

Role of Triose Phosphate Utilization in Regulating Trade-Off between Carbon and Nitrogen Assimilation

P.S. RUBASHRI AND M.S. SHESHSHAYEE

Department of Crop Physiology, College of Agriculture, UAS, GKVK, Bengaluru

THIS study investigates the regulatory role of triose phosphate utilization (TPU) in coordinating carbon and nitrogen assimilation in rice under altered source-sink dynamics. Using defoliation and panicle removal treatments, we simulated source and sink limitations to assess TPU's impact on photosynthetic performance, nitrogen metabolism and yield. Source-limited treatments exhibited increased carbon assimilation under high CO₂ and light conditions, with enhanced chlorophyll retention and elevated nitrite and nitrate reductase activities. In contrast, sink-limited treatments showed reduced nitrate reductase activity. Soluble protein content was significantly higher in source-limited plants, although source limitation led to yield reductions, which were even more pronounced under sink limitation. Interestingly, the 100-seed weight remained consistent across all treatments, irrespective of source or sink limitations. Under stress conditions, the variety Dhaksha showed carbon assimilation comparable to the high-protein variety Navara, with both genotypes exhibiting increased soluble protein content but a reduction in yield. These findings underscore TPU's essential role in regulating carbon and nitrogen pathways, offering insights for improving crop resilience and productivity in variable environments.

Influence of Leaf Mass Area on Water Use Efficiency among Rice Germplasm under Aerobic Condition

R. SWETHA AND K.V. SHIVAKUMAR

Department of Crop Physiology, College of Agriculture, V.C. Farm, Mandya

RICE is one of the major food crops which serves as a staple food for majority of the world's population. Uneven rainfall and frequent droughts have brought the necessity to adopt aerobic cultivation. Water use efficiency (WUE) is an important physiological trait which determines the growth rates and has relevance under both resource sufficient as well as deficit conditions. WUE is a complex trait controlled by both photosynthesis and transpiration. Leaf thickness and stomatal frequency are two important traits that determine WUE through their influence on net assimilation rate (NAR) and mean transpiration rate (MTR), critical subcomponents of WUE. A study was conducted to evaluate the consistency of leaf mass area (LMA) and WUE among eight genotypes and these genotypes were grown in phenomics facility under two water regimes *i.e.*, well-watered (100% FC) and water-limited (60% FC) conditions to evaluate WUE, LMA and stomatal frequency. Leaf anatomical characters in altering LMA was also evaluated among the genotypes. Intrinsic water use efficiency (iWUE) increased under water limited condition and the genotypes belonging to high WUE maintained the high intrinsic water use *i.e.*, consistency is maintained. The genotype with low LMA has significant difference in leaf vein area among control and stressed plants, that is leaf vein area of low LMA genotype had high leaf vein area compared to high LMA genotype. SEM images representing the contrast genotypes for LMA showed that high LMA genotype had high midrib thickness, high leaf thickness with low area of airspace and low vascular bundle pore, whereas the low LMA genotype showed low midrib thickness, low leaf thickness, with high area of airspace and high vascular bundle pore. The area of airspace more in low LMA type is due to more death cell in them.

Evaluation of Microbial Consortium for Plant Health Management of Cowpea (*Vigna unguiculata* L. Walp)

H.S. RAJU AND N.N. ASHA

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

THE *Rhizobium* associated with cowpea nodules were isolated, characterized and screened for plant growth promotional activity. The elite isolate was identified as *Rhizobium nepotum* OR574343. The bioinoculants viz., *Bacillus subtilis*, *Frateruria aurantia*, *Pseudomonas fluorescens* and *Trichoderma harzianum* were also used in the study to develop microbial consortium. *In vitro* screening of bioinoculants was carried out by dual culture method against the cowpea fusarium wilt pathogen (*Fusarium oxysporum*). The per cent growth inhibition by *B. subtilis* (48.15 %), *P. fluorescens* (61.11 %), and *T. harzianum* (76.30 %) was recorded. A pot experiment was conducted under greenhouse conditions at the Department of Agricultural Microbiology, GKVK, with thirteen treatments replicated thrice consisting of various NPK levels (50, 75, and 100 percent RDF), microbial consortium and *F. oxysporum*. The microbial consortium application method was varied viz., seed treatment, soil application and combined application (seed treatment and soil application). The treatments with 100% RDF + Microbial consortium (Seed treatment + soil application) + *Fusarium oxysporum* (T_7) and 75% RDF + MC (ST+SA) + *Fusarium oxysporum* (T_{10}) recorded higher disease reduction of 90.91% and 86.36%, respectively. The same treatments recorded significantly higher growth and yield attributes viz., plant height (164.33 and 162.67 cm), number of branches per plant (24.33 and 25.67 branches) and pod yield (99.33 and 107.00 g/plant), respectively and also recorded higher soil macronutrient availability and plant nutrient uptake at harvest. The application of the microbial consortium improved crop growth and yield by controlling the fusarium wilt disease.

Effect of *Bradyrhizobium japonicum* and AM Fungus on Growth and Yield of Vegetable Soybean (*Glycine max* L.)

SHAIKASFIYA AND N.N. ASHA

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was conducted to isolate *Bradyrhizobium* sp. from soybean root nodules collected from National Seed Project, Zonal Agricultural Research Station (GKVK), ARS, Chintamani and Chikkaballapura district farmers field using yeast extract mannitol agar (YEMA) medium. Among the 35 isolates, four were Gram-positive, 11 and 20 were fast and slow-growing *Rhizobium* sp. and *Bradyrhizobium* sp., respectively based on morphological and biochemical characterization. The production of indole acetic acid and gibberllic acid indicated plant growth-promoting capabilities and exhibited superior nodulation, significantly higher plant biomass and nitrogen content. The isolate BR-4, identified as *Bradyrhizobium japonicum* was selected and evaluated under greenhouse conditions at various NPK levels (100, 75 and 50% RDF) supplemented with *Glomus mosseae* in vegetable soybean variety Karune cultivation. The treatment T_6 : 100 % RDF + *Bradyrhizobium japonicum* + *Glomus mosseae* showed significantly the highest in plant parameters like plant height (78.65, 89.21, 97.31 cm), leaves, branches at 30, 45 and 60 DAS, respectively and increased nodule number (29.55), nodule fresh and dry weight (211.92 and 90.47 mg /plant), chlorophyll content, plant biomass, per cent root colonization (55.73%), spore count (84.03) at 45 DAS compared to uninoculated control. The pod yield significantly increased to 48.37g over the control (18.12g). The co-inoculation of *Bradyrhizobium japonicum* with *Glomus mosseae*, positively influenced growth, nodulation, yield and nutrient status of soil in vegetable soybean variety Karune cultivation.

Bio-Efficacy and Genome Analysis of Indigenous *Bacillus thuringiensis* Isolates against Groundnut Bruchid, *Caryedon serratus* (Olivier)

C. SOUMYA AND K. TAMILVENDAN

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

Bacillus thuringiensis, a soil bacterium serves as a biocontrol agent against various members of insect orders. Efficacy of *B. thuringiensis* against the coleopteran pest groundnut bruchid, *Caryedon serratus* (Olivier) remains seldom documented. Understanding the genetic diversity of *B. thuringiensis* and its entomopathogenicity against *C. serratus* would be a viable option to manage *C. serratus*. In the present study, a total of twenty-five *B. thuringiensis* isolates were isolated from soil and deceased larvae of *Holotrichia serrata*. Bioassay of these isolates against second instar larvae of *C. serratus* yielded an efficient *B. thuringiensis* strain NBAIR-BtHS with the pest mortality rate of 68 per cent and recorded significantly lower LC_{50} value (15.96 $\mu\text{g/mL}$) compared to control. Whole genome sequencing of this isolate through Illumina next generation platform revealed the presence of 5.5 Mbp and 2.2 Mbp of genomic and plasmid DNA that contained 5,845 and 2,283 genes, respectively. Mining for novel insect toxicity related genes using BtToxin scanner revealed a total of 18 genomic DNA borne genes (*chitinase C*, two copies of *zwa6*, two copies of *inhA1*, four copies of *zwa5A*, four copies of *bmp1*, *enhancin*, *mpp46Ab1*, *vpb4Ca1* and *spp1Aa1*) and 6 plasmid borne genes (two copies of *zwa5A*, *mpp46Ab1*, *vpb4Ca1*, *spp1Aa1* and *bmp1*). The current study provides genetic insights into the *B. thuringiensis* strain NBAIR-BtHS and documents the presence of novel insecticide toxicity related genes which can be used for the development of transgenic plants resistant to coleopteran insects in general and *C. serratus* in particular to prevent post-harvest loss of groundnut.

Effect of Oil Cakes and their Isolates on Growth and Yield of Soybean (*Glycine max* (L.) Merr.)

SHAMEENABEGAM M. KAMATAGI AND R.N. LAKSHMIPATHI

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

A study was conducted to isolate potassium solubilizing bacteria from oil cake samples and isolates were inoculated to soybean to check their efficiency with respect to growth and yield. Potassium solubilizing isolates (25) were isolated from the different oil cakes samples collected from UAS, GKVK, Bengaluru. The nine efficient isolates producing a prominent halo zone were selected for detailed studies. Morphological and biochemical characterization of selected isolates were performed. Among the bacterial isolates, KSIP-2 and KSIC-2 showed the highest potassium solubilizing efficiency on agar medium (140.00 % and 133.30 %) and in broth (45.00 and 41.00 mg L^{-1}), respectively. These two isolates were tested positive for siderophore and organic acid production. All the bacterial isolates were able to produce phytohormones viz., IAA and GA_3 and the maximum phytohormone production was recorded by the isolates KSIP-2 (44.57 and 35.42 $\mu\text{g mL}^{-1}$) and KSIC-2 (42.05 and 33.85 $\mu\text{g mL}^{-1}$). These isolates were identified as *Priestia megaterium* and *Kosakonia pseudosacchari*, respectively, by molecular characterization. The inoculation of these two identified isolates to soybean under greenhouse study resulted in the highest plant height, root length, number of nodules, number of pods, grain weight and nutrient uptake. This study has provided evidence that *Priestia megaterium* and *Kosakonia pseudosacchari* have significant effects on potassium solubilization and plant growth promotion.

Studies on Enhancement of Vitamin D₂ in Oyster Mushroom (*Pleurotus eous*) using UV Radiation

B.C. PAVANI AND N. UMASHANKAR

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

THE vitamin D deficiency is significantly influenced by modern lifestyles and limited dietary sources around the globe. To meet the vitamin D requirement, exploring various strategies to increase vitamin D production is a need of hour. One such approach is fortifying foods, especially mushrooms, which contain ergosterol, a precursor of vitamin D which can be converted to vitamin D₂ upon UV exposure. Therefore, the present study investigates the enhancement of vitamin D₂ content in pink oyster mushrooms (*Pleurotus eous*) by exposing UV radiation. Three commercially available forms of pink oyster mushrooms (whole, sliced and powdered forms) were exposed to UV radiation for different time intervals (0, 10, 20, 30, 40, 50, 60 and 70 minutes) and various parameters were analysed. The maximum conversion of ergosterol to vitamin D₂ (whole: 21.95 µg/g, slice: 41.37 µg/g and powdered: 246.31 µg/g) was recorded, when mushroom was exposed to UV radiation for 50 min without significant changes in its nutritional properties. This exposure time (50 mins) was adopted further for storage studies to examine the retention of vitamin D₂ content, where UV irradiated whole and sliced mushroom was treated with 1% acetic acid as a preservative and stored at 4°C. During the storage, there was no significant loss of vitamin D₂ (whole: 18.38 µg/g and sliced: 41.45 µg/g) and other nutrients up to 6 days. Further, UV irradiated powdered mushrooms stored in refrigerated conditions retained vitamin D, for 30 days with minimal nutrient loss compared to mushroom stored at room temperature. The overall results indicate that exposure of mushroom under UV radiation for 50 minutes was sufficient to increase vitamin D₂ levels. Additionally, UV irradiated fresh mushrooms treated with 1 per cent acetic acid and UV irradiated powdered mushrooms stored at 4°C, proved as an effective method for higher retention of vitamin D₂.

Studies on Corn-Rind-Carrier Based Biofertilizer on Growth and Yield of Capsicum (*Capsicum annuum* L.) under Field Condition

Y.V. SHIVAKUMAR AND N. UMASHANKAR

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

THE current study aimed to evaluate the efficacy of corn-rind-carrier based biofertilizer on growth and yield of capsicum (*Capsicum annuum* L.) under field condition. The experiment was conducted during the *rabi* season, 2023-24, at UAS, GKVK, Bengaluru, using the capsicum hybrid as a test crop. The experiment has eleven treatments comprises of recommended dose of NPK, FYM, corn-rind-carrier based biofertilizer (NPK) and talc carrier based biofertilizer (NPK) as a check. Results revealed that higher microbial population (bacteria, fungi and actinomycetes) was observed in T₈ (Soil application of corn-rind-carrier based biofertilizer + 100 % RD (NPK) + FYM) further the functional microbes N₂ fixers, Phosphate solubilizers and potassium solubilizers were also more compared all other treatments. The enzyme activities (Dehydrogenase, urease, acid and alkaline phosphatase activities) and nutrient availability were also recorded higher in T₈ throughout the cropping period. Plant growth parameters such as height, number of branches and chlorophyll content were recorded significantly higher in T₈. Furthermore, T₈ recorded significant improvement in capsicum yield, with higher shoot and root biomass, fruit weight and overall yield (38.89 tons/ha) and found on par with T₉ (Soil application of talc carrier based biofertilizer + 100 % RD (NPK) + FYM). These effects were attributed to better nutrient release and uptake facilitated by corn-rind-carrier based biofertilizer. Compared to T₃ (100 % RD (NPK) + FYM), treatment T₈ recorded increased nutrient uptake (nitrogen: 12.16 %, phosphorus: 23.08 % and potassium: 12.84 %) and there was an increase of 10.42 per cent yield. Therefore, corn-rind powder showed comparable efficacy to talc powder, offering a viable alternative as a carrier material for biofertilizer production.

Evaluation of Beneficial Microorganisms and Phosphate Rich Organic Manure (PROM) on Growth and Yield of Soybean (*Glycine max* L.)

JYOTI SHETTAR AND R.N. LAKSHMIPATHI

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

A study was conducted to evaluate the effect of beneficial microorganisms (N_2 fixer and Phosphatic inoculants) and PROM on growth and yield of soybean. Phosphate solubilizing bacteria were isolated from the rhizosphere soil of soybean plant collected from different regions of Karnataka. Among the 25 isolates, nine efficient isolates producing a prominent halo zone around them were selected for further studies. Morphological and biochemical characterization of selected isolates were performed. The isolate, PSBD-2 recorded the highest phosphate solubilizing efficiency on agar medium (126.44 %) and in broth (140.25 mg L^{-1}) and the highest acid and alkaline phosphatase activity (5.98 and $4.86 \mu\text{mol mL}^{-1} \text{ min}^{-1}$). The isolates were tested positive for siderophore, ammonia and organic acid production. All the selected isolates were able to produce phytohormones viz., IAA and GA_3 and the highest was recorded by PSBD-2 (36.18 and 114.85 mg L^{-1}). This isolate was identified as *Pseudomonas thivervalensis* by molecular characterization. PROM was prepared using vermicompost and rock phosphate. The nutrient content of PROM was analyzed and was used as an alternative to DAP. The treatment T_8 (100 % NK + PROM + PSB (i) + AM) under greenhouse study resulted in highest plant height (92.25 cm), number of branches (19.91), leaves (56.95) and pods (37.55), grain weight (15.48 g) and nutrient content over the control. This study has provided evidence that *Pseudomonas thivervalensis* has a significant effect on phosphate solubilization, plant growth promotion and PROM can be used as a substitute for chemical phosphatic fertilizers.

Evaluation of *Gluconacetobacter diazotrophicus* on Growth and Yield of Little Millet (*Panicum sumatrense* L.)

ANKITA C. BAGEWADI AND R.N. LAKSHMIPATHI

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

A study was conducted to isolate *Gluconacetobacter diazotrophicus* bacteria from sugar rich crops and the efficient isolate was inoculated to little millet to check the efficiency with respect to growth and yield. *G. diazotrophicus* strains (30) were isolated from sugar rich crop samples collected from different regions of Karnataka. The isolates were screened for N-fixing ability and ten elite isolates were further screened for phosphate solubilization efficiency. The eight isolates were found to be superior and were further carried for detailed studies. The morphological and biochemical characterization of the selected isolates were performed. All the isolates produced brown and orange to yellow pigmented colonies on PDA and LGI-P media, respectively. The cells were Gram negative, rods and non-endospore formers. Some isolates were positive for chalk ethanol test, urease test and catalase test. Among the isolates, GD-1 performed better *w.r.t* siderophore, GA ($5.76 \mu\text{g 25mL}$), IAA production ($5.18 \mu\text{g/mL}$), Zn solubilization, ammonia and organic acid production. The efficient isolate was identified as *Gluconacetobacter diazotrophicus*, using molecular characterization. The isolate was inoculated to little millet under greenhouse conditions. The inoculation resulted in the highest plant growth and yield viz., plant height (59.91 cm), number of leaves, chlorophyll content, test weight (3.17g), panicle weight (3.89g), straw and grain yield in treatment 14 (75% N + 75% P + 100% K + isolate + *Glomus mosseae*). The study has also provided an evidence that *Gluconacetobacter diazotrophicus* has significant effects on N- fixation, phosphate solubilization and plant growth promotion.

Screening and Evaluation of Silicate Solubilizing Bacteria for Mitigation of Drought Stress in Groundnut (*Arachis hypogaea* L.)

A.N. NAMRATHA AND K. NAGARAJU

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

DROUGHT severely affects plant growth and productivity, particularly in arid regions, jeopardizing global food security. Utilizing drought-tolerant plant growth-promoting bacteria (PGPBs), especially silicate-solubilizing bacteria (SSB), offers a promising solution to enhance plant stress tolerance and growth. Keeping this in mind, a cursory study was conducted to isolate, characterize and evaluate drought-tolerant rhizobacteria capable of solubilizing silicate to improve groundnut (*Arachis hypogaea* L.) growth under pot culture experiment. Initially fifty bacterial isolates were isolated from groundnut rhizosphere soil using Bunt and Rovira medium supplemented with magnesium trisilicate (0.25%), among them twenty-nine isolates demonstrated efficient silicate solubilization, in which isolate SSB-13 recorded higher solubilization efficiency (252.85%) with available silicate content (96.68 mg/L). Six isolates (SSB-8, SSB-10, SSB-12, SSB-13, SSB-14 and SSB-24) were selected for further investigation, along with the reference strain *Citrobacter koseri*. The isolates were tested for drought stress tolerance using polyethylene glycol (PEG) to stimulate different water potentials. SSB-13 showed exceptional drought tolerance, maintaining growth even at 30% PEG (-0.92 MPa) and exhibited the highest antioxidant activity (77.59%) and proline accumulation (35.9 µg mL⁻¹) under drought stress and identified as *Pseudomonas taiwanensis* strain UASB_SSB_13 through molecular analysis. A pot experiment was conducted to assess the effect of SSB inoculation on groundnut growth under drought stress (75% and 50% field capacity). Inoculation with *Pseudomonas taiwanensis* strain UASB_SSB_13, supplemented with calcium silicate (CaSiO₃) at 10%, significantly enhanced plant growth, photosynthetic activity, mineral nutrition and yield (5,126.67 kg/ha at 50% FC) while reducing oxidative stress markers like malondialdehyde. These findings revealed the potential of SSBs, particularly SSB-13, as a sustainable solution for improving drought resilience and growth in groundnut, especially under moderate drought condition.

Potentiality of Sulphur Oxidizing Bacteria for Growth and Yield of Groundnut (*Arachis hypogaea* L.)

K.L. VARSHITHA AND K. NAGARAJU

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

THE study aims to isolate sulphur oxidizing bacteria (SOB) and their plant growth promoting potentials in groundnut. A total of 31 SOB isolates were isolated from the groundnut rhizospheric soil and purified using thiosulphate broth. The isolates were qualitatively screened for dye and pH reduction. Among all isolates, SOB-1 isolate reduced the maximum pH from 8 to 4.54. Eighteen isolates that showed positive results for dye and pH reduction were further screened quantitatively for sulphate ion production. SOB-1 isolate produced the maximum (1.36 mM) sulphate ion concentration. Nine isolates produced less than 0.5 mM of sulphate ion. Seven efficient isolates producing higher sulphate ion were selected for further studies. Morphological and biochemical characterization of seven efficient isolates were studied. *In vitro* study revealed that all seven isolates promoted plant growth by producing ammonia, hydrogen cyanide, indole-3-acetic acid (IAA), siderophores and phosphate solubilization. Efficient SOB-1 isolate was molecularly identified as *Stenotrophomonas maltophilia*. In greenhouse study, the treatment with 100 per cent elemental sulphur+ *Stenotrophomonas maltophilia* resulted in increased parameter of growth (plant height, nodule number and weight, fresh and dry weight of plant) yield (seed yield, oil content) and nutrient content over control. This study has provided evidences that *Stenotrophomonas maltophilia* strain SOB-1 when combined with elemental sulphur application at 30 kg/ha effectively enhanced plant growth and yield, suggesting *Stenotrophomonas maltophilia* strain SOB-1 as a potential biofertilizer for groundnut cultivation.

Development of Lignocellulolytic Microbial Formulation and Evaluation of its Degrading Ability on Crop Residues

NISARGA S. GOWDA AND R. MUTHURAJU

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

AGRICULTURAL waste can be efficiently degraded by lignocellulolytic microorganisms, offering a sustainable alternative to prevent nutrient loss caused by traditional burning practices. The efficacy of lignocellulolytic microbial consortia in accelerating the decomposition of coffee pulp, sugarcane trash and paddy straw was investigated in this work. The consortium of four lignocellulolytic microorganisms namely *Phanerochaete chrysosporium* (UASBLCF-01), *Purpureocillium lilacinum*, (UASBLCF-02), *Bacillus inaquosorum* (UASBLCB-03), *Streptomyces viridosporus* (UASBLCA-04) was used to prepare three types of formulations. The liquid microbial formulation containing 1.5% PVP has recorded the maximum microbial population of 9.01 (bacteria), 8.01 (actinomycetes) and 8.12 (fungi) log₁₀ cfu/ml after 180 days of shelf life studies. Further, decomposition of wastes were studied under *in vitro* condition for different treatments. Treatment with lignocellulolytic microbial consortia, 10 per cent cow dung and 2 per cent urea showed highest degradation of paddy straw, sugarcane trash and coffee pulp and these results were similar to PUSA decomposer treatment. The composting for 60 days has resulted in a notable reduction in the C: N of sugarcane trash from 95.96 to 14.65, coffee pulp from 28.21 to 11.71 and paddy straw from 80.57 to 8.88. There was a significant reduction in Neutral Detergent Fiber (NDF) content, from 84.12%, 55.28%, 73.86% to 15.83%, 15.42% and 14.11% in sugarcane waste, coffee pulp and paddy straw, respectively. The quality of compost was further evaluated for humic acid and fulvic acid content which was found to be significantly higher than control. Compost produced has positive impact on seed germination and seedling vigour indices of different crops. This approach enhances the conversion of organic matter in agricultural residues by restoring essential nutrients back into the soil.

Biodegradation of Herbicides (Atrazine and Pendimethalin) by Biofilm-Forming Bacteria

ASISH ROYAL TALLURI AND K. TAMILVENDAN

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

EXCESSIVE herbicide usage contaminated the agricultural soils threatening the soil biodiversity, water bodies and groundwater. Atrazine and Pendimethalin, though banned in many countries, are still in use in India. These herbicides have longer half life time in the environment and jeopardize the ecosystem. The existing conventional methods of remediation proved costly and ineffective warranting the development of alternate ecofriendly remediation strategies. Under the circumstance, developing an ecofriendly approach assumes a greater significance. Biofilm-forming bacteria producing biosurfactants would offer a viable option as they help in absorbing the pesticides from the environment better than its planktonic forms. Therefore, biofilm-forming bacteria along with biosurfactant producing capacity were isolated from fields contaminated with Atrazine and Pendimethalin. In minimal salt medium, the consortium comprising of two isolates degraded 91.5 per cent of Atrazine and 70.1 per cent of Pendimethalin. These two isolates were identified as *Klebsiella variicola* and *Pseudomonas putida*, respectively through molecular analysis. These isolates could tolerate a maximum concentration of 500mg/L of atrazine and 400mg/L of pendimethalin. Soil microcosm study revealed that the consortium decreased the half-life of herbicides significantly (0.28 and 1.15 days) compared to control (22.1 and 57.5 days) achieving more than 95 per cent degradation of Atrazine and 80 per cent of Pendimethalin. To validate the degradation potentials of these isolates in real time conditions, a pot experiment was conducted under greenhouse conditions using Maize as a test crop. The consortia not only degraded and reduced the half life time of these herbicides in the rhizosphere but also improved the plant growth compared to control and non-biofilm forming bacteria. The present study documents that biofilm formation in the bacterial species remediates the herbicides due to cooperative metabolic interactions among the cells in addition to the extracellular polysaccharides in the biofilms.

Bioethanol Production from Lignocellulosic Agro-Biomass

M. KEERTHI PATEL AND R. MUTHURAJU

Department of Agricultural Microbiology, College of Agriculture, UAS, GKVK, Bengaluru

AN experiment entitled 'Bioethanol production from lignocellulosic agro biomass' focuses on optimizing the bioethanol production process from lignocellulosic agricultural residues (paddy straw, maize stover and sugarcane trash). These substrates were selected due to their high lignocellulose content, making them ideal for bioethanol conversion. The primary objectives were to optimize the growth conditions for selected microorganisms (*Bacillus inaquosorum*, *Phanerochaete chrysosporium* and *Streptomyces viridosporus*) was 30°C and neutral pH levels were optimal for maximizing lignocellulolytic activity. Various pretreatment was carried out using physical, chemical and combined methods. Among these, a combined alkali-assisted hydrothermal pretreatment yielded the highest reducing sugar release in paddy straw (2695.00 µg g⁻¹) and maize stover (2864.72 µg g⁻¹) while, acid-assisted hydrothermal pretreatment yielded the highest reducing sugar release in sugarcane trash (2736.95 µg g⁻¹), significantly enhancing the digestibility of the biomass. Using simultaneous saccharification and fermentation (SSF) with *Zymomonas mobilis*, ethanol yields were evaluated. Sugarcane trash exhibited the highest ethanol yield (3.28 %), followed by maize stover (2.14 %) and paddy straw (2.12 %). The combined pretreatment approach demonstrated significant improvement in ethanol production efficiency, underscoring the importance of substrate-specific pretreatment for maximizing output. This research contributes valuable insights into bioethanol production from crop residues, promoting sustainable energy solutions.

