross resistance mechanism both *invitro* and *invivo*. Results revealed the presence of pathogenic variability among the isolates collected from different places. Pathogenicity of the pathogen isolates were confirmed through in planta method, whereas molecular studies using ITS and species-specific primers *viz*., actin and calmodulin confirmed *P. oryzae* associated with blast of rice. *In vitro* fungicidal evaluation studies revealed variable efficacy and differential resistance patterns. Prochloraz and Mancozeb completely inhibited mycelial growth, while Kasugamycin and Carbendazim showed reduced activity, indicating emerging resistance. Among systemic fungicides Iprobenfos and Hexaconazole were highly effective. Whereas, combi-fungicides likeTebuconazole + Trifloxystrobin, Azoxystrobin + Difenoconazole and Prochloraz + Tricyclazole achieved complete growth inhibition. Cross-resistance was confined to fungicides sharing similar target sites (*e.g*., MBCs, dithiocarbamates), while no cross-resistance occurred among different chemical classes. In pot culture studies, systemic and combi-fungicides exhibited superior efficacy against rice blast compared to contact fungicides. Tebuconazole + Trifloxystrobin achieved better control, followed by Prochloraz + Tricyclazole. Among systemic fungicides, Hexaconazole was most effective, whereas Mancozeb was least effective, emphasizing the advantage of systemic and combination products for blast management.Present study revealed considerable variation in fungicidal sensitivity among *P. oryzae* isolates by underscoring emerging resistance and cross-resistance patterns. Systemic and combi-fungicides exhibited superior efficacy, while contact fungicides remain essential for rotation and resistance management, highlighting the importance of chemical class rotation for sustainable rice blast management.

Studies on gummy stem blight of watermelon

VISHWANATH LAMANI — MAJOR ADVISOR: Dr. SURESHA D. EKABOTE

Watermelon (*Citrulluslanatus*) is an important commercial cucurbitaceous crop cultivated throughout tropical and subtropical regions, known for its sweet, refreshing fruit rich in essential nutrients like lycopene, b-carotene, citrulline and minerals. However, its cultivation is severely affected by several diseases. Among them, gummy stem blight disease caused by *Stagonosporopsis cucurbitacearum* is considered as major constraint. Watermelon samples showing typical disease symptoms were collected from the districts of Davanagere, Shivamogga and Haveri. The pathogen was isolated from infected samples and confirmed as *S. cucurbitacearum* through pathogenicity test. Cultural studies showed that potato dextrose agar medium and oat meal agar medium supported the best growth and development of the pathogen. Morphological studies indicated that, colonies appeared creamish white, cottony with regular margins and later turned into olive to dark brown or black. Conidia were found to be hyaline, cylindrical, mono-septate, measuring 5.2 to 14.5 µm in length and 3.1 to 5.2 µm in width. Further, molecular characterization using ITS rDNA primer confirmed all three isolates as *S. cucurbitacearum,* showing over 98 per cent of sequence homology. *In vitro* evaluation of fungicides indicated that Propineb 70% WP (89.97%) among contact fungicides, Tebuconazole 45% EC (94.07%) among systemic fungicides and Tebuconazole 50% EC + Trifloxystrobin 25% WG (88.40%) among combi product fungicides, exhibited the highest mean mycelial growth

inhibition. *In vivo* evaluation results revealed that, Tebuconazole 50% EC + Trifloxystrobin 25% WG at 0.05 per cent concentration achieved the highest per cent disease reduction over control (73.02%) and enhanced fruit yield upto 36.76 ton/ha. Screening of ten watermelon genotypes revealed that, DCMLC-6, DCMLC-9, DCMLC-2 and DCMLC-8 exhibited the lowest Per cent Disease Index (40-60 %) and were categorized as moderately resistant genotypes.

Fungicidal cross resistance against *colletotrichum* spp. an incitant of leafspot of arecanut

K. R. MONISHA — MAJOR ADVISOR: Dr. B. GANGADHARA NAIK

Arecanut (*Areca catechu* L.) is an important plantation crop grown across India. Among the different states, Karnataka contributing nearly 70 per cent of national production. Recent outbreaks of leaf spot disease caused by different species of *Colletotrichum* have become a major constraint in arecanut production, especially in hilly and coastal regions. Present investigation (2024-25) with respect to isolation, characterization and identification of pathogen along with assessing fungicidal sensitivity test to assess cross resistance, *invitro* and *invivo*. Result revealed the prevalence of different species of *Colletotrichum* across the surveyed area. Pathogenicity of the pathogen confirmed through detached leaf assays method, whereas molecular studies using ITS and species-specific primers *viz*., identified *C. gloeosporioides* as predominant species associated with leaf spot disease. *In vitro* assessment of fungicides revealed that triazoles *viz.,*Tebuconazole, Propiconazole, Hexaconazole were highly effective at 150 ppm achieving more than 85 per cent mycelial inhibition, with no cross-resistance mechanism by the pathogen. Carbendazim showed initial effectiveness, while strobilurins (Azoxystrobin, Trifloxystrobin) exhibited moderate activity, indicating emerging resistance with those fungicides. Multi-siteaction fungicides (Bordeaux mixture, Mancozeb, Copper oxychloride, Copper hydroxide) were generally less effective, however Propineb showed comparatively higher inhibition. Post-exposure assays revealed reduced efficacy of combi-fungicides prior fungicide treatments. In planta studies confirmed the superiority of systemic triazoles and combi-fungicides in disease management, wherein with Tebuconazole + Trifloxystrobin giving maximum suppression of leaf spot compared to others. The study highlights predominance of *C. gloeosporioides*in diseased garden variability in fungicide responses and rising resistance risk in strobilurins. Systemic triazoles and combi-fungicides proved most effective, while contact fungicides remain valuable for resistance management. Integrated use of fungicides, with long term monitoring, resistant variety development and eco-friendly alternatives, is essential for sustainable arecanut leaf spot management.

MICROBIOLOGY

Development and evaluation of endophytic plant growth promoting rhizobacteria from weed plants for sustainable maize production

ASHISH JAGADISH NAIK — MAJOR ADVISOR: Dr. M. S. NANDISH

The investigations on "Development and evaluation of endophytic plant growth promoting rhizobacteria from weed plants for sustainable maize production" was carried out during 2024-25 at the Department of Microbiology, KSNUAHS, Shivamogga. In the present investigation, as many as 27 endophytic bacteria were isolated from five weed plants (*Parthenium hysterophorus, Chromolaena odorata, Celosia argentea, Lantana camara and Tephrosia purpurea*) collected across cultivated fields of Shivamogga district, Karnataka, India and systematically characterized using morphological, biochemical and molecular approaches. Out of twenty-seven endophytic bacterial isolates, four efficient bacterial isolates *viz., Citrobacter freundii* (SENDO – 5), *Achromobacter xylosoxidans* (SENDO – 6), *Citrobacter braakii* (SENDO – 17) and *Achromobacter insuavis* (SENDO – 27) were selected based on their ability to solubilize nutrients (P, K, Si, Zn), produce phytohormones (IAA, GA, HCN) and suppress phytopathogen (*Exserohilum turcicum*). Further the compatibility studies confirmed their suitability for consortial development and both solid (talc-based) and liquid formulations were developed. Later, pot culture experiments on maize revealed that the100% RDF + liquid formulation of endophytic plant growth promoting bacterial consortia at sowing and solid formulation of endophytic plant growth promoting bacterial consortia at 30 days after sowing, significantly enhanced plant growth parameters, nutrient uptake and yield (89.29 q ha^{-1} and 122.55 q ha^{-1} of grain and stover yield respectively) compared to untreated controls. Notably, the dual application of liquid inoculant at sowing and solid formulation at 30 days after sowing increased maize yield by nearly 20%, while also improving micronutrient assimilation.The study demonstrates that weed-derived endophytic bacteria function as cost-effective, eco-friendly biofertilizers, reducing reliance on chemical inputs and supporting sustainable maize production. Their multifunctional traits enhance nutrient availability, stress tolerance and plant health, providing a strong basis for field validation and broader application in modern agriculture.

Isolation, characterization and evaluation of plant growth promoting methylotrophic bacteria for transplanted rice production

KAVYA C. KADEMANI — MAJOR ADVISOR: Dr. M. S. NANDISH

The investigations on "Isolation, Characterization and Evaluation of Plant Growth Promoting Methylotrophic Bacteria for Transplanted Rice Production" was carried out during 2024-25 at the Department of Microbiology, KSNUAHS, Shivamogga. In the present investigation, 15methylotrophic bacteria were isolated from rhizosphere soil and paddy leaf samples collected from paddy cultivated fields of Shivamogga district, Karnataka, India and systematically characterized using morphological, biochemical and

molecular approaches. Out of 15 methylotrophic bacterial isolates, four efficient bacterial isolates *viz., Methylococcus capsulatus* (SMB – 1), *Methylobacterium indicum* (SMB – 5), *Methylosarcina quisquiliarum* (SMB – 6) and *Methylorubrum extorquens* (SMB – 10) were selected based on their ability to solubilize nutrients (P, K, Si, Zn), produce phytohormones (IAA, GA, HCN) and suppress phytopathogen (*Rhizoctonia solani*). Further the compatibility studies confirmed their suitability for consortial development and both solid (talc-based) and liquid formulations were developed. Later, pot culture experiment on paddy revealed that the 100% RDF + liquid formulation of methylotrophic bacterial consortia as basal dose and at panicle initiation stage (625 ml ha^{-1}), significantly enhanced plant growth parameters and yield (54.78 q ha^{-1}) compared to untreated controls. Notably, the dual application of liquid inoculant as basal and liquid formulation at panicle initiation stage increased paddy yield by nearly 20%, while also improving micronutrient assimilation.The study demonstrates that methylotrophic bacteria served as low-cost technology, eco-friendly biofertilizers, reducing reliance on chemical inputs and supporting sustainable paddy production. Their multifunctional traits enhanced nutrient availability, stress tolerance and plant health, providing a strong basis for field validation and broader application in modern agriculture.

ECONOMICS

Comparative economic analysis of liquid and solid jaggery production in Karnataka

H. P. ANJU — MAJOR ADVISOR: Dr. Y. S. RAMESHA

Jaggery production is an important agro-based enterprise in India providing livelihood and supplementing income to millions of farmers. The study was conducted to analyze the comparative economics of sugarcane cultivation, liquid and solid jaggery production, their marketing and customer preferences in Shivamogga and Mandya districts of Karnataka. The study covered 120 sugarcane farmers, 20 jaggery processing units, and 100 consumers in equal proportion from above districts. The primary data was collected using structured interview schedule. Enterprise budgeting, capital budgeting techniques, conjoint analysis, and marketing efficiency measures were employed. The results indicated that the cost of cultivation was higher in Mandya (₹ 97,937.30/acre) compared to Shivamogga (₹ 88,563.30/acre), while net returns was slightly higher in Shivamogga (₹ 1,02,236.70/acre) compared to Mandya (₹ 1,00,462.70/acre). Solid jaggeryunits required higher investment (₹ 38.81 lakh) compared to liquid jaggery units (₹ 30.00 lakh). Solid jaggery units realized higher gross returns (₹ 2.35 crore) compared to liquid jaggery units (₹ 1.68 crore), but net returns were higher in liquid jaggery units (₹ 59.79 lakh) compared to solid jaggery (₹ 46.02 lakh). The capital budgeting analysis indicated that investment was economically viable in both the cases. Solid jaggery units had higher NPV (₹ 2.24 crore) compared to liquid jaggery (₹ 1.65 crore), Benefit-Cost ratio and Modified internal rate of returns was relatively higher in liquid jaggery units (1.24 and 66%) compared to solid jaggery units (1.20 and 53%). Conjoint analysis highlighted that taste (19.33 per cent) was the most important factor for liquid jaggery, whereas colour (27.23%) strongly influenced solid jaggery preference. Marketing efficiency analysis revealed MC-I (17.40) as the most efficient channel for liquid jaggery and MC-III (10.58) for solid jaggery. The study suggested for establishment of *Joni Bella Park* in Malnad region in line with solid jaggery park at Mandya.

Economic prospects of tender mango (Appemidi) in Malnad region of Karnataka

N. C.ASHIKA — MAJOR ADVISOR: Dr. S. RAVEESHA

Appemidi, the indigenous tender mango variety of Karnataka's Malnad region, is renowned for its unique taste, aroma, and long shelf life, making it highly valued in pickle industry. Despite its cultural and genetic importance, earlier research has focused mainly on biological aspects, while its economic prospects remain underexplored. The present study was undertaken to analyze the economics of Appemidi cultivation, nursery enterprises, pickle processing, consumer preferences, and conservation efforts in the Malnad region. The study was conducted in Shivamogga and Uttara Kannada districts, selected purposively due to the prevalence of Appemidi-based enterprises. A total of 175 respondents were covered, comprising 30 farmers, 10 nursery owners, 5 pickle entrepreneurs, 100 consumers and 30 farmers having Appemidi tree as a natural vegetation. Data were collected using pre-tested interview schedule. Enterprise budgeting, capital budgeting techniques.,value addition analysis, and conjoint analysis were employed to evaluate profitability and consumer preferences. The results revealed that the establishment cost of Appemidi garden was ₹ 1.21 lakh/acre. The annual maintenance costs of ₹ 29,336.29/ acre, yielding profit of ₹ 22,723.66. Mother block maintenance was highly profitable, generating net returns of ₹ 88,345.44/acre. Nurseries emerged as the most lucrative enterprise, with annual net returns of ₹ 9.19 lakh and strong economic viability wit (NPV (₹ 37.21 lakh) BC ratio (1.78), MIRR (70%). Pickle making was also profitable, with net annual returns of Rs.14.06 lakh and BC ratio of 1.65. Value addition analysis showed higher per cent of value addition in Sada Appemidi pickle (94.17%) compared to JeerigeAppemidi pickle (90.63%). Conjoint analysis highlighted taste and appearance (41.84%), price of pickle (24.32%), variety of Appemidi (16.67%) as major factors influencing. Transaction cost in conservation of natural Appemidi vegetation was came to ₹ 4034.12/tree/year, yielding net returns of ₹ 37290.88.

Economic analysis of value chain management of major vegetables in the davangere district of Karnataka

T. B. CHETHANA — MAJOR ADVISOR: Dr. S. RAVEESHA

Vegetable cultivation is one of the most important agricultural enterprises in Karnataka, providing substantial income and employment to rural households. The study was undertaken to analyze the profitability, economic viability, value addition, and marketing efficiency of major vegetables *viz.,* tomato, cabbage, and chilli and to assess the financial feasibility of vegetable nurseries under polyhouse condition. The study was conducted in Nyamathi and Jagalur taluks of Davangere district by selecting by selecting 40 each of tomato,

chilli and cabbage growers vegetable growers, 10 vegetable nursery units, and 20 market intermediaries including commission agents, wholesalers, retailers, and organized buyers such as Reliance Retail Limited and Supermarket. Primary data were collected through personal interviews using a structured schedule. Enterprise budgeting, capital budgeting technique, value chain mapping, Acharya's measure of marketing efficiency, and Garrett's ranking method were employed for the analysis. The results revealed that the average capital investment on vegetable nurseries was ₹ 8.47 lakh per 10 gunta. Investment analysis showed that the nursery enterprises were economically viable, with a Net Present Worth of ₹ 22.60 lakh, Discounted Benefit–Cost Ratio of 1.11, and Modified Internal Rate of Return of 45 per cent. Among the vegetables, the net returns was the highest in chilli (₹ 3,19,784.06/acre), followed by cabbage (₹ 2,56,809.73/acre) and tomato (₹ 1,29,331.53/acre). Value chain analysis revealed that Channel III (Farmers → Reliance → Collection Centre →Supermarket → Consumer) was the most efficient for tomato and cabbage, while Channel II (Farmers → Retailer → Consumer) was more efficient for chilli. Major production constraints were pest and disease incidence, expensive quality seed and labour scarcity, while marketing constraints included price fluctuation, middlemen exploitation, and lack of storage facilities. The study concluded that promoting vegetable nurseries entrepreneurship, strengthening market linkages, and developing cold storage and processing facilities would enhance profitability and sustainability of the vegetable sector in Davangere district.

Economic impact of modern production technologies and e-marketing in sericulture

M. N. RASHI

MAJOR ADVISOR: Dr. Y. S. RAMESHA

The present study was conducted to assess the impact of modern production technologies and e-market in silk cocoon production. For the impact assessment, primary data was collected from 160 farmers drawn from four villages of two taluks of Mandya district. To assess profitability of waste management 30 sample farmers were considered. Enterprise and partial budgeting techniques were employed for impact assessment. Impact of e-tendering on prices and arrivals was assessed considering monthly modal prices of silk cocoon from Ramanagara, Shidlaghatta (e-tendering) and Shirahatti (non-e-tendering) markets for the period of 16 years from 2009-2025 using Difference in Difference model. Cointegration analysis was performed using monthly prices of silk cocoon from 2017-2025 for Kollegala, Shidlaghatta, Ramanagara and Kanakpura markets using Johansen cointegration analysis. The results indicated that high adopters of modern technologies (HAMT) reaped additional profit of ₹ 6.62 lakhs compared to Low adopters of modern technologies (LAMT). HAMT farmers incurred ₹ 166.77 and realized net returns of ₹ 355.50 per kg of cocoon compared to LAMT farmers (cost of ₹ 278.08 and net returns ₹ 215.49 per kg). Farmers reaped net returns of ₹ 10,695.30 from composting of sericultural wastes. The DiD (Difference in Difference) analysis demonstrated the positive impact of e-tendering on prices of silk cocoon at ₹ 85.58 in Ramanagara and ₹ 92.96 in Shidlaghatta compared to Shirahatti. The impact was negative with decline in arrivals of -326.31 and -288.44 in Ramanagara and Shidlaghatta markets, respectively. Excepting Kanakpura, all the markets were found to be integrated. The speed of adjustment of disequilibrium was highest in case of Ramanagara-Kollegala markets. The study advocates policy interventions for adoption of modern technologies through targeted capacity building programme, encouraging systematic composting for wealth generation and expansion of e-tendering to non e-markets by strengthening price integration to ensure transparency and fair pricing.

AGRICULTURAL STATISTICS

Fall armyworm management: A meta-analysis

B. J. BHARATHKUMAR

MAJOR ADVISOR: Dr. H. B. MALLIKARJUNA

The fall armyworm has recently emerged as a serious threat to global agriculture, causing extensive damage to maize and other cereal crops. Considering its rapid spread and severe impact on crop productivity, this study aimed to assess the effectiveness of various fall armyworm management practices through a meta-analysis. Data were extracted from 246 published studies from 2020 to June 2025, of which 67 studies meeting the inclusion criteria were selected for quantitative analysis, comprising 320 individual observations. The meta-analysis was conducted in R software using the meta and meta for packages, with percentage pest reduction as the primary outcome measure. The funnel plot showed a symmetrical distribution of studies, indicating minimal publication bias and reliable pooled estimates, whereas the forest plot revealed considerable heterogeneity due to variations in treatments and experimental conditions. The results indicated significant differences among management strategies, with Integrated Pest Management (IPM) showing the highest pooled effectiveness (90.48%), followed by chemical control (73.53%), while biological (64.52%), cultural (63.95%), and mechanical (58.07%) strategies exhibited moderate effectiveness. Within chemical control, the combination of Emamectin Benzoate + Lufenuron 400 g/L achieved the highest pest reduction (91.44%), followed by Deltamethrin (89.20%), Spinetoram (84.54%), Chlorantraniliprole 18.5 SC (82.50%), and Spinosad 45% SC (79.33%). Moderate to lower effectiveness were recorded for Lufenuron 5% (77.35%), Lambda Cyhalothrin 5% EC (76.71%), and Chlorpyrifos (69.21%), while Novaluron 10% EC (58.72%), Cypermethrin (52.12%), and Flubendiamide (49.44%). Overall, the meta-analysis highlighted that IPM remains the most effective and sustainable approach, integrating high-efficacy pesticides with biological and cultural methods for long-term fall armyworm management and sustainable crop productivity. The findings provide, evidence-based recommendations for policymakers, farmers and researchers to developeffective management strategies and make informed decision.

Statistical analysis of dynamics in bovine population of Karnataka

PRATHVIRAJ Y. RATHOD — MAJOR ADVISOR: Dr. BASAVARAJ I. HALINGALI

Karnataka ranks ninth in India in terms of bovine population and milk production. In recent years, composition of bovine population has undergone notable changes due to factors such as labour shortages, reduced grazing lands and limited fodder availability. The study assessed dynamics in bovine population, trends and instability in milk production, decomposition of milk production, factors driving transition in bovine composition and the economics of milk production thereof. Secondary data on bovine population and milk production was collected from Livestock Census reports of 1997, 2003, 2007, 2012 and 2019. Growth rate of bovine population and milk production were estimated for indigenous, crossbred and buffalo using selected best trend model *viz*, linear, exponential, logarithmic, quadratic, cubic and polynomial. Decomposition analysis was performed to decipher the effects of population and productivity on milk production. Further, the study also identified the factors responsible for transition in bovine composition. The results indicated a significant decline in indigenous cattle and buffalo population in most of the districts, while crossbred cattle population increased steadily in 13 districts at an exponential rate. The decomposition analysis indicated that productivity has led to increased milk production in indigenous cattle in several districts, while for crossbred cattle number of animals has paved a way for increased production. In case of buffaloes mixed contribution was observed. Economic, biological, infrastructural, institutional and utility factors were identified as the major factors influencing transition in bovine composition. The economic analysis of milk production across transition type indicated that rearing of crossbred cattle was more profitable compared to indigenous cattle. The decline in indigenous breeds has raised concern about sustainability and genetic diversity. Hence, policies to sustain genetic diversity by conserving local/indigenous breeds simultaneously by improving productivity need to be formulated.

Crop diversification in Shivamogga district: A spatio-temporal analysis

T. H. VINAYAK — MAJOR ADVISOR: Dr. H. B. MALLIKARJUNA

This study examines two decades of cropping dynamics and diversification in Shivamogga district, Karnataka (2003–04 to 2022–23), employing a mixed analytical framework across seven taluks. Temporal shifts in cropped area were quantified using Compound Annual Growth Rates (CAGR), while inter-crop land reallocation was analyzed through Markov Chain analysis. The extent of diversification was assessed using the Simpson Index (SI), Entropy Index (EI) and Herfindahl Index (HI). Determinants were identified using a Tobit model on primary data collected from 100 farmers (50 each in Shivamogga and Soraba taluks). Perceived constraints and motivators were prioritized using the Garrett ranking technique. Results indicate a district-wide, statistically significant expansion of arecanut in most of the taluks, contrasted by persistent declines in sugarcane and paddy. Maize and fruits have taluk-specific, mixed trajectories, reflecting structural shifts toward perennial and high-value crops. Diversification patterns varied across taluks: Hosanagara, Sagar, and Soraba showed increasing SI/EI and declining HI (indicating greater diversification), whereas Bhadravati and Shivamogga trended toward specialization, reflected by falling SI/EI and rising HI. District-level indices peaked around 2020–21, followed by modest re-concentration by 2022–23. The Tobit estimation revealed context-specific drivers of farm diversification across two taluks. In Shivamogga, diversification was increased significantly with education, landholding size and irrigation access. Conversely, higher farm income significantly reduced diversification, indicating a income-led specialization pattern in this region. The drivers in Soraba were distinct: older age significantly reduced diversification, whereas greater on-farm family labor enhanced it. The overall model fit was statistically highly significant. Garrett rankings identified labour scarcity and poor price realization as the top constraints in both taluks, while family food security, risk minimization and higher returns were the primary motivators.

AGRICULTURAL EXTENSION EDUCATION

Impact assessment of integrated farming system on beneficiary farmers

AASHITA — MAJOR ADVISOR: Dr. BASAVARAJ BEERANNAVAR

The present study was conducted in Davanagere and Shivamogga districts during 2024-25, to assess the impact of Integrated Farming System on beneficiary farmers. A total of 160 respondents were selected, consisting of 80 beneficiary and 80 non-beneficiary farmers from both the districts. The results revealed that the majority of beneficiary farmers (53.75%) and non-beneficiary farmers (47.50%) had medium level of knowledge. The increase in the yield of paddy and vegetables was highly significant compared to non-beneficiary farmers. Nearly half of the beneficiaries (45.00%) had grown three to five crops in a cropping year whereas only 31.25 per cent of non-beneficiaries had two crops in a year. Significant difference in cropping intensity, employment generation, organizational participation and self-sufficiency could be observed with beneficiary farmers of IFS compared to non-beneficiary farmers. Among the beneficiary farmers 38.75 per cent had an enterprise combination of Agriculture+ Horticulture + Livestock + Bee-keeping+ Silviculture and in contrast the maximum number of non-beneficiaries (63.75 %) had Agriculture only. It was observed that 41.25 per cent of beneficiary farmers possessed three to five livestock animals and only 35.00 per cent of them had more than five livestock. With respect to adoption of IFS practices 76.25 per cent of beneficiaries hadadopted selection of site followed by fish farming (72.50%), maintenance of livestock health and hygiene (71.25%). Extension contacts and economic motivation were highly significantly associated with adoption level. Major constraints were fluctuations in the prices of agricultural commodities with garret mean score of 54.82 followed by pest and disease outbreaks (53.57). Setting up of direct market linkages and forming cooperatives (77.50%) and providing technical guidance on plant protection measures (73.75%) were the important suggestions given by beneficiary farmers.IFS had a positive impact on the productivity and livelihood of beneficiary farmers.

A study on socio-economic prospects of agricultural startups in Karnataka

A.THIPPESH — MAJOR ADVISOR: Dr. S. SAHANA

Agricultural startups in Karnataka have emerged as a promising avenue for revitalising the rural economy and fostering sustainable agricultural development. This study examines the socio-economic prospects of agricultural startup entrepreneurs in the state. Snowball sampling technique was used to select 40 agricultural startup entrepreneurs. Entrepreneurial behaviour was assessed on eight components using acceptable scales. Among the eight components of entrepreneurial behaviour, entrepreneurial creativity was ranked first with a mean score of 82.14. Entrepreneurial behaviour index was developed by using factor analysis indicated that 42.50 per cent of entrepreneurs possessed very high level and 17.50 per cent had very low level of entrepreneurial behaviour. The social performance of entrepreneurs was assessed by taking five indicators among which standard of living was the prime factor with a mean score of 5.00. The economic performance of agricultural startups revealed that ventures dealing with farm inputs achieved the highest benefit-cost ratio of 2.05, while startups engaged in farm mechanization recorded the lowest benefit-cost ratio (1.02). Most of the startups (37.50%) generated employment in the range of 5 to 10 workers per year. SWOC–AHP analysis indicated that strength of the startups emerged as crucial factor with group priority value of 0.44 among the SWOC components followed by opportunities (0.29), challenges (0.15) and weaknesses (0.12). Financial constraint was identified as the most pressing issue with a mean score of 3.16, followed by marketing (2.74) and technological constraint (2.28). Easy availability of loans and funds (95.00%) and improved infrastructure facilities (92.20%) were the crucial suggestions offered by entrepreneurs. In order to improve the entrepreneurial behaviour from moderate to high level suitable capacity building program has to be organised. To foster startup culture, policies enabling ease of doing business like reduced taxes, provision of production subsidies need to implement.