Cloning of Lipase Gene from *Pseudomonas aeruginosa* and its Expression in *E. coli*

K.R. GANESH AND T.M. NINGARAJU

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

LIPASES, enzymes that perform the hydrolysis of triglycerides into fatty acids and glycerol, present a potential paradigm shift in the realms of food and detergent industries. Their enhanced efficiency, energy conservation and environmentally friendly attributes make them promising substitutes for chemical catalysts. Motivated by this prospect, our investigation targeted the heterologous expression of a *lipase* gene, employing *E. coli* as the host organism. The *lipase* gene was sourced from *Pseudomonas aeruginosa* genomic DNA open reading frame spanning 936 bp by PCR using gene-specific primers. Initial cloning into the T/A vector (pTZ57 R/T) paved the way for subsequent sub-cloning into the pET-28a(+) bacterial expression vector. Transformation into *E. coli* BL21 codon plus strain ensued for the expression of the recombinant protein which was induced at 37 °C. The resultant insoluble protein fraction, having the expected molecular mass of 37 kDa, was subjected to partial purification and immobilized in sodium alginate beads to assess its enzymatic activity. The purified recombinant lipase exhibited a remarkable specific activity of 6595.71 U/mg in the dialyzed fraction, markedly surpassing the crude fraction's 1182.87 U/mg. Optimal activity of the recombinant enzyme was found to be at 40°C and pH 8.0. Further optimization of growth media and transesterification conditions for cooked sunflower oil, yielded good outcome. Under optimized conditions (oil to methanol molar ratio of 1:3, 15 g of immobilized enzyme, at 37 °C for 48 hours), a methyl ester yield of 68.43 per cent was achieved, underscoring the potential of current recombinant lipase in industrial applications.

Transcription Analysis of the Momilactone Biosynthetic Gene Cluster and Momilactone Synthesis in Paddy under Drought Stress

BATHULA SRIVALLI AND P.S. BENHERLAL

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

RICE is a staple food crop for one-third of people worldwide and the production of rice needs to be increased to meet the demands of world increasing population. Abiotic and biotic stress factors are the major concern with respect to rice productivity considering the future changes in climatic conditions. Under biotic and abiotic stress conditions rice produces several secondary metabolites. Momilactone is one among them which is majorly associated with allelopathic activity. Stress factors such as; drought, salinity, UV radiations, bacterial and fungal infections induces the momilactone synthesis. The present study assessed the effect of drought stress on momilactone biosynthetic gene cluster transcript levels and momilactone synthesis in two contrasting paddy genotypes (821, tolerant; 340, susceptible) imposed with varied drought stress levels; 100, 75, 50 and 25 per cent field capacity. The expression of gene *OsCPS4*, belongs to momilactone biosynthetic gene cluster and the momilactone were quantified. Phenotypic observations such as shoot length, death rate, number of leaves, fresh weight and dry weight were estimated to assess the drought tolerance. Genotype 821 showed better drought tolerance than that of 340. *OsCPS4* gene expression analysis showed that in both tolerant and susceptible genotypes, the expression levels were similar under stress condition. However, momilactone synthesis was found more in tolerant genotype and also proportional to the stress. Hence, it was understood that, though *OsCPS4* is the upstream gene in momilactone biosynthesis was found not regulating momilactone synthesis and hence, further studies on the role of other downstream genes in regulation of momilactone biosynthesis is required.

High-Throughput *in vivo* Screening for Immune Modulating Phyto-Nutraceuticals Using *Drosophila melanogaster* M.

B.J. ANIL SAGER AND JITENDRA KUMAR

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

NF- κ B (Nuclear Factor kappa B) pathway plays a crucial role in regulating immune responses, inflammation and cellular functions in most organisms. Dysregulation of this pathway is associated with various health issues including Covid-19 and cancer, making it an attractive target for therapeutic intervention. Phyto-nutraceuticals having immunomodulation ability could be used to treat diseases relating to inflammation. In this study, *Drosophila melanogaster* M. was used as an *in vivo* model to establish a high-throughput screening platform for immunomodulatory phyto-nutraceuticals targeting the NF- κ B/Toll pathway. The *D. melanogaster* based model had activated Toll pathway, achieved through the genetic activation in the F₁ generation by crossing *C564Gal4;drs-GFP* flies with *UASToll10b/Cyo;drs-GFP* flies, proved to be suitable for screening candidate immunomodulatory phyto-nutraceuticals. Seventy phyto-nutraceuticals were selected based on their ADMET (Absorption, Distribution, Metabolism, Excretion and Toxicity) attributes and docking studies involving seven protein targets highlighted asiaticoside and curcumin as one of the few promising candidates, displaying favourable docking scores ranging from -5.0 to -7.0 kcal/mol. Subsequent *in vivo* testing with varying concentrations of asiaticoside (1 μ M, 5 μ M, 10 μ M) and curcumin (5 μ M, 50 μ M, 250 μ M) revealed no adverse effects on the lifespan of *D. melanogaster* and had immune modulating capabilities across all tested concentrations, as confirmed by assessing the immune response in infected flies. This study emphasizes the potential of *D. melanogaster* as a valuable model for screening immunomodulatory compounds or drugs, providing a cost-effective and ethical alternative to mammalian models in the early stages of drug discovery. The adoption of this approach has the potential to streamline the identification of immunomodulators, thereby contributing to the refinement of pre-clinical testing processes and advancing animal welfare.

Exploring Plant-Derived Compounds for Cancer Therapy: A Computational Study of RAS Pathway Proteins with Molecular Docking

K. MANIKANTA REDDY AND JITENDRA KUMAR

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

CANCER remains a global health challenge, urging a continuous quest for novel therapeutic approaches. This research presents an explorative investigation into plant-derived compounds for potential anticancer activity, specifically targeting the RAS pathway proteins. Utilizing computational techniques, a rigorous analysis of over 8,000 phytochemicals was conducted, employing molecular docking as the primary screening tool. The study involved multi-tiered screening methods—High Throughput Virtual Screening (HTVS), Standard Precision (SP) and Extra Precision (XP) docking—to identify the top 1 per cent of compounds showing promising binding affinities. Moreover, Molecular Dynamics (MD) simulations were performed for the top ligand-protein complexes, particularly focusing on KRAS G12C mutation, revealing stable binding of Guaiacylglycerol, suggesting its potential as a lead compound for inhibiting this mutation. The study further strengthened the computational findings through PASS prediction, ADMET analysis, MMGBSA scoring and toxicity assessments, reinforcing the compound's drug-like properties and safety profile. This comprehensive computational investigation underscores the promising role of plant-derived compounds, particularly Guaiacylglycerol, as a prospective candidate for further development in cancer therapy. The study provides a foundational platform for future *in vitro* and *in vivo* validation, emphasizing the potential translational impact of these computational findings in the realm of cancer therapeutics.

In-silico Docking Analysis of Iturin, Surfactin, Fengycin of *Bacillus subtilis* against Potential Target Sites of *Phytophthora infestans*

VIDYADHAR G. DHANGONDA AND S.N. NAGESHA

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

IN response to the urgent requirement for biocontrol to mitigate losses caused by plant pathogenic fungi, particularly *Phytophthora infestans* leading to late blight in *Solanaceae* crops, this study addresses environmental and resistance concerns linked to chemical pesticides. The research focuses on biopesticides, specifically lipopeptides, which demonstrate potent antimicrobial properties. These compounds offer environmentally friendly alternatives for managing not just *Phytophthora infestans* but also other plant pathogens. Our study focused on harnessing *Bacillus* lipopeptides antifungal properties. *Bacillus* sp. strain (T6) from the western ghats of Karnataka, India was selected for its reported efficacy in promoting plant growth and providing protection. We isolated and confirmed the genomic DNA of iturin, surfactin and fengycin genes through PCR amplification, followed by sequencing to understand their *in-silico* antifungal activity. Using the trRosetta tool, we built 3D structures of lipopeptides and target proteins of *Phytophthora infestans*. Conducting molecular docking experiments with the HADDOCK server to reveal compelling interactions. Surfactin exhibited the strongest binding energy (-10.1 kcal/mol) with the MAP3K target. Iturin showed notable binding energies (-19.2 kcal/mol, -13.4 kcal/mol, -9.8 kcal/mol) for ubiquitin E3 ligase, TOR and PLCP targets. Fengycin displayed promising binding energies (-9.1 kcal/mol, -12.7 kcal/mol, -14.9 kcal/mol, -8.8 kcal/mol) for DHODH, RXLR, lipases and SFI3 targets, respectively. Notably, fengycin emerged as the most effective lipopeptide against *Phytophthora infestans*.

Efficient and Stable Transformation of Orchid *Phalaenopsis* Species with Reporter Gene

R. V. RAJESH AND N. NAGESHA

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

Phalaenopsis orchid has a significant commercial value in the global market among all the orchidaceous plants. As the demand for unique and visually striking ornamental plants escalates, the successful incorporation of fluorescence is a promising strategy in increasing value. Hence, the present study was conducted with an objective to develop an efficient and stable genetic transformation method in *Phalaenopsis* species using a reporter gene green fluorescent protein (GFP). *Phalaenopsis* orchid regeneration using floral stalk nodes and the introduction of the *GFP* gene into *Phalaenopsis* orchid was standardized. The two *Agrobacterium* strains (LBA4404 and GV3101) were used for *in planta* transformation of *Phalaenopsis* with *GFP* gene. The transformation efficiency of *Agrobacterium* strain LBA4404 was found to be higher compared to GV3101 strain. The transformed *Phalaenopsis* orchid with *GFP* gene was confirmed by PCR amplification using gene specific primers of conserved and full-length genes with amplicon size of 512 bp and 711 bp, respectively. The transformed plants were further analysed for green fluorescence under the fluorescent microscopy. Further, agroinfiltration was carried out in tobacco and *Phalaenopsis* leaves with *GFP* gene construct. The presence of *GFP* gene of 711 bp was confirmed by PCR and the transient GFP expression was confirmed by SDS-PAGE with protein size of 27 kDa GFP in comparison with control leaves. These results demonstrated the presence and expression of GFP in *Phalaenopsis* orchid which will be utilized for transformation of other fluorescence genes in *Phalaenopsis* for increasing ornamental value and market demand.

Optimization of Fermentation Conditions for *Cordyceps militaris* and *in-silico* Analysis of Antifungal Property of Cordycepin with *in-vitro* Validation

MANSOOR SHOWKAT AND N. NAGESHA

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

Cordyceps militaris, a medicinal fungus has gained considerable attention due to its potential health benefits, including its production of bioactive compounds such as cordycepin with notable antifungal, antibacterial and antiviral properties. The study aimed to optimize the fermentation conditions for *Cordyceps militaris* to enhance mycelia and cordycepin production and explore its *in-silico* antifungal activity. The optimization process involved the manipulation of key fermentation parameters, including temperature, pH, carbon source and nitrogen source. The highest cordycepin and mycelial yield was achieved at a temperature of 20°C, with a pH range of 4 to 6, glucose and sucrose as the carbon source, yeast extract and casein hydrosylate as the nitrogen source, respectively. The mycelial growth was rapid on rice substrate as compared to wheat and bajra for quality spawn production indicating rice as the best option for spawn production of *Cordyceps militaris*. *In-silico* studies such as molecular docking, protein modelling were conducted to predict the antifungal activity of cordycepin against common pathogenic fungi *Alternaria mali* and *Alternaria alternata*. Among the chosen six protein targets of both *A. alternata* and *A. mali*, cordycepin had the highest binding energy with all the proteins in comparison with the control fungicide tebuconazole which was validated with *in-vitro* assay also in which mycelial extract of *Cordyceps militaris* showed around 75 per cent inhibition of fungal growth at 6000 ppm concentration. This study demonstrates the significance of optimizing fermentation conditions for *Cordyceps militaris* to enhance both mycelia and cordycepin production for various industrial applications while *in-silico* analysis provides valuable insights into the antifungal activity of cordycepin against pathogenic fungi.

Isolation and Characterization of Novel *Lipase* Gene of Bacteria from Oil Contaminated Soils

K.R. HARISH AND T.M. NINGARAJU

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

MICROORGANISMS in crude oil-contaminated soil offer a promising source of novel lipase-producing bacteria. This study aimed to isolate and characterize potent lipase producers from such environments. A total of twenty-eight bacterial isolates were isolated from twenty diverse oil-contaminated soil samples and eleven different bacterial genera were identified by molecular characterization, including *16S rRNA* gene sequencing. Preliminary screening for lipase expression revealed that *Staphylococcus warneri* exhibited superior lipid hydrolyzing efficiency (56.11 per cent) and lipase activity (224.23 Units/ mL). Consequently, this strain was selected for further investigations, including cloning and expression studies. The *lipase* gene was isolated from the genomic DNA of *Staphylococcus warneri* by PCR, using *lipase* gene specific primers. *Lipase* gene consists of an open reading frame of 2.1 kb which encodes 716 amino acids. Initially, the isolated *lipase* gene was cloned in to T/A cloning vector (pTZ57 R/T). Further, it was sub-cloned into pET-28a(+) bacterial expression vector and transformed into *E. coli* BL21 codon plus strain for recombinant protein expression. The small scale recombinant protein expression was achieved by inducing with 1 mM IPTG at 37°C with 4 hrs of induction time. The expected size of the expressed recombinant protein was estimated to be 80 kDa upon electrophoresis with 12 % SDS-PAGE. This study not only identifies a novel lipase-producing strain, *Staphylococcus warneri*, but also presents a comprehensive molecular characterization and successful expression of its *lipase* gene in *E. coli* BL21, laying the groundwork for further exploration of its industrial applications.

Transformation of Antifungal Gene *Chitinase* in Maize against Downy Mildew and *in silico* Analysis of *Chitinase* Gene

PRIYA KRISHNAN PUTHIYA PURAYIL AND N. NAGESHA

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

MAIZE is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. The demand for maize is significantly diversified from its use as a source of food to livestock feed, industrial processing, seed and other alternative uses. Downy mildew is one of the most destructive diseases of maize affecting the quality and quantity. The present study was carried out to transform maize variety (African tall) against downy mildew. *Chitinase* gene was isolated from bitter melon and PCR amplified *chitinase* gene was cloned to cloning vector. It was cloned into pBI121 plant expression vector and further transferred into *Agrobacterium tumefaciens*. The *Agrobacterium* strain GV3101 with *chitinase* was used for *in planta* transformation of maize using the germinated cotyledons. The presence of *chitinase* gene of 1.2 kb in transformed maize was confirmed by PCR amplification by using gene specific primers. *In silico* analysis of *chitinase* gene was carried out including molecular docking and protein modelling to study the antifungal activity of chitinase against downy mildew causing fungus. Molecular docking analysis of *chitinase* revealed that with all the three target proteins of downy mildew fungus, *chitinase* gene has the highest binding energy as compared to control metalaxyl. These results will further help in developing transgenic maize plants against downy mildew infection.

Integrative Analysis of Metabolome of Sandalwood (*Santalum album* L.) during Drought Host-Parasite Interaction

V. VISHWAS AND VEENA S. ANIL

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

SANDALWOOD proudly bears the designation of the state tree of Karnataka. Sandalwood as a hemiparasite requires host for its growth and development throughout its life. Drought is one of the important abiotic stress in agriculture. This study investigates host-parasite interactions in a hydroponics system, focusing on sandalwood and *Alternanthera* under drought stress. Various treatments were employed, including sandalwood alone, *Alternanthera* alone and their combinations with sandalwood. Drought stress was induced using 25% PEG-8000, causing significant leaf drop in four days. Leaf and root exudate samples were collected for protein extraction and metabolome analysis. Peroxidase (POX) and superoxide dismutase (SOD) enzyme activity increased in sandalwood and *Alternanthera* leaves under drought. Sandalwood paired with *Alternanthera* exhibited notable POX (86.47 µg/min/mg Protein) and SOD (27.85 µg protein for 50 per cent inhibition) activity. Following a 30-day recovery, sandalwood paired with *Alternanthera* showed superior leaf recovery. GCMS analysis of leaf samples and root exudates identified unique metabolite profiles for each treatment. Thiocetic acid production, associated with the lipoic acid pathway, was found in sandalwood with *Alternanthera* under drought. *Octanoyl transferase* and *Lipoyl synthase*, crucial enzymes in lipoic acid synthesis, were identified through database mining. Sandalwood sequences homologous to these enzymes were extracted, revealing potential regulatory elements in upstream regions of these genes. STIFDB (Arabidopsis Stress Responsive Transcription Factor Database) analysis uncovered transcription factor binding sites (TFBS) associated with stress response regulation. This study elucidates the molecular mechanisms underlying sandalwood and *Alternanthera* response to drought stress and provides insights into genetic pathways and regulatory elements involved.

Isolation and Characterization of Bioactive Compounds in Vegetable Soybean (*Glycine max* L.)

PRIYADARSANI SATAPATHY AND MOHAN CHAVAN

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

SOYBEAN as a high protein-containing pulse crop has reported of containing bioactive compounds which possess properties of anti-diabetic, anti-cholesterol and tumour suppressants. This study evaluates various vegetable soybean lines, characterizes bioactive proteins and identifies isoflavones and protease inhibitors, summarizing their bioactive properties. The investigation found diverse pheno-morphological characteristics in the germplasm. Germination rates ranged from 97 to 100 per cent with I-578 and JS335 displaying the highest rates. Time to 50 per cent flowering varied from 43 to 48 days, with I-1724 flowering the fastest. Maturity occurred between 59 and 75 days, with I-1724 maturing the earliest. Vegetable soybeans consistently matured faster than grain-type soybeans with an average difference of 13.05 to 22.03 days across stages. The experiment demonstrated that vegetable soybeans had high protein (29.76% in Karune) and high sugar content (16.57 % in I-1724) compared to grain-type soybean at R6 stage. Protein concentrations in leaves and seeds varied among lines, in I-578 (4.90 mg/g) and Karune (235.33 mg/g) exhibiting the highest protein recovery. Isoflavone content was found to be more in vegetable soybean variety Karune (40.80 mg/g Genistein and 25.46 mg/g Daidzein) than grain type. Concentrations of albumin (mean 80.88 %), globulin (78.46 %), and prolamin (83.44 %) are notably higher in vegetable soybean. Zymography results revealed heightened protease activity in albumin (0.18), globulin (0.03) and prolamin (0.07) in grain soybean. Upon assessment of trypsin inhibition activity of soybean seed Karune displayed the lowest trypsin unit inhibited per milligram of protein i.e., 14.4 to 53.8 TUI/mg. The comprehensive investigation provides valuable insights into the phenotypic and biochemical diversity of vegetable soybean lines, emphasizing their potential for nutritional and functional properties.

***In-silico* Identification of Gene Markers for Plant Architectural Genes in Browntop Millet (*Urochloa ramosa* L.)**

T. HARIPRASAD AND P. BHAVANI

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

BROWNTOP millet (*Urochloa ramosa* (L.) T.Q. Nguyen), is a warm-season perennial grass cultivated for cereal and forage. Seed-shattering and lodging are the major causes of yield loss in this crop. This study focuses on the identification of candidate genes associated with seed-shattering to be used in molecular breeding. Genes associated with seed-shattering in rice viz., *An1*, *Labal*, *Spr3*, *qSh1*, *Sh1*, *Sh4*, *Shat1* and *Ssh1* were used for analysis in browntop millet. Clustering of the selected genes through orthology analysis across closely related millet species finger millet, foxtail millet, great millet, hails panic grass, browntop signalgrass, switchgrass and maize and domain analysis confirmed the functional relevance of these genes. Leveraging transcriptome data from signal grass, a comprehensive assembly and analysis was carried out to explore the availability of selected seed-shattering genes and their extension to browntop millet. The *qSh1* gene was observed to be present in browntop millet among all the selected genes, screened from signalgrass transcriptome through PCR experiment. Further, the gene was validated in browntop millet by sequencing the amplified PCR product and subjecting the sequence to BLAST analysis. The association of *qSh1* with seed-shattering traits needs to be studied for breeding strategies, offering avenues to mitigate challenges and enhance yield in this crucial millet crop.

Examining the Possibility of Two White Grubs, *Holotrichia serrata* (F) and *Leucophalis coneophora* Burmeister (Coleoptera: Scarabaeidae) Gut Bacteria for the Degradation of Lignocellulose

GATTA VISHNU VYAS AND B.N. RAMESH

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

WHITE GRUBS (*Holotrichia serrata* and *Leucophalis coneophora*) are major pests in sugarcane and arecanut cultivation in the Karnataka region. These grubs contain gut microbiota that are rich in cellulolytic bacteria, which significantly aid in the breakdown of cellulose. Despite its economic importance as a pest, little is known about the diversity and community structure of symbiotic gut bacteria that potentially function in cellulose digestion. To fill this gap, a culture-dependent approach was employed to evaluate and characterize cellulose-degrading bacteria from the fermentation chamber of white grubs. In this study, Cellulolytic bacteria isolated from the white grub were identified and characterized using 16S rRNA sequencing. A total of 17 morphologically distinct bacterial isolates were successfully obtained, 13 of which exhibited significant cellulolytic activity. Among these isolates, four promising isolates LC1B1, LC3B1, H4B3 and H5B2 were identified for their robust cellulolytic capabilities and were selected for further investigation. Notably, LC3B1 (*Bacillus toyonensis*) exhibited the highest substrate degradation of corncob powder (28.15%), paddy straw (31.45%) and groundnut husk (33.25%). LC3B1 showed significant β -1,4-endoglucanase activity of 3.614 ± 0.02 IU/mL and 2.082 ± 0.02 IU/mL on groundnut husk and corncob, respectively. Field emission scanning electron microscopy (FESEM) revealed that the adhesion of the bacteria to the substrate caused structural alterations due to hydrolysis. The hydrolysis of the substrate was further substantiated through FTIR analysis, which revealed a decrease in the intensity of the cellulose bands in the infrared range of 400 - 4000 cm^{-1} indicating the degradation of cellulose. This study highlights the diverse cellulolytic capabilities found in the gut bacteria of white grubs, offering promising avenues for biotechnological applications in lignocellulosic biomass degradation and biofuel production.

***In silico* and *in vitro* Screening of Antidiabetic Pentacyclic Triterpenoid Compounds from Medicinal Plants**

S.N. MEGHANA AND S. SHYAMALAMMA

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

Diabetes mellitus (DM) is a metabolic disorder characterised by persistent hyperglycemia and abnormalities in the metabolism of proteins, fats and carbohydrates caused due to deficiencies in either of the insulin production or action. There is a need to explore natural compounds which mimic the insulin and reduce blood glucose levels and also reduce side effects of synthetic drugs. Triterpenes present in some medicinal plants have demonstrated insulin secretion, glucose transport, uptake, absorption and enhanced glycogen synthesis in various studies. Thus, the study focused on medicinal plants and their potential for managing *Diabetes mellitus*. The research involved screening selected medicinal plants known for their antidiabetic properties, with a focus on pentacyclic triterpenoids (PTCs). Methods included quantitative phytochemical analysis, identification of compounds through GC-MS, evaluation of antioxidant and antidiabetic activities through *in vitro* enzyme inhibition assays. GC-MS analysis identified various PTCs in *Artocarpus heterophyllus* and *Tinospora cordifolia* showing the highest number. Lupeol, Oleanan-3-yl acetate, D:A-Friedooleanan-7.alpha.-ol and 20-A-Friedooleanan-3-ol were shown to possess significant antidiabetic activity. Dichloromethane extracts of *A. heterophyllus* exhibited the strongest inhibition of α -amylase ($68.63 \pm 2.51 \mu\text{g/mL}$) and α -glucosidase enzymes ($53.86 \pm 0.57 \mu\text{g/mL}$), comparable to the standard drug acarbose with α -amylase ($32.07 \pm 2.34 \mu\text{g/mL}$) and α -glucosidase ($49.56 \pm 1.71 \mu\text{g/mL}$) inhibition. *A. heterophyllus*, has potential in diabetes management due to presence of higher phenols ($226.10 \pm 4.46 \text{ GAE mg/100 g dry weight}$), flavonoids ($555.22 \pm 7.9 \text{ RE mg/100 g dry weight}$) and triterpenoids ($627.09 \pm 78.23 \text{ UAE mg/100 g dry weight}$) content which have inhibitory action on above mentioned enzymes.

CRISPR/Cas9 Mediated *MaACO1* gRNA Transformation and Molecular Screening in Banana Protoplast

B.V. UDAY KUMAR AND N. NAGESHA

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

BANANA ripening is a rapid, complex process resulting in post-harvest losses limiting the fruit's shelf life and commercial value. In the present investigation, 3 banana varieties viz., Yelakki, Rasabale and G-9 were analysed for morphological and biochemical parameters which demonstrated significant changes during ripening, including colour shifts from green to black and a marked decline in firmness from 5000 mm/s on 3rd day to 500 mm/s on 6th day and similar decline was observed in Yelakki and Rasabale. Increased soluble sugar content was observed in G-9 with 10 $\mu\text{g/g}$, whereas Yelakki and Rasabale with 9 $\mu\text{g/g}$ on 9th day. Increased protein content was observed in all 3 varieties, where decline in β -carotene was observed from 35-60 $\mu\text{g/g}$ to 13-18 $\mu\text{g/g}$ upon ripening. This research aimed to address these challenges by employing CRISPR/Cas9 to edit the *MaACO1* gene, a key regulator in fruit ripening. Expression analysis of *MaACO1* performed via qRT-PCR indicated high expression in the pulp and peel during ripening particularly in Rasabale pulp. This tissue-specific expression pattern supported *MaACO1* as an ideal CRISPR/Cas9 target gene for delaying ripening. Three guide RNAs were designed to target specific *MaACO1* regions, where two gRNAs successfully cloned into plant expression vectors and transformed into G-9 banana protoplasts. Editing was confirmed by PCR and sequencing. The results showed single-nucleotide substitutions, insertions and deletions. This down regulation is anticipated to delay the ripening process, extending shelf life. The results demonstrate that CRISPR/Cas9 can be effective in modulating ripening associated genes, by improving banana post-harvest quality.