Study on technology gap of cashew nut cultivation

H. G. SWAROOP — MAJOR ADVISOR: Dr. T. H. GAJENDRA

The present study was carried out to analyze the technological gap and knowledge level of cashew farmers in traditional (Dakshina Kannada) and non-traditional (Chitradurga) cashew growing districts of Karnataka. A total sample of 180 cashew growers (90 from each district) were selected using a purposive sampling method. The findings revealed considerable technological gaps in both locations, although trends differed based on the level of commercialization and agro-climatic suitability. In Dakshina Kannada high adoption was observed for timely planting (96.67%), grafted planting material (100%) and pit size (100%). However, high technological gaps existed in fertilizer dosage (71.11%), spacing (64.44%), plant population (64.44%), irrigation (87.77%) and split fertilizer application (91.11%). On the contrary, Chitradurga farmers reported high adoption of the Vengurla varieties (94.45%), closer spacing (92.23%) and irrigation (73.34%) owing to commercial plantation trends. Yet, the district showed substantial high gaps in fertilizer dosage (61.61%) and disease management (77.77%). Overall knowledge assessment indicated that (42.22%) farmers in Dakshina Kannada and in Chitradurga had a medium knowledge level. Higher awareness was recorded in nursery management and nutrient management in Dakshina Kannada, while Chitradurga farmers demonstrated relatively better knowledge in land preparation, marketing, and pest control practices.The major production constraints perceived by farmers were the non-availability of Tea Mosquito Bug resistant varieties (Garrett score 54.92), labour shortage (53.05), lack of knowledge on canopy and nutrient management, inadequate advisory services and poor storage and processing facilities. Suggested solutions included development and supply of pest-resistant varieties (80.00%), provision of timely advisory services (73.50%), pest awareness programs (61.75%) and improvement in storage infrastructure (59.50%). The study recommends concentrated research need to be taken on development of tea mosquito bug resistant variety. Strengthening extension services, improving access to quality inputs, capacity building and institutional support (insurance, pest surveillance, diversification) are key to sustainable cashew cultivation.

HORTICULTURE

Impact of different sources of nutrition and plant growth promoting rhizobacteria (pgpr) on growth, yield and quality of cucumber (*Cucumis sativus* L.) under naturally ventilated polyhouse

DUMSAPURAM SARIKA REDDY — MAJOR ADVISOR : Dr. B. HEMLANAIK

An experiment was conducted during *kharif*2025 at College of Agriculture, KSNUAHS,Shivamogga, to study the impact of different sources of nutrition and Plant Growth Promoting Rhizobacteria (PGPR) on growth, yield and quality of cucumber under naturally ventilated polyhouse conditions. The experiment was laid out in Randomized Completely Block Design(RCBD) with eleven treatments and replicated thrice. Treatments includedabsolute control, 100% Recommended Dose of Fertilizer (100:60:60 NPK kg ha^{-1}), varying levels of nitrogen (80%, 75%, 70%) and combinations of recommended dose of nitrogen with Areca husk compost orVermicompost (on N equivalent basis) along with PGPR consortia.The treatment received 80% recommended dose of nitrogen + 20% through Vermicompost on N equivalent basis (13 t/ha) + PGPR consortia showed significantly higher vine length (361.67 cm), vine girth (12.13 mm), number of leaves (37.73), internodal length (12.25 cm),branches per vine (11.97), chlorophyll content (47.40), net assimilation rate (0.01442 g dm^{-2} day^{-1}), crop growth rate (3.11 g m^{-2} day^{-1}), minimum days to flower bud initiation (32.33), days for 50% flowering (36.67), node at which 1st flower formed (4.03), number of female flowers (18.39), days for 1st harvest (39.04), number of fruits per vine (9.65), fruit length (15.35

cm), fruit diameter (4.33 cm), fruit weight (191.67 g), fruit yield per vine (1.85 kg), per plot (36.93 kg), per 1000 m^2 (30.47 q) and per hectare (304.73 q), total soluble solids (3.66^{0}Brix), ascorbic acid (8.41mg/100 g), shelf life (8.09 days), and soil nutrient status with higher organic carbon (0.75%), available N, P_2O_5 and K_2O (292.86, 66.33 and 211.38 kg ha^{-1}), total bacteria, fungi and actinomycetes (124.21, 40.08 and 18.65cfu g^{-1} soil). Higher net returns (₹ 1,53,286.7 per 1000 m^2) and BCR (2.69) were recorded. Fruit yield increased by (14.68%) with (20%) reduction in nitrogen usage over 100% recommended dose of nitrogen.

Heterosis and combining ability studies for yield and quality traits in tomato (*Solanum Lycopersicum* L.)

J. SANJANA — MAJOR ADVISOR: Dr. D. THIPPESHA

Tomato is one of the most popular and widely grown vegetable crops next to potato. The present demand for tomato is based on industrial requirement and consumer's preference. The present investigation focused on "Heterosis and Combining Ability Studies for Yield and Quality Traits in Tomato". The experiment was laid out in RCBD design. Employing eight parents in half- diallel fashion to generate 28 hybrids. They were planted during January 2025 with two replications to identify the better performing hybrids. Analysis of Variance (ANOVA) revealed highly significant genetic variability among the genotypes for all 15 traits. The combining ability analysis showed that both additive (GCA) and non-additive (SCA) gene actions contributed to trait expression, with a predominance of non-additive effects for most yield and quality parameters, confirming the potential of heterosis breeding. Parents with high GCA effects were identified as key donors for multiple desirable traits. 'KashiVishesh' emerged as a good general combiner for yield, ascorbic acid and firmness, while 'Krishnaprabha Bhari' showed potential for improving lycopene content and fruit size. Significant heterosis was observed for several traits, with the hybrid KashiVishesh × KashiAdarsh recording the highest fruit yield per hectare (85.71 t/ha) and demonstrating superior SCA for key yield components. Furthermore, the cross KashiVishesh × Krishnaprabha Bhari was notably superior for quality, recording the highest lycopene content. Other crosses such as KashiAdarsh × Krishnaprabha Shalmala and RFTS-1 × KrishnaprabhaTunga also exhibited desirable SCA effects for yield and nutritional parameters. The predominance of non-additive gene action in these crosses confirmed that hybrid breeding is the most effective strategy for exploiting their potential. The findings of this study demonstrate that tomato improvement can be effectively achieved through heterosis breeding, particularly by exploiting crosses with high SCA and parents with strong GCA effects. The hybrids KashiVishesh × KashiAdarsh, KashiAdarsh × KrishnaprabhaShalmala, and KashiVishesh × Krishnaprabha Bhari stand out as the most productive and nutritionally superior combinations

B. HORTICULTURE

VEGETABLE SCIENCE

Performance of potato (*Solanum tuberosum* L.) clones for growth, yield and quality

S. DEVIKA — MAJOR ADVISOR: Dr. V. SRINIVASA

The study was undertaken to evaluate fifteen genotypes of potato with Kufri Himalini as a check for growth, yield and quality traits at AICRP on Potato, Horticulture Research and Extension Centre, Somanahallikaval during the year 2024-25. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications during the *kharif* and *rabi* seasons. The highest tuber length (8.70 cm and 8.50 cm), tuber weight (118.83 g and 112.33 g), number of tubers per plant (9.23 and 8.00), tuber yield per plant (822.15 g and 640.17 g), total tuber yield per plot (13.67 kg and 12.09 kg), total tuber yield per hectare (18.99 and 16.79 t/ha) and marketable yield per hectare (17.10 t/ha and 15.65 t/ha) was recorded in the genotypes P-1 and P-7 respectively during *kharif* and *rabi* seasons respectively. For the quality parameters C-17 and P-7 recorded highest TSS (7.80^o Brix and 7.40^o Brix), total sugars (2.78% and 2.58%) vice versa for tuber dry matter (24.40% and 24.75%) and starch content (24.00% and 22.70%) during *kharif* and *rabi* seasons respectively. Overall, P-1 and P-7 were identified as elite genotypes for yield and quality traits. Path coefficient analysis for total tuber yield per plot showed that during *kharif* season, germination percentage, plant height at 75 DAP, leaf area per plant at 75 DAP, plant spread EW at 75 DAP, plant spread NS 75 DAP and tuber weight and during *rabi* season germination percentage, plant height at 75 DAP, leaf area per plant at 75 DAP, plant spread EW at 75 DAP, plant spread NS 75 DAP, tuber circumference and tuber weight had positive direct effect at genotypic level suggesting the possibility of increasing tuber yield per plot by selecting these traits directly for further crop improvement.

Development and evaluation of F hybrids for growth and yield attributes in okra (*Abelmoschu sesculentus* L.)

N. M. PALLAVI — MAJOR ADVISOR: Dr. PRAKASH KERURE

The present investigation on "Development and Evaluation of F Hybrids for Growth and Yield Attributes in Okra (*Abelmoschus esculentus* L.)" was carried out at the College of Horticulture, Hiriyur, Chitradurga during *kharif* 2024–25. The study aimed to estimate heterosis and combining ability through a line × tester mating design. Nine lines and three testers were crossed to generate twenty-seven F hybrids, which along with their parents and standard checks (NS7774 and Arka Nikitha), were evaluated in a randomized block design with three replications. A total of thirteen characters related to growth, earliness, yield, and quality were studied. The analysis of variance revealed highly significant differences among genotypes, parents, and hybrids for most traits, confirming the presence of sufficient

genetic variability. Heterosis analysis indicated that several hybrids exhibited significant heterosis over standard checks in desirable directions. Among the hybrids, $L_5 \times T_2$ and $L_4 \times T_2$ recorded maximum heterosis for plant height, while $L_7 \times T_3$ and $L_2 \times T_2$ were superior for earliness traits. The hybrid $L_3 \times T_2$ performed exceptionally well for number of fruits per plant, average fruit weight, total yield per plant, and chlorophyll content, while also registering reduced crude fibre content. In addition, $L_2 \times T_3$ and $L_7 \times T_3$ excelled for fruit length, whereas $L_6 \times T_1$ and $L_2 \times T_3$ were superior for fruit diameter. Combining ability analysis revealed that both general combining ability (GCA) and specific combining ability (SCA) variances were significant for nearly all traits, highlighting the importance of both additive and non-additive gene actions. Parents L_3, L_2, L_6, and L_7 were identified as good general combiners, while crosses such as $L_3 \times T_2$, $L_1 \times T_1$, and $L_7 \times T_3$ expressed favorable SCA effects. Overall, hybrids F_5-AP-2-1-13 × PhuleVimuktha, F_5-CP-67-3-21 ×Arka Anamika, F_5-AP-77-7-29 ×Arka Anamika, and F_5-BP-145-20-31 ×Parbhani Kranti were identified as promising for growth, yield, and quality attributes, and hold potential for direct commercial cultivation as well as future heterosis breeding programmes.

Development of F_1 hybrids in bitter gourd (*Momordica charantia* Linn.) for hill zone of Karnataka

SUSHMA ASHOK CHOUGULE — MAJOR ADVISOR: Dr. DEVARAJU

The present investigation entitled "Development of F_1 Hybrids in Bitter Gourd (*Momordica charantia* Linn.) for Hill Zone of Karnataka" was conducted during 2024-25 at the Department of Vegetable Science, College of Horticulture, Mudigere. Twenty one F_1 hybrids were developed by crossing seven lines with three testers in a Line × Tester mating design and evaluated along with their parents and standard check (Phule Green Gold) in a Randomized Complete Block Design with three replications. Analysis of variance revealed significant differences among genotypes for most traits, confirming adequate genetic variability. Considerable standard heterosis was observed for yield and quality traits. Positive and significant heterosis was recorded for vine length at 30 DAS (51.96%), fruit length (74.79%), fruit diameter (74.81%), number of fruits per vine (55.62%), fruit yield per vine (80.00%), estimated fruit yield per hectare (68.99 %), ascorbic acid content (25.50%) and dry matter content (21.39%). Earliness was associated with significant negative heterosis for node at first male flower appearance (–53.77%), node at first female flower appearance (–35.99%) and days to first harvest (–10.53%). The hybrid Kashi Urvashi × Pusa Aushadhi was most promising, showing the highest heterosis for yield (80.00 % per vine and 68.99 % per hectare) along with superiority in quality traits. Among parents, KashiUrvashi, Arka Harit and Pusa Aushadhi were good general combiners, while Kashi Urvashi × Pusa Aushadhi and Arka Harit × PusaAushadhi were superior specific combiners. Predominance of additive gene action, indicated by higher general combining ability variance over specific combining ability, suggested that these promising hybrids can be effectively utilized for genetic improvement of bitter gourd for yield, earliness and quality traits.

Evaluation of advanced breeding lines of tomato (*Solanum lycopersicum* L.) under protected condition

A. PRAPTHI — MAJOR ADVISOR: Dr. V. SRINIVASA

The present investigation was undertaken to assess the performance, genetic variability and resistance to bacterial wilt disease in twenty advanced breeding lines of tomato (*Solanum lycopersicum* L.). The study was conducted at the College of Horticulture, Mudigere under protected condition and the Agriculture and Horticulture Research Station, Sringeri during 2024-25. The evaluation of advanced breeding lines was carried out in a Randomized Complete Block Design (RCBD), while the screening against bacterial wilt was laid out in a Completely Randomized Design (CRD) with three replications. Standard check varieties, namely ArkaVikas, Pusa Ruby and Arka Abhed were included for comparison. Analysis of variance showed significant differences among the genotypes for all the traits studied. High Genotypic Coefficient of Variance and Phenotypic Coefficient of Variance were recorded for number of branches at 30, 60 and 90 DAT (Days After Transplanting), number of locules per fruit, â-carotene, titrable acidity and non reducing sugars. High heritability (>60 %) coupled with high genetic advance (>20 %) as per cent over mean was observed for plant height at 60 DAT, number of branches at 30, 60 and 90 DAT, days to first flowering, fruit yield per plant, average fruit weight, number of locules per fruit chlorophyll a, b and total chlorophyll, lycopene, â-carotene, titrable acidity, non reducing sugars and shelf life. Results indicate the predominance of additive gene action, suggesting that direct selection would be effective for improving these traits. Among the lines minimum bacterial wilt was observed in CHMT-3 and CHMT-20 and maximum in CHMT-1, CHMT-7, CHMT-8, CHMT-5, CHMT-17, CHMT-9, CHMT-10, CHMT-11 and CHMT-2. Based on the performance for growth and yield attributes, the lines such as CHMT-1, CHMT-4 and CHMT-20 were found superior for most of the traits while CHMT-3 and CHMT-20 showed notable resistance. Hence, these lines can be used for future crop improvement programme.

Heterosis and combining ability studies in sponge gourd (*Luffa cylindrica* L.)

D. R. SINDHU — MAJOR ADVISOR: Dr. DEVARAJU

The present investigation entitled "Heterosis and Combining Ability Studies in Sponge Gourd (*Luffa cylindrica* L.)" was carried out at the experimental block, Department of Vegetable Science, College of Horticulture, Mudigere during 2024-25. Twenty one F hybrids were developed by crossing 7 lines with 3 testers in a Line × Tester mating design. These hybrids along with their parents were evaluated in a Randomized Complete Block Design (RCBD) with three replications. The mean sum of squares due to different sources of variation showed significant differences for most of the traits studied. Heterosis over the standard check (Kashi Sowmya) was observed desirable and significant for several traits including vine length at 90 DAS (26.17%), days to first female flower appearance (-20.20%), average fruit weight (8.80%), fruit length (22.94%), fruit yield per vine (51.61%) and crude fiber content (-26.78 %). The cross KRCCH-6 × PusaChikni expressed the highest positive standard heterosis of 20.91 per cent for estimated fruit yield per hectare and 10.39 per cent for number of seeds per fruit. Among the ten parents studied, KRCCH-6, Pusa Sneha and Pusa Chikni

emerged as good general combiners for days to first female flower appearance, fruit length, fruit diameter and fruit yield per vine. The hybrids KRCCH-6 × Pusa Chikni, Pusa Sneha × Pusa Chikni and KRCCH-5 × Kashi Divya were identified as superior specific combiners for vine length at 90 DAS, fruit diameter, fruit yield per vine and fruit yield per plot. The predominance of additive gene action was evident as variance due to general combining ability (GCA) was greater than that of specific combining ability (SCA). The promising heterotic hybrids identified in this study hold potential for genetic improvement of sponge gourd through the exploitation of transgressivesegregants for yield and other economic traits in future generations.

Evaluation of ivy gourd (*Coccinia grandis* L.) genotypes for growth, yield and quality under hill zone of Karnataka

M. NETHRAVATHI — MAJOR ADVISOR: Dr. P. UMAMAHESWARAPPA

The present investigation entitled "Evaluation of ivy gourd (*Coccinia grandis* L.) genotypes for growth, yield and quality under hill zone of Karnataka" was conducted at experimental block, College of Horticulture, Mudigere during the year 2024-25. The study involved sixteen ivy gourd genotypes evaluated in a Randomized Complete Block Design (RCBD) with three replications to ascertain extent of variability, heritability and genetic advance for yield and yield attributing traits. Analysis of variance revealed highly significant differences were observed among the genotypes and characters studied. The high heritability coupled with high genetic advance as per cent mean was observed for vine girth, petiole length, number of secondary branches, node at first female flower appears, days to first female flowering, days to fifty per cent flowering, days to first fruit set, days to first fruit harvest, fruit length, number of fruits per vine, fruit yield per vine, fruit yield per hectare, TSS and ascorbic acid reflect that additive gene action plays a predominant role in their expression. Association studies showed that fruit yield per vine showed a highly significant and positive relationship with vine length, internodal length, number of primary branches, fruit length, fruit volume, average fruit weight, number of fruits per vine, total chlorophyll content and carotenoid content. Path analysis revealed that number of fruits per vine exerted the highest positive direct effect on fruit yield per vine, followed by fruit volume, fruit length, average fruit weight and fruit diameter suggesting these as key yield-contributing characters. Based on the mean performance, genotypes Malur local selection, Hoskote local selection and have been identified as promising for higher yield, which can be utilized for the further crop improvement programme under the hill zone of Karnataka.

Studies on combining ability and heterosis through diallel cross in Okra (*Abelmoschu sesculentus* L.) under hill zone of Karnataka

VIDYA C. KOUJALAGI — MAJOR ADVISOR: Dr. P. UMAMAHESWARAPPA

The present investigation entitled "Studies on combining ability and heterosis through diallel cross in okra (*Abelmoschus esculentus*L.) for Hill Zone of Karnataka" was conducted during 2024-25 at the Department of Vegetable Science, College of Horticulture, Mudigere. Ten F_1 hybrids were developed by crossing five genotypes in a half diallel mating design and evaluated along with their parents and standard check (Arka Nikita) in a Randomized Complete Block Design with three replications. Analysis of variance revealed significant differences among genotypes for most traits, confirming adequate genetic variability. Considerable standard heterosis was observed for yield and quality traits. Positive and significant heterosis was recorded for plant height at 30 DAS (16.93%), fruit length (22.80%), fruit diameter (20.04%), average fruit weight (23.97%), number of fruits per plant (24.00%), fruit yield per plot (68.53%), estimated fruit yield per hectare (51.92%), number of ridges per fruit (13.72%) and total chlorophyll content (70.00%). Earliness was associated with significant negative heterosis for days taken for first flower bud initiation (-12. 42%), days taken for 50 per cent flowering (-14.24%) and days to first fruit harvest (-9.55%). The hybrid Siddapur local 2 × Arabhavi local was most promising, showing the highest heterosis for yield (88.69% per plant, 68.53% per plot and 51.92% per hectare) along with superiority in quality traits. Among parents, Siddapur local 2 and Arabhavi local were good general combiners, while Siddapur local 2 × Arabhavi local, Sirsi local 1 × Siddapur local 2 and Halubhendi × Siddapur local 2 were superior specific combiners. The greater magnitude of general combining ability variance over specific combining ability indicates the predominance of additive gene action, implying that these superior hybrids can be efficiently used for enhancing yield, earliness and quality traits in okra.

FLORICULTURE AND LANDSCAPING

Performance studies on dracaena for growth, quality and yield of cut foliage under hill zone of Karnataka

D. U. GAGANA — MAJOR ADVISOR: Dr. S. Y. CHANDRASHEKHAR

An experiment entitled "Performance studies on Dracaena for growth, quality and yield of cut foliage under hill zone of Karnataka" was carried out at the experimental block of Department of Floriculture and Landscaping, College of Horticulture, Mudigere, under Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga during 2024 -2025. The experiment was conducted in Randomized Complete Block Design with 13 species *viz*., *Dracaena reflexa, Dracaena warneckii*, *Dracaena sanderiana, Dracaena marginata*"Green",*Dracaena marginata*"Red", *Dracaena terminalis*"Mahatma", *Dracaena terminalis*"Green",*Dracaena massangeana*, *Dracaena fragrans*, *Dracaena surculosa*"Gold dust", *Dracaena terminalis*"My Darling yellow", *Dracaena deremensis*"Limelight" and *Cordyline fruticosa* which were replicated thrice. Among the species, *Dracaena terminalis*"Mahatma" recorded the maximum plant height (119.60 cm), plant spread in E-W (75.10 cm) and N-S (78.50 cm), internodal

length (4.13 cm), leaf length (46.26 cm), leaf width (9.26 cm), leaf area per plant (9798.66 cm^2) leaf area index (15.66), petiole length (12.60 cm), fresh weight (6.10g) of leaf and also observed the maximum number of leaves per plant (36.50), number of shoots per plant (5.00), chlorophyll a, b, total chlorophyll and carotenoid content (0.99, 0.56, 1.55 and 0.27 mg/g fresh weight, respectively), shelf life (12.30 days), vase life (19.16 days) and B:C ratio (3.88). The results suggest that *Dracaena terminalis*"Mahatma" was a promising species for growth, quality and yield of cut foliage in hill zone of Karnataka. The *Dracaena terminalis* "Mahatma" recorded maximum leaf fresh weight (3.29 g), relative fresh weight (61.40%), cumulative water uptake (25.46g) vase life (24.40 days) and minimum physiological weight loss (1.50 g) for treatment of 6% sucrose + 50 ppm aluminium sulphate

Analysis of genetic diversity of petunia (*Petunia hybrida* Vilm.) genotypes for morpho-physiological and seed yield attributes

C. IMPANA

MAJOR ADVISOR: Dr. S. Y. CHANDRASHEKHAR

An experiment entitled "Analysis of Genetic Diversity of Petunia (*Petunia hybrida* Vilm.) Genotypes for Morpho-Physiological and Seed Yield Attributes" was conducted at the College of Horticulture, Mudigere (KSNUAHS, Shivamogga) during 2024-25. The experiment was laid out in Randomized Complete Block Design with 20 genotypes *viz.,* Petunia Debonair Black Cherry, Petunia Dreams, Petunia Daddy Peppermint, Petunia Dreams Picotee, Petunia Red Picotee, Petunia Rose Picotee, Petunia Daddy, Tritunia Star, Petunia Mirage Star, Supercascade Black Berry, Supercascade Burgundy, Petunia Lime Bicolor, Petunia Black, Supercascade Red, Supercascade Blue, Supercascade Pink, Supercascade Rose, Supercascade White, Petunia Debonair Lime Green and Supercascade Green and replicated thrice. The results revealed that Supercascade Green exhibited maximum number of leaves per plant (158.78), number of branches per plant (19.80), leaf length (5.97 cm), leaf breadth (4.02 cm), leaf area (13.50 cm^2/plant), minimum days to flower bud initiation (31.89), days taken to flower opening (6.78), longest flowering duration (91.00), number of capsules (22.56), capsule length (0.73 cm), capsule diameter (0.49 cm), capsule yield per plant (2.97 g), capsule yield per plot (9.12 g), number of seeds per capsule (71.33), seed weight per capsule (17.90 mg), seed yield per plant (1.18 g) and test weight (0.105 g), while Petunia Black showed maximum plant height (28.13 cm) and plant spread in East-West direction (35.66 cm) and maximum days to 50 per cent flowering (54.00). High heritability coupled with high genetic advance were observed for all the characters studied, except leaf length, leaf width, duration of flowering, chlorophyll a, total chlorophyll, days taken for flower bud initiation, plant spread, days taken for flower opening and days taken for 50 per cent. Correlation and path analysis showed that seed yield per plant was strongly influenced by growth, flowering, flower quality and seed yield attributes. Among the genotypes under study, the best performing in order of merit are Supercascade Green, Petunia Black and Supercascade Pink.

Fertigation studies on growth and yield of cut chrysanthemum (*Dendranthema grandiflora* Tzvelev.) under protected cultivation

MAHAMMAD ATIF

MAJOR ADVISOR: Dr. P. HEMANATH KUMAR

Chrysanthemum is a globally important cut flower, valued for its diverse forms, vibrant colours and extended vase life. Optimizing its cultivation practices is vital to enhance commercial production for meeting the growing market demand. A study was conducted during 2024–25 at the Department of Floriculture and Landscaping, College of Horticulture, Mudigere, KSNUAHS, Shivamogga to investigate the effect of different fertigation levels on growth, flowering and yield of cut chrysanthemum cv. 'Arctic Queen' under protected cultivation. The experiment was laid out in a Randomized Block Design with seven treatments (T_1–T_7) comprising varying percentages of the recommended dose of fertilizers (RDF) for N:P, O… :K, O, ranging from 70 per cent RDF (94:101:195 kg/ha) in T_1 to 160 per cent RDF (217:285:418 kg/ha) in T_7 with three replications. Pooled data across two seasons revealed that T_7 (160% RDF) significantly outperformed other treatments, recording the maximum plant height (118.59 cm), plant spread in N–S (23.91 cm) and E–W (24.00 cm) directions, internodal length (5.73 cm), stem girth (5.42 mm), leaf area (5.71 cm^2) and chlorophyll content (1.60 mg/g fresh weight). T_7 also resulted in enhanced floral and yield traits with the earliest bud initiation (52.64 days), flower opening (72.71 days) and 50 per cent flowering (74.67 days) coupled with maximum flowering duration (10.02 days), flower diameter (7.65 cm), stalk length (107.35 cm), fresh weight of flower stalk (86.64 g), number of flowers per stalk (8.75) and vase life (13.66 days). Economic analysis revealed the highest benefit–cost ratio of 3.55 and 3.35 during the first and second seasons respectively, in T_7. In contrast, T_1 (70% RDF) recorded the lowest values for most of the parameters. The findings demonstrate that fertigation with (160%) RDF substantially improves growth, yield and profitability of cut chrysanthemum cv. 'Arctic Queen' under protected cultivation which can be further recommended to the farmers for cultivation.

Genetic variability and diversity studies in different genotypes of waterlily (*Nymphaea* spp.)