Identifying Therapeutic Phytochemicals for Acute Myeloid Leukemia Based in *in silico* Screening, Admet, Docking and Molecular Dynamics Simulation Studies

UDDALAK DAS AND JITENDRA KUMAR

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

CANCER is a major cause of global mortality with acute myeloid leukemia (AML) presenting significant treatment challenges due to low survival rates, especially in older patients. Leveraging phytochemicals for their bioactivity and low toxicity, this study employs a computational approach using the COCONUT database to identify natural product-based drug candidates for AML. A robust *in silico* pipeline was implemented, combining pharmacophore modelling, ADMET profiling, molecular docking, molecular dynamics (MD) simulations and MMGBSA binding free energy calculations to assess interactions and stability of candidate compounds targeting key AML proteins: FLT3, DNMT3A, IDH1/2, BCL2 and MCL1. Screening revealed compounds with strong binding affinities, including CNP0347183 and CNP0099279 for FLT3, CNP0375130 and CNP0256178 for DNMT3A, Ternstroside D (CNP0166496) for dual IDH1/2 inhibition, CNP0237679 and CNP0420384 for BCL2, and CNP0161565 and CNP0405001 for MCL1. These candidates demonstrate stable binding profiles and favourable pharmacological properties, underscoring their potential as AML therapeutics. Future steps include *in vitro* and *in vivo* validation to confirm efficacy, structure-activity relationship (SAR) studies to optimize selectivity and potency and mechanistic investigations to ensure safety and minimize off-target effects. This study showcases the efficacy of computational drug discovery in identifying natural phytocompounds with therapeutic potential for AML, paving the way for innovative treatment options.

Computational Chemistry Studies to Engineer Enzymes involved in Vitamin D Synthesis; Research to improve Biofortification in Staple Food Crops

N.U. VINOD AND JITENDRA KUMAR

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

VITAMIN D (Vit. D) plays a crucial role in calcium and phosphate homeostasis. The evolving work culture, lifestyle shifts and rising pollution levels have contributed to a significant increase in Vit. D deficiency, even in tropical regions. To address this, strategies such as prescribing supplements for deficient individuals and implementing food fortification for the general population are in use. Plants synthesize Vit. D via the phytosterol synthesis pathway, certain plants are reported to contain its active form. Current efforts aim to biofortify Vit. D in food crops. Recognizing the absence of a dedicated sequence and structure database of plant sterol synthesis enzymes, this study aims to establish a comprehensive database (https://pamb0223.github.io/Plant_enzyme_db_Vitamin_D.github.io/), including 795 enzymes from diverse plants, each with predicted thermodynamic stability parameters. Additionally, Sterol C-14 demethylase (CYP51) was engineered for enhanced activity with substrates Obtusifoliosol and 31-nor-24(25)-dihydrolanosternol through active site saturation engineering. The identified LEU112LYS_THR356ASN mutation improved substrate stability in near-attack conformations, as confirmed by molecular dynamic simulations. This study thus provides an *in-silico* resource focused on enzymes in the plant Vit. D synthesis pathway, accessible via the provided QR code.

Molecular Characterization of Vegetable Soybean [*Glycine max* (L.) Merrill] Genotypes and Comparative Analysis of Grain Type and Vegetable Type Soybean Genotypes Using Morphological Traits

MADHUMITA SAHA AND MOHAN CHAVAN

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

THE study characterized ten soybean genotypes (four grain type and six vegetable type), focusing on phenotypic, reproductive and genetic traits to explore their diversity and potential for breeding. Significant variation was observed in key traits such as plant height, branch count, pods per cluster, pod length and seed size. Vegetable soybeans matured earlier, with EC892880 reaching reproductive stages R1–R7 (37–57 days), while grain-type RKS-18 took the longest (112 days). EC892882 had the longest pods (5.63 cm) and EC892880 exhibited a greater number of pods per cluster (6.93). Analysis of variance revealed high genetic control (GCV > 25%, PCV > 20%) and heritability (>90%) for traits like days to 50 per cent flowering (99.89) and test weight (99.74), indicating their suitability for direct selection. Hierarchical clustering grouped genotypes into two primary clusters with vegetable types showing higher intra-group similarity. PCA showed PC1 and PC2 accounted for 84.5 per cent of total variation, driven by traits like days for pod setting and days taken to reach R7 stage. Tocher's clustering revealed the largest genetic distance between Clusters II and III ($D^2 = 28,292.49$). SSR marker analysis out of 45 markers have shown amplification for 41 markers, but polymorphism was absent, suggesting limited genetic diversity. This comprehensive characterization underscores the breeding potential of vegetable soybeans and recommends expanded genomic marker utilization for enhanced molecular insights and sustainable crop improvement.

Studies on Morphological and Biochemical Markers in Vegetable Soybean (*Glycine max* L.)

KAMBLE PRAVIN AUDUMBAR AND MOHAN CHAVAN

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

THIS investigation explored morphological and biochemical markers in vegetable soybean (*Glycine max* L.). Key findings include significant variability in pheno-morphological traits and biochemical compositions between vegetable and grain soybean lines. Morphological traits showed no significant differences in seeds per pod (2.66-3.0). Plant height varied greatly with Karune at 48.7 cm and RKS-18 at 27.3 cm. Test weights ranged from 14.2 g to 33.2 g, with Karune achieving the highest. Phenotypic features like leaf pubescence and pod colour varied; vegetable types generally matured faster (13-22 days earlier than RKS-18). Biochemical analysis showed vegetable soybeans had higher total protein content in seeds (33.4-49.4 mg/g) than grain soybeans (RKS-18: 7.15 mg/g). Protein profiles identified rich fractions of albumin, globulin and prolamin in vegetable soybeans. Phenols and free amino acids were also higher in vegetable types with phenol content averaging 19.16 GAE/100 mg and amino acids at 48.5 mg/g in seeds, indicating greater antioxidant activity. Conversely, grain soybeans contained higher flavonoid levels, averaging 51.4 mg/g. The study underscores vegetable soybeans nutritional and biochemical analysis with different qualitative and quantitative morphological traits. These findings highlight the health benefits and diverse applications of vegetable soybeans, the investigation provided a comprehensive understanding of the pheno-morphological characteristics, total proteins, phenols, flavonoids and amino acids in vegetable soybean lines compared to grain-type soybeans. These findings contribute valuable insights into the potential health benefits and agronomic implications of vegetable soybeans, paving the way for further research and development in soybean breeding and cultivation practices.

Compost Tea Derived Microbial Consortia for Enhancing Production of Organic Groundnut: Metabolomics and Biochemical Evaluation to Understand Mode of Action

R.P. LOHITH AND VEENA S. ANIL

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

THIS study evaluates the potential of compost tea-derived microbial consortia in enhancing biomass, yield, defense mechanisms and drought tolerance in groundnut (*Arachis hypogaea* L.) under organic cultivation. Liquid and solid consortia were developed from six bacterial strains representing nitrogen fixers, phosphate solubilizers and PGPR (NPF) isolated from aerated and non-aerated compost teas. In the field experiment, there was significantly enhanced biomass, chlorophyll content, defense enzyme activities SOD (29.66 µg/min/mg) and POX (212.51 µg/min/mg), phenolic, flavonoid levels and yield parameters treated with fresh NPF compared to two-month-old NPF consortia, which in turn was superior than control treatment. Fresh NPF-treated plants achieved higher plant height (44.01 cm), chlorophyll content (4.67 mg/g FW), and pod yield (43 pods/plant), demonstrating superior performance over two months old formulations. Disease suppression was high in NPF treatment reducing Late Leaf Spot (LLS) severity to 39.73 per cent at 90 DAS, compared to 73.06 per cent in the control. Pot experiments further substantiated these findings, particularly under drought conditions. Under drought stress, NPF-treated plants exhibited lower reductions in chlorophyll content (3.16%) and relative water content (23.2%) compared to control plants, which showed reductions of 28.88 and 60.4 per cent, respectively. NPF treatment also led to increased superoxide dismutase (SOD) and peroxidase (POX) activities, highlighting the consortia's role in abiotic stress priming. GC-MS analysis revealed the enrichment of bioactive metabolites that play roles in plant growth, development and drought tolerance. Shelf-life evaluation of consortia revealed that storage reduced microbial population density, but with storage accumulation of high auxin and gibberellin levels and unique metabolites was observed, that can enhance root growth. This study emphasizes compost tea-derived microbial consortia as a sustainable, eco-friendly approach to improving crop resilience.

Studies on Evaluation of *Clitoria ternatea* (Butterfly Pea) and *Macroptilium atropurpureum* (Purple Bush Bean) for Antimicrobial and Insecticidal Activities

K.R. GAGANDEEP AND B.N. RAMESH

Department of Plant Biotechnology, College of Agriculture, UAS, GKVK, Bengaluru

PLANTS produce a wide range of secondary metabolites, which play an important role in the plant defence mechanism. Among those cyclotides are a distinct class of defence peptides found only in particular plant families. Cyclotides have a unique cystine-cystine knot structure with a cyclic backbone. Because of their unusual structure, cyclotides are extremely resistant to enzymatic and thermal destruction. Cyclotide has antibacterial, insecticidal, anti-HIV and anticancer properties. Cyclotides also act as the potential ligands for G protein-coupled receptors (GPCRs). As far as the Fabaceae family is concerned cyclotides are identified only in *Clitoria ternatea* (Butterfly pea). In the current study *Clitoria ternatea* and *Macroptilium atropurpureum* (Purple bush bean) were investigated for their insecticidal and antimicrobial properties. Different concentrations of crude peptide extracts from *Clitoria ternatea* and *Macroptilium atropurpureum* were used to assess antibacterial, antifungal and insecticidal properties. Results show both plants extracts had antimicrobial activity, particularly *Macroptilium atropurpureum* extracts with better effectiveness against *Escherichia coli* and *Clitoria ternatea* extracts with better effectiveness against *Staphylococcus aureus* and *Xanthomonas oryzae*. *Clitoria ternatea* exhibited significant antifungal properties, while *Macroptilium atropurpureum* did not show significant antifungal properties on *Alternaria alternata* and *Fusarium solani*. Both extracts lacked insecticidal properties but only *Clitoria ternatea* exhibited significant antifeedant activity on *Spodoptera litura* and *Helicoverpa armigera* larvae. The possibility of the presence of cyclotides in *Macroptilium atropurpureum* is eliminated by *in-silico* approach: CyPred. Molecular docking identified Cter36 and Cter1 as the best interacting cyclotide with insect GPCR targets which are targeted for insecticidal activity by synthetic insecticides suggesting broad interaction potential of the cyclotide with insect GPCRs. GC-MS analysis of flowers and leaves extracts of *Clitoria ternatea* and *Macroptilium atropurpureum* identifies antimicrobial and insecticidal compounds.

Morphological Characterization and Deciphering Genetic Variability in Germplasm Accessions of Barnyard Millet (*Echinochloa frumentacea* L.)

PRAMOD AND T.E. NAGARAJA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

BARNYARD millet is one of the important small millet crops used for food and fodder purpose. Utilization of diverse germplasm is important in any breeding programme to attain improved genetic gain. In the present study, 930 barnyard millet germplasm and 2 checks were characterized for 20 morphological traits during *kharif* 2022 in augmented design. The analysis of variance (ANOVA) was performed for ten quantitative traits evaluated in barnyard millet germplasm accessions. The mean sum of squares of the accessions were significant for days to 50 per cent flowering, plant height, number of basal tillers, panicle length, peduncle length, lower raceme length, flag leaf length, flag leaf width, grain yield plant⁻¹ and test weight indicating the presence of variability among them. Descriptive statistics like mean, range and genetic parameters like phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability in broad sense (h^2) and genetic advance as percent of mean (GAM) were estimated that assists a plant breeder to formulate suitable selection indices for crop improvement. A narrow difference between GCV and PCV for all the traits under investigation, suggested least influence of the environment. Therefore, phenotypic selection would be effective for the improvement of such traits. The accessions and checks were distributed into nine clusters based on 'K means clustering'. The highest inter-cluster distance was observed between cluster IV and cluster VI indicating that the accessions between these clusters were highly divergent. Therefore, the accessions of most diverse cluster may be used as parents in recombination breeding to develop high yielding barnyard millet varieties. Twelve accessions produced higher grain yield in comparison to the checks, therefore they can be further used in barnyard millet improvement programme.

Identification of Rust Resistant Germplasm Accessions in Cowpea [*Vigna unguiculata* (L.) Walp]

P.S. DEEKSHA AND T.V. KRISHNA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

THE cowpea (*Vigna unguiculata* L. Walp) is an annual herbaceous self-pollinated legume with high resilience to harsh conditions, including hot and dry environments and poor soils. Numerous biotic stresses limit the improvement of cowpea, among which rust disease plays a major role in the reduction of yield. A set of 153 cowpea germplasm accessions was evaluated under the augmented design at GKVK, Bengaluru during *kharif* 2022 to study genetic variability for yield-related traits, to identify resistant sources to rust disease and to validate the SSR markers linked to the disease resistance. High PCV, GCV and heritability values were observed for yield traits. k-means clustering analysis categorised the accessions into 11 clusters indicating substantial genetic diversity among the accessions. Based on *per centage* disease index, four accessions were found to be absolutely resistant and 52 accessions were found to be highly resistant. Based on screening of the germplasm accessions for natural infection of rust disease, 27 accessions with disease scores under 1.5 were selected for validation of SSR markers linked to resistance against rust disease. A total of seven reported SSR markers linked to cowpea rust resistance were utilized for the validation. All the markers were found to be monomorphic. The genotypes NBC 32, IC 402104, NBC 8, IC 107120, IC 462099, IC 402114, IC-249588, NBC 7 W, PCP0306-01 and IC 198355(45) were resistant to rust disease under natural infection and showed yield performance higher than the checks, KBC 9 and C 152.

Evaluation of Backcross Inbred Lines for Late Leaf Spot Disease Resistance and Pod Yield in Groundnut [*Arachis hypogaea* L.]

TALLAPELLI VIKAS AND N. MARAPPA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

GROUNDNUT (*Arachis hypogaea* L.) is one of the important oil seed crops and rich source of proteins, oil and carbohydrates. One of the major constraints in peanut production is late leaf spot disease that hinders yield and reduces the quality of kernels. So to identify LLS resistant genotypes with high yield, oil content, oleic acid and resembling TMV2 type, the present investigation was conducted using 170 backcross inbred lines derived from two crosses C1 [(TMV-2 × ICGV 86699) × TMV-2] and C2 [(TMV2 × GBFDS 272) × TMV-2] in BC₁F₄ generation sown following augmented design. Twenty genotypes showed resistance reaction to LLS disease and resembling TMV2 type were assessed for oil content, seed quality traits and yield parameters in BC₁F₅ generation. Variability estimates, PCV and GCV were high for *per cent* disease incidence, number of pods per plant, pod yield per plant, kernel yield per plant, shelling percentage, sound mature kernel *per cent* in both the crosses suggesting that influence of additive genes in controlling these traits. Association analysis revealed that pod yield per plant was significantly and positively correlated with number of pods per plant, kernel yield per plant, shelling percentage, sound mature kernel *per cent*, plant height. Oleic acid and linoleic acid were found to have significant negative correlation. Genotypes C2-45, C2-100, C2-103, C2-29, C2-101, C2-108, C2-107, C1-48 recorded high pod yield per plant and highly resistant to LLS disease. Five genotypes C1-23, C2-44, C2-109, C2-104 and C2-107 registered high oil content. Genotypes C2-103, C2-45, C2-100, C2-108, C2-107 were found to have high oleic acid than check varieties. These eight genotypes with high pod yield and LLS disease resistance, five genotypes with high oil content can be used in further groundnut breeding programmes.

Stability Analysis of New Hybrids for Yield and Associated Traits in Sorghum [*Sorghum bicolor* (Linn.) Moench]

VINAYAKA N. SWAMY AND G. SOMU

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

FOR developing high yielding hybrids, the important step is to estimating the stability of hybrids in different locations. The G × E interaction underlies the very success of a breeding programme related to stability of varieties. Keeping in view the importance of *rabi* sorghum, an attempt was made to evaluate hybrids to assess the stability, an investigation was carried out on genotype and environment interaction over 3 locations: 1) AICRP on Sorghum, Haradanahalli Farm, Chamaraajanagara, 2) AICRP on Sorghum, Hagari Farm, Bellary and 3) College of Agriculture, V. C. Farm, Mandya during *rabi* 2021-2022. To compute G × E interaction, AMMI methods were used. The base material for experiment included male sterile line, maintainer line and different restorer lines maintained at AICRP on sorghum, Chamaraajanagara. Restorer lines which are synchronized with male sterile lines were crossed during *rabi* 2020 at AICRP Sorghum, Chamaraajanagara to produce F₁ hybrids. A total of twenty-seven F₁ hybrids along with two checks CSH-30 and CSH-14 were used in this study for comparison of yield attributing characters and quality parameters. The estimates of stability parameters viz., mean (X), regression coefficient (bi), deviation from regression (s²di), IPCA 1, 2 and A.M.M.I biplot 1 and 2 were analysed by using stability model of Eberhart and Russel (1966) and A.M.M.I. model biplots. The stability analysis for grain yield revealed that the hybrids viz., CNSH-7, CNSH-21, CNSH-12 and CNSH-23 had high mean, unit regression coefficient (bi), indicating that these hybrids were well adapted to all environments. Similarly, the hybrids CNSH-29, CNSH-16 and CNSH-25 were found to be most suitable for Brix value, whereas, the hybrids CNSH-23, CNSH-7, CNSH-21 and CNSH-12 were found to be specifically adapted to unfavourable environments for pollen fertility (%).

Haplotype Based GWAS for Weed Competitive Traits in 3k Panel of Rice (*Oryza sativa* L.)

B. SHREYA PATEL AND C.A. DEEPAK

Department of Genetics and Plant Breeding, College of Agriculture, V.C. Farm, Mandya

RICE is the most important cereal crop and main source of energy for majority of the world population. Weed competitive ability and early seedling vigour (ESV) are important traits for direct seeded or aerobic rice cultivation. In this study, 200 accessions selected from rice 3k panel were phenotyped for weed competitive, yield and yield attributing traits during *khari* 2022 under weed free and weedy conditions. With an aim to identify superior haplotypes and to understand significant marker trait associations, a genome wide association (GWAS) study and haplotype analysis was performed based on the phenotypic and genotypic data obtained from 200 accessions for weed competitive ability traits. A total of 146 marker trait associations (MTA) were identified using four different models (MLM, mrMLM, FASTmrMLM and FASTmrMLMEMMA) of GWAS in both the conditions. For haplotype analysis, each MTA was considered as a candidate gene by fixing a window region of 100kb upstream and downstream to the SNP position. In total, 599 and 711 significant haplotypes were identified in weedy and weed free conditions, respectively. Further, based on *per cent* grain yield reduction, a total of twenty-three accessions were selected with least yield reduction when grown in weedy condition and evaluated for ESV traits under laboratory condition. Genotypes carrying superior haplotypes for weed competitive traits were also identified. Overall, from the current study we found that the superior accessions with weed competitive traits possessed potential haplotype variants, which can be validated and exploited for haplotype-based breeding programmes.

Deciphering the ‘B’ Genome Donor of *Eleusine coracana* Subsp. *Coracana* (L.) Gaertn. through Whole Genome Syntenic Approach

RAVINDRA SINGH AND H.B. MAHESH

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

FINGER millet is one of the most important millet crops grown for grain and fodder in India and Africa. It is a cultivated allotetraploid species with a chromosome number of $2n=4x=36$ having an AABB genome. Total 17 accessions representing eight different species were characterized for morphological variations and revealed significant variations for growth habit, stem branching and ear shape. Phenotypically, an erect growth habit (82%), stem culm branching (65%) and an open ear shape (76%) were most commonly observed traits in the genus *Eleusine*. Light brown seed color (41%) ovoid seed shape (53%) and rough seed surface texture (53%) were the most prevalent seed characteristics. The whole genome of EC516245 (*E. indica*) was sequenced and assembled, yielding a total scaffold size of 485.87 Mbp with 52.91 per cent of the genome predicted to consist of interspersed repeats, the majority of which were retroelements (39.45%). Orthologous gene clustering of 84,217 proteins revealed that 16,610 gene clusters were common among all the three genomes viz., ‘A’ genome and ‘B’ genome of KNE796 and *E. indica* genome. Similarly, 18,559 gene clusters were shared between ‘A’ genome of KNE796 and *E. indica* genome. Inter-genome BLAST analysis identified 33,882 regions (>500bp) unique to ‘B’ genome, of which PCR primers were designed for 65 randomly chosen regions. *E. intermedia* and *E. floccifolia* exhibited high genome similarity, as inferred by DNA fingerprinting, indicating a close genetic relationship with the cultivated tetraploid finger millet. Therefore, we interpret that these species could be probable ‘B’ genome donors of cultivated finger millet.

Identification of High Yielding Rust Resistant Germplasm Accessions in Cowpea [*Vigna unguiculata* (L.) Walp]

PRATIBHA B. HONNANNAVAR AND T.V. KRISHNA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

THE rust disease causes considerable yield losses in cowpea. Development and use of high yielding rust resistant cultivars helps in stabilizing yield levels. Genotypic variations among germplasm accessions for response to rust disease is the potential source of rust resistance. A set of 156 accessions were evaluated in augmented design at GKVK, Bengaluru during *Kharif* 2023 to study variability for yield and attributing traits. These accessions were also evaluated in *Rabi* 2023 for resistance to natural infection of rust disease under field conditions, followed by confirmation of resistance reactions by artificial inoculation in polyhouse. High variability was observed among the accessions. High GCV, PCV and heritability and GAM were observed for most of the traits. k-means clustering analysis grouped the accessions into nine clusters with inter cluster distance ranging between 7.8 to 3.2 D² units indicating the presence of substantial diversity among the accessions. Based on PDI, 48 accessions showed rust resistance (PDI ≤ 10%) reaction under field conditions. These were taken for artificial inoculation in polyhouse. Out of these 48 accessions, two were found to be absolutely resistant, eight were highly resistant, 17 were moderately resistant, 18 were moderately susceptible and three were susceptible. Ten accessions i.e., IC257430, EC244046, EC528420, EC-724319, IC202791, IC296094, IC209151, IC202925, IC400103 and GC-3 which showed PDI ≤ 10% under both natural epiphytotic and artificial inoculation were considered as rust resistant accessions. Among these, two accessions IC202925 and EC528420 were recorded to be high yielding than checks C-152 and KBC-9 and were identified as high yielding rust resistant accessions.

Does Maternal Cytoplasm Influence Inheritance of Seed Morphological Traits in Cowpea? [*Vigna unguiculata* (L.) Walp]

P.K. AMAYA AND A. MOHAN RAO

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

To investigate the involvement of cytoplasm in the expression of seed morphology and productivity traits, experiments were conducted involving green- bold seeded cowpea genotype (IC 590843) having black hilum colour used as common (male and female) parent hybridized with a set of parents contrasting for seed coat colour, hilum colour and seed size to derive seven F₁ hybrids and their derived F₂ populations. Further, reciprocal cross differences were also assessed in terms of potentiality of these crosses using usefulness criterion. Parental lines, seven F₁ hybrids and their derived F₂ populations were evaluated during Summer 2024. F₂ populations derived from IC 590843 × IC 488271 and IC 488271 × IC 590843 displayed seed coat colour to be controlled by two genes with complimentary epistasis, while hilum colour exhibited simple Mendelian inheritance both in straight and reciprocal crosses, indicating absence of cytoplasmic influence. Significant differences for trait mean, absolute range, standardized range, absolute phenotypic variance, phenotypic coefficient of variation, genotypic coefficient of variation, transgressive segregation index and Usefulness criterion were also not observed between straight and reciprocal cross derived F₁ hybrids and their F₂ populations for grain yield plant⁻¹, 100 grain weight and pods plant⁻¹ suggesting the absence of role of cytoplasm in determining breeding potential of populations. However, considering the overall ranks estimated across grain yield plant⁻¹, 100 grain weight and pods plant⁻¹, F₂ population derived from the cross IC 608044 × IC 590843 was found to possess high breeding potential and worth forwarding.

Development of Genomic Resources for Resistance to Neck and Finger Blast and Grain Yield in Finger Millet [*Eleusine coracana* (L.) Gaertn.]

B.M. HEMANTH KUMAR AND H.B. MAHESH

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

FINGER millet is a climate-resilient nutri-cereal with significant potential for sustainable agriculture and nutrition. Blast disease is an important biotic stress affecting yield and quality in most finger millet growing areas. Identifying resistance to blast disease through genome-wide association studies (GWAS) by combining phenotypic and SNP data has paramount significance in advancing precision breeding, enabling development of resistant finger millet cultivars. An alpha lattice design was used to evaluate 85 finger millet accessions, comprising germplasm lines and improved cultivars, for yield related traits and blast disease reaction across three locations. Variability among the genotypes in the association panel was analysed using ANOVA. The study found significant genotypic differences for all nine traits across three locations, showing substantial genetic diversity among the genotypes. This diversity indicates potential for improving yield, blast resistance, and other traits. Significant variation was observed for both types of blast across the locations. Seventeen moderately resistant genotypes for neck blast were identified across all three locations. GWAS analysis identified 18 marker-trait associations (MTAs) for finger blast, with four SNPs at a significant threshold level ($P < 0.01$) explaining 10 to 20 per cent of the phenotypic variance (PVE); these SNPs were located on chromosomes 4B and 5A and associated with genes related to DNA ligase and gamma tubulin complex components, respectively. The findings from this study have valuable implications for finger millet breeding, particularly in enhancing resistance to blast disease.

Combining Ability of New Inbreds under Drought Stress Conditions for Grain Yield in Maize (*Zea mays* L.)