J. N. PRAJWAL

MAJOR ADVISOR: Dr. B. V. CHAMPA

An investigation entitled "Genetic Variability and Diversity Studies in Different Genotypes of Waterlily(*Nymphaea* spp.)*"* was carried out during 2024-25 at the Department of Horticulture, College of Agriculture, Navile, Shivamogga. The study focused on the survey, collection and evaluation of waterlily genotypes for morphological, flowering, yield, quality and biochemical traits along with genetic variability parameters, correlation, path and cluster analysis. The experiment was conducted in a Completely Randomized Design (CRD) with three replications. A total of 33 genotypes were collected from different regions of Karnataka and one genotype from Kolkata, India. Among the collected genotypes, N.R. Pura genotype exhibited maximum vegetative vigour with the highest number of leaves per plant (35.33), leaf area (217.86 cm^2), leaf length (25.05 cm), leaf width (46.75 cm), leaf thickness (2.40 mm) and stalk length (36.53 cm). Savalanga-2 recorded the earliest bud initiation (34.87 days), whereas genotype N.R. Pura showed superiority in flower quality traits such as bud diameter (27.86 mm), bud length (27.86 cm), number of flowers (4) and stalk width (13.35 mm). Among biochemical traits,

N.R. Pura and Abbalagere-3 genotypes recorded maximum chlorophyll content (5.38 mg/100 g) and Savalanga-2 recorded maximum anthocyanin content (1.77 mg/100 g). Genetic variability estimates revealed high heritability (>60 %) coupled with high genetic advance (>20%) for traits such as stalk length, petal length, vase life and number of flowers per plant indicating strong additive gene action and suitability for direct selection. Correlation and path coefficient analysis showed that the number of flowers per plant had a strong positive association with stalk length, leaf area and petal length. Mahalanobis D^2 statistics grouped the 33 genotypes into four clusters confirming good genetic diversity for hybridization prospects. Pest and disease incidence varied widely with certain genotypes showing natural resistance due to morphological and biochemical traits. Overall, N.R. Pura, Abbalagere-3 and Savalanga-2 were identified as promising genotypes for further improvement and utilization in waterlily breeding programme.

Studies on character association and path analysis for quality and yield parameters in lisianthus (*Eustoma grandiflorum* Shinn.) genotypes

SANNIDHI SAMPAGAVI MAJOR ADVISOR: Dr. B. HEMLA NAIK

The present investigation "Studies on character association and path analysis for quality and yield parameters in Lisianthus (*Eustoma grandiflorum* Shinn.) genotypes" was conducted at the College of Agriculture, Shivamogga during 2024-25, from the Department of Floriculture and Landscaping, College of Horticulture, Mudigere. The experiment was laid out in a Randomized Complete Block Design with 12 genotypes *viz.,* Rosita 3 Lavender Ver 3, Rosita 3 Bright Blue, Rosita 3 Clear Pink, Aube 4 Pure White Ver 2, Rosita 3 Jade, Rosita 3 Green, Rosita 3 Pink Picotee, Rosita 3 Blue PicoteeVer 2, Rosita 3 Pure White Ver 3, Rosita 3 Pure White Ver 4, Rosita 3 Type Blue 193 and Robella 3 Type Pink were replicated thrice. The genotypes Rosita 3 Clear Pink exhibited maximum plant height (99.68 cm), number of leaves per plant (35.78), branches per plant (3.56) and buds per stalk (10.89), leaf area (2669.78 cm^2/plant), internodal length (12.53 cm), chlorophyll content (1.99 mg/g), flowering duration (18.67 days), stalk length (70.93 cm), spikes per plant (2.00), per m^2 (132.00) and per 1000 m^2 (1,32,000). Aube 4 Pure White Ver 2 produced maximum petals per flower (28.33) and flower length (5.84 cm), while Rosita 3 Blue PicoteeVer 2 recorded maximum spike weight (21.29 g) and stalk girth (1.65 mm). High heritability with high genetic advance over per cent mean was observed for branches per plant, internodal length, chlorophyll content, buds per plant, stalk girth, petals per flower, leaf area and spikes per plant. Correlation and path analysis showed that spike yield per plant was strongly influenced by growth, flowering and quality traits. The maximum B:C ratio (4.28) was recorded in Rosita 3 Clear Pink and minimum (2.14) recorded in Rosita 3 Blue PicoteeVer 2. Among the genotypes assessed, the best performing genotypes in order of merit are Rosita 3 Clear Pink, Rosita 3 Bright Blue, Rosita 3 Lavender Ver 3 and Rosita 3 Pink Picotee.

Assessment of terrestrial orchid diversity and ecological niche modelling of *Pecteilis gigantea* (Sm.) Raf. in western ghats of Cikkamagaluru

I. SHREELEKHA MAJOR ADVISOR: Dr. P. HEMANATH KUMAR

The Western Ghats, a biodiversity-rich region with remarkable diversity of wild orchids, especially terrestrial orchids inhabiting a wide range of highly specialized environments. The present study focused on the "Assessment of Terrestrial Orchid Diversity and Ecological Niche Modelling of *Pecteilis gigantea* (Sm.) Raf.in Western Ghats of Chikkamagaluru" was conducted at the College of Horticulture, Mudigere, KSNUAHS, Shivamogga during 2024-25. Field exploration conducted across various vegetation reported the occurrence of thirty-five species belonged to sixteen genera and found that *Habenaria* was the dominant genera with twelve species. The species *Habenaria heyneana* Lindl.recorded the maximum frequency (0.60) and *Nervilia plicata* (Andrews) Schltr recorded the minimum frequency (0.01). *Habenaria heyneana* Lindl.was densely populated (111.11), whereas the lowest density was observed for *Geodorum densiflorum* (Lam.) Schltr.(0.02). Similarly, *Habenaria heyneana* Lindl.found to be the most abundant species (118.33) while *Geodorum densiflorum* (Lam.) Schltr. and *Calanthe tricarinata* Lindl. exhibited the lowest abundance (0.20). Devaramane scored the highest Shannon (2.48) and Simpson (0.89) diversity index while Sakkarayapattana and Kalasapura had the lowest (0.00). By considering the declining population of terrestrial orchids, ecological niche modelling of *Pecteilis gigantea* (Sm.) Raf. was undertaken to find its distribution range in India. The key climatic variables affecting the distribution were Precipitation of Wettest Quarter (BIO16), Mean Temperature of Warmest Quarter (BIO10), Precipitation of Warmest Quarter (BIO18), Temperature annual range (BIO7) and Precipitation Seasonality (BIO15). Maxent analysis predicted that under SSP126 scenario, the total suitable area found to expand significantly between 2021-2040 and 2081-2100, whereas under SSP585 the range is expected to shrink. Results indicated that the region of high suitability majorly belongs to Western ghats concentrated in protected areas like national parks, wildlife sanctuaries and biosphere reserves. For conservation and reintroduction in future, priority can be given in these areas for ensuring the species long-term survival.

Seed germination studies in lisianthus (*Eustoma grandiflorum* Shinn.)

S. Y. GEETHANJALI MAJOR ADVISOR: Dr. B. V. CHAMPA

An investigation entitled "Seed Germination Studies in Lisianthus (*Eustoma grandiflorum* Shinn.)" was carried out during 2024–25 at the Department of Floriculture and Landscaping, College of Horticulture, Mudigere and Department of Horticulture and Department of Biotechnology, CoA, Navile, Shivamogga. The research was planned to study the effect of chilling temperatures, priming techniques and *in-vitro* performance to improve the seed germination in Lisianthus. The first experiment was conducted using Factorial Completely Randomized Design (FCRD), while the second and third experiments were conducted on Completely Randomized Design (CRD). In the first experiment, among 16 treatments with three replications, T_2D_3 (11 days, @ 3°C) recorded maximum germination

percentage (GP) of 93 per cent, germination energy (GE) of 91.60 per cent, germination value (GV) of 6.13, mean germination time (MGT) of 7.26 days, survival rate (SR) of 76.33 per cent, vigour index (VI) of 1066, plumule length (PL) of 5.27 mm, radical length (RL) of 6.20 mm, seedling fresh weight (SFW) of 2.10 g and seedling dry weight (SDW) of 0.63 g. In the second experiment, among 13 treatments with three replications, T_7 (GA_3 @ 700 ppm) was most effective, which recorded maximum GP (97%), GE (92.15%), GV (6.46), MGT (6.55 days), SR (80.70%), VI (1399), PL (6.20 mm), RL (6.80 mm), SFW (2.22 g) and SDW (0.21 g). In the third experiment, among 10 treatments with three replications, T_9 (MS Media + IBA (0.5 mg/l) + BAP (3.0 mg/l) + GA_3 (0.5 mg/l)) was most effective, recorded maximum GP (95.37%), GE (82.02%), GV (6.58), MGT (6.80 days), SR (67.27%), VI (1239), PL (6.10 mm), RL (6.62 mm), SFW (1.24 g) and SDW (0.19 g). Among all three experiments, seed priming with GA_3 @ 700 ppm proved the most effective in overcoming seed dormancy to improve germination and other related parameters.

Optimization of planting density under naturally ventilated polyhouse and vase chemicals for quality of lisianthus (*Eustoma grandiflorum* Shinn.) cut flower

TEJASWINI BASAPPA GANIGER — MAJOR ADVISOR: Dr. B. HEMLANAIK

The present investigation entitled "Optimization of Planting Density under Naturally Ventilated Polyhouse and Vase Chemicals for Quality of Lisianthus *(Eustoma grandiflorum* Shinn.) Cut Flower" was undertaken during 2024–25 at the Department of Horticulture, College of Agriculture, Navile, Shivamogga, and Department of Floriculture and Landscaping, College of Horticulture, Mudigere. The study was carried out under Naturally Ventilated Polyhouse (NVPH) using Randomized Complete Block Design (RCBD) with six planting densities, *viz.,* T_1(10 × 10 cm, 100 plants m^{-2}), T_2 (10 × 15 cm, 66 plants m^{-2}), T_3 (10 × 20 cm, 50 plants m^{-2}), T_4 (15 × 15 cm, 44 plants m^{-2}), T_5 (15 × 20 cm, 33 plants m^{-2}) and T_6 (20 × 20 cm, 25 plants m^{-2}) each replicated four times. The results revealed that T_1(100 plants m^{-2}) significantly outperformed other treatments with maximum plant height (107.13 cm), number of leaves per plant (47.67), internodal length (11.03 cm) and number of branches (2.00). It also recorded the maximum flowering duration (19.93 days), number of buds (11.58), stalk length (73.20 cm), stalk girth (1.15 mm) and individual stalk weight (20.63 g). The same treatment had maximum spikes per plant (1.64), 164.42 spikes m^{-2} and 1,64,420 spikes per 1000 m², with the highest B:C ratio (7.50). Thus, a spacing of 10 × 10 cm (100 plants m^{-2}) is recommended for commercial cultivation of Lisianthus variety Rosita 3 Clear Pink under NVPH. The evaluation of vase chemicals indicated that T_{10} (Sucrose 6% + Aluminium sulphate 500 ppm) was most effective, exhibiting maximum water uptake (14.8 g day^{-2}), highest fresh weight (34.56 g), lowest physiological loss in weight 36.69%) and maximum vase life (21.23 days), compared to control (9.33 days). Hence, the use of Sucrose 6% + Aluminium sulphate 500 ppm is recommended for the extending vase life and improving post harvest quality of Lisianthus cut flowers.

FRUIT SCIENCE

Influence of plant growth substances on flower induction and fruit yield in pomegranate (*punica granatum* L.) cv. Bhagwa

A. PAVITHRA — MAJOR ADVISOR: Dr. R. SRIDHAR

The field experiment was carried out in Hiriyur, (Chitradurga district) during the year 2024-25 on "Influence of plant growth substances on flower induction and fruit yield in pomegranate (*Punica granatum* L.) cv. Bhagwa". Pomegranate is a major fruit crop grown in dry regions of India, but inconsistent flowering and a lower proportion of bisexual flowers leads to lower fruit yield. The experiment was laid out comprising eleven treatments *viz.,* T_1- Control (water spray), T_2- NAA (20 ppm), T_3- NAA (40 ppm), T_4 - 6- Benzyl adenine (20 ppm),T_5- 6- Benzyl adenine (40 ppm),T_6- Cycocel (1500 ppm), T_7- Cycocel (2000 ppm), T_8- Amino acids (1000 ppm), T_9 - Amino acids (2000 ppm), T_{10}- Seaweed extract (2000 ppm) and T_{11}- Seaweed extract (4000 ppm) with three replications, sprayed at 15 days after the first irrigation, 60 and 105 days after the first spray. Among the treatments, T_7- Cycocel (2000 ppm) recorded minimum days taken for flowering (39.66 days), maximum number of hermaphrodite flowers (152.54), flower size (5.11 cm), pistil length (31.66 mm), stigma style length (11.15 mm), ovary width (12.81 mm) and also T_7- Cycocel (2000 ppm) proved most effective in yield improvement, recorded maximum fruit set per cent (79.05%), fruit yield (15.06 kg/ plant), fruit weight (328.34 g), fruit length (8.37 cm), fruit width (7.92 cm), fruit volume (342.40 cc), number of arils per fruit (549.99), aril weight (223.67 g) and 100–aril weight (41.29 g). However, highest proline (2.38 µmoles/g FW), carbohydrates (19.40%), chlorophyll 'a' (1.82 mg/g FW), chlorophyll 'b' (0.73 mg/g FW), total chlorophyll (2.54 mg/g FW), total soluble solids (17.97 ºBrix), total sugars (14.72 %) and TSS-Acid ratio (46.38) were recorded in T_{11}- Seaweed extract (4000 ppm). T_7- Cycocel (2000 ppm) recorded maximum anthocyanin (23.23 mg/100g) and minimum acidity (0.39%) with highest B:C ratio (2.19:1). Hence, T_7- Cycocel (2000 ppm) proved to be best in improving the number of hermaphrodite flowers per plant. Similarly, Cycocel (2000 ppm) and Seaweed extract (4000 ppm) proved to be enhancing yield and fruit quality in pomegranate.

Screening of pickling cultivars of mango (*Mangifera indica* L.) for softwood grafting

SHWETA — MAJOR ADVISOR: Dr. D. THIPPESHA

The present investigation entitled "Screening of Pickling Cultivars of Mango (*Mangifera indica* L.) for Softwood Grafting" was carried out in the "appemidi mother block" maintained at Ankur nursery, Ripponpet, Shivamogga district, during 2024–25. The experiment comprised of eight appemidi mango cultivars *viz.,*Dombesara jeerige, Genasinakuni jeerige, Kalkoppa jeerige, Quadragi jeerige, Adderi jeerige, Sadaappe, Karpooradappe and Kanchappe as treatments and laid out in a randomized block design with three replications. The study aimed to assess the grafting compatibility and graft survivability of Appemidi cultivars under nursery conditions. Among the cultivars

evaluated, Dombesara jeerige excelled in most of the growth parameters as it took less days to sprout (11.34), sprouting percentage (93.80), survival percentage (77.48), scion girth (8.45 mm), scion length (26.24 cm), number of leaves (12.84), leaf length (15.64 cm), leaf breadth (4.21 cm), leaf area (46.32 cm^2), dry matter accumulation (7.74 g) and graft success rate (81.67%). It also showed superior physiological and biochemical traits such as total chlorophyll content (3.64 mg/g), carotenoids (1.27 mg/100g), phenols (3.00 mg GAE/100 g), carbohydrates (12.90%), proteins (3.57 mg/g) and total sugars (8.11 %). This was followed by Quadragi jeerige which was also performed well in several important parameters. In contrast, Adderi jeerige recorded the lowest values for most of the parameters studied, indicating poor graft compatibility and weak vegetative growth response under nursery conditions. This results clearly indicate that Dombesara jeerige is highly suitable for softwood grafting, showing early sprouting, high graft success and vigorous vegetative growth and enhanced biochemical potential under nursery conditions. It's superior performance makes it ideal for commercial propagation and softwood grafting can be used for conservation of elite Appemidi mango cultivars under low cost polyhouse conditions.

Effects of bioextracts on quantitative and qualitative characters of pomegranate (*Punica granatum* L.) CV. bhagwa under central dry zone of Karnataka

KAVYA DILLEPPA VALMIKI MAJOR ADVISOR: Dr. B. S. SHIVAKUMAR

The field experiment on "Effects of Bioextracts on Quantitative and Qualitative Characters of Pomegranate (*Punica granatum* L.) cv. Bhagwa under Central Dry Zone of Karnataka" was carried out in a farmer's field at Aluru village, Chitradurga district during the year 2024–25. Pomegranate being commercial fruit crop cultivated in the dryland regions of India, where in achieving optimum yield and quality is often hindered on application chemical fertilizers. The experiment was laid out in a Randomized Complete Block Design (RCBD) with eight treatments and three replications. Among the different treatments, T_7 (Seaweed extract @ 2000 ppm + Moringa leaf extract @ 6000 ppm + *Prosopisjuliflora* leaf extract @ 5000 ppm) recorded best quantitative and qualitative traits such as number of fruits per plant (66.21), fruit yield (16.41 kg/plant), maximum fruit weight (265.13 g), fruit length (7.75 cm), fruit diameter (7.81 cm), fruit volume (293.13 cc), rind weight (98.90 g), rind thickness (2.17 mm), arils weight (177 g/fruit), least rind – aril ratio (0.55), number of arils per fruit (427.1) and highest shelf life (31.16 days). It also recorded highest TSS (17.33ºBrix), total sugars (13.88%) anthocyanin (26.56 mg/100 g) and lower acidity (0.34%). Whereas, in concern to disease scoring, T_6 (Moringa leaf extract @ 6000 ppm + *Prosopisjuliflora* leaf extract @ 5000 ppm) recorded the lowest disease reduction over control in leaves (74.52 %) and fruits (78.43%). Hence, the combined application of T_7 proved highly effective in enhancing the yield and quality of pomegranate under dryland conditions and T_6 proved less disease incidence occurrence over control.

Effect of pruning levels and months on performance of rambutan (*Nephelium lappaceum* L.) in coastal Karnataka

PANCHAMI ANIL MAJOR ADVISOR: Dr. B. S. SHIVAKUMAR

The field experiment was conducted at the experimental orchard in Kedoor village, Udupi district, Karnataka during 2024-25 to evaluate the effect of pruning levels and months on performance of rambutan (*Nephelium lappaceum* L.) in coastal Karnataka. The study was laid out in a Factorial Randomized Complete Block Design with three replications, comprising four pruning levels (0, 30, 45, and 60 cm from the shoot tip) and two pruning months (4th week of July and August). Early sprouting (15.70 days) was recorded in 60 cm depth pruning during August 4th week (P_3M_2), while the maximum sprout density (69.11 shoots/m^2) was recorded in P_1M_1 (30 cm pruning during July 4th week). The earliest flowering (124.00 days) and 50 per cent flowering (157.00 days) was observed in P_2M_2 (45 cm pruning during August 4th week), which also recorded the highest panicle density (16.74 panicles/m^2). The shortest duration to fruit development (187.00 days) was observed in P_1M_2 (30 cm pruning during August 4th week), while the fruit set (1.46%) was noticed in P_3 (60 cm pruning from the shoot tip). The highest average fruit weight (58.20 g) was observed in P_1M_2 (30 cm pruning during August 4th week) while the maximum fruit yield per tree (27.10 kg/tree) was obtained in P_2M_2 (45 cm pruning during August 4th week). In addition, shelf life was longest (5.95 days) in P_1M_2 (30 cm pruning during August 4th week) which also recorded the superior fruit quality, including total soluble solids (19.10°Brix), total sugars (16.70%), and reducing sugars (8.46%) and low titratable acidity (0.26%). Economic analysis revealed that P_1M_1 (30 cm pruning during July 4th week) recorded the highest B:C ratio (4.18) followed by P_2M_2 (45 cm pruning during August 4th week) with a B:C ratio of 4.16. Hence light to moderate pruning at 30 to 45 cm during the fourth week of August was found to be most effective in enhancing growth, yield, and fruit quality of rambutan under coastal Karnataka conditions

Evaluation of passion fruit (*Passiflora* spp.) genotypes for yield and quality

R. SHRAVANI MAJOR ADVISOR: Dr. NAGARAJAPPA ADIVAPPAR

An experiment was conducted in farmer's field at Ranganathapura village, Bhadravathitaluk, Shivamogga during the year 2024-25 to evaluate the passion fruit genotypes (seedling origin) for growth, yield and quality parameters. The experiment was laid out in Augmented design with 50 genotypes and two checks *i.e.,* Kaveri and JJ-51. Analysis of variance showed significant differences among genotypes on comparision with checks regarding growth, yield and quality parameters. The genotype JJ-46 has recorded maximum fruit length (6.27 cm), fruit width (5.32 cm), fruit weight (111.58 g), fruit volume (108.33 cc), pulp weight (47.66 g), juice content (39.97%), number of fruits per vine (156.12) and fruit yield per vine (17.42 kg/vine). The bio-chemical parameters have shown significant difference among passion fruit genotypes. The highest values were recorded for fruit quality traits like TSS (JJ-6: 17.17^{0}B), titratable acidity (JJ-42: 4.91 %),

reducing sugars (JJ-9: 10.53%), non-reducing sugars (JJ-4: 5.29%), total sugars (JJ-4: 13.59%), TSS: acid (JJ-6: 9.04), sugar: acid (JJ-6: 5.65), ascorbic acid (JJ-51: 39.61 mg/100g), antioxidant activity (JJ-9, JJ-11, JJ-28, JJ-30: 15.47%) and total phenols (JJ-42: 31.81 mg GAE/g dry weight). Moderate levels of GCV and PCV, high heritability coupled with high genetic advance as per cent mean (GAM) were observed for most of the characters studied, which shows broad genetic base. Correlation studies revealed that all the traits have significant positive association with fruit yield except pericarp thickness, number of seeds/fruit and total soluble solids. Diversity studies revealed that 52 genotypes were grouped into eight clusters. The fruit weight (27.90%) contributed more towards total genetic divergence followed by fruit volume (22.02%). The genotype JJ-46 found superior in terms of yield and yield parameters, JJ-6 found superior with respect to quality traits. Therefore, genotypes JJ-46 and JJ-6 were found most promising and can be used either for further evaluation or selection as a commercial cultivar or as gene source in passion fruit improvement programme.

PLANTATION, SPICES, MEDICINAL AND AROMATIC CROPS

Studies on roasting and blending on cup quality of coffee

T. VANATHI

MAJOR ADVISOR: Dr. H. R. BHOOMIKA

The present experiment was conducted at the Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Mudigere during 2024–25 to study the effect of roasting levels and blending on coffee quality in Arabica, Robusta and Liberica. The statistical design adopted was Factorial Completely Randomized Design. Among the treatments involving roasting of individual coffee species, T_1(Arabica – Light roast) recorded the highest *L** value (37.0), 100-bean weight (14.80 g), dry recovery (82.76%), powder recovery (98.19%) and moisture content (2.1%). Liberica–Light roast (T_7) recorded the lowest caffeine content (1.05%), whereas Robusta–Medium roast (T_5) had the highest caffeine (2.75%) and antioxidant activity (93.27%). The highest chlorogenic acid (5.970%) and flavonoid content (3.45 mg/g) were observed in Robusta–Light roast (T_4). The highest cupping score (79.50) was observed in T_8 (Liberica–Medium roast). Among the treatments involving roasting of coffee blends (Arabica: Robusta: Liberica), the highest cupping score (79.50) was recorded in treatment T_3 (50:10:40 + Dark roast), T_5 (50:20:30 + Medium roast), T_8 (50:30:20 + Medium roast) and T_{15} (34:33:33 + Dark roast). T_{10} (50:40:10 + Light roast) recorded the highest flavonoid content (3.11 mg/g), protein (13.15%) and antioxidant activity (88.00%) whereas, T_2 (50:10:40 + Medium roast) had the lowest caffeine (1.410%). The highest Benefit–Cost Ratio (1.75) was recorded in T_1 (50:10:40 + Light roast), T_4 (50:20:30 + Light roast), T_7(50:30:20 + Light roast) and T_{10} (50:40:10 + Light roast), indicating excellent profitability of light roast blends. Overall, Liberica–Medium roast achieved the highest cupping score with moderate caffeine content, while Liberica–Light roast recorded the lowest caffeine and Arabica–Light roast showed favorable physical attributes with moderate cupping score. Among blends, T_5 (50:20:30 + Medium roast) and T_{10} (50:30:20 + Medium roast) recorded the highest cupping scores (79.50) with moderate caffeine and appreciable antioxidant activity, while also maintaining strong economic performance, indicating the most suitable treatments for improving coffee quality and profitability.

Effect of liquid nutrition and foliar application of growth substances on quality suckers production in small cardamom (*Elettaria cardamomum* Maton) CV. njallani green gold

KIRTI N. DANADAMANI

MAJOR ADVISOR: Dr. C. S. RAVI

A field experiment was conducted at Zonal Agricultural and Horticultural Research Station, Mudigere during 2024-25 in Factorial Randomized Complete Block Design with two factors namely liquid nutrition and growth substances. The factor liquid nutrition at three levels [N_0: RDF - 48:48:96 g per plant, N_1: Urea (0.5%) + DAP (1%) + MOP (0.5%) and N_2: Urea (1%) + DAP (1.5%) + MOP (1%)] and growth substances at six levels [G_1: Humic acid (0.5%), G_2: Sea Weed Extract (0.5%), G_3: Triacontanol (0.5%), G_4: Benzyl Adenine @ 250 ppm, G_5: Gibberellic acid @ 250 ppm and G_6: Cycocel @ 1000 ppm)] comprising of eighteen treatments replicated thrice. Among different treatments studied at 180 days after treatment, the treatment T_{17} [Urea (1%) + DAP (1.5%) + MOP (1%) + Gibberellic acid @ 250 ppm)] recorded highest pseudostem height (4.01 m), leaf area per clump (23.95 m²), total dry matter production (218.65 g), dickson quality index (10.41), sturdiness quotient (46.79) and volume index (3433.94). While, the treatment T_{16} [Urea (1%) + DAP (1.5%) + MOP (1%) + Benzyl Adenine @ 250 ppm)]recorded highest pseudostem girth of 9.53 cm and root thickness of 0.91 mm. The total number of new suckers emerged per clump (31.85), number of primary roots (26.83), number of secondary roots (95.00), root volume (315.00 cc), fresh weight of roots (183.03 g), dry weight of roots (56.17 g) and suckering percentage (53.54%) were found to be highest in T_{13}: [Urea (1%) + DAP (1.5%) + MOP (1%) + Humic acid (0.5%)] at 180 DAT.