SHREEDHAR HALEMANI AND J. SHANTHALA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

THE present investigation was carried out to assess the combining ability of new inbred lines under drought stress and non-drought stress conditions for grain yield and its component traits and heterosis of hybrids for grain yield and its component traits. 25 new inbred lines were crossed with three testers in Line $\times$ Tester mating design during *kharif* 2023. The resultant 75 hybrids along with the three standard check hybrids *viz.*, MAH 14-5, NK 6240 and DKC 9133 were evaluated in simple lattice design and parents were evaluated separately in RCBD design with two replications each in drought stress and non-stress conditions during summer, 2024 for grain yield and its attributing traits. The GCA effect values from the study revealed that MAI 723, MAI 227-1 and MAI 204-1-2 in non-stress conditions, whereas in drought stress, MAI 168-3, MAI 712-1 and MAI 1-2 were the good parents for grain yield per plant. The hybrids having higher SCA, have also shown a higher magnitude of heterosis over all the check hybrids notably MAI 393-1 $\times$ CML 451, MAI 204-1 $\times$ CAL 1443 and MAI 393-1 $\times$ CAL 1443 in non-stress and MAI 393-1 $\times$ LM 13, MAI 168-3 $\times$ LM 13 and MAI 295-2 $\times$ CML 451 in drought stress conditions were found heterotic over all the check hybrids for grain yield per plant. These are found to be high-yielding and drought-tolerant hybrids. Hence, these hybrids could be further evaluated at multilocation trials to confirm their stability for commercial cultivation.

Does Direction of Cross Influence Inheritance of Fruiting Habit and Fruit Length in Chilli (*Capsicum* spp.)?

RENUKA A. SHAHAPUR AND A. MOHAN RAO

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

FRUIT length in chilli determines consumer acceptability and contributes directly to the yield. Large spectrum of variability for fruit length exists among chilli germplasm accessions. Fruiting habit could be solitary-erect (SE), solitary-pendent (SP), clustered erect (CE) and clustered-pendent (CP). Assessing spectrum of variability for fruiting habit traits, fruit length and productivity traits among F_2 segregating populations derived from straight and reciprocal crosses could determine cytoplasmic influence if any on trait expression and also assist in identifying direction of parents to be used in generating crosses. Under this premise an investigation was carried out using six diverse genotypes contrasting for fruit length and fruiting habit traits to derive twelve F_1 hybrids and six F_2 segregating and two back cross populations. Further, Parental lines, twelve F_1 hybrids, their derived F_2 and back cross populations were evaluated during Summer 2024. Fruit node⁻¹ and fruit orientation were found to be controlled by two independently assorting nuclear bi allelic genes suggesting absence of influence of maternal cytoplasm on inheritance pattern of these traits. Significant differences for trait mean, absolute range, standardized range, phenotypic variance, phenotypic coefficient of variation, genotypic coefficient of variation, transgressive segregation index and usefulness criterion were observed between straight and reciprocal cross derived F_2 populations for green fruit yield plant⁻¹ and fruits plant⁻¹, suggesting role of cytoplasm in determining breeding potential of populations. Further, population derived from the cross Phule Jyoti × Sankeshwara was potential and worth forwarding.

Identification of Male Sterility Maintenance and Fertility Restoration Responses of Backcross Inbred Lines Derived from Cultivated × Wild Sunflower (*Helianthus annuus* L.) Species

C . TEJASWAN AND S.D. NEHRU

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

AN experiment was conducted to examine the sterility maintenance and fertility restoration behaviour of 11 backcross derived inbred lines across seven CMS lines, as well as to assess the combining ability and heterosis through Line × Tester mating design during the *rabi* season of 2023. The resulting 56 fertile hybrids out of the 77 hybrids that were produced, together with four check hybrids (KBSH-44, KBSH-78, KBSH-85 and GK 2002), were evaluated in alpha lattice design and parents were evaluated in RCBD design with 2 replications during summer, 2024 for seed yield and related traits. Eight backcross derived inbred lines (PB-1620, PB-1638, PB-1639, PB-1640, PB-1641, PB-1648, PB-1649, PB-1649-1) were identified as fertility restorers for all seven CMS lines. Two lines (PB-1643-1 and PB-1647) were sterility maintainers and one line (PB-1650) was a partial restorer for all seven CMS lines. CMS 207B and CMS 903B were identified as good general combiners for earliness, seed yield plant⁻¹ and oil content whereas, tester PB-1640 was a good general combiner for seed yield plant⁻¹ and oil content and PB-1649-1 was a good general combiner for earliness and seed yield plant⁻¹. Hybrids having higher SCA, have also shown higher magnitude of heterosis over all the checks notably NDCMS 2A × PB1640, CMS 903A × PB1639, and CMS 234A × PB1649-1 for earliness, seed yield plant⁻¹ and oil content making them promising candidates for multilocation trials to confirm commercial potential. Backcross derived inbred lines that maintained sterility of all seven CMS lines could serve as potential new CMS lines through backcross breeding programmes.

Identification of Desirable Inbred Lines for Use in Hybrid Maize (*Zea mays* L.) Breeding Programmes

KULDEEP SAIKIA AND S. RAMESH

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

ESTABLISHMENT of heterotic groups (HGs), identification of best heterotic pattern (HP) and identification of most desirable tester(s) are critical (among others) to enhance the efficiency of breeding hybrids in crops including maize. In the present study, 34 diverse inbred lines were classified into HGs using two pairs of testers, namely- (i) NAI 137 and MAI 105 & (ii) MAI 115 and MAI 121 based on two different methods, namely- (i) specific combining ability (SCA) and (ii) heterotic group's specific and general combining ability (HSGCA). Inbred lines were grouped into two HGs (HG-A & HG-B) by SCA method, while they were grouped into three HGs (HG-A, HG-B & HG-C) by HSGCA method. Best HP was identified between HG-B and HG-C established by HSGCA method using 2nd pair of testers (MAI 115 and MAI 121). HSGCA method was identified as more efficient than SCA method based on the breeding efficiency statistic, which was estimated based on the ratio of greater number of high-yielding inter-HG hybrids and low-yielding intra-HG hybrids. The 2nd pair of testers MAI 115 and MAI 121 more efficiently classified the inbred lines into HGs than the 1st pair of testers. From the established HP, best triplet combinations of inbred lines (two for developing breeding populations from within a HG + one for use as tester from opposite HG) were identified based on the estimates of average test cross (TC) performance. MAI 121, one of the parents of elite single cross hybrids was identified as the most desirable tester based on four criteria, namely (i) greater TC hybrid mean (ii) greater GCA effects (iii) greater TC hybrid variance and (iv) greater accuracy to rank the inbred lines.

Induced Mutation Derived Chemo-Morphic Variability in Davana (*Artemisia pallens* Bess)

ARUN J. GANIGER AND K. MADHUSUDAN

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

DAVANA (*Artemisia pallens* Bess.), an important medicinal and aromatic herb known for its highly valued essential oil having exquisite and delicate fragrance used in perfumery and pharmaceuticals. Davanone, key component of Davana oil is of high commercial and medicinal value. However, limited genetic diversity, fluctuating oil production in existing cultivars and tiny flowers hinder supply to increasing demand for Davana oil. To address these challenges, present study focused on enhancing oil and davanone content through mutation breeding by employing chemical mutagen, Ethyl Methane Sulphonate (EMS) to induce genetic variability in Davana. The key objectives were to standardize lethal dose (LD₅₀) and select high-yielding mutants for oil and davanone content. Seeds of local cultivar 'Bengaluru' were treated with various EMS doses, using probit analysis 0.4% (16 hrs) was found as optimal dose for inducing variability. Significant morphological and chemical variability was observed in the M₂ generation with 22 mutants showing higher oil content. Gas-chromatography analysis of davana oil revealed that davanone concentration was notably higher in 14 mutants than control, demonstrating the effectiveness of EMS in enhancing biosynthetic pathways. Oil yield was found significantly correlated with number of flowers/plant, flower head diameter and fresh herb yield. Molecular diversity analysis using 20 ISSR markers showed high polymorphism (79%) among 16 mutants, indicating genetic variability. The study identified several superior mutants, including DM₂158 (highest oil content-0.50%) and DM₂103 (highest davanone content-70.92%), suggesting that mutation breeding can be a powerful tool to develop new Davana varieties with improved oil and davanone content.

Identification of Terminal Drought Tolerant High Yielding Advanced Breeding Lines in Soybean [*Glycine max* (L.) Merrill]

TEJASHWINI TULASIGERI AND T. ONKARAPPA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

PREDOMINANTLY rain-fed crops like soybean frequently experience terminal moisture stress (TMS) leading to significant grain yield losses. Development and deployment of TMS tolerant cultivars will help to stabilize soybean production under TMS environments. Based on empirical studies across crop groups, we hypothesized that segregating populations/advanced breeding lines derived from crosses involving landraces/locally adapted genotypes are putative candidates for selecting TMS tolerant genotypes in soybean. The F₆ generation derived from seven biparental crosses of soybean [*Glycine max* (L.) Merrill] was evaluated at ZARS, UAS, GKVK, Bengaluru during *Kharif* 2023 to quantify genetic variability for yield and yield relating traits. High PCV, GCV and heritability values were observed for grain yield plant⁻¹ and number of pods plant⁻¹. During *Rabi* 2023-24, 42 high-yielding ABLs selected from *Kharif* 2023 were evaluated for grain yield under non-stress (NS) and terminal moisture stress (TMS) environments. Tolerant genotypes to TMS environment were selected based on drought tolerant indices, Arithmetic Mean Productivity (AMP), Geometric Mean Productivity (GMP), Harmonic Mean Productivity (HMP), Stress Tolerance Index (STI), Drought Tolerant Efficiency (DTE) and Drought Susceptibility Index (DSI). Based on the criteria of (i) better ability to discriminate ABLs for responses to TMS environment and (ii) high magnitude of correlation of indices with grain yield plant⁻¹ under NS and TMS environments, AMP, GMP, HMP, STI and DSI were found desirable. Based on the combination of these indices, five ABLs (ABLs 7, 26, 9, 1, & 27) were identified as TMS tolerant ones with high grain yielding potential under both NS and TMS environments.

Evaluation of Germplasm Accessions in Black Gram [*Vigna mungo* (L.) Hepper] for Grain Yield and Terminal Drought Stress under Field Conditions

N.B. RACHANA AND J. SHANTHALA

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

BLACK GRAM [*Vigna mungo* (L.) Hepper] is a highly valued pulse crop cultivated globally but often suffers significant yield losses due to biotic and abiotic stresses, particularly terminal moisture stress (TMS). Ninety six germplasm accessions, along with two checks (Rashmi and LBG791), were evaluated using an augmented design during the 2023 *kharif* season to identify high-yielding accessions under optimum growth conditions. These accessions were further assessed in an alpha lattice design during the 2023–2024 *rabi* season at the University of Agricultural Sciences, Bangalore to identify TMS-tolerant accessions under field conditions. Analysis of variance (ANOVA) revealed significant genetic variability for most traits, except for pod length. Traits such as pod yield and seed yield exhibited high broad-sense heritability and genotypic coefficient of variation (GCV), indicating limited environmental influence. K-means clustering grouped the accessions into nine clusters, with inter cluster distances ranging from 3.53 to 6.37 D², revealing substantial genetic diversity. Four high yielding accessions identified for pod yield and seed yield plant⁻¹ were AVUB-2017, TU-98-18, RU-16-20, and AVUB-2021. The germplasm accessions exhibited wide variability and strong positive correlations with seed yield under both non-stress (NS) and TMS conditions for all three traits in early and late flowering sets. Indices such as Arithmetic Mean Productivity (AMP), Geometric Mean Productivity (GMP), Harmonic Mean Productivity (HMP) and Stress Tolerance Index (STI) were effective for selecting TMS-tolerant accessions. High-yielding, TMS-tolerant accessions identified included AVUB-2020, RU-16-20 and TU-98-18 (early flowering), as well as MBG-5, VBN-9, UH-04-04 and CN-281987 (late flowering). These accessions offer significant potential for breeding programs aimed at enhancing drought resilience in black gram.

Development of Genomic Resources for Resistance to Neck and Finger Blast, and Grain Yield in Finger Millet [*Eleusine coracana* (L.) Gaertn.]

B.M. HEMANTH KUMAR AND H.B. MAHESH

Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru

FINGER millet is a climate-resilient nutri-cereal with significant potential for sustainable agriculture and nutrition. Blast disease is an important biotic stress affecting yield and quality in most finger millet growing areas. Identifying resistance to blast disease through genome-wide association studies (GWAS) by combining phenotypic and SNP data has paramount significance in advancing precision breeding, enabling development of resistant finger millet cultivars. An alpha lattice design was used to evaluate 85 finger millet accessions, comprising germplasm lines and improved cultivars, for yield related traits and blast disease reaction across three locations. Variability among the genotypes in the association panel was analysed using ANOVA. The study found significant genotypic differences for all nine traits across three locations, showing substantial genetic diversity among the genotypes. This diversity indicates potential for improving yield, blast resistance, and other traits. Significant variation was observed for both types of blast across the locations. Seventeen moderately resistant genotypes for neck blast were identified across all three locations. GWAS analysis identified 18 marker-trait associations (MTAs) for finger blast with four SNPs at a significant threshold level ($P < 0.01$) explaining 10 to 20 per cent of the phenotypic variance (PVE); these SNPs were located on chromosomes 4B and 5A and associated with genes related to DNA ligase and gamma tubulin complex components, respectively. The findings from this study have valuable implications for finger millet breeding, particularly in enhancing resistance to blast disease.

Effect of Silicon Application on the Incidence of Rice Yellow Stem Borer, *Scirpophaga incertulas* (Walker) (Lepidoptera: Crambidae) with Special Reference to Mechanism of Resistance and Management

D.M. DIVYA AND L. VIJAY KUMAR

Department of Agricultural Entomology, College of Agriculture, V.C. Farm, Mandya

THE investigation on effect of silicon application on the incidence of rice yellow stem borer, *Scirpophaga incertulas* (walker) (Lepidoptera: Crambidae) with special reference to mechanism of resistance and management were carried out at the Department of Agricultural Entomology and 'A' Block, College of Agriculture, V. C. Farm, Mandya, Karnataka during 2023 and 2024. Among the silicate fertilizers used to manage the yellow stem borer (YSB), diatomaceous earth at 0.6 t ha⁻¹ proved most effective in reducing the dead heart per cent (3.05 %) and the white ear to (5.40%), with significantly higher yield (57.11 q ha⁻¹). Studies on varietal resistance in popular rice cultivars revealed that treating BR 2655 with diatomaceous earth at 0.60 t ha⁻¹ had significantly reduced the percentage of dead hearts (2.58%) and white ears (1.97%). The field evaluation of 252 local landraces against yellow stem borer identified ten resistant and forty-five moderately resistant rice varieties. Among the biophysical characters, width and angle of flag leaf, second leaf and third leaf were found positive association with infestation, While, the parameters viz., plant height, length of flag leaf, second leaf and third leaf were negatively correlated. Likewise, Among the biochemicals total free amino acids, tannins, phenols, phosphorous, potassium, calcium, zinc, manganese, copper and silicon were negatively associated with stem borer infestation. While, total soluble sugars, total reducing sugars, crude protein, nitrogen, magnesium, sulphur and iron were found positively correlated with infestation. Among the tested insecticides spinetoram 0.8 GR at 9.5 kg ha⁻¹ and chlorantraniliprole 0.4 G at 10 kg ha⁻¹ was found effective against borer infestation. However, spinetoram 0.8 GR at 9.5 kg ha⁻¹ was found to be superior in recording higher grain yield, net return and better C:B ratio (1:3.03) compared to other treatments.

Evaluation of Synthetics and Ecofriendly Pesticides against Yellow Mite, *Polyphagotarsonemus latus* (Banks) and Assessment of their Safety to Silkworm *Bombyx mori* L.

BHAGYALAXMI AND VIDYA MULIMANI

Department of Agricultural Entomology, College of Agriculture, UAS, GKVK, Bengaluru

THE study on the effectiveness of synthetic and eco-friendly pesticides against yellow mite, *Polyphagotarsonemus latus* (Banks) and their safety to silkworm, *Bombyx mori* L. was conducted at the Department of Agricultural Entomology, University of Agricultural Sciences, Bangalore from 2023-2024. The results of the field trial-I revealed that, cyenopyrafen 30SC @ 0.5 ml/L recorded lowest population of mites in all the time interval with the per cent reduction of 94.33 over control followed by spiromesifen 22.9SC @ 0.8ml/L (88.78%). The next best chemical was pyridaben 20WP @ 0.8g/L recording 85.15 per cent reduction over control. In the trial II, pyridaben 20WP @ 0.8g/L recorded highest per cent reduction over control (80.12), followed by spiromesifen 22.9SC @ 0.8ml/L (79.74%) and cyenopyrafen 30SC @ 0.5 ml/L (79.11 %). The fungal pathogens (*Metarhizium anisopliae* (Mechnikov) Sorokin) @ 4g/L and NBAIR fungal product Shatpada all-rounder (@ 4g/L) and the botanical product (azadirachtin 10000ppm @ 2ml/L) were least effective in controlling *P. latus* in both the trials. Studies on the safety of chemicals to silkworm larvae showed that, the cyenopyrafen 30SC @ 0.5 ml/L and chlorfenapyr 10SC @ 1.5ml/L (standard check) were safer to larval, cocoon and pupal parameters at both 15 and 20 days after spraying. On the contrary, the chemical pyridaben 20WP @ 0.8g/L was highly toxic to silkworm as well as spiromesifen 22.9SC @ 0.8ml/L. Thus, cyenopyrafen 30SC @ 0.5 ml/L was found effective against yellow mite and also safer to silkworm, followed by chlorfenapyr 10SC @ 1.5ml/L and can be used for the yellow mite management in mulberry.

Exploration of Entomopathogenic Endophytes from *Simarouba glauca* against Fall Armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)

VEERLA SHARONROJA AND B. SHIVANNA

Department of Agricultural Entomology, College of Agriculture, UAS, GKVK, Bengaluru

ENDOPHYTES are the symbiotic microorganisms residing within plant tissues, enhance plant resistance to pests by producing phytohormones and bioactive compounds. The exploration of entomopathogenic endophytes from *Simarouba glauca* against *Spodoptera frugiperda* was studied using culture-dependent techniques based on ITS gene and 16S rRNA sequencing. Eight fungal and ten bacterial endophytes were isolated from the bark, leaves and seeds of *S. glauca* and characterized morphologically and molecularly. Among them, *Bacillus cereus* was found in all three parts of *S. glauca*, while *Bacillus subtilis* and *Penicillium citrinum* were belong to the bark and leaves. Fungal isolates belonged to the phylum Ascomycota. While 8 bacterial isolates were belong to the phylum Bacillota. Seven fungal isolates SBF1, SBF2, SBF3, SBF4, SLF2, SLF3 and SSF1 (1×10⁶ conidia/ml) and seven bacterial isolates SBB1, SBB2, SBB3, SBB4, SLB1, SLB4 and SSB2 (6×10⁶ cfu/ml) were screened for their effects on *S. frugiperda*. The fungal isolates significantly impacted the survival and development of *S. frugiperda*. Among them, SBF1-*Cladosporium perangustum* and SBF2-*Diaporthe hongkongensis* exhibited the highest larval mortality (35.15 and 24.91%, respectively). Additionally, fungal treatments prolonged larval and pupal durations and reduced larval and pupal weights. *Cladosporium perangustum* notably reduced pupation (73.33%) and adult emergence (72.86%), while also decreasing female adult longevity and fecundity. Egg hatchability was drastically reduced in larvae treated with SBF3-*Penicillium citrinum*. Bacterial isolates, particularly SBB2-*Bacillus subtilis* and SSB2-*Enterobacter hormaechei*, caused significant larval mortality (24.14 and 17.24%, respectively). *B. subtilis* notably prolonged developmental periods, reduced pupation rates (76.67%) and affected adult emergence (78.57%).

Management of Fusarium Wilt of Castor Caused by *Fusarium oxysporum* f. sp. *ricini* (Nanda and Prasad) by Using Soil Amendments and Bioagents

SHWETA KADAM AND K. KARUNA

Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru

CASTOR wilt caused by *Fusarium oxysporum* f. sp. *ricini* is a devastating and recurrent problem affecting castor production worldwide. The fungus isolated by standard tissue isolation technique from roots of wilted castor plants on Potato Dextrose Agar produced fluffy mycelia with pinkish to purple pigmentation. Pathogenicity was established by proving Koch's postulates by standard sick pot method. Based on pathogenicity and morphological characters the pathogen was identified as *F. oxysporum* f. sp. *ricini* by comparing with the original descriptions. PCR amplification with ITS primers revealed amplicon of 550 bp and BLAST result confirmed the molecular diagnosis of *Fusarium* spp. In *in vitro* assessment of extract of soil amendment, neem cake extract (33.34, 54.03 and 58.47 % at 5, 10 and 15 %, respectively) recorded maximum mycelial growth inhibition of the pathogen followed by pongamia cake extract (17.01, 18.51 and 27.68 at 5, 10 and 15 %, respectively). Among bioagents tested Th-14 strain of *Trichoderma harzianum* (81.11 %) exhibited maximum mycelial inhibition. Among the nanoparticles tested *in vitro*, silver nanoparticle (11.11, 31.11 and 41.11 % at 50, 100 and 200 ppm) exhibited maximum mycelial growth inhibition of pathogen. Pot experiment for management of wilt, indicated seed treatment with *Trichoderma harzianum* (Th-14) and soil incorporation of neem cake effectively managed wilt disease with disease incidence of 0 per cent followed by soil incorporation of neem cake (10 %).

Epidemiology and Management of Maydis Leaf Blight Disease Caused by *Bipolaris maydis* (Y. Nisikodo and C. Miyake) Shoemaker on Maize through Induced Resistance

K. NIVEDITHA AND N.S. PANKAJA

Department of Plant Pathology, College of Agriculture, V.C. Farm, Mandya

MAIZE (*Zea mays* L.) is a staple crop with significant economic value. One of its major challenges is Maydis leaf blight, a fungal disease caused by *Bipolaris maydis*. This disease can result in yield losses of up to 42.66 per cent, making it a serious concern for farmers. To address this issue, studies has been conducted to investigate the effect of different sowing dates on the disease incidence and severity, biotic and abiotic elicitors in inducing resistance and physiological characterization of *B. maydis*. Across different sowing dates, the mean Per cent Disease Index and Area Under Disease Progress Curve ranged from 11.11 - 88.88 per cent and 987.59 - 4611.81, respectively. Results indicate that late October and mid-January sowing dates led to a significant decrease in disease severity in maize variety 900M GOLD. In addition, weather parameters viz., morning relative humidity, wind speed and sunshine hours fostered disease growth, whereas higher temperature and afternoon relative humidity hindered it. These findings were confirmed by regression analysis. Elicitors studies revealed, abiotic elicitor 1mM salicylic acid recorded the highest Peroxidase activity ($1.812 \Delta \text{Abs min}^{-1} \text{g}^{-1}$), Phenylalanine ammonia lyase activity ($1.672 \Delta \text{Abs min}^{-1} \text{g}^{-1}$), Polyphenol oxidase activity ($1.472 \Delta \text{Abs min}^{-1} \text{g}^{-1}$), and total phenol content (8.943 mg/g of fresh wt.) at 48 hrs post inoculation, demonstrated greatest potential in inducing resistance against *B. maydis*. Physiological study of the pathogen showed maximum radial growth and dry mycelial weight at continuous 24 hrs light (61.43 mm and 82.65 mg), a pH of 8 (64.12 mm and 109.90 mg), and a temperature of 30 °C (69.43 mm and 106.93 mg). Additionally, glucose and sodium nitrate, at a concentration of 2 per cent, found to be the best carbon and nitrogen sources for *B. maydis* growth recording maximum radial growth and dry mycelial weight of 78.34 mm, 105.83 mg and 67.44 mm, 96.04 mg, respectively.

Mechanistic Understanding of Sulphur Inducing Resistance against *Ralstonia solanacearum* in Tomato and Chilli

NARASAPURAM VAMSIDHAR REDDY AND M.K. PRASANNA KUMAR

Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru

Ralstonia solanacearum is the major wilt causing pathogen in tomato and chilli causing severe yield loss. A pot culture experiment was conducted to study the role of sulphur in inducing resistance against *R. solanacearum* in Tomato and Chilli. In current study, 0.5 per cent (90 % WDG) of sulphur was applied to tomato and chilli seedlings and challenge inoculated with pathogen. Increased chlorophyll content and delayed wilting was noticed upon sulphur application in both chilli and tomato compared to other treatments. Also, enzymatic analysis revealed the elevated levels of Superoxide dismutase, Peroxidase, Polyphenol oxidase and Glutathione synthase in sulphur treated and pathogen inoculated seedlings compared to other treatments. Lignin staining showed increased intensity of the stain in sulphur treated and pathogen inoculated seedlings of chilli and tomato, as a result of post structural defence mechanism. Expression analysis of defence genes (*PPO*, *NPR 1* and *PR 1*) and sulphur pathway genes (*Cysteine synthase*, *ACC synthase* and *APS reductase*) showed increased expression in sulphur treated seedlings during the infection process. Metabolome analysis revealed that various metabolites involved in sulphur assimilation upregulated when the plants were treated with sulphur. Increased abundance of amino acids, fatty acids, organic acids and flavonoids which imparted defence against pathogen was observed in the infected plants with sulphur treatment. KEGG pathway analysis revealed the enrichment of amino acids, phenylalanine and polypropanoid pathways suggesting the role of sulphur in defence. This study provides the comprehensive mechanism of sulphur induced resistance against *R. solanacearum*.

Discovery of Novel Viruses Associated with Maize and Sugarcane in Natural Ecosystem and Development of Diagnostic Protocols for their Detection

V.G. NAVYA AND C.N. LAKSHMINARAYANA REDDY

Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru

TRADITIONAL techniques of virus detection have limitations in detecting novel viruses. To overcome these drawbacks, novel approaches such as Next Generation Sequencing technologies have been used for improved detection and characterization of new or unusual viruses affecting diverse plants. Virome analysis was carried out in maize and sugarcane to identify the viruses associated with them in their natural ecosystem. Twenty five samples of maize and twenty samples of sugarcane were collected based on symptomatology by a roving survey conducted in different districts of Karnataka in the year 2024. Total RNA was isolated from the samples through phenol-chloroform lithium chloride extraction protocol which yielded high quality RNA as reflected by clear and intact bands in gel electrophoresis. The total RNA's from the samples were pooled separately for maize and sugarcane on equimolar concentration and subjected to rRNA depletion. The mRNA library was then constructed for whole transcriptome sequencing using the Illumina NOVASEQ 6000 platform. The analysis of whole transcriptome raw data revealed the presence of MSRV, MaYMV and SCMV in maize. In sugarcane, SCBMV and BSCAV were detected. From the virus associated contigs, whole genome of MSRV and near complete genome of MaYMV were recovered. Partial genome was recovered for SCMV, SCBMV and BSCAV. The neighbour network analysis for SCMV displayed reticulate topologies indicating potential recombination events, which was confirmed through RDP analysis which revealed one significant recombination event. The two viruses, MaYMV and SCMV identified in maize were validated through RT-PCR assays using specific primers.

Assessment of Disease Severity and Management of Chrysanthemum White Rust Caused by *Puccinia horiana* P. Hennings

SACHIN R. KONDAGURI AND N.S. PANKAJA

Department of Plant Pathology, College of Agriculture, V.C. Farm, Mandya

CHRYSANTHEMUM (*Dendranthema × grandiflorum* Tzvelev), which is known as the ‘Queen of the East’ or ‘Winter Queen’ is one of the oldest flower crops that is grown in the world. The crop is prone to be affected by several diseases. Among the fungal foliar diseases, chrysanthemum white rust (CWR) caused by *Puccinia horiana* is considered as one of the deadliest disease, which is regarded as the quarantine pest in many countries. A roving survey was employed to assess rust disease severity in Mandya, Mysore, Hassan, and Chikkaballapur districts during 2023-24. The mean disease severity of CWR ranged from 7.60 to 62.22 % in various locations. Hassan district had the highest mean disease severity (45.33 %), followed by Mandya (30.44 %), Mysore (26.77 %), and Chikkaballapur (24.50 %) districts. Among the different elicitors tested on the susceptible variety (Poornima), the foliar spray of 1mM Salicylic acid at 3 days post-inoculation recorded the highest peroxidase activity ($1.865 \Delta \text{Abs min}^{-1} \text{g}^{-1}$), phenylalanine ammonia-lyase activity ($1.537 \Delta \text{Abs min}^{-1} \text{g}^{-1}$), polyphenol oxidase activity ($1.378 \Delta \text{Abs min}^{-1} \text{g}^{-1}$), and total phenol content (8.392 mg/g of fresh wt.) across all the treatments at 24 hrs post application (PA) which are considered as disease resistance inducers. A notable upsurge in the defence enzymes and total phenol content was observed from 24 to 48 hrs PA of all the elicitors. Nine different fungicides were evaluated against the CWR disease, all the nine fungicides were found to be significantly effective as compared to the control. Among the treatments, Propiconazole 13.9 % + Difenconazole 13.9 % EC at 0.1 % was found significantly effective with the least per cent disease severity (7.62 %) and also recorded a maximum average yield (16.91 t/ha) with a highest benefit-cost ratio (3.79).

Revitalising Maydis Leaf Blight Management: Harnessing New-Generation Fungicides and Host Plant Resilience in Maize

T.K. SUCHITHRA AND G. JADESHA

Department of Plant Pathology, College of Agriculture, V.C. Farm, Mandya

MAIZE (*Zea mays* L.), the third most important cereal of the Poaceae family, faces significant challenges from diseases like Maydis Leaf Blight (MLB), caused by *Bipolaris maydis*. This polycyclic foliar fungal disease can cause up to 40 per cent yield loss. To address its economic impact, studies focused on fungicide management, identifying resistant sources, biochemical traits, and microbial diversity analysis. Azoxystrobin 18.2% + Difenconazole 11.4% SC achieved 100% mycelial inhibition at 75 ppm *in vitro*, while Mancozeb 75% WP showed the least (45.88%). In field conditions, Azoxystrobin 18.2% + Difenconazole 11.4% SC was most effective, reducing disease by 83.70% with a PDI of 13.69%, whereas Mancozeb 75% WP had the lowest reduction (57.50%) with a PDI of 35.51%. Among 246 genotypes screened, 27 were resistant, 125 moderately resistant, 65 moderately susceptible, and 29 susceptible with a PDI values ranging from 11.56% to 88.89% and AUDPC values from 303.33 to 2418.89. Biochemical parameters including total phenols, peroxidase, polyphenol oxidase, and phenylalanine ammonia lyase, were significantly higher in the resistant genotype (CP 202) than in the susceptible genotype (MAH 14-138). Thus, all parameters showed a negative correlation with MLB disease severity. Phenolic Profiling using LCMS revealed 18 phenolic compounds in both resistant and susceptible genotypes. The resistant genotype showed notable increases in compounds such as p-hydroxybenzoic acid, 3-hydroxybenzoic acid, benzoic acid, t-cinnamic acid, and p-coumaric acid. The microbial community associated with maize genotypes revealed five fungal genera: *Trichoderma* spp., *Aspergillus* spp., *Penicillium* spp., *Rhizopus* spp., and *Fusarium* spp. The dual culture technique showed that *Aspergillus* spp. from the resistant genotype exhibited the highest inhibition of *B. maydis* (84.29%). *Fusarium* spp. showed the least inhibition (42.86%).

Epidemiology and Management of Powdery Mildew of Sunflower Caused by *Golovinomyces cichoracearum* (DC) V.P Heluta

SUSHMITA AND M. MAHESH

Department of Plant Pathology, College of Agriculture, UAS, GKVK, Bengaluru

SUNFLOWER (*Helianthus annuus* L.), a vital oilseed crop of *Asteraceae* (*Compositae*) family, confronts significant yield losses due to major disease, powdery mildew. Morphological and molecular analysis identified as *Golovinomyces cichoracearum* (DC) V. P. Heluta the pathogen responsible for cause of the disease. Epidemiological studies of the disease based on different dates of sowing revealed that during *Kharif* 2023-24, disease onset was at 50-60 DAS for the first two sowings and at 30-40 DAS for the later two, with weather factors being insignificant. Whereas, in *Rabi* 2023-24 sowings, symptoms emerged around 35-60 DAS due to favorable conditions. Maximum and minimum temperatures were significantly positively correlated and relative humidity was negatively correlated with the disease peaking in mid-March 2024. R^2 values of 0.97 to 0.99, explained 97 to 99 per cent of variation in PDI. The highest AUDPC value (551.91) and 'r' value (0.54) were recorded during the first sowing of *Rabi*. Among the 94 genotypes screened for powdery mildew resistance, none were immune, however, PM-3 showed resistant reaction. *In-vitro* studies revealed that, difenoconazole (98.92%), myclobutanil (98.33%) among systemic; wettable sulphur 80% WP (89.50) among contact; captan 70% + hexaconazole 5% WP (87.39%) in combination; neem (47.48%) among botanicals and *Pseudomonas fluorescens* (63.78%) in bio-agents were effective. Under field conditions, two sprays of difenoconazole 25% EC @ 0.5 ml/L recorded lowest PDI (16.21) and highest yield (17.73 q/ha), which was on par with myclobutanil 10% WP @ 0.5 g/l.

Performance of Different Varieties of Okra [*Abelmoschus esculentus* (L.) Monech.] for Growth, Yield, Quality and Ratooning

S. NAGARJUNA AND G. GOPINATH

Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru

AN experiment was conducted to study the 'Performance of different varieties of okra [*Abelmoschus esculentus* (L.) Monech.] for growth, yield, quality and ratooning' at Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru, during *summer* 2022. The research encompassed various parameters, both before and after ratooning, to assess plant characteristics, flowering, pod development, yield and post-harvest characteristics. Key findings variations in plant height, stem girth, leaf number, and internodal length among the different varieties. Green Round Perennial Okra exhibited thicker stem girth (3.48 cm). Head back for ratooning was done on 75th day after sowing, indicating the potential for multiple harvests. After ratooning resulted in differences in days to initiation of branches (12.26 days), flowering (20.00 days) and fruit set (29.00 days), among the varieties with Dharwad Local showing earliness. Yield traits such as number of pods (23.51), pod length (15.69 cm) pod weight (22.13 g) and yield (47.48 t) varied significantly among the varieties, Green Round Perennial Okra outperformed others in yield and attributes. Assessing quality parameters like tenderness, phenolic and flavonoid contents revealed varietal-specific characteristics. Tenderness of okra pods (14.64 N) was highest in the variety Co-9. Greater Phenolic (6.99 mg/100 g) and flavonoid (4.98 mg/100 g) was observed in Red Okra. Shivamogga Local exhibiting longer shelf life in both polyethylene bags (9.33 days) and aluminum foil packages (12.33 days). Economic analysis indicated the highest gross (Rs.14,24,400) and net income (Rs.11,46,400), with the highest benefit- cost ratio (5.12:1) in Green Round Perennial Okra.

Effect of Biostimulants on Growth, Yield and Quality Parameters of Ornamental Sunflower (*Helianthus annuus* L.) var. GKVK-1

MAHESH NAGARAJ CHINNAPPAVARA AND R. VASANTHA KUMARI
Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru

In the present study, conducted during 2023-24 at the Floriculture unit of the Department of Horticulture, University of Agricultural Sciences Bangalore, the effects of various biostimulants on the growth, yield and quality of the ornamental sunflower variety GKVK-1 were investigated. The experiment comprised of 13 treatments featuring three different biostimulants: Seaweed extract, Humic acid and Isabion, each replicated thrice in Randomized Block Design. Biostimulants were applied three times by foliar spray at 5 ml/L concentration at 10-day intervals (10, 20, and 30 days after sowing), with seed treatments at 100 ml/L. The highest germination percentage (94.5 %) was observed in T₉ (Isabion treated seeds @ 100 ml/L) followed by T₁ (Seaweed extract treated seeds @ 100 ml/L). The growth parameters were recorded at an interval of 15, 30 and 45 days after sowing. Significant results were obtained in treatment T₂ (10 DAS Seaweed Extract @ 5 ml/L) in which highest plant height (169.35 cm), maximum number of leaves (42.33) and stem girth (89.87 mm) on 45th day after sowing were recorded. Treatment T₄ (30 DAS Seaweed extract @ 5ml/L) resulted in earliest flower bud initiation (35.40 days), maximum flower diameter (15.03 cm), maximum flowering duration (67.50 days), highest number of flower stems per acre (40222.18), maximum seed yield per acre (1235.56 kg), highest benefit-cost ratio (4.33), longest vase life (7.20 days) and highest vase solution uptake (294.00 ml). Thus, biostimulants positively impact flowering, yield and post-harvest quality, making them vital in modern horticulture for enhancing plant production.

In vitro Callus Induction and Shoot Regeneration in Grapefruit (*Citrus paradisi* Macfad.)

SHIVU M. PATIL AND P. VENKATESHA MURTHY
Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru

GRAPEFRUIT (*Citrus paradise* Macfad.) is an economic fruit crop, cultivated for its nutritional value. So far, the variation in the cultivar of this species has arisen naturally through somatic mutation. Breeding through conventional methods have also faced lots of physiological challenges. The *in vitro* culture technique requires highly responsive regeneration protocol. Therefore, the present study was undertaken to develop a protocol for *in vitro* propagation and multiplication of disease free planting material. The *in vitro* grown leaves are used as explant for callus induction and nodal segments were used for shoot regeneration. The *in vitro* grown leaves were cultured on MS media supplemented with different concentrations and combinations of 2,4-D and NAA. Better response was obtained when growth regulators were used individually rather than in different combinations. Better proliferation of calli was observed when cultured on MS medium consisting of NAA 2.0 mgL⁻¹ as it recorded minimum days (12) for callus induction, maximum callus weight (1.85 g), callusing percentage (80 %) and compact green callus, which regenerated in to shoots when transferred to a medium containing 3 mgL⁻¹ BAP. The surface sterilised nodal segments were cultured on MS media supplemented with different concentrations and combinations namely BAP, meta-Topolin and GA₃. The combination of GA₃ at 3.0 mgL⁻¹ and meta-Topolin at 1.0 mgL⁻¹ produced the maximum number of shoots (3) in nodal segments, which can be used for producing a greater number of planting materials.

Efficacy of Bio-Stimulants on Growth, Yield and Quality of Okra [*Abelmoschus esculentus* (L.) Moench]

MANOJ PITAMBAR KASHILKAR AND KAVITA KANDPAL

Department of Horticulture, College of Agriculture, UAS, GKVK, Bengaluru

THIS study examines the impact of bio-stimulants in enhancing plant growth, yield and quality parameters in okra [*Abelmoschus esculentus* (L.) Moench]. The experiment was conducted during the late Rabi season of 2023 at the Department of Horticulture, GKVK, Bengaluru, to evaluate foliar application of Moringa Leaf Extract (MLE) and Seaweed Extract (*Ascophyllum nodosum*) (SWEA), both individually and in combination, across various concentrations. The results demonstrated that the combined application of MLE @ 35 ml/L + SWEA @ 4 ml/L was the most effective, leading to significant improvements in multiple growth parameters such as plant height (76.08 cm), leaf area (137.04 cm²), fresh weight (113.17 g) and dry weight (72.42 g) of plant at 60 DAS. Additionally, significantly improved physiological and flowering traits, including earlier first flowering (32.8 days) and 50 per cent flowering (35.9 days) were recorded under this treatment. Yield attributes also showed remarkable improvement, with the highest pod length (17.37 cm), pod weight (14.06 g) and pod yield per plant (265.72 g), representing 40.3 per cent increase over the control. Seed yield attributes, such as the number of seeds per pod (38.80) and seed yield per plot (0.89 kg) and chlorophyll content (52.21 SPAD at 60 days) was also improved. The highest gross return (Rs.590,479.2) and net return (Rs.349,489.2) were achieved, resulting in a cost-benefit ratio of 1:2.45. The findings suggest bio-stimulants as promising alternatives to chemical fertilizers for improving crop quality and resilience under diverse growing conditions.

Trade Competitiveness of Afghanistan's Major Agricultural Exports in World Market - An Economic Analysis

FAHIMULLAH WARDAK AND M.N. VENKATARAMANA

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THE present study examines the trade competitiveness of Afghanistan's major agricultural exports in the global market using secondary data from 2008 to 2023 by employing tools viz., CAGR, CDVI, RCA, RSCA, NPC, Johansen Co-integration and ARCH/GARCH models to measure exports of raisins, figs, almonds, fresh grapes and pistachios. Findings showed that, agriculture contributed an average of 24.43 per cent to Afghanistan's GDP, with agricultural exports comprising about 71.65 per cent of total exports. Growth in export quantities of Afghanistan's raisins (7.20 %), figs (18.49 %), fresh grapes (19.92 %), almonds (7.05 %) and pistachios (30.05 %) were highly significant compared to other countries. The country had strong comparative advantage in export of figs, raisins and almonds while Iran faced decline in pistachios and almonds. The monthly prices analysis of integration and volatility during 2015 to 2023 revealed substantial volatility, driven by both domestic and international market dynamics. Co-integration tests showed alignment between Afghanistan's raisins prices and those of other major exporters, while limited integration was observed for figs and pistachios. Price volatility indicated persistent fluctuations, particularly for raisins and fresh grapes, with past volatility significantly influencing current prices. During 2008 to 2018 (Before ANTP), Afghanistan's agricultural exports grew sharply, with quantities up by 1,016.08 per cent and values by 1,111.85 per cent and during 2019 to 2023 (post-ANTP) export quantities fell by 25.96 per cent but value rose by 110.58 per cent. During 2008 to 2023, Afghanistan's agricultural exports experienced a positive break in 2016 and decline in 2020. Raisin's exports showed positive breaks in 2016 and 2020, while fresh grapes exports saw a sharp rise in 2015 followed by a decline in 2019. Almond's exports declined in 2009 but increased significantly in 2015, whereas pistachios exports recorded positive breaks in 2012 and 2021.

Technical Feasibility and Economic Viability of Zero Budget Natural Farming - A Study in North Coastal Region of Andhra Pradesh

VENKAT DEDIPYA MANISHA VITHEMSETTI AND G.M. GADDI

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

NATURAL farming relies on natural processes and local resources and eliminate the need for costly external inputs. The present study in North coastal region of Andhra Pradesh used data from 40 farmers each practicing natural farming and conventional farming in each of the three major districts viz., Vizianagaram, Parvathipuram Manyam and Alluri Seetha Ramaraju practicing natural farming. Data were analysed using logistic regression and Multinomial logistic regression, Bisaliah's decomposition model, Contingent valuation, other suitable analytical tools. Results of the study indicated that adoption of natural farming was higher among younger, educated and small farmers. The estimates of logistic regression revealed that education (0.2235), livestock ownership (2.3047), higher returns (0.0002), and health benefits (1.4604) were the key determinants for adopting natural farming. Natural farming reduced cultivation costs by 15 per cent, 14 per cent and two per cent for paddy, cotton and ragi, respectively, with relatively higher net returns than their conventional farming practicing counterparts. Carbon emissions were consistently lower from crops under natural farming compared to conventional practices. Major challenges in natural farming included intensive labour requirement, cumbersome input preparation, low initial yields, limited marketing and consumer awareness. Value chain analysis revealed that farmers fetched premium prices for naturally grown paddy and ragi. The consumer preference analysis for naturally grown produce revealed that health, dietary inclusion and taste as major reasons for their choice but were unhappy with irregular availability and lack of certification. Educational status and income significantly influenced willingness to pay a premium for natural products. Study advocates enhanced support and policy interventions for promotion of natural farming through suitable certification procedures for better price realization and provision of incentives proportional to the extent of emissions reduction.

A Study on Potential of Cashew Cultivation in Enhancing Livelihood of Farmers in Cuddalore District of Tamil Nadu

R. AARTHI AND H. LOKESHA

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THIS study was undertaken in the Cuddalore district of Tamil Nadu to analyse the economic viability and resource use efficiency of cashew cultivation, income and employment drivers of cashew farmers and major constraints in cashew cultivation. The primary data were collected from 90 cashew farmers comprising 45 each from Panruti and Vridhachalam taluks, respectively. The data were analysed using capital budgeting techniques like, NPV, BCR and IRR, production function and sentiment analysis. The results revealed that cashew cultivation is both economically viable and financially feasible with positive NPV (Rs. 1,06,635), BCR (1.38) and IRR (21.75 %) greater than 12 per cent. The efficiency analysis revealed that area (0.66) and labour (0.22) were over-utilized while the inputs such as FYM (2.44), fertilizers (19.74) and PPCs (1.85) were under-utilized. Income and employment generation through various cashew processing activities was found to be the highest for the women belonging to marginal and small farmers categories contributing to 52.19 and 37.5 per cent, respectively to their annual income. The scarcity of rainfall and non-availability of FYM were the major constraints faced by the cashew farmers. Older cashew orchards above 25 years have to be replaced / rejuvenated with high-yielding varieties to enhance productivity followed by profitability. Women working in processing industries have to be provided with adequate precautionary measures to prevent various health issues and imparted with financial literacy which would enable them to effectively utilize their earnings and improve their living standards.

Study on Status of Banana Production in Uttara Kannada District of Karnataka

ARPITA KRISHNA NAIK AND K.B. VEDAMURTHY

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was headed to investigate banana production in the Uttara Kannada district of Karnataka to document spatial distribution, analyze economic efficiency, study price behavior and develop a suitable forecast model for forecasting banana future prices. Using purposive sampling, Sirsi and Siddapur talukas were selected for the study, from which a total of 80 sample farmers were chosen by employing multi-stage random sampling. The district exhibited a positive growth in banana area, production and productivity but faces medium instability. Major production constraints were labor scarcity, poor planting material, pest and disease issues. Labor usage patterns, costs and yields varied across main and ratoon crops of the same crop. The cost of cultivation was found to be Rs.1,45,577 per acre (Crop-I) and Rs.91,815.55 per acre (Crop-II), respectively. The production function analysis revealed that suckers, fertilizers and plant protection chemicals as significantly influence the banana output despite of economic efficiency analysis indicating room for improvement, especially in Crop-II. Johansen's co-integration test established long-term equilibrium among chosen banana markets followed by Granger causality tests revealing unidirectional causality between specific market pairs. Employing ARIMA (2,1,1) modeling for price forecasting, the study predicts an increase in Bengaluru market banana prices by August 2024 to Rs.2019.424 per quintal, aiding farmers and traders in future planning. Thus, this study provides a comprehensive understanding of regional banana production and gives valuable insights for strategic planning.

An Economic Analysis of Cold Pressed Edible Oil Units in Anantapur District of Andhra Pradesh

BOBILI ROOPA AND MAHIN SHARIF

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

EDIBLE oils are crucial for human nutrition, with recent consumer trends favoring locally produced cold-pressed varieties despite their higher cost compared to refined oils. This study focuses on the economic analysis of cold-pressed edible oil units in Andhra Pradesh's Ananthapur district. Primary data from 30 cold-pressed oil units and 30 consumers were collected, while secondary data on oilseed production trends from 2012 to 2020 were analyzed. Notably, all oilseed crops except oil palm witnessed a decline in cultivation area, with groundnut and oil palm showing positive growth trends in production and productivity. The total establishment cost for a cold-pressed oil unit amounted to Rs.3,66,186, with machinery being the highest cost component followed by rent and equipment. Variable costs primarily comprised raw material expenses, power charges, repairs, maintenance, transportation, handling and miscellaneous costs, totaling Rs.10,09,187. Combining fixed and variable costs, the total expenditure for a cold-pressed oil unit in the study area was Rs.13,73,497. Consumers' preference for cold-pressed oil, especially groundnut and sesame oil, was driven by perceived health benefits and freshness, despite challenges such as higher processing costs and shorter shelf life. The study recommends providing financial assistance, low-interest loans or grants to small-scale cold-pressed oil producers to enhance their competitiveness against larger refined oil producers.

Value Chain and Export Potential of GI Tagged Wayanaad Robusta Coffee - An Economic Analysis

K. V. KAVYA AND G.M. GADDI

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THIS study was undertaken in Wayanad district of Kerala where GI tagged Wayanaad Robusta coffee is grown extensively. The study focussed on analysing the economic feasibility, value chain, consumer preference and export potential of coffee. The study was based on both primary and secondary data. The data from farmers (50), traders (5) processors (2), processor cum exporter (2) exporter (1) and consumers (50) were analysed using capital budgeting techniques like, NPV, BCR and IRR, Conjoint analysis. Secondary data collected from the various websites like UN Comtrade, trade map and Coffee Board were analysed using NPC, RCA and RSCA. Results revealed that the investment in coffee plantation was financially feasible with positive NPV (Rs.1,90,882) and high B:C ratio (1.31). The IRR (21.60 %) was also found to be greater than the prevailing bank rate of interest (12 %). The results of conjoint analysis showed that flavour is the most significant attribute influencing consumer preferences with a relative importance of 38.99 per cent followed by price (29.86 %), blend (17.73 %) and source of purchase (14.42 %). The value chain analysis showed that the Channel-1 (Producer-Trader-Processor-Exporter) showed wider price spread (Rs.8,728.42/q) than Channel-2 (Producer-Exporter) (Rs.7,623.32/q). Producers share in export price was comparatively lower in Channel-1 (77.43%) than Channel-2 (80.29 %). The export performance analysis revealed lack of competitiveness of Indian coffee in the global markets with an NPC value being greater than unity (1.17). Similarly RCA and RSCA values also confirmed the lack of competitiveness of Indian coffee in global market.

Impact of Chintamani-1 Cashew Variety on Farm Economy in Chikkaballapur District of Karnataka

D. NAGESH AND K.R. NETHRAYINI

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THE current study was undertaken to know the impact of chintamani-1 cashew variety on farm economy in Chikkaballapur district of Karnataka, whereas objectives undertaken were to analyse the trends in cashew production, to evaluate economic impact of Chintamani-1, marketing efficiency and the constraints faced by farmers. The primary data was collected from 30 farmers growing Chintamani-1 and 30 farmers growing Ullal-1 cashew variety. Information pertaining to marketing channels was collected from 25 market intermediates which includes five each wholesaler, APMC traders, Processors, Retailers and Village traders. The collected data was analysed using analytical tools like CAGR, Cost and returns, Partial budgeting, Acharya method of market efficiency and Garrett ranking techniques. The results indicated increasing trend in the area, production and productivity of cashew in Karnataka and Chikkaballapur district from 1991-92 to 2022-23 while, the total establishment cost and annual maintenance cost per acre of cashew orchard was Rs.1,06,213.18 and Rs.56217.85, respectively in Chintamani-1 whereas it was Rs.104847.89 and Rs. 55716.91 per acre, respectively in Ullal-1. The net returns were found to be more in Chintamani-1 (Rs. Rs.37224.42) as compared to Ullal-1 (Rs.25055.64). Similarly, returns per rupee of expenditure was 1.60 and 1.41 in Chintamani-1 and Ullal-1, respectively, which signifies higher profitability of Chintamani-1. Among the three marketing channels the marketing efficiency (1.40) was higher in channel- III compared to channel- II (1.16) and channel- I (1.14). Higher investment costs, labour scarcity, Price fluctuation were the major constraints faced by cashew growing farmers. The study recommended to adopt Chintamani-1 variety to get more yield and income.

Dynamics of Production and Trade of Ginger in Shivamogga District of Karnataka : An Economic Analysis

M.H. NANDINI AND G.M. GADDI

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

GINGER (*Zingiber officinale* Roscoe), stands as a culinary and medicinal marvel. India is the major producer and exporter of fresh and dried ginger. The present study analysed growth performance, resource use efficiency, prices and export competitiveness of ginger. To achieve the objectives of study required primary data were collected from 60 ginger cultivators and 20 market intermediaries from Shivamogga district, while secondary data on area, production, arrivals, prices, exports, etc. were collected for the period from 2005 to 2022. Results showed positive growth in area, production and productivity for Karnataka and Shivamogga district. The increased ginger production was mainly contributed by area as revealed by the decomposition analysis both in Karnataka and Shivamogga. Farmers incurred a cost of Rs.3,38,674.20 in producing 170.93 q/acre and realised returns of Rs.3.33 per rupee of investment. The trend in ginger arrivals in Hassan and Hunsur markets were found to be steadily declining while the prices exhibited an upward trend in Hunsur market but negative trend in Hassan market. Among the four marketing channels prevalent for ginger in the study area, the marketing efficiency was highest in Channel II (Producer-Commission Agent Cum Trader-Retailer-Consumer) with 72.86 per cent of producer share in consumer rupee. The calculated Nominal Protection Coefficient (NPC = 0.26) indicated the existence of higher competitiveness of Indian ginger exports. Major constraints reported by the respondents included non-availability of quality plating material and high price fluctuations, which calls for necessary measures from the concerned departments and institutions to address these issues for sustainable ginger cultivation.