Characterization and evaluation of nutmeg (*Myristica fragrans* Houtt.) genotypes of coastal Karnataka for yield and quality attributes

SANGANAGOUDA

MAJOR ADVISOR: Dr. H. R. BHOOMIKA

The present investigation entitled *"*Characterization and evaluation of nutmeg (*Myristica fragrans* Houtt.) genotypes of coastal Karnataka for yield and quality attributes*"* was carried out during 2024–25 in Dakshina Kannada and Udupi district of coastal Karnataka. Thirty nutmeg accessions were identified and evaluated from Mandarthi, Mudrady, Ajekar and Bandaje village. Morphological characterization revealed variation in tree vigour, canopy shape, flowering behaviour, fruit, mace and seed traits. All accessions were female, predominantly cluster bearing, with diversity in fruit shape, mace colour and seed shape. Growth and yield traits varied significantly among the accessions. Maximum tree height (10.82 m) was recorded in accession 15. Whereas, accession 24 exhibited maximum canopy spread (38.06 m²), stem girth (65.34 cm), fruit length (73.53 mm) and fruit weight (92.59 g). Further

accession 24 also recorded the highest number of fruits per tree (660), mace yield per tree (694.90 g), fresh weight of nut (19.21 g), dry weight of nut (8.67 g) and kernel yield per tree (4278.67 g). The next best accession for fruit yield was Acc. 30 with 560 fruits per tree. Accession 21 consistently recorded the lowest values, for tree height (3.03 m), fruit weight (52.96 g) and fruits per tree (207.67). Biochemical evaluation showed that accession 24 had the highest mace volatile oil content (6.24%), kernel volatile oil content (6.73%) and kernel oleoresin content (34.17%). GC–MS profiling of superior accessions *i.e.,* Acc. 24 and Acc. 30 confirmed Myristicin and Safrole as major active principles in kernel essential oil. Correlation and path analysis indicated kernel and mace traits as major yield contributors, while clustering confirmed genetic diversity. This study confirmed the presence of significant variability among the accessions and identified accessions 24 and 30 for superior yield and quality traits. These accessions could be used for nutmeg improvement.

Genetic variability studies for growth, yield and quality traits in black pepper (*Piper nigrum* L.)

H. R. SRI HARSHA

MAJOR ADVISOR: Dr. SADASHIV NADUKERI

Field investigations was undertaken to comprehensively characterise and evaluate 25 diverse black pepper (*Piper nigrum* L.) genotypes in the Hillzone of Karnataka. The study assessed genetic variability, diversity, character associations and path analysis to identify superior genetic resources and to frame an effective breeding strategy. The experiment was laid out in a Randomised Complete Block Design (RCBD), revealed highly significant variation for all 20 quantitative traits, confirming the presence of a broad genetic base. Substantial variation was observed not only for yield but also for important architectural and quality traits, highlighting the scope for selection and improvement.Dry berry yield per vine, the principal economic trait, exhibited a significant difference among genotypes (1.23–11.46 kg). The genotypes Panniyur-1 (11.46 kg), Vellanamban (9.08 kg) and Arakulamundi (8.80 kg) were recognised as elite high-yielders suitable both for direct cultivation and as parents in hybridisation programmes. The highest genotypic (82.94%) and phenotypic (83.44%) coefficients of variation, along with exceptionally high heritability (98.82%) and a very high genetic advance as percentage of mean (169.85%), indicating the predominance of additive gene action and confirming that direct phenotypic selection is a dependable strategy for rapid genetic improvement. Path coefficient analysis showed that fresh berry yield per vine exerted the maximum positive direct effect (0.722) on dry berry yield, followed by dry recovery percentage, identifying them as critical traits for direct selection. The non-significant correlations between yield and key quality traits (oleoresin and essential oil) further indicated that high yield and high quality can be improved simultaneously without undesirable trade-offs. Genetic divergence analysis using Mahalanobis D^2 statistics grouped the genotypes into six distinct clusters. The greatest inter-cluster distance was between high-yielding Cluster V (Panniyur-1) and superior-architecture Cluster VI (V-2) suggesting these as the most divergent parents for pyramiding complementary traits and achieving heterosis.

Effect of foliar application of nutrients on growth, yield and quality of cocoa (*Theobroma cacao* L.) under hill zone of Karnataka

C. R. TEJAS

MAJOR ADVISOR: Dr. G. RAVIRAJASHETTY

A field experiment on "Effect of foliar application of nutrients on growth, yield and quality of cocoa (*Theobroma cacao* L.) under hill zone of Karnataka" was carried out during 2024-25 at Zonal Agricultural and Horticultural Station, Mudigere, Chikkamagaluru. The experiment was laid out in Randomized Complete Block Design comprising of seven treatments with three replications.Results revealed that trees treated with foliar spray with19:19:19 (1.5%) + $MgSO_4$ (0.5%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + Borax (0.3%) recorded maximum incremental increase in plant height (0.39 m), leaf length (29.50 cm), leaf width (12.90 cm), leaf area/leaf (254.18 cm^2), chlorophyll a (1.18 mg/g), chlorophyll b (0.71 mg/g), total chlorophyll content (1.78 mg/g), total number of flower cushions/tree (189.60), number of flowers/ cushions (7.82), number of cherelles/tree (62.86), percentage of fruit set per tree (4.24%), number of pods harvested per tree per season (31.31), pod value (10.4), pod length of (17.19 cm), pod girth (26.68 cm), pod weight (382.14 gm), number of beans per pod (42.53), single fresh bean weight (2.48 g), single dry bean weight (1.11 g), fresh bean weight per pod (98.40 g), dry bean weight per pod (47.20 g), dry bean yield per tree (1477.83 g) and estimated yield per hectare (546.79 kg ha^{-1}). The same treatment recorded highest fat content (48.15%), protein content (14.96 mg g^{-1}) and total carbohydrates (21.28%) in cocoa beans. The economic analysis revealed that foliar application of 19:19:19 (1.5%) + $MgSO_4$ (0.5%) + $ZnSO_4$ (0.5%) + $FeSO_4$ (0.5%) + Borax (0.3%) (T_7) yielded the highest B:C ratio of 2.76, indicating maximum returns. Hence, it can be concluded that T_7 proved to be promising treatment to enhance growth, yield and quality of cocoa.

POST HARVEST MANAGEMENT

Standardization of vase solution for floral foams

B. M. AMRUTHA VARSHINI

MAJOR ADVISOR: Dr. N. KIRAN KUMAR

The present investigation was studied in Department of Post harvest Management, College of Horticulture, Mudigere, during 2024-25, to standardized the vase solution for floral foams on longevity of multiple cut flowers. For vase chemicals standardization the experiment was conducted in Completely Randomized Design and each replication contains eight flowers (rose, carnation, gerbera and chrysanthemum). Among, fifteen treatments, the best three vase-chemical combinations T_2 (Floralife crystal clear, 5ml/L), T_9 (Sucrose 2.0% + $Al_2(SO_4)_3$ 150 ppm + BA 75 ppm) and T_{14} (Sucrose 2.5% + $Al_2(SO_4)_3$ 100 ppm + BA 100 ppm) significantly recorded the higher vase life of (15.09), (14.65) and (13.75 days) respectively. Further, these three best standardized chemicals were selected and solutions was incorporated into floral foams.The experiment was laid out in Factorial Completely Randomized Design with two factors *i.e.*, Foams (F) (F_1:

Phenolformaldehyde and F_2: Bio degradable floral foam) and Vase solutions (V) (V_0: Control, V_1: Floralife crystal clear (5ml/L), V_2: Sucrose (2.0%) + Aluminium sulphate (150 ppm) + Benzyl adenine (75 ppm) and V_3: Sucrose (2.5%) + Aluminium sulphate (100 ppm) + Benzyl adenine (100 ppm). The interaction between foams and vase solution concentrations significantly affected the flowers and vase solution parameters of cut flowers. Among different combinations, F_2V_3 - Biodegradable floral foam combined with Sucrose (2.5%) + Aluminium sulphate (100 ppm) + Benzyl adenine (100 ppm) concentration exhibited the maximum cumulative solution uptake (114.42 g), cumulative transpiration loss (115.01 g), cumulative water balance (-0.59 g), fresh weight (74. 83g), pH (3.72) and sensory score (4.91), with the minimum bacterial count (2.12 CFU × 10^4 ml^{-1}) and physiological loss in weight (15.67%) leads to increased vase life of 5.10 days compared to control (2.10 days). This helps the floral decorators to maintain the freshness of cut flowers for a longer period, resulting in better returns compared to using regular foam.

Optimization of jackfruit seed flour for preparation of quality gulab jamun mix

D. P. SAHANA — MAJOR ADVISOR: Dr. Y. KANTHARAJ

The present investigation entitled "Optimization of jackfruit seed flour for preparation of quality gulabjamun mix" was carried out at the Department of Post harvest Management, College of Horticulture, Mudigere, during 2024–25. The experiment was laid out in a Completely Randomized Design (CRD) with twelve treatments and three replications, wherein the treatments were formulated by varying proportions of Jackfruit Seed Flour (JSF), Refined Wheat Flour (RWF), Skimmed Milk Powder (SMP) and Other Ingredients (OI). Among the treatments, T_5 (40% JSF + 10% RWF + 35% SMP + 15% OI) recorded the most desirable physical properties with the lowest moisture content (5.65%), shortest frying time (4.92 min) and minimal oil absorption (80.58%), along with superior nutritional composition comprising fat (12.96%), protein (17.97%), fiber (1.15%), carbohydrate (52.75%), calcium (70.15 mg 100 g^{-1}) and potassium (64.83 mg 100 g^{-1}). It also obtained the favorable sensory scores for color and appearance (8.32), flavor (8.79), texture (8.33) and overall acceptability (8.50), while also exhibiting economic feasibility with a benefit–cost ratio of 1.83. The standardized premix (T_5) was further optimized for sugar syrup concentration, wherein T_6 (65°Brix) exhibited the shortest soaking time (30 min), highest porosity (42.17%), maximum product weight (13.81 g) and greatest volume expansion (32.78 mm), along with maximum sensory scores for color and appearance (8.72), texture (8.63), sweetness (8.85) and overall acceptability (8.67). During 180 days of storage, T_5 exhibited the least variation in physical, chemical and sensory attributes of the jackfruit seed flour based gulabjamun mix. Thus, the T_5 (40% JSF + 10% RWF + 35% SMP + 15% OI) premix with 65°Brix sugar syrup was identified as the most suitable formulation for the preparation of jackfruit seed flour based gulab jamun.

Development of kokum rind powder chewable tablets

E. S. SWATHI — MAJOR ADVISOR: Dr. Y. KANTHARAJ

The experiment was conducted during 2024-25 at College of Horticulture, Mudigere and National College of Pharmacy, Shivamogga, with the objective of developing kokum rind powder chewable tablets. The study focused on standardizing the ingredients and evaluating physico-chemical properties. The experiment was laid out in Factorial Completely Randomized Design (FCRD) with three factors *viz*., kokum rind powder, sucrose and mannitol, each at two levels. Among the treatment combinations consisting of 400 mg kokum rind powder + 300 mg sucrose + 150 mg mannitol exhibited superior pre-compression characteristics with bulk density (0.52 g ml^{-1}), tapped density (0.57 g ml^{-1}), Carr's index (8.77%), Hausner ratio (1.09) and angle of repose (25.30°), indicating excellent flowability. In ingredient standardization, tablets recorded desirable physico-chemical attributes including uniform weight (9.03 g), maximum hardness (5.23 kg cm^{-2}), friability (0.16%), shortest disintegration time (21.45 min), water activity (0.48), pH (4.80), ascorbic acid (6.55 mg g^{-1}), titratable acidity (8.57%), anthocyanin content (54.95 mg g^{-1}), antioxidant activity (20.84%), hydroxycitric acid (92.34 mg g^{-1}), overall acceptability (4.83) and an optimum benefit-cost ratio (2.00). During 0 to 180 days of storage under ambient conditions, 400 mg kokum rind powder + 300 mg sucrose + 150 mg mannitol maintained excellent stability with only marginal variations in uniform weight (9.03 to 9.00g) hardness (5.23 to 5.20 kg cm^{-1}), friability (0.16 to 0.19%), disintegration time (21.45 to 21.42 min), water activity (0.48 to 0.50), pH (4.64 to 4.85), ascorbic acid (6.55 to 6.40 mg g^{-1}), titratable acidity (8.57 to 8.24%), anthocyanin content (54.95 to 54.92 mg^{-1}), antioxidant activity (20.84 to 20.82%), hydroxycitric acid (92.34 to 92.32 mg g^{-1}) and overall acceptability (4.83 to 4.80), confirming it's stability in storage. Optimization through Response Surface Methodology (RSM) identified the ideal formulation as 450 mg kokum rind powder + 275 mg sucrose + 125 mg mannitol. These findings provide a strong scientific basis for the development of functional kokum rind powder chewable tablets with considerable nutraceutical and commercial potential.

Standardization of wood apple fruit leather fortification with chia seeds

MAHANTESH S. PATIL — MAJOR ADVISOR: Dr. N. KIRAN KUMAR

The experiment was conducted during the year 2024-25 at College of Horticulture, Mudigere and the experiment was laid out in a Completely Randomized Design (CRD). First experiment to focus on optimizing the pulp concentration and Sugar/Jaggery concentration for leather was studied with ten treatments with three replications. Based on the results obtained T_1 (40% Pulp + 60% Sugar) and T_6 (40% Pulp + 60% Jaggery) recorded appreciable physical parameter Calorimetric value *L** (28.92 & 29.72), *a** (5.76 & 5.83), *b** (-2.29 & -2.93), leather recovery per cent (79.43 & 81.46%) and chemical parameters total soluble solid (65.83 & 66.95°Brix), titratable acidity (2.15 & 2.14%), ascorbic acid (16.62 & 16.65 mg / 100g), total antioxidant activity (69.35 & 74.87 mg AAE / 100g) respectively. Based on the sensory evaluation the best overall acceptability score obtained in T_1 (8.26) and T_6 (8.42). The best treatments were fortified with different concentration of chia seeds wood apple leather prepared using 40 per cent pulp, 60 per cent jaggery and addition of 25g chia seeds showed better results in

terms of physical parameter *L** (29.72), *a** (5.83), *b** (-2.93), leather recovery percent (81.46%), drying duration (9.14 hrs), chemical parameters total soluble solid (66.21°Brix), titratable acidity (2.17%), ascorbic acid (17.19 mg /100g), total antioxidant activity (76.84 mg AAE /100g), total carbohydrate (65.26%), protein (4.82%), fat (1.62%) and fiber content (5.22%).The same treatments were subjected to organoleptic evaluation the highest score was received with respect to colour value (8.78), flavour (8.80), texture (8.78), taste (7.92) and overall acceptability (8.57). During storage no significant changes was noticed with respect to physico chemical properties. But, significantly the highest overall acceptability score was noticed in T_6 (8.42) and also recorded the highest benefit cost ratio more than 3.00. These findings scientifically prove the product is nutritionally enriched and commercially viable.