Evaluation of Economic Viability of Oil Palm : A Critical Analysis in West Godavari District of Andhra Pradesh

PENAGANTI INDU KUMARI AND K.B. VEDAMURTHY

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was conducted in West Godavari district of Andhra Pradesh to analyse the economic viability, productivity and technical efficiency of oil palm, evaluate comparative advantage and competitiveness of palm oil production. Primary data was collected from 90 oil palm and 30 coconut farmers and secondary data regarding international prices were obtained from websites such as Solvent extractor's association of India, FAOSTAT. The data was analysed using capital budgeting techniques, stochastic frontier analysis and policy analysis matrix. The results revealed that investment on oil palm plantations were highly profitable and economically viable, with higher returns from intercropped systems, having NPV of Rs.180648.93, compared to NPV of Rs.110760.19 for sole crops. The stochastic frontier analysis revealed that average technical efficiency was 86.27 per cent with labour, manure, irrigation and education as significant determinants of efficiency. A comparative analysis with coconut, a competing crop through PAM highlighted the comparative advantage of oil palm due to lower input costs and higher returns. However, the discrepancies between private and social prices indicate market distortions due to input subsidies, affecting the true economic profitability of oil palm. The lower DRC value of oil palm plantation (0.79) revealed competitiveness of domestic palm oil production over imports. However, the sensitivity of palm oil production to international market conditions emphasized the need for policy interventions that support efficient and sustainable oil palm production in India.

Comparative Analysis of Production and Marketing Preference for Kari Yale and Savanur Yale in Haveri District of Karnataka

PRASANNA A. BELLAD AND G.M. GADDI

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was undertaken in Haveri district to analyze the comparative economics of Kari yale and Savanur yale cultivation. Study used data collected 40 farmers cultivating Kari yale and 40 farmers cultivating Savanur yale. Data were analysed using growth rate analysis, DEA and indices of marketing efficiency. Results of the study revealed that betel leaves production was stable (0.10) and increased significantly (6.65%), due to significant increase area (4.85%) and yield (1.71%). Farmers incurred Rs.1,05,140 and Rs.94,699 for establishment, while Rs.3.55 lakhs and Rs.3.17 lakhs towards annual maintenance of Kari yale and Savanur yale, respectively. Farmers yield realise of 72 pendies (12000 leaves) of Kari yale sold at Rs.15,542 per pendu and earned net returns of 2.15 rupees for every rupee spent in its cultivation. The respective values for Savanur yale was 79 pendies, Rs. 9,792 and 1.44. The overall mean technical efficiency on farms of Kari Yale was 0.92 under CRS and 0.95 for VRS. The corresponding values for Savanur betel vine were 0.93 and 0.96. The marketing efficiency indices were higher (2.46 and 44.70) as per the Acharya's method and Shepherds' method for Kari yale in Channel I (Farmer-Retailer-Consumer) than in Channel II (Farmer-Commission agent- Retailer-Consumer) [2.04 and 28.47]. Similarly, indices for Savanur yale in Channel I were 2.41 (Acharya's method) and 49.76 (Shepherds' method), while in Channel II the respective indices were 2.13 and 23.80. Timely dissemination of new practices and enchaining market linkages would benefit all the stakeholders in betel vine production and marketing.

Field to Market: Different Cropping Systems and Profitable Marketing of Ragi in Eastern Dry Zone of Karnataka

C. SANJAYGOWDA AND JAGANNATH OLEKAR

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was undertaken in Eastern Dry Zone of Karnataka to analyse the trends in ragi production, economics of different cropping systems, marketing efficiency and factors influencing choice of marketing channels for ragi. The primary data were collected from 90 ragi farmers, with 30 farmers each marketed their produce through APMC, Village traders and KFCSC. The data were analysed using growth rate analysis, cost and returns analysis, Acharya & Shepherds method of marketing efficiency and multinomial logit regression analysis. The results revealed that area under ragi decreased, while its productivity increasing. The cultivation of ragi under cropping system- II (Ragi + Field bean) was found to be relatively more profitable (Rs.8306.27 per acre) followed by cropping system- IV (Ragi + Field bean + Cow pea) (Rs.7,286.50 per acre), cropping system- III (Ragi + Red gram) (Rs.6,391.25 per acre) and cropping system- I (Sole ragi) (Rs.5,167.67 per acre). The marketing efficiency was found to be more in channel- II with index value of 14.88 compared to channel- I (4.20) and channel- III (4.46). The results of multinomial logit regression shows that education, distance to the market, price, financial urgency, quantity sold and payment at the point of sale are the major factors which influencing choice of the channels. Farmers need to focus on cultivating ragi intercropping systems instead of sole crop for higher returns. Farmers preferred selling to KFCSC. However, delayed payments force them to explore other channels, so government need to ensure timely payments.

Trends in Production and Marketing of Soybean in Dharwad District of Karnataka –An Economic Analysis

SHILPA A. HABIB AND M.K. ARAVINDA KUMAR

Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bengaluru

SOYBEAN (*Glycine max* L.) is a versatile crop, serving as both an oilseed and pulse. The present study to estimate economics of soybean was undertaken during 2022-23 in Dharwad and Kalaghatgi taluks of Dharwad district, Karnataka. The primary data required for the analysis were obtained from 90 respondents, categorized into 30 small and medium farmers, 30 large farmers and 30 market intermediaries. Secondary data on area, production and productivity in major soybean-growing districts, for the period 2000 to 2022 were analysed and results revealed a negative growth in Bagalkot, but positive trends in other major districts viz., Bidar, Belagavi, Dharwad, Haveri and Kalaburagi. The cost of cultivation incurred by large farmers was higher (Rs.55,501/acre) than small and medium farmers (Rs.48,147/acre). Returns per rupee of expenditure realised were 1.21 for large farmers and 1.18 for small and medium farmers. Resource use efficiency analysis revealed underutilization of resources like seed, FYM, chemical fertiliser, plant protection chemicals and labour. Among the three marketing channels identified in the study area, the marketing efficiency in Channel I (Producer-Processor) was found to be 17.71 and proving to be the most efficient with producers share in consumers' rupee of 94.64 per cent. Labour scarcity and high incidence of pests and diseases were the major production constraints while, higher price fluctuations and delayed payments were the major marketing constraints faced by the farmers. The study recommended to adopt recommended agricultural practices and good agricultural practices for optimizing resource utilization and increase production efficiency.

A Study on Nutritional Security and Environmental Sustainability through Urban Nutri-Gardens in Bengaluru

S.N. PREM KISHOR AND K.P. RAGHUPRASAD

Department of Agricultural Extension, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was undertaken to investigate the adoption of good management practices, nutritional security and environmental sustainability gained through urban nutri-gardens. Data was collected from 90 respondents in the Bengaluru Urban district, employing both purposive and snowball techniques for respondent selection. A standardized schedule was developed for assessing the adoption of good management practices, a composite index for nutritional security and a scale for environmental sustainability. Data was collected through structured pre-tested interview schedules, observations, discussions and digital recordings. The descriptive and diagnostic research along with Ex-post facto research design was used for the study. The overall adoption of urban gardening practices revealed that half (50.83%) of the respondents fell into the high category of adoption of good management practices. It can be inferred that, out of the 37 recommended practices, significant portion of respondents fully adopted 29 practices, while one was partially adopted and seven were not adopted. The overall mean score for the urban gardeners Nutritional Security Index was 0.49. Dimensions such as availability (0.50), utilization (0.55) and stability (0.58) had higher mean index scores than the overall nutritional security index. Regarding environmental sustainability, the analysis with urban gardeners using 48 statements resulted in a mean score of 4.28. Approximately two-fifths of the respondents (41.11 %) fell within the medium category of environmental sustainability through urban nutri-gardens. The study elucidated financial, input, management, personal, technical and social constraints on urban gardening practices. Urban gardeners suggested to begin with leafy vegetables on a small scale and gradually expand it, staggered sowing for year-round vegetable supply, installation of shade nets for crop protection in summer, minimizing expenditure on inputs and to conduct urban farm expos and melas to create awareness about gardening practices.

A Critical Study on Modernization of Tribes and Knowledge on Processing of Non-Timber Forest Products in Meghalaya

DEINICHTWA DKHAR AND K.P. RAGHUPRASAD

Department of Agricultural Extension, College of Agriculture, UAS, GKVK, Bengaluru

MODERNIZATION of tribes and the processing of non-timber forest products (NTFPs) represents a delicate balancing act between tradition and progress in the tribal community of the state. The research study took place in East Khasi Hills and Ri Bhoi districts of Meghalaya during 2022-23. Ex post facto research design was employed with the primary objective to develop a standardized scale to measure the degree of modernization among the tribal farmers, examine their knowledge regarding NTFPs processing and document the major constraints perceived by them. A total of 160 respondents were randomly selected using a simple random sampling technique. Results showed that approximately three-fourths (71.26%) of respondents belong to medium and high modernization category. Interestingly, statistical analysis indicated no significant difference in modernization levels between the two districts, highlighting a uniform trajectory of change. With respect to technological modernization, majority (76.25%) belong to high and medium category, other dimensions namely agricultural, political, cultural, economic, social and lifestyle showed a predominant presence in the low to medium category, indicating a mixed picture of progress. Despite modernization trends, knowledge regarding NTFPs processing among respondents remained relatively low to medium (80.00%). Notably, farmers in East Khasi Hills demonstrated a better knowledge compared to those in Ri Bhoi, with mean scores of 91.92 and 69.08, respectively. Insufficient infrastructure for processing and storage coupled with a lack of knowledge regarding potential value and proper processing techniques emerged as primary constraints. Addressing these hurdles necessitates collaborative efforts among government agencies, non-governmental organizations (NGOs) and training institutes.

A Study on Performance of Farmer Producer Organizations in Bagalkote District of Karnataka

P. RAGHAVENDRA AND A.D. RANGANATHA

Department of Agricultural Extension, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was conducted to analyze the performance of Farmer Producer Organizations in Bagalkote district of Karnataka state. *Ex-post facto* research design was used for the study. Ten FPOs from Bagalkote district were selected randomly. Evaluated performance by using NABARD performance grading tool and ranked based on their performance. Thirty members each from first two and last two ranked FPOs were selected. Thus, a total of 120 respondents served as the sample for the study. Personal interview method was used to collect the data. Out of ten selected FPOs Hunagunda Horticulture Farmer Producer company, Amrutha Farmer Producer company and Kaladagi Horticulture Farmer Producer company were having better level of performance with the score of more than 75 per cent and these three FPOs are eligible for credit linkage. Two fifth (40.83 %) of FPO members were had medium level of knowledge about FPO activities followed by low (30.00 %) and high (29.17 %) level of knowledge, respectively. The major constraints faced by FPO members were lack of participation by members in FPO activities, lack of well-developed processing and storage units, non-existence of procurement system, lack of credit facilities in FPOs and high transportation charges. make availability of procurement system in FPO, making registration process easy and Providing processing units and proper storage facility in FPOs were major suggestions expressed by FPO members.

Perception and Economic Performance of Farmers Practicing Natural Farming in Chikkaballapur District of Karnataka

MUHAMMED ARIF AND K.P. RAGHUPRASAD

Department of Agricultural Extension, College of Agriculture, UAS, GKVK, Bengaluru

THE research study was conducted in Chikkaballapur district of Karnataka during 2022-23 with main objective to analyse the perception and economic performance of farmers practicing natural farming. Equal number (60) of Ragi and Maize growers practicing natural farming were selected by simple random sampling technique. Thus, making the total sample size of 120. The findings revealed that nearly half (46.66%) of farmers had an average perception towards natural farming, followed by poor (29.17%) and better (24.17%) perception, ragi growers had better perception towards natural farming than maize growers. Regarding economic performance, more than two fifth (43.33%) of farmers had an average economic performance in natural farming, followed by poor (30.83%) and better (25.83%) economic performance. Ragi growers had a slightly better benefit cost ratio (1.54) than maize growers (1.39) when following natural farming practices. The independent variables like age, education, farming experience, knowledge, land holding, extension participation, deferred gratification, information seeking behaviour, innovative proneness, scientific orientation, risk orientation and achievement motivation were found to have significant relationship with dependent variables of growers' perception and economic performance. The major constraints expressed by growers were low yield in the initial years, asthras in natural farming can only be used as a preventive measure, lack of certification and marketing facilities for natural farming produce. Support for initial 3 years to withstand yield loss followed by all plant protection measures should be imposed in anticipation of pest and diseases, Government should create certification and marketing facilities for natural farming produce, so that it provides better price to produce were the important suggestions expressed by growers to overcome the constraints faced by farmers in natural farming.

Entrepreneurial Behaviour and Economic Performance of Sericulturists in Chickballapur District

A. HARISH AND N. MANJULA

Department of Agricultural Extension, College of Agriculture, UAS, GKVK, Bengaluru

THE present investigation was carried out to assess the Entrepreneurial Behaviour and Economic Performance of Sericulturists in Chickballapur district of Karnataka during 2022-23. Sidlaghatta and Chintamani taluks were purposively selected for the study by considering the area of sericulture and importance of sericulture in the livelihood of people. The sample size was 120, the research design was ex-post facto research design, and the structured pre-tested interview schedule was developed for eliciting information from the respondents. The findings of the study revealed that, nearly half of the (49.16 %) sericulturists belonged to medium followed by high (30.84 %) and low (20.00 %) level of entrepreneurial behavior category. Further, 45.00 per cent of the sericulturists had medium level of economic performance followed by low (28.33 %) and high (26.67 %). On an average, cocoon yield harvested was 85 kg per 100 DFLs, with the gross income of Rs.34850 at Rs.410 per kg of cocoon. The cost of production was Rs. 29246.18 and hence, the net income was Rs.5603.82 per 100 DFLs with B:C ratio of 1.19. With respect to personal and socio-economic characteristics of the sericulturists, majority of them belonged to medium category. The variables namely, occupation, annual income, social participation, extension participation, extension contact and cosmopolitaness were found to have significant relationship with entrepreneurial behavior and economic performance of the sericulturists at one per cent level of significance. The major production constraints expressed by sericulturists were high cost of inputs for mulberry cultivation, high cost of silkworm rearing equipment and marketing constraint was high fluctuation in market prices. The important suggestions to overcome the constraints were, regular and timely supply of fertilizers and subsidy to the inputs and equipment, providing training on management of pest and diseases in mulberry cultivation and silkworm rearing.

Problems and Prospects of Oil Seed Growers of Central Dry Zone of Karnataka

S. BINDU AND Y.N. SHIVALINGAIAH

Department of Agricultural Extension, College of Agriculture, UAS, GKVK, Bengaluru

THE study was purposively carried out in Chitradurga district to identify the problems and prospects of oilseed growers of central dry zone of Karnataka during 2022-23. The primary data was collected from 120 oilseed growers by personal interview method, considering 60 groundnut and 60 sunflower growers in which 30 small and 30 big farm growers were randomly selected from Hiriyur, Challakere and Molkalmuru taluks. *Ex-post-facto* research design was adopted. The results revealed that an equal proportion (43.33 %) of small and big farm groundnut growers were comes under poor and better overall performance category. Whereas, more than two-fifths (43.33 %) of small and exactly two-fifth (40.00 %) of big farm sunflower growers had moderate and better overall performance categories. The yield gap was higher among small farm groundnut growers (42.85 %) and small farm sunflower growers (51.17 %). The benefit-cost (BC) ratio of groundnut and sunflower was 1.23 and 1.38. Variables such as annual income, farming experience, extension contact, extension participation, information seeking behaviour, mass media exposure, risk orientation and scientific orientation had significant association with the performance of groundnut and sunflower growers. Majority of the farmers expressed that the major factors influencing the production of groundnut and sunflower were rainfall pattern, minimum support price and availability of human labour. The significant negative compound annual growth rates were found in the production and area under groundnut and sunflower. The major problems related to groundnut and sunflower production were high wage rates, uneven distribution of rainfall and disease and pest incidence were major production, marketing, technical and financial constraints. They have expressed that providing minimum support price, providing seeds and fertilizers at a reasonable cost and at the right time and incentives and subsidies for inputs were the important suggestions.

Production and Marketing of Turmeric in Bagalkot District of Karnataka – An Economic Analysis

N.A. GURUSWAMY AND G. BASAVARAJ

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study on production and marketing of turmeric was conducted in Bagalkot district of Karnataka. The primary data was collected from 60 growers and 30 market intermediaries. The results of the study showed that growth rate of area and production of turmeric in Bagalkot district was increasing, with high level of instability. The cost of cultivation of turmeric revealed that variable cost was the major contributor at (74.14%) compared to fixed cost (16.47%) and managerial cost (10%) in the total cost at Rs.90,342.27 per acre of turmeric cultivation. The net returns over total cost was Rs.66,268.14 per acre and the return per rupee of expenditure was Rs.1.73. The study showed that, majority of growers (55%) traded turmeric through Channel-III (farmer - wholesaler cum trader - processor – retailer - consumer). The findings of the study also showed that, the producer's share in consumer rupee was 50.74 per cent in Channel-I (farmer - wholesaler cum trader – retailer – consumer), 50.12 per cent in Channel-II (farmer - commission agent - wholesaler cum trader - retailer- consumer) and 41.10 per cent in Channel-III. The marketing efficiency was maximum for Channel-I (1.03) than Channel-II and Channel-III (1.00 and 0.70, respectively). Major constraint in turmeric production was high variation in yield as opined by sample respondents while in marketing, it was lack of remunerative price. In order to reduce intermediaries in the market and increase farmers' share in consumers income, turmeric growers can collectivize themselves into farmer producer organizations to process and sell the produce directly to the end consumer.

Women Entrepreneurs in Sericulture – A Study in Chikkaballapur District of Karnataka

ABHISHEK M. KALLAMMANAVAR AND K.R. NETHRAYINI

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was conducted on women entrepreneurs in Sidlaghatta and Chintamani taluks of Chikkaballapur district of Karnataka to examine the various enterprises undertaken by women entrepreneurs. The primary data was collected from 180 entrepreneurs performing different sericulture activities. A total of each 30 respondents were selected from reeling and rearing activities as these were the major enterprises. Majority of the women entrepreneurs were doing cocoon production as a main occupation (93.33%) and belonged to SC/ST (46.67%), followed by OBC (28.33%) and minority (21.67%). The total cost and gross returns incurred on cocoon production for 125 DFL's for 8.5 batches per year was Rs.4,68,364/- and Rs.6,82,550/-, respectively and resulting in net returns of Rs.2,14,185/- per year. The total cost and gross returns of mulberry raw silk production was estimated to be Rs.1,06,05,919/- and Rs.1,19,05,426/- and net returns was Rs.13,72,046/- per year per six reeling basins. The survey found that majority of the respondents agreed that sericulture is a women-friendly occupation that enhances the economic status of women sericulturists. Most common weaknesses are insufficient training opportunities and skill development programmes. The increasing interest of farm women in adopting new technology creates promising opportunities for women in this sector. The most common challenges include urbanization, which leads to migration of farmers from rural areas and competition from other crops. The suggestions include the initiatives for weaving and bio-craft, exploring minimum support price for cocoons to address pricing challenges and reduction of synthetic fiber usage. Empowering women entrepreneurs in sericulture can significantly contribute to rural development, economic growth and overall sustainability.

Production and Marketing of A2 Milk – A Study in Ramanagara District of Karnataka

K. HARISH KUMAR AND C.P. GRACY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study aims at assessing the costs, returns and marketing channels of A2 cow milk in Ramanagara district of Karnataka. The primary data was collected from 60 dairy farmers and five intermediaries. Cost and return analysis, Acharya's marketing efficiency and Rank-Based Quotient for constraints were used to analyse data. The total cost of milk production per animal per year of Hallikar and Sahiwal was Rs.36,945 and Rs.47,774, respectively. Out of total cost, the variable cost contributed about Rs.29,338 and Rs.38,791, respectively and fixed cost of Rs.7607 and Rs.8983, respectively. The gross returns in Hallikar and Sahiwal amounted to Rs.68,201 and Rs.84,645, respectively. The returns per rupee of investment was higher in Hallikar (1.84) compared to Sahiwal (1.77). The sample A2 cow milk producers marketed A2 cow milk through the following three channels: Channel - I: (Milk producer → Milk merchant → Consumer), Channel - II: (Milk producer → Collection centre → Surabhi Amrutha Dairy → Consumer), Channel - III: (Milk producer → MPCS → BAMUL → Distributor → Retailer → Consumer). The channel - I had higher marketing efficiency index compared to channel - II and channel - III because it stands out with the highest Acharya's index value of 4 followed by channel - II (2.07) and channel - III (1.79). Seasonal fluctuation of A2 cow milk due to flush and lean period was the major challenge in production and marketing of A2 milk. It is suggested to Government for conservation of indigenous cow breeds by encouraging farmers with developmental schemes and incentives.

Value Chain Analysis of Bengal Gram in Kalaburagi District of Karnataka

KARTIK V. NAGANGOUDAR AND C.P. GRACY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE research focus was to estimate cost and returns of Bengal gram production, value chain mapping and identification of value chain constraints faced by stakeholders in the study area. Primary data for 2022-23 season was collected from 60 farmers, 35 market intermediaries and 30 consumers through personal interview method. The cost of Bengal gram cultivation per acre was Rs.18,635.65 with average yield of 5.36 q, with a gross return of Rs.27,257.2 and net returns of Rs.8,621.55. The return per rupee of investment was Rs.1.46. About 1/4th of respondent farmers sold through channel I (Farmer → Village trader → Commission agent → Processor → Wholesaler → Retailer → Consumer), 50 per cent through channel II (Farmer → Commission agent → Processor → Wholesaler → Retailer → Consumer) and 23.33 per cent through channel III (Farmer → Processor → Wholesaler → Retailer → Consumer). The value-added products of Bengal gram are dal, fried gram and flour. The degree of value addition for dal and fried gram in the above channels was the highest for farmer (51.06, 54.50 and 53.17 per cent, respectively), followed by processor (30.76, 29.68 and 32.11%) and retailer (9.64, 9.17 and 8.18 per cent, respectively). The recovery rate from one quintal of Bengal gram comprised of 80.00 per cent dal, 17.00 per cent husk and 3.00 per cent broken dal. Major challenges in production were high disease and pest incidence, followed by inadequate rainfall, high fertilizer and pesticide costs. Majority of consumers in Kalaburagi town purchase dal (73.33 %) and flour (60 %) once in a month. The most preferred place of purchase for Bengal gram, dal and flour is grocery store, with 56.67, 60.00 and 66.66 per cent of consumers reporting this as a major source.

Entrepreneurial and Marketing Behavior of Coconut Growers in Tumakuru District of Karnataka

M. MANOJ KUMAR AND K. SHIVARAMU

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study was undertaken in Tiptur and Turvekere taluk of Tumakuru district of Karnataka State to analyze the Entrepreneurial and Marketing behavior of coconut growers. Eighty coconut growers were personally interviewed using pre tested interview schedule and constituted sample of the research study. The results revealed that 46.25 per cent of coconut growers belonged to medium entrepreneurial behavior, while 31.25 per cent of respondents belonged to high entrepreneurial behavior and remaining 22.50 per cent of coconut growers were having low entrepreneurial behavior, respectively. Further 46.25 per cent of coconut growers were having medium marketing behavior, while 33.75 per cent of respondents were having high marketing behavior and remaining 20.00 per cent of coconut growers were having low marketing behavior. In addition, results also revealed that education, land holding, annual income, cosmopolitaness, mass media participation, extension agency contact and extension participation of coconut growers were significantly associated with entrepreneurial and marketing behavior. Major constraints expressed by coconut growers were lack of information on improved cultivation practices of coconut, inadequate irrigation facility, more fluctuations in prices of coconut and high cost of fertilizers. Remunerative prices, uninterrupted power supply, availability of required quantity of agricultural inputs like fertilizers and plant protection chemicals on time nearer to the village, providing relevant marketing information were the important suggestions expressed by coconut growers.

Competitiveness of B to B Supply Chain of Vegetables – A Study in Bengaluru City

A. MANOJKUMAR AND M. ARUN

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

WITH significant efforts in bringing farmers and consumers closer, B2B companies played a crucial role, apart from B2C and modern retailers. This study was initiated with an overall objective of studying competitiveness of B2B supply chain of vegetables in Bengaluru city of Karnataka. The study elicited the primary data from 30 each of participating and non-participating farmers, as well as retailers and vendors in the Chikkaballapur district and further from the two B2B firms viz., the BigBasket and Ninjakart. Top five vegetables procured in the procurement area (Chikkaballapur) were considered. The study observed a small difference in the flow of vegetables in the two B2B business models, as each supply chain is designed considering their own strengths and weaknesses. Monthly cost incurred by Ninjakart (Rs.5.85 lakhs) was found to be more as compared to Bigbasket (Rs.4.97 lakhs) indicating a better cost efficiency of the farmer. The per quintal marketing costs of vegetables among participating and non-participating farmers viz. tomato (Rs.73 and Rs.122.6), bottle gourd (Rs.35.06 and Rs.118.95), cabbage (Rs.38.47 and Rs.114.56), chili (Rs.61.84 and Rs.291.61), ridge gourd (Rs.64.68 and Rs.252.4) showed it to be considerably higher among non-participating group. Relatively higher profit among participating farmers is also a result of higher price realized, while the rejection due to non-complying quality grade is a problem in the B2B supply chain for farmers. The participation of retailers with the B2B firms resulted from convenience factors such as fair pricing, timely delivery, app-based ordering, uniform grades and scientific handling.

A Study on Pesticide Brand Preference by Grape Growers in Eastern Dry Zone of Karnataka

B.S. SHARATHKUMAR AND G.M. GADDI

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study examined the pesticide brand preference by grape growers in Eastern Dry Zone of Karnataka, focusing on grape production, cost of production, pest and disease management and farmers' pesticide preferences. The secondary data from various departments and published reports were also used for selection of study area. The primary data were collected from 80 respondents which comprising of 60 grape growers and 20 pesticide retailers using personal interview method. Results on growth performance revealed that India witnessed a significant (6.13%) increase in grape production, while Karnataka showed even higher growth rates (9.84%) over the study period 2010-11 to 2022-23. Notably, grape productivity was stagnated in Karnataka, underscoring a need for focused interventions despite overall production gains. Varietal analysis revealed varied performance trends. In the total cost of cultivation (Rs.9.47 lakhs/ha) the proportion of variable costs (62.62%) was higher than fixed costs (37.38%). The common diseases are Downy mildew and Powdery mildew, along with prevalent pests. Farmer preferences for specific pesticides indicated reliance on trusted brands like Ridomil Gold and Confidor. These preferences were influenced by factors such as effectiveness, retailer recommendations and brand reputation. Market analysis revealed Syngenta and Bayer Crop Science, with Ridomil Gold as the dominant players for fungicide sales with an average annual sale of Rs.9.23 lakhs, while Bayer Crop Science's Confidor topped insecticide sales with Rs.5.56 lakhs. The findings on economics of grape cultivation, pest and disease management and market dynamics provided valuable insights for strategic decision-making in the agricultural sector.

Consumer Preference for Bamboo Based Furniture in Bengaluru Urban District – A Business Study

P. ABHISHEK REDDY AND M.K. ARAVINDA KUMAR

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

BAMBOO is a versatile and fast-growing plant known for its remarkable strength, sustainability, cultural significance, wide-ranging application and environmental benefits. In recent years, there has been a noticeable shift in consumer preferences toward sustainable living practices so bamboo, often referred to as the 'green gold' of sustainable resources, can emerge as a beacon of hope in world of furniture production. Global bamboo furniture market is valued at USD 12.11 billion by the end of 2022 and it is projected to reach USD 20.261 billion, by 2030. With a CAGR of (6.651%) over the forecast period (2023-2030). The study was conducted with the objective of consumer buying behaviour, factors influencing consumer preference and constraints faced by the sellers towards bamboo based furniture. The study was conducted in Bengaluru Urban district with 100 respondents, which comprises 80 consumers and 20 sellers. The result of the study revealed that 26.90 per cent of consumers prefer buying in local retail outlets. About 28.75 per cent of consumers preferred buying chairs over other types of bamboo furniture. 63.75 per cent of consumers were buying once in their lifetime. Durability, eco friendliness, price, aesthetic look were the major factors influencing the consumer preference. Among the constraints in marketing of bamboo-based furniture limited market awareness, low demand and transportation and logistics problem of the bamboo-based furniture is ranked first, second and third with the Garrett's score of 77.7, 70.8 and 62.7, respectively. Therefore to encourage more individuals to purchase bamboo-based furniture it is advised to emphasize the eco-friendly nature and collaborate with designers, architects and influencers to create limited edition or signature collections.

An Analysis of Consumer Preference for Wine in Bengaluru City

S. KUMAR AND C.S. SATHISH GOWDA

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study aims to understand the factors influencing wine consumption and preferences among consumers in Bengaluru city. The methodology involved a detailed survey of 120 respondents from various age groups and income levels, conducted at wine retail outlets, bars and clubs. Primary data was collected using a pre-tested questionnaire that gathered information on demographics, wine preferences and factors influencing consumer choices. Secondary data was sourced from published materials and online platforms to document the varieties and brands of wine available in the market. The data analysis employed were descriptive statistics and Garrett's ranking technique to identify the key trends and patterns in consumer behavior. The major findings indicated that wine consumption in Bengaluru is influenced by several factors, including age, gender, income and education level. The survey revealed that males predominantly prefer red wines, while females showed a preference for white and sparkling wines. Among the different types of wine, red wine was the most favored, followed by white and sparkling wines. Quality, taste and brand reputation emerged as the most significant factors affecting consumer preferences, with a notable inclination towards Indian wines. Health benefits and pleasure were the primary reasons for consumption, with stress relief and habitual drinking also notable. Most respondents consumed wine occasionally and preferred drinking on weekends. Consumers valued brand reputation, perceived quality and packaging aesthetics. Additionally, social media, wine clubs, tasting events and recommendations from friends or family were identified as critical influencers in purchasing decisions. The study provided valuable insights into the wine consumption patterns in Bengaluru city, highlighting the importance of targeted marketing strategies to cater to the diverse preferences of consumers in this vibrant city.

Value Chain Analysis in Flattened Rice and Puffed Rice Production in Davanagere District of Karnataka

P.B. SHIVARAJ AND G.M. GADDI

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study analysed the value chain of flattened rice and puffed rice production in Davanagere district, Karnataka with key objectives of understanding trends in paddy production, profitability, marketing channels and value chain potential using both primary and secondary data. Results revealed differing trends in paddy cultivation across India, Karnataka and Davanagere district during study period from 2010-11 to 2021-22. India showed a positive growth rate in production (2.24%) of paddy with positive growth in area (0.47%) and productivity (1.75%). Contrastingly, Karnataka experienced a decline in the paddy area (1.66%) but slight increase in production (0.31%) and productivity (1.36%). Davanagere district, however, faced significant declines with a negative annual growth rate of 5.08 per cent in area, 5.45 per cent in production and 0.93 per cent in productivity, indicating challenges in sustaining paddy cultivation in the region. Processing of paddy into flattened rice and puffed rice proved profitable with corresponding benefit-cost ratio of 1.22 and 1.30. Among the three marketing channels identified, Channel-II found to be the most preferred channel for flattened rice, while Channel-I was popular for puffed rice. Channel-III showed higher marketing efficiency for flattened rice, while Channel-I was the most efficient for puffed rice. Challenges faced by processors included high raw material costs, issues with irregular and high cost of electricity, lack of timely raw material availability, labour issues, price fluctuations and insufficient government support. Despite these constraints, flattened rice and puffed rice processing activities are profitable ventures with room for value chain enhancement.

An Economic Analysis of Production and Marketing of Nendran Banana in Chamarajanagara District of Karnataka

M.S. UDAYSHREYAS AND C.S. SATHISH GOWDA

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THIS study aims to analyse the Nendran Banana cultivation in the Chamarajanagara district, considering the resources and market dynamics involved. The methodology involved a detailed survey of 85 respondents from various age groups and income levels among the selected 4 villages. Primary data pertaining to cultivation and marketing practices of Nendran Banana cultivating farmers was elicited through personal interviews. Additional insights were obtained from 45 stakeholders, including vendors, wholesalers and retailers, while secondary data on area, production and productivity were sourced from the Karnataka State Department of Horticulture. Data analysis employed various methods, including growth rate analysis, instability analysis, marketing efficiency under shepherd's method and Garrett's ranking technique to discern problems faced by the respondents. Findings indicate a positive Compound Annual Growth Rate (CAGR) in Banana productivity in Chamarajanagara compared to state averages. Analysis revealed that production growth is primarily attributed to area expansion, though productivity remains constrained by factors such as pest and disease incidence, drought, price fluctuations, and inadequate management practices. The study underscores the necessity for varietal improvements and increased awareness of best management practices to enhance productivity. Ultimately, the research provides valuable insights into effective marketing strategies and highlights the importance of adopting best management practices for sustainable Nendran Banana cultivation in Chamarajanagara.

Economics of Production and Marketing of Maize in Belagavi District of Karnataka

AKASH DUNDAPPA ARGH AND SIDDAYYA

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was carried out in Belagavi district of Karnataka to analyze trends in area, production and productivity, cost and returns, marketing channels and price spread and relationship between MSP and market price of maize. Primary data was collected from 60 farmers and 40 market intermediaries through personal interview, and secondary data from Directorate of Economics and Statistics and Karnataka State Agricultural Marketing Board. The results revealed a positive growth in maize area, production and productivity in Belagavi district during 2008-2022, with a CAGR of 2.28, 5.80 and 3.27 per cent, respectively. The cost of cultivation per acre was Rs.48,182.56. The average yield was 28.27 quintals, generating a gross return of Rs.71,370.69 per acre. The return per rupee of investment was Rs.1.48. About 28.34 per cent of the farmers sold their produce through channel I (Producer→Village trader→Wholesaler→Processor), 41.66 per cent through channel II (Producer→Village trader→Wholesaler→Retailer→Consumer) and 30 per cent through channel III (Producer→Commission agent/wholesaler→Retailer→Consumer). The price spread per quintal of maize was higher in channel II (Rs.425) due to more intermediaries, followed by channel III (Rs.380) and channel I (Rs.325). However, Acharya's marketing efficiency was relatively higher in Channel-I compared to other two channels. The analysis of relationship between MSP and market price showed a positive relation with significant regression coefficients and a high value of R^2 (0.96).

Business Analysis of Silk Reeling Units in Ramanagara District, Karnataka

G. JAYASHREE AND G. RANGANATH

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was carried out in Ramanagara district of Karnataka to analyze the financial viability of silk reeling units, labour competency in silk reeling units, marketing channels of raw silk yarn and the SWOC analysis in production and marketing of raw silk. Primary data was collected from 95 silk reelers, through personal interview and secondary data from Ramanagara district at glance. The study shows less returns in charaka reeling units, the return per rupee of investment was 1.06 with IRR 39 per cent, more returns from Automatic Reeling machine (ARM), the return per rupee of investment was 1.45, with IRR of 69 per cent. Skill gap varied from Charka to ARM, better competency in ARM with proficient technical skills, communication skill, problem solving ability, safety protocols was observed. About 60 per cent of the reelers sold through channel I (Reeler→Twister→Weaver) and 40 per cent through channel II (Reeler→Trader→Twister→Weaver). The price spread per kg of silk was higher in channel II (Rs.4,474) due to more intermediaries, followed by channel I (Rs.4011). Net Producer's share in consumer's price was high in channel I (18.22) and least in channel II (13.12) because of less intermediaries in channel I. The channel I was more efficient than Channel II. The major silk production strength was higher net income, while its weakness was, labour intensiveness, while its opportunity was growing demand for natural fibres and major challenge was price volatility of raw silk.

Profitability of Silk Reeling Units – A Study in Chikkaballapur District, Karnataka

P. NANDINI AND C.P. GRACY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was conducted on profitability of silk reeling units in Chikkaballapur district of Karnataka to examine the various silk reeling enterprises undertaken by reelers. The primary data was collected from 30 reeling units performing operations using different reeling machines. A total of 20 filature reeling units were selected as these were the major type of reeling units. Further, 5 multi-end reeling and 5 automatic reeling units were selected. In case of profile of reeling units, automatic reeling units had highest production capacity, producing up to 60 kg of silk per day, followed by multi-end reeling units producing 13-15 kg and filature reeling units producing 4-9 kg. The study showed that filature reelers obtained total expenditure of Rs.6,17,812 per month and gross income realized to be of Rs.7,47,065 and net income of Rs.1,29,246 with benefit cost ratio of 1.21. Further multi-end reelers obtained total expenditure of Rs.16,73,466 and gross income realized to be of Rs.22,77,580 and net income of Rs.6,04,144 with benefit cost ratio of 1.36. Automatic reeling unit reelers obtained total expenditure of Rs.55,86,197 and gross income realized was Rs.39,29,679 and net income of Rs.16,56,518 with benefit cost ratio of 1.42. Hedonic price model was used to identify the values of the quality attributes of the silk. Cocoon silk are valued for their utility bearing characteristics. The prices vary directly with the specific amount of each characteristic that the cocoon silk is embodied with. Opportunities in silk reeling units, based on the RBQ scores was analyzed, which highlighted several key areas of potential such as good reeling water, technological advancements, employment generation etc. Further constraints faced by reelers like scarcity of skilled labour, silk exchange located far and Absence of quality cocoons was observed in the study.

Value Chain Analysis of Black Pepper in Karnataka

H.K. SANGEETHA AND SIDDAYYA

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

BLACK PEPPER (*Piper nigrum* L.), known as the ‘King of Spices’, is a widely used spice renowned for its pungent aroma, which not only imparts its own distinctive flavor to dishes but also enhances the taste of other ingredients. The present study ‘Value Chain Analysis of Black Pepper in Karnataka’ covers Kodagu and Chikkamagaluru districts of Karnataka. The analytical tools used include compound growth rate analysis, descriptive statistics and Garrett’s ranking. Over the past two decades, the area, production and productivity of black pepper in Karnataka have shown positive growth with annual growth rates of 16.05, 17.23 and 1.059 per cent, respectively. In the black pepper value chain, the major participants include input suppliers, farmers, traders, wholesalers, retailers and consumers. A key focus of this study is to analyse the extent of value addition across different stages. Value addition was highest at the retailer stage (9.37%), followed by the wholesaler stage (6.89%) and the trader stage (2.14%). This indicates moderate increases in value addition at the wholesale and retail stages but limited processing opportunities, as black pepper is predominantly sold whole. The study also examines consumer preferences and behaviors towards pepper and pepper-based products, revealing a strong inclination for whole peppercorns, primarily purchased from supermarkets and local markets. Quality was identified as the most important attribute when purchasing black pepper, followed by price, availability, flavor intensity and brand. The study also explored the price behavior of black pepper by analysing seasonal, cyclical, trend and irregular variations. Prices are typically highest in December (index of 101.33) and lowest in February (index of 96.89), reflecting seasonal variations in availability and demand. The study concludes that enhancing post-harvest practices, market access, and infrastructure could improve profitability and stability in Karnataka’s black pepper industry.

A Study on Marketing Potential and Consumer Preference for Indoor Plants in Bengaluru Urban District

G.S. DEEPA AND M.S. GANAPATHY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was conducted to document the profile of indoor plants, the sourcing and marketing strategies of indoor plants by retailers, the major factors influencing the purchase of indoor plants, opportunities and challenges in marketing of indoor plants in Bengaluru urban district. A total of 100 samples were selected, out of these, 60 consumers, 30 retailers and 10 household producers were drawn for the study. The primary data was collected using a pre-tested structured schedule and data was analysed using descriptive statistics, Likert scale and Garrett's ranking technique. The results revealed that all retailers procured indoor plants from wholesalers (100 %). Every single retailer (100 %) targeted consumers from the middle income group and (90 %) engaged in counter sales. Herbaceous perennials were the most preferred type of indoor plant (45 %) by the sample consumers. The major reason behind growing indoor plants was for aesthetic purpose. Majority (48 %) of the consumers belonged to the age group of 21-35 years and majority (43 %) of the respondents were graduates. The frequency of purchase varied significantly between consumers with income group ranging from Rs.15,001 to Rs.50,000 as compared to other income groups and high-income groups were not the potential consumers of indoor plants in the study area. Consumers awareness on air pollution was the major criteria which encouraged retailers to market the indoor plants. The price fluctuation and high price in Bengaluru were the major challenges faced by retailers during the study period.

Supply Chain Management of Sweet Flag in Tumakuru District of Karnataka

N. LAVANYA AND M.R. GIRISH

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study examined the economics of sweet flag production; backward and forward linkages of sweet flag; marketing channels of sweet flag; and constraints in production and marketing of sweet flag. The primary data was collected from a sample of 40 sweet flag farmers, five traders and five retailers of Tumakuru district. The results indicated that the average yield of sweet flag was 42.04 quintals per acre. The total cost of cultivation of sweet flag was Rs.1,11,597.14/- per acre with gross returns and net returns of Rs.1,89,159.76/- and Rs.77,562.62/-, respectively. In the case of backward linkages, majority of sample farmers used planting material from their own sources, used water from their own borewells, borrowed credit from local money lenders, purchased fertilisers from private fertiliser shops and hired machinery from fellow farmers. In the case of forward linkages, all the sample farmers sold their produce to the traders in APMC. All the sweet flag traders used marketing channel II (Farmer – Trader – Wholesaler – Processor – Pharmaceutical Shop – Consumer) to sell their produce followed by those (80 %) who used channel III (Farmer – Trader – Dealer – Processor – Pharmaceutical Shop – Consumer), and those (60 %) who used channel I (Farmer – Trader – Retailer – Consumer). However, most (86.52 %) of the produce was traded through channel III and traders received the highest price in channel I (Rs.11,000/- per quintal). The major production constraints faced by sweet flag farmers were scarcity of labour and lack of technical knowledge and guidance while the major marketing constraints faced by them were price fluctuation and lack of market information and intelligence. The Government may support private companies in establishing processing units in the study area, so that it enables producers to sell their produce directly to processors which in turn would enhance the producer's share in consumer rupee.

A Study on Export Competitiveness of India's Fresh Mangoes

N.R. KARTHICK REDDY AND M.S. GANAPATHY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THIS study explored the dynamics of India's fresh mango export sector, utilizing secondary data from APEDA and ITC Trade Map and primary data collected from exporters, farmers and vendors. Analytical tools, including descriptive statistics, Compound Annual Growth Rate (CAGR), and Cuddy Della Valle's Instability Indices were employed to assess export trends and trade stability. Markov Chain analysis examined trade direction, while Revealed Comparative Advantage (RCA) and Revealed Symmetric Comparative Advantage (RSCA) indices measured India's global competitiveness. Key findings revealed that exporters dominated the value chain, capturing 90.39 per cent in Channel I and 91.18 per cent in Channel II, while farmers contributed only 5.31 per cent and 5.32 per cent, respectively. In Channel III, where farmers directly exported, their share increased significantly to 94.76 per cent, demonstrating the benefits of vertical integration. Although export quantities for fresh mangoes and pulp declined (CAGRs of -5.12 per cent and -2.93 per cent), export value rose by 7.75 per cent and 3.34 per cent, indicating that higher prices or value-added products offset lower volumes. Regionally, Oman and the UAE proved to be stable markets with high export value stability observed in the USA. The study noted a decline in the Alphonso variety (CAGR of -2.75 per cent), contrasted by growth in Kesar and Chausa varieties, which showed positive CAGRs of 18.80 per cent and 25.71 per cent, respectively. Competitiveness indices showed a downward trend, with RCA values decreasing from 1.70 in 2012 to 0.82 in 2023. Sanitary and Phytosanitary (SPS) measures posed major challenges for exporters, emphasizing the need for improved regulatory compliance. This study provided strategic insights to enhance competitiveness and stability in India's mango export sector, highlighting market adaptation, regulatory considerations and increased farmer participation in the value chain.

Supply Chain Analysis of Coloured Capsicum in Bengaluru Rural District of Karnataka

H.R. RAKESH AND M.S. GANAPATHY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study conducted on the supply chain of coloured capsicum in the Bengaluru Rural district of Karnataka. Coloured capsicum, commonly known as bell pepper or sweet pepper is prized for its vibrant colours. Karnataka is a major producer of capsicum in India, yielding 55.66 million kg in 2023 of which 20 per cent consisted of coloured capsicum. Primary data was collected using random sampling methods through structured schedule with a total of 60 randomly selected respondents, comprising of 30 farmers, five wholesalers, five vendors, 10 retailers and 10 consumers. The results revealed that, with cost of cultivation Rs.6,60,360/ ac under net houses yielded 40.73 tonnes/ ac and Benefit-Cost Ratio (BCR) of 2.48, driven by high gross returns Rs.16,42,912/ ac and 47 per cent of the farmers achieve a resource use efficiency of 90 per cent. Supply chain mapping identified three channels: Channel II (Producer-wholesale vendors-secondary market-exports) handled the majority of the produce, Channel III (Producer-to-retailer) offered better prices but managed smaller quantities and Channel I (Producer-APMC trader-wholesaler-retailer) handled smaller quantities and offered lower prices. Quality factor was found to be the critical factor influencing prices across Market. The study identified three grades of coloured capsicum (Grade A, B, and C) in two colours (red and yellow). Among these, Grade A, defined by superior weight and minimal damage, fetched premium prices in export markets. The major strength of coloured capsicum production was high demand and advanced farming techniques. The important weakness is high input cost and high labor requirement. The study provides a comprehensive overview of the coloured capsicum production, marketing, price and quality, offering valuable insights for stakeholders.

An Economic Analysis of Cold Pressed Edible Oil Units in Chitradurga District of Karnataka

MARUTHI B. RAJ AND H. LOKESHA

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was initiated with the objective of analysing the Economics of Cold Pressed edible oil units in Chitradurga district of Karnataka along with its operational efficiency and consumer preferences for edible oils. The study is based on the primary data from 30 cold pressed oil units based in Chitradurga district and from 90 consumers. The establishment cost of 5, 10 and 15 HP cold pressed oil unit was Rs.11,23,750, Rs.12,29,491 and Rs.21,42,071 including land, building and machinery costs. The percentage share of edible oil processed was highest in groundnut with 52.75 per cent followed by sunflower, coconut and sesamum with 24.26, 13.88 and 9.11 per cent. The total cost of 5, 10, 15 HP oil expellers including fixed and variable cost amounted to Rs.13,40,305, Rs. 9,97,600 and Rs. 22,88,046 per unit. The net returns across 5, 10 and 15 HP expellers was Rs.37,633, Rs. 1,86,003 and Rs. 2,67,628 per unit. The returns per rupee of expenditure realised across 5, 10 and 15 HP expellers was 1.02, 1.18 and 1.12. Majority of the oil expellers purchase raw material from APMC's, followed direct purchase from farmers and own production. Majority of the consumers purchase cold pressed edible oil directly from processors followed by supermarkets and kirana stores. Purity, taste and health benefits are the most preferred traits in cold pressed oils. The study advocates for increasing the capacity utilization of cold pressed oil units from present level of 45.31 per cent to 80 per cent to enhance the profitability.

An Economic Analysis of Cotton Ginning Mills in Raichur District of Karnataka

SUSHMITHA AND K.R. NETHRAYINI

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study examined the economic performance and challenges of cotton ginning mills in Raichur district, Karnataka. Cotton, a crucial fibre crop for domestic textiles and export earnings, supported millions of Indian livelihoods. Raichur contributed notably to the sector, producing 19.29 lakh bales in 2023 over 6.86 lakh hectares. The study evaluated 15 ginning mills across small, medium and large categories using primary data collected. Analytical tools such as Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR) and Payback Period (PBP) were used to assess financial viability, profitability, along with SWOC analysis and Acharya's approach. Key findings indicated that larger mills required more capital investment but also generated higher returns and profitability, with economies of scale being evident. For instance, large mills had a positive NPV of Rs.9,822.38, BCR of 1.57, IRR of 27 per cent and a payback period of 2 years and 4 months, compared to smaller mills with a positive NPV of Rs.3,115.40, BCR of 1.39, and IRR of 21.05 per cent. Marketing efficiency analysis revealed that marketing costs were less in Channel I (Rs.2,073.89) and more in Channel II (Rs.2,303.89), producer share was high in Channel I (35.45 %) and less in Channel II (33.65 %), and greater marketing efficiency in Channel I (0.55) than Channel II (0.51), making it more cost-effective and profitable option for ginned cotton marketing. The SWOC analysis revealed strengths such as financial viability, skilled labour and market access, while key weaknesses included high energy costs, infrastructure limitations and seasonal demand volatility. Opportunities lay in rising demand for quality yarn and technological modernization. Whereas challenges included transportation issues, raw material shortages and labour dependency. Overall, the study provided valuable insights into improving the operational efficiency and profitability of cotton ginning mills in Raichur.

An Economic Analysis of Production and Marketing of Betel Leaves in Davanagere District of Karnataka

RAMANGOUDA AND M.S. GANAPATHY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was carried out in Davanagere district of Karnataka to document growth rate in area, production and productivity, cost, returns and resource use efficiency, marketing channels and consumer preference of Betel leaves. The Primary data was collected from 60 farmers, 20 market intermediaries and 30 consumers through personal interview, and secondary data from Directorate of Economics and Statistics, and Karnataka State Agricultural Marketing Board. The findings show a positive growth in CAGR (2.60%), but a decline in both production (-2.62%) and productivity (-5.13%) from 2011 to 2021. The cultivation costs per acre were Rs.3,76,019 for Kari yale and Rs.3,40,681 for Savanur yale, with average yields of 60 and 65 pendies per acre, respectively. Gross returns per acre were Rs.7,87,800 for Kari yale and Rs.5,36,250 for Savanur yale, resulting in respectively Rs.2.09 and Rs.1.57 return per rupee, Resource use efficiency was ninety per cent for both varieties. Channel-I (Producer→Village Trader→Retailer→Consumer) emerged as the most efficient marketing channel, providing a producer's share of 65.45 per cent for Kari yale and 59.43 per cent for Savanur yale. Consumer preference analysis indicated a higher demand for Kari yale due to its taste, spiciness and traditional significance. Recommendations include strengthening extension networks by the Department of Horticulture and government support in the marketing process. Policies should also focus on sustainable practices to enhance quality and flavor that promoting increased consumption of Betel leaves.

Comprehensive Analysis of Inland Fish Production in Tumakuru District of Karnataka

H.R. PUNEETH AND JAGANNATH OLEKAR

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was undertaken in Tumakuru district of Karnataka to analyse the trends in fish production, economics of fish production, technical efficiency of fish farmers and production constraints in fish farming. The primary data were collected from 30 fish farmers and secondary data from department of fisheries, Tumakuru. The data were analysed using cost and returns analysis, data envelopment analysis and Garrett's ranking. The results revealed that area under inland fish farming was growing at 0.5 per cent while the production was at 13.1 per cent in the study area. The total costs involved in inland fish farming was Rs.5,30,795/- per acre pond. The gross returns realized was Rs.10,46,250/- per acre pond and the corresponding net returns was Rs.5,15,455/- per acre pond. Out of the total farmers, under constant returns to scale approach, 16 per cent farmers operated were at 70-79 per cent efficiency, while 26 per cent farmers achieved 80-89 per cent efficiency, The largest group, 33 per cent farmers, operated between 90-99 per cent efficiency, and 23 per cent were fully efficient at 100 per cent, while under variable returns to scale approach, 60 per cent achieved perfect efficiency (100 per cent), 16 per cent farmers were in 90-99 per cent range, 10 per cent farmers were in the 70-79 per cent range and 13 per cent farmers in the 80-89 per cent range. The major production constraints faced by fish farmers were elevated feed expenses and limited access to quality fish seed.