C. FORESTRY

FOREST BIOLOGY AND TREE IMPROVEMENT

Tree diversity, regeneration and soil nutrient status in mixed plantations and evergreen forests

KARAN J. NAIK — MAJOR ADVISOR: Dr. B.N. SATISH

The ecological dynamics between mixed plantations and natural forests in the Kodagu district of the Western Ghats, India, offer significant insights into biodiversity and nutrient management. The investigation aimed to assess tree diversity, regeneration patterns, and soil nutrient status in mixed plantations and evergreen forests, with field surveys conducted to evaluate these aspects across plantations aged 10, 20 and 30 years and their neighboring natural forests. The findings revealed that natural forests adjacent to 10-year-old plantations exhibited the highest species richness, with 43 species identified compared to 30 species in the mixed plantations; however, species richness declined with increasing plantation age, resulting in only 19 species recorded in the 30-year-old plantations. Regeneration counts were significantly higher in natural forests, particularly those adjacent to the 10-year-old plantations, which recorded a regeneration density of 4964.29 individuals ha^{-1}, while the 20- year-old plantations displayed notable diversity as indicated by Menhinick's index. Soil assessments indicated pH levels ranging from 3.77 to 4.17, reflecting high acidity across both land-use types, with natural forests consistently exhibiting greater organic carbon content and superior nitrogen retention, notably a nitrogen content of 238.94 kg ha^{-1} in the natural forest adjacent to the 30-year-old plantation. Higher phosphorus and potassium concentrations were detected in the mixed plantations, especially in the 10-year-old plantation, which recorded a phosphorus content of 43.90 kg ha^{-1}, likely attributed to management practices such as fertilization. The results underscored the complementary roles of mixed plantations and natural forests; while plantations enhanced nutrient availability, natural forests were essential for maintaining biodiversity through effective organic carbon retention and nutrient cycling. Thus, both land-use types were vital for effective nutrient management, with plantations contributing to increased nutrient levels and natural forests supporting ecosystem stability and resilience.

SILVICULTURE AND AGROFORESTRY

Growth performance of half-sib progenies of *Aquilaria malaccensis* Lamk. in Malanad region of Karnataka

M. S. NEETHU — MAJOR ADVISOR: Dr. V. MAHESWARAPPA

Aquilaria malaccensis Lamk. is an economically important tree species of the family Thymeleaceae, valued for its resin-impregnated heartwood used in incense, fragrances, perfumes and pharmaceuticals. Overexploitation and unsustainable harvesting have led to its decline in natural populations, necessitating genetic improvement and cultivation efforts. The present study was conducted at the Main Agricultural and Horticultural Research Station, Iruvakki, Karnataka, in the experimental plot established from half-sib progenies of *A. malaccensis*. The experiment was laid out in a Row-Column design with fourteen half-sib progenies of *Aquilaria malaccensis* collected from different locations across Northeast India and five replications. The study assessed growth performance, genetic parameters, trait correlations and soil nutrient status. Progeny 10 (NL-12) recorded the maximum height (7.3 m), Progeny 14 (TR-34) showed the highest GBH (30.63 cm) and stand volume (47.93 m^3 ha^{-1}) and Progeny 9 (ML-11) had the largest crown projection area (11.86 m^2). Progeny 4 (AS-06) and Progeny 13 (TR-33) exhibited superior stem straightness, axis persistence and overall timber form. Genetic parameter analysis indicated that height and GBH were strongly influenced by environmental factors, with very low heritability and genetic advance, whereas crown projection area eaxhibited relatively higher genetic control. Correlation analysis showed highly significant and positive associations, particularly between height and GBH, confirming their reliability as predictors of stand volume. Soil analysis revealed moderately acidic soils with low salinity, high organic carbon ranging between 0.54 –2.07 per cent, low to medium nitrogen (194.55–351.41 kg ha^{-1}), low phosphorus (9.27–12.80 kg ha^{-1}) and moderate to high potassium levels (217.43–311.69 kg ha^{-1}). Among the progenies, Progeny 9 (ML-11), Progeny 10 (NL-12), Progeny 4 (AS-06), Progeny 13 (TR-33) and Progeny 14 (TR-34) emerged as best performing candidates for future planting in the Malanad region.

Studies on tree components of agroforestry practices in Chitradurga district

C. MANJUNATHA — MAJOR ADVISOR: K. L.VASUDEV

Agroforestry is widely practiced in the semi-arid regions of Karnataka for livelihood security, soil improvement and environmental sustainability. To understand the role of tree components in farm-based systems, a study was conducted in different taluks of Chitradurga district. The objectives of the study were to document existing tree species, species composition, aboveground biomass, carbon stock, growth, stumpage value and farmers perceptions. Majorly, three agroforestry systems were identified such as agri-silviculture, silvopastoral and others. Among these, agri-silviculture with boundary plantations was the most prominent practice (97.50%), followed by bund plantations (20.00%). In small and medium landholdings a total number of 1,163 and 3,602 trees representing 22 and 23 species respectively were recorded. *Tectona grandis* was the dominant species, contributing the highest relative density (25.97%) in small and (35.04%) in medium holdings, followed by *Azadirachta indica*, *Tamarindus indica* and *Mangifera indica*. *Azadirachta indica* exhibited the highest relative frequency (16.34%) in small and (24.12%) in medium landholdings. *Tamarindus indica* recorded the highest aboveground biomass (41.91 Mg 100 trees^{-1}) and lowest was recorded in *Sesbania grandiflora* (0.70 Mg 100 trees^{-1}). The highest carbon stock was recorded in *Vachellia nilotica* (35.65 Mg 100 trees^{-1}). Carbon sequestration was recorded highest in *Vachellia nilotica* (130.69 CO, -eq. 100 trees^{-1}). In small landholding, stumpage value was highest in *Tectona grandis* (₹ 48,09,062) and lowest was recorded in *Eucalyptus tereticornis* (₹ 518) under agri-silvi boundary. In medium landholdings, highest stumpage value (₹ 3,35,371) was recorded in *Santalum album* (sapwood) under woodlots and lowest was *Swietenia mahagoni* (₹ 6,382) under the agri-silvi boundary system. Farmers perceived agroforestry as beneficial for timber, fuelwood, fodder, income, soil fertility, microclimate regulation, despite constraints of land scarcity, long rotations and limited technical support.

D. COMMUNITY SCIENCE

FOOD AND NUTRITION

Utilisation of banana peel for the development of innovative value added products

AKSHATA M. BIDARI — MAJOR ADVISOR: Dr. A.M. MARUTHESH

The present investigation was conducted in Iruvakki during the year 2024-25 to standardise Banana Peel Powder (BPP) and utilise it for the development of value-added products, namely Instant Soup Mix (ISM) and cookies and to evaluate their physical, chemical, nutritional, sensory and storage characteristics. Banana peels were subjected to various treatments which includes blanching (2-10 mins), citric acid and salt (0.1- 0.5% + 1-3.5%) and salt immersion (5-25 mins). Blanching for 2 minutes yielded the highest Overall Visual Quality (OVQ) score (7.80 ± 1.77). Hence, peels which were blanched for 2 minutes were sun dried for 32°C ± 3 for 3 days, powderedand used for formulation. Nutritional composition revealed notable differences. Moisture (8.76%) was highest in ISM. Fat (24.80%) was highest in cookies, Fiber was maximum in BPP (19.02%), Protein was highest in BPP (6.77%), Carbohydrates (68.04%) were maximum in BPP, Mineral analysis showed that, BPP was rich in potassium, Storage studies indicated that both ISM and cookies exhibited a gradual sensory decline over 90 days. However, High Density Polyethylene (HDPE) packaging preserved product quality more effectively than Low Density Polyethylene (LDPE), slowing down deterioration in appearance, texture, flavour, and overall acceptability. Similarly, moisture uptake was better controlled in HDPE than LDPE. For ISM, moisture increased from 8.76% to 9.25% in HDPE compared to 9.90% in LDPE. In cookies, moisture increased from 4.80% to 5.16% in HDPE and to 6.20% in LDPE. These findings confirm that HDPE packaging is superior in minimizing moisture and maintaining sensory acceptability for longer storage periods. In conclusion, banana peel powder proved to be a nutritionally rich in fiber and mineral with significant functional potential in food systems. The results found that banana peel powder incorporation levels (5–10%) in instant soup mix and cookies can enhance nutritional quality.

Formulation and nutrient evaluation of chia nutri bar

PREETI M. MAYANNAVAR — MAJOR ADVISOR: Dr. JYOTI M. RATHOD

A study on "Formulation and Nutrient Evaluation of Chia Nutri Bar" was conducted during 2024–25 at the Department of Food and Nutrition, KSNUAHS, Shivamogga. The objectives were to standardize chia nutri bars, assess the physico-chemical properties, evaluation of shelf life and to study consumer acceptability. Nutri bars were prepared using chia, flaxseeds, groundnuts and jaggery or date. Eight formulations were developed and the best-accepted bars (T_2) were subjected to further analysisbased on organoleptic evaluation. Textural analysis showed that, jaggery-based bars were harder and firmer whereas, date-based bars were softer with higher adhesiveness and cohesiveness. However, nutrient analysis indicated, the jaggery-based bar was rich in carbohydrate (69.90%), energy (460.9 kcal) and iron (3.89 mg/100g) and the date-based bar was rich in protein (22.52%), fiber (11.84%), calcium (336.89 mg/100g), potassium (1338.47 mg/100g) and zinc (5.56 mg/100g). The antioxidant activity was lower in jaggery-based bar (175 mg AAE/100 g) compared to date-based bar (245 mg AAE/100 g). The anti-nutritional factors in jaggery and date-based bars *i.e.* phytic acid (1.16 and 1.18 mg/100g respectively) and oxalic acid (66 and 67 mg/100g respectively) were minimal. The storage study was conducted at 15 days interval, for a period of 90 days. The jaggery-based bar retained

better sensory quality, lower moisture (5.23%), free fatty acid (0.65%) and lipid peroxide values(1.50 mg MDA/kg) compared to date-based bar packed in HDPE packing, which exhibited reduced stability after 60 days. Microbial counts were lower in jaggery-based bar (bacteria: 1.6 $\times 10^4$ and yeast: 1.2 $\times 10^4$) than date-based bar (7.8 $\times 10^4$ and 6.8 $\times 10^4$) in HDPE packaging. The jaggery-based bar was more cost-effective (B:C 1.21) than date-based bar (1.08) which shows the profitability of the bars. The study concluded that jaggery-based chia nutri bar exhibited superior sensory acceptability, shelf life and economic feasibility compared to date-based chia nutri bar.

Development of millet enriched todedevu - a Malnad delicacy of Karnataka

V. VARSHINI

MAJOR ADVISOR: Dr. S. JAYASHREE

The present investigation entitled "Development of Millet Enriched *Todedevu* - A Malnad Delicacy of Karnataka was carried out in the Department of Food and Nutrition, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga during 2024-25. This study aimed to standardize *Todedevu*, a traditional sweet from the Malnad region of Karnataka, by incorporating different millets as substitutes for rice. Developed Six formulations (T_1–T_6) using foxtail millet, finger millet, pearl millet, and little millet in varying blends. Sensory evaluation was done and the data were analyzed using a Completely Randomized Design (CRD). Among the formulations, little millet-based *Todedevu* (T_5) recorded the highest overall acceptability score (8.7 ± 0.15). Nutritional analysis revealed that T_5 had significantly higher protein (13.48g), crude fibre (2.50g), and ash (7.85g) compared to the T_1 (control) with 5.38g of protein, 1.20g of crude fibre, and ash content of 5.07g. Phytochemical and antinutrient estimations indicated that total phenolic content (TPC) was higher in T_5 (63.44 mg/100 g) than T_1 (51.47 mg/100 g), and total flavonoid content (TFC) was also higher in T_5(45.86 mg/100 g) compared to T_1 (39.23 mg/100 g). Total polyphenol content was slightly increased in T_5 (12.83 mg/100 g) compared to T_1 (12.03 mg/100 g). Antinutrients such as tannins (9.32 mg/100 g), phytic acid (0.0521 mg/100 g) content was found to be high in T_5 and oxalate content was low (1.10 mg/100 g).However, tannins (7.68 mg/100 g) and phytic acid (0.0416 mg/100 g) content was lower in T_1 and oxalate content was high (1.26 mg/100 g). Antioxidant activity, determined by DPPH radical scavenging assay, was highest in T_5 (86.75 AAE mg /100 g) compared to T_1 (74.52 AAE mg /100 g). Mineral analysis showed that T_5contained higher levels of calcium (19.7 mg/100 g), zinc (1.24 mg/100 g), and phosphorus (44.85 mg/100 g), but a lower level of iron (0.22 mg/100 g) compared to T_1. Storage studies indicated that laminated pouches better retained sensory attributes and minimized rancidity compared to HDPE packaging during 90 days of storage. The study concludes that little millet makes *Todedevu* healthier, tastier and more shelf- stable.