A Study of Farmer Producer Organizations (FPOs) in Bagalkot District of Karnataka

KUMARI SUNITA PATIL AND SIDDAYYA

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study was undertaken in Bagalkot district of Karnataka state during 2023-24 to evaluate the economic benefits of members over non-members of Farmer Producer Organizations (FPOs) in catering different services and activities to the farmer members. A sample of 60 members from each FPO *i.e.*, Bagalkot Raithara Belegarara Producer Company Limited (BRBPCL) and Krishi Kirana Farmers Producer Company Limited (KKFPCL), jurisdiction (10 each) from six villages and 40 non-members from FPOs jurisdiction were selected for the study. The findings of the study have shown that the prices of all agriculture inputs supplied by FPOs were lower by three to five per cent compared to retailers in the market and about 12.50 per cent for agricultural machinery rental services provided by the FPOs. On accumulative basis, the overall reduction in cost of purchase of inputs for members was to the extent of Rs.1804.78 and Rs.1749.20 for BRBPCL and KKFPCL, respectively. The cumulative savings due to transaction costs (distance & time) for members over non-members was Rs.752.10 and Rs.426.10, respectively. The overall savings for members marketing their produce through FPOs over non-members was Rs.1378/q for jowar and Rs.1425/q for maize. Inability of FPOs to keep adequate stock of farming inputs emerged as the most important constraint faced by members of FPOs followed by lack of financial assistance. Inadequate working capital and high operational costs were threats for long term sustainability of FPO business. Hence, increasing equity, handholding support from Government and diversifying business are some of the measures to be adopted for long term sustainability.

An Economic Analysis of Export of Selected Minor Spices of India

K.S. VAISHNAVI AND M.R. GIRISH

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE glory of Indian Spices is known throughout the world. In recent years, the trade of minor spices has gained significant momentum. The present study examined the trends in area, production and export of selected minor spices from India for the period from 2002-03 to 2022-23. It also analysed the composition and direction of minor spices exports for the period from 2012-13 to 2022-23, along with the constraints and prospects associated with these spices. The minor spices studied include Celery, Coriander, Cumin, Fennel, Fenugreek, Other Seed Spices, Garlic and Nutmeg & Mace. The results indicated that the area and production of all selected minor spices registered significant positive growth rates. The productivity of all the minor spices except celery exhibited positive significant growth rates. Similarly, the quantity and value of all selected minor spices exported registered significant positive growth rates. However, the export of these minor spices showed instability over the reference period. USA for celery; Malaysia for coriander; Bangladesh for cumin; Yemen North for fenugreek; Nepal for other seed spices; USA for garlic; and Vietnam for nutmeg and mace were the most stable markets. However, all the major importers of fennel turned out to be unstable. Failure to meet SPS measures imposed by the importing countries was the major export constraint of the selected minor spices. The prospects of exporting minor spices from India is promising, driven by a combination of increasing global demand, advancements in agricultural practices, technological advancements in agriculture and strategic market opportunities. The Government may invest in improving food safety and quality standards by providing technical training and certification programmes for farmers and exporters. Additionally, establishing robust monitoring systems to ensure compliance with international SPS regulations could further enhance the export potential of Indian minor spices.

Supply Chain Analysis of Sweet Lime in Anantapur District, Andhra Pradesh

SIDDAMREDDY VENKATA HARITHA REDDY AND M.S. GANAPATHY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study analysed seasonal variation in prices, arrivals, supply chain marketing efficiency, cost and returns of sweet lime production, marketing and price spread in different channels and SWOC in production and marketing of sweet lime. The data was collected from randomly selected 30 farmers and 20 market intermediaries from Anantapur. The study reveals that the seasonal indices of prices were higher during April to August and lowest during October in Bengaluru market. Where as in Hyderabad market, price indices were higher during May to December and lowest during February to April. The supply chain analysis highlights two primary marketing channels. About 74 per cent of the farmers sold through Channel-II (Producer → Pre-harvest contractor → Distant wholesaler → Distant Retailer → Distant Consumers) and about 25 per cent in channel-I (Producer → Commission agent cum wholesaler → Local Retailers → Local Consumers). Price spread was higher in Channel-II (Rs.34,325) compared to Channel-I (Rs.12,835). The first-year investment on one acre of sweet lime orchard was Rs.1,60,708, while during the three years of gestation period (from 2nd through 4th year) was Rs.1,21,980. The cost of cultivation was Rs.64,078 per acre during bearing period for sweet lime. Average yield per acre is 5.10 tonnes and gross returns per acre is Rs.1,86,150 with B:C ratio of 2.90. The major strength of sweet lime production and marketing were consistent income and regular demand. The important weakness is lack of access to market information and scarcity of labour. This study provides a comprehensive overview of sweet lime production, marketing and cost dynamics, offering valuable insights for stakeholders in the industry.

Groundnut Value Chain Analysis in Anantapuram District, Andhra Pradesh

GAJULA BALIJA NAVYA AND C.P. GRACY

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THIS study was undertaken by obtaining primary data from a random sample of 30 groundnut producers, 10 traders, 10 processors, 10 retailers and 30 consumers in Anantapuram district for the crop year 2023. Key actors identified in the value chain of groundnut were credit and input suppliers, farmers, commission agents, traders, processors, wholesalers, retailers and consumers. The cost of cultivation of groundnut was Rs.51,601 per acre of which human labour and seed cost constituted about 23.83 and 19.28 per cent, respectively. The gross returns and Benefit-Cost ratio from an acre of groundnut crop were respectively, Rs.63,673 and 1.23. The degree of value addition was the highest by processors in the value chains of kernel (9.18 %) and oil (9.67 %), followed by retailers and traders. Value chain of groundnut oil (19.28 %) had a higher degree of value addition compared to groundnut kernels (16.23 %). Rank Based Quotient (RBQ) revealed that major production constraints of farmers were uncertain weather (drought), shortage of labour and high cost of quality inputs, while non-availability of appropriate market price on farm produce, unauthorised deduction of produce by traders and distinct markets were the major marketing constraints. Traders and processors encountered low quality of kernel, inadequate storage facility, wastage during storage, lower capacity of mills as major constraints. Best–Worst analysis indicated medium size kernel and medium price range (Rs.100-110) were most preferred attributes of kernel with Standard Score of 0.425 and 0.341, respectively, while aroma and colour for groundnut oil with Standard Score of 0.200 and 0.116, respectively.

Consumer Preference for Value Added Food Products of Coconut – A Study in Bengaluru City

MEGHA METI AND MAHIN SHARIF

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

COCONUT is a traditional plantation crop in India and it has attained the status of a high-value commercial crop. India accounted for about 31.45 per cent of the world's total production during 2022-2023, The popularity of value-added coconut food products among consumers has dramatically increased due to urban families and dual income earning people of the households opting for coconut food products offers a multitude of benefits that cater to both taste and health. The study was conducted with the objective of documenting and analyse the consumer preferences and their buying behaviour of food products of coconut by collecting data from 90 consumers. The sale promotion strategies used by retailers collecting data from 30 retailers. The results of study revealed that KLF Coconad, Amul, Dabur, etc. were major brands available in retail outlets. The socio-economic characteristics of consumers revealed that the majority of consumers with 34.44 per cent were private employees and other characteristics analysed by using descriptive statistics. The study used factor analysis, with the KMO measure at 0.530, revealing quality, taste and flavour, nutritional value major factors influencing consumer preferences. The coconut products include coconut ice cream, milk powder. Brands like Amul, Britannia and Dabur were consumer favourites. Supermarkets and online platforms like Big Basket were common purchase points. Health benefits and flavour were key purchase drivers. It is essential to provide accurate information to consumers through various channels, such as mass media, advertising and consultations with healthcare professionals and dietitians one of the major policy implications.

Entrepreneurial Culture and Business Ethics among Agri-Input Dealers in Haveri District

NAGARAJ S. DUNDIYAVAR AND G. RANGANATH

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE present study was undertaken in Haveri and Ranebennur taluks of Haveri district in Karnataka state during 2023-2024 to assess the entrepreneurial behavior and examine the impact of business ethics on credibility and trustworthiness of agri-input dealers. 30 agri-input dealers were personally interviewed using a pre-tested schedule. It was found that more than one-third of the agri-input dealers were belonging to medium level of innovativeness (43.33 %), achievement motivation (40.00 %), risk orientation (46.66 %), business orientation (43.33 %) and scientific orientation (46.66 %), and more than half number of agri-input dealers were having medium level of leadership ability (53.33 %), management orientation (53.33 %). Majority of the agri-input dealers (76.67 %) were belonging to medium to high entrepreneurial behaviour category. Entrepreneurial behavior showed significant correlations with age, experience as a dealer, social participation, research/extension contact and income from agri-input enterprise. There is a strong positive correlation between entrepreneurial behavior and income, supporting the hypothesis that entrepreneurial behavior positively impacts business performance. The f-square values for the impact of business ethics on credibility (1.129) and trustworthiness (1.031) emphasizes the significant influence of business ethics on these constructs. The path coefficients (b-values) show strong positive relationships between business ethics and credibility ($b = 0.728$) and trustworthiness ($b = 0.712$), supporting the acceptance of both hypotheses. Late payment by farmers (76.34) and low margin for different agri-inputs (72.50) were major constraints faced by agri-input dealers. Agri-input dealers should offer consultancy services alongside sales to build trust, credibility and support sustainable agricultural practices.

A Study on Supply Chain Management of Chrysanthemum in Chikkaballapura District

C.S. ASHWINI AND G. BASAVARAJ

Institute of Agri-Business Management, College of Agriculture, UAS, GKVK, Bengaluru

THE study focused on supply chain management of chrysanthemum in Chikkaballapura district. The primary data was collected from 60 growers and 30 market intermediaries. Data were analyzed using descriptive statistics, cost and returns concepts and modified marketing efficiency. The study analysed the cost and returns, resource use efficiency, backward and forward linkages and post-harvest losses and its impact on marketing efficiency. The cost A_1 for cultivation of chrysanthemum was Rs.1,50,733 per acre while the cost C_3 was Rs.1,75,811.69 per acre. The yield realized was 46.70 quintals / acre and the net returns over cost C_3 was Rs.91,584.75 / acre. Returns per rupee of expenditure was found to be 1.67 and the cost of production was Rs.3,422.17 per quintal. The co-efficient for seedlings, FYM, human labour and machine labour had positive relationship whereas, fertilizers and PPC contributed negatively to the output. The backward linkages included credit, labour, seedlings, machinery, FYM, fertilisers, PPC and irrigation while the forward linkages included sale of chrysanthemum viz., supply chain - I: producer→commission agent→wholesaler→retailer→consumer, supply chain - II: producer→village level trader→commission agent cum wholesaler→retailer→consumer. The total PHL was 16.42 per cent, which comprised loss at the field level, wholesale level and retail level with 3.95, 7.21 and 5.26 per cent, respectively. To reduce the PHL and increase marketing efficiency, farmers and supply chain functionaries have to be trained by creating awareness on how to handle the flower and avoid injury to flowers.

Studies on Non-Linear Growth Models for the Spread of Powdery Mildew (*Oidium mangiferae*) in Mango (*Mangifera indica*)

PALLAVI AND R. VENUGOPALAN

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

MANGO, known as the 'king of fruits', is a vital tropical crop with significant nutritional and economic importance. This study examines the impact of meteorological factors on the incidence of powdery mildew, which severely affects mango production, focusing on the early flowering Lazzat Baksh, mid-flowering Alphonso, and late-flowering Neelum varieties during the growing seasons. Data recorded at the IIHR, Bengaluru, Karnataka, from December 2021 to March 2023 includes visual assessments of the percent disease index and analyses weekly weather data, including maximum temperature, minimum temperature, relative humidity, evaporation, wind speed and rainfall separately for each year. Correlation and stepwise regression utilised to identify key weather factors influencing disease progression revealed that maximum temperature and evaporation significantly predict powdery mildew incidence, while relative humidity at 1:30 PM negatively correlates with disease severity. The developed statistical models demonstrate strong predictive capabilities, accounting for a substantial 96-98 per cent of variance in PDI. Among various non-linear growth models (Logistic, Gompertz, Monomolecular, Malthus, and Richards) developed to describe disease progression, logistic model showed superior performance, accounting for 96-98 per cent of the variance in PDI with higher adjusted R values and least Mean Squared Error. The severity of powdery mildew peaked at different times for each variety between the first and second weeks for Lazzat Baksh, the third and fourth weeks for Alphonso and the eleventh and twelfth weeks for Neelum. The Area Under Disease Progress Curve quantified disease intensity over time, aiding in the development of precise management strategies. Residual analyses confirmed model validity through tests of randomness and normality. The research underscores the necessity of weather-based forecasting systems for managing powdery mildew, aiming to minimize economic losses in mango production and provides valuable insights for farmers and researchers, enhancing decision-making to reduce yield losses and promote sustainable mango cultivation.

Statistical Analysis of Area, Production and Productivity of Potato in Selected Districts of Karnataka

RASHMI PATIL AND A.S. KAMBLE

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

AN attempt was made to analyse the trend in area, production and productivity of potato in selected districts (Hassan, Chikkamagaluru and Belagavi) of Karnataka. The secondary data on aspects of potato was collected from the official website of DES, Department of Agriculture from 1998-99 to 2021-22. The data subjected using linear, quadratic, cubic, quartic, exponential, logistic, log-logistic and gompertz models. The best fitted model was selected using minimum MAPE and highest R^2 . Cubic model was the best fitted for the area (MAPE = 28.01, $R^2 = 0.68$), production (MAPE = 20.34, $R^2 = 0.65$) and productivity (MAPE = 12.32, $R^2 = 0.50$) in Hassan. Logistic model found best fitted for area (MAPE = 13.51, $R^2 = 0.81$) and linear model found best fitted for production (MAPE = 181.25, $R^2 = 0.72$) and productivity (MAPE = 157.22, $R^2 = 0.55$) in Chikkamagaluru. Linear model found best fitted for area (MAPE = 13.40, $R^2 = 0.75$) and quadratic model found best fitted for production (MAPE = 15.21, $R^2 = 0.58$) and productivity (MAPE = 10.89, $R^2 = 0.58$) in Belagavi. Study reveals that there is a cyclical trend for area, production and productivity of potato in Hassan, whereas Chikkamagaluru experience an upward trend but in Belagavi there is downward trend for area, production and productivity. Further an attempt was made in forecasting of potato production for the period from 2022-23 to 2026-27, using exponential smoothing methods are compared with best fitted model. The suitable method was selected based on the minimum MAPE. Cubic model was used for the forecasting in Hassan and Brown's method (MAPE=165.18) used for the forecasting in Chikkamagaluru, shows increasing production in both the districts. However, quadratic model was used for the forecasting in Belagavi shows the decreasing production.

Statistical Analysis of Area, Production and Productivity of Onion in Selected Districts of Karnataka

G.M. SHASHWATHI AND A.S. KAMBLE

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

AN effort was made to analyse the trend in area, production and productivity of onion in selected districts (Vijayapura, Chitradurga and Bagalkot) of Karnataka. The secondary data on the aspects of onion was collected from the Directorate of Economics and Statistics, Government of Karnataka, for the period from 1998-99 to 2021-22. The data was analysed using linear and non-linear models. The best fitted model was selected based on the minimum MAPE and highest R^2 . Quartic model was the best fitted model for the area (MAPE = 33.19) and productivity (MAPE = 27.68), Cubic model as best fit for production (MAPE = 53.42) in Vijayapura. Quadratic model found best fitted for area (MAPE = 14.81) and production (MAPE = 27.28) and quartic model found best fitted model for productivity (MAPE = 14.19) in Chitradurga. Exponential model found best fitted for area (MAPE = 13.40), logistic model found best fitted for production (MAPE = 39.79) and quartic model found best fitted for productivity (MAPE = 19.22) of onion in Bagalkot district. Findings reveals that there is a cyclical trend for area in Vijayapura and productivity in all three districts. There is increasing trend for area of Chitradurga and Bagalkot and production in Vijayapura, Chitradurga and Bagalkot district. An attempt was made in forecasting of onion production for the period from 2022-23 to 2026-27, using Exponential smoothing methods and compared with best fitted model. The suitable method was selected considering the minimum MAPE value. Cubic model was used for the forecasting in Vijayapura showed increasing onion production, quadratic model used for the forecasting in Chitradurga showed the increasing onion production. Further, Holt's method (MAPE = 36.49) used for the forecasting of onion in Bagalkot district showed increasing in production.

Time Series Modelling and Forecasting of Cyclical Data in Agriculture

SHIVASHANKAR TANAKANAKAL AND H.K. RANGANATH

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

THE Box-Jenkins Auto-Regressive Integrated Moving Average (ARIMA) methodology dominated time series data analysis up until the late 1970s. However, a key limitation of the ARIMA approach lies in its reliance on the assumption of stationarity, which is not always feasible to achieve through differencing or transformations. Consequently, ARIMA is applicable to only a limited subset of data. Over the past three decades, the field of non-linear time series modeling has developed rapidly to address these challenges. The non-linear time series models such as Self-Exciting Threshold Auto-Regressive (SETAR) and Generalized Exponential Auto-Regressive (EXPAR) models have been introduced to model and forecast cyclical data effectively. As an illustration, we considered jute production data of India, which exhibits cyclical fluctuations. The parameter estimation methods such as Least Squares, Conditional Least Squares (CLS) and Non-Linear Least Squares have been employed for fitting these models using R software. Among these models, the SETAR model excelled in capturing non-linearity, by achieving the lowest AIC and BIC values and demonstrating superior forecasting accuracy with minimal RMSE and MAPE. In recent years, machine learning techniques have further enhanced research in this domain by improving predictions for crop yields, disease forecasting, and the impacts of weather. Machine learning methods effectively handle complex, non-linear relationships in large datasets, uncovering intricate patterns in weather, soil and crop data. To leverage these advantages, we applied machine learning models, including Artificial Neural Networks (ANN), Support Vector Machines (SVM), Extreme Gradient Boosting (XGBoost) and Random Forests (RF) to jute production data of India. Among these, the XGBoost model demonstrated the best performance in forecasting jute production by achieving the lowest forecast error measures.

Study on Nested Designs and their Applications in Agriculture

K. VENUGOPAL AND H.K. RANGANATH

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

NESTED block designs are useful in experimental situations where heterogeneity in experimental units is caused by two factors, with one factor nested within the other. The Nested Balanced Incomplete Block (NBIB) Designs and Nested Partially Balanced Incomplete Block (NPBIB) Designs available in the literature are beneficial for inferring all possible elementary treatment contrasts. However, these designs may not be efficient when the focus is on a subset of treatment comparisons, such as all elementary contrasts between each test and control(s). Nested Balanced Treatment Incomplete Block (NBTIB) Designs have been developed for comparing several tests with a single control. However, NBTIB designs are not available for all parametric combinations. Therefore, it is desirable to develop Partially Balanced Nested Block Designs for making tests-control comparisons. Moreover, situations may arise where the experimenter is interested in comparing tests with more than one control. To overcome this problem introduced Nested Partially Balanced Bipartite Block (NPBBB) Designs. We developed four methods to obtain NPBBB designs using the approaches of reinforcement of treatments to each block (adding controls to existing design in tests) and initial block solutions have been obtained and catalogues of NPBBB designs for $v \leq 15$, $r_1 \leq 15$ (replication of tests), $r_2 \leq 30$ (replication of control) have been prepared. In practical agricultural experiments, minimally replicated nested designs with unequal block sizes are valuable when experimenters face resource constraints. Therefore, it is desirable to obtain Nested Partially Balanced Incomplete Block (NPBIB) Designs with unequal sub-block sizes. We developed four methods to obtain NPBIB designs with unequal sub-block sizes using the known association schemes such as GD, L_2 , rectangular and NGD association scheme have been obtained and catalogues of NPBIB designs for $r \leq 20$, along with their variance and Canonical Efficiency Factors (CEFs) have been prepared.

Statistical Analysis of Area, Production and Productivity of Millets in India

BORA VINAY KUMAR AND T.L. MOHANKUMAR

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

THIS study analyzes the trend in area, production and productivity of millet in India for 72 years (1950-51 to 2021-22) data obtained from Indiastat using linear and non-linear models. The cubic model best explained the area trend under sorghum, bajra and ragi crops, whereas logistic model for minor millets. The area under all millet crops showed a declining trend. For production, quadratic model captured the decreasing trend in sorghum and ragi, exponential model explained the increasing trend in bajra and the cubic model explained the decreasing trend in minor millets. The linear, exponential, logistic and cubic models were best-fit for the productivity of sorghum, bajra, ragi and minor millets, respectively, indicating an increasing trend in productivity. The study period is divided into three sub-periods viz., Period-I (1950-51 to 1979-80), Period-II (1980-81 to 1999-2000) and Period-III (2000-01 to 2021-22) to analyze temporal variation using coefficient of variation (CV %), ANOVA and Cuddy-Della Valle Index (CDVI %). Sorghum, bajra and ragi area was more consistent during Period-I (CV: 5.88, 8.26 and 6.53 %). Sorghum and ragi production stabilized in Period-II (CV: 15.41 and 8.61%). In Period III, productivity of these crops showed greater consistency (CV: 12.82, 22.21 and 13.32%). Whereas, productivity of minor millets became increasingly unstable by Period-III (CV: 24.97 %). Further, H-ES, ARIMA, LSTM, NNAR and ANN models were employed to forecast millet area and production. The ANN model with 'ReLU' activation function emerged as the best-fitted model. By 2026-27, bajra's cultivation area may rise to 80.71 lakh hectares, sorghum to 50.26 lakh hectares, ragi maintain stable growth and minor millets decline to 5.84 lakh hectares. Bajra production peaks at 96.97 lakh tonnes in 2024-25 before declining. Sorghum production fluctuates, ragi remains stable with slight decline and minor millets steadily increase to 4.25 lakh tonnes by 2026-27.

Statistical Analysis of Arrivals and Prices of Arecanut in Major Markets of Karnataka

G.S. THANESH PATEL AND T.L. MOHAN KUMAR

Department of Agricultural Statistics, Applied Mathematics and Computer Science,
College of Agriculture, UAS, GKVK, Bengaluru

THIS study analyses the arrivals and prices of arecanut in major Karnataka markets using 17 years of secondary monthly data from the Krishimaravahini website (January, 2007 to December, 2023). Trend in arrivals and prices were analyzed for Shivamogga, Sirsi, Sagara, Channagiri and Yellapura markets using linear and nonlinear models. No significant trend in arrivals of arecanut was found across all selected markets. The logistic model best fits the prices of arecanut in Shivamogga, Sirsi, Sagara and Yellapura markets, while Gompertz model for Channagiri market. Prices showed an upward trend across all markets. Seasonal indices calculated using the ratio-to-moving-average method indicated that arrivals were higher after harvest season (January to April), while prices peaked during or before harvest season (August to January). Temporal variations were examined by dividing the study period into three periods: Period I (2007–08 to 2011–12), Period II (2012–13 to 2017–18) and Period III (2018–19 to 2022–23). Period II exhibited the highest variability in arrivals with coefficient of variation (CV: 90.27 to 213.02 %) across markets, while Period III showed less variability with CV (35.32 to 72.56 %). Similarly, Period II had the highest volatility in prices with CV (38.69 to 40.48 %), while Period III showed less variability with CV (15.56 to 17.44 %). Result exhibits significant fluctuations during Period II, followed by enhanced market stability in Period III despite rising prices. Further, Holt-Winter's, SARIMA and ANN models were employed to forecast arecanut prices. The SARIMA model performed best among all models employed across all markets with lowest MAPE for training and testing data. The best-fitted SARIMA models are: SARIMA (3,1,3)(0,1,1)₁₂ for Shivamogga, SARIMA (4,1,5)(0,1,1)₁₂ for Sirsi, SARIMA (3,1,4)(1,1,1)₁₂ for Sagara, SARIMA (4,1,3)(0,1,1)₁₂ for Channagiri, and SARIMA (2,1,4)(0,1,1)₁₂ for Yellapura. Forecasted values indicated that prices of arecanut will further increase across all selected markets.

Studies on Integrated Nutrient Management in Horsegram (*Macrotyloma uniflorum* L.)

AISHWARYA VEERANNA BASAPUR AND M.R. ANAND

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment entitled 'Studies on Integrated Nutrient Management in Horsegram (*Macrotyloma uniflorum* L.)' was conducted at AICRP on Arid Legumes, GKVK, University of Agricultural Sciences, Bangalore. The experiment involved the combined application of nutrients and seed treatment at sowing, with ten treatments replicated three times in a RCBD. The growth and yield attributes were significantly varied with the combined application of 100% RDF + seed treatment with *Rhizobium* & PSB (4g/kg) + foliar spray of 19:19:19 @ 1% (10 g/Litre) which recorded higher plant height (57.6 cm), dry matter production (13.7 g plant⁻¹), leaf area plant⁻¹ (454 cm²), pod length (5.6 cm) and number of seeds pod⁻¹ (6.0) and it was on par with 100% RDF + seed treatment with *Rhizobium* & PSB + foliar spray of urea @ 2% (20 g/Litre) and 100% RDF + foliar spray of 19:19:19 @ 1%, respectively. Whereas, lower plant height (27.1 cm), dry matter production (8.0 g plant⁻¹), leaf area plant⁻¹ (135 cm²), pod length (4.1 cm) and number of seeds pod⁻¹ (3.4) were recorded with the application of 100% RDF (Control). The experiment summarised that higher seed yield, net returns and BC ratio (2310 kg ha⁻¹, Rs.43,898 ha⁻¹ and 2.72, respectively) were recorded with application of 100% RDF + seed treatment with *Rhizobium* & PSB + foliar spray of 19:19:19 @ 1%. Whereas, lower seed yield, net returns and BC ratio (1364 kg ha⁻¹, Rs.16,318 ha⁻¹ and 1.66, respectively) were recorded with 100% RDF (Control).

Bioefficacy of Pre and Post Emergence Herbicides in Sunflower (*Helianthus annuus* L.)

S.N. YASHASWINI AND K.N. KALYANA MURTHY

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted for evaluation of herbicides in sunflower during *kharif* 2023 at 'K-7' block, AICRP on sunflower, UAS, GKVK, Bengaluru. The experiment was laid out in RCBD with seven treatments replicated thrice. The treatments consisted of three pre-emergent herbicides (Pendimethalin 30% EC @ 1 kg a.i. ha⁻¹, Diclosulam 84% WDG 22 g a.i. ha⁻¹ and Pyriothion Sodium 3.1% + Pendimethalin 34% ZC @ 750 ml ha⁻¹) and two post-emergent herbicides (Imazethapyr 10% SL @ 80 g ha⁻¹ and Quizalofop-p-ethyl 10% EC @ 37.5 g a.i. ha⁻¹) which were compared with weedfree check and unweeded control. Among herbicide treatments, application of Diclosulam 84% WDG @ 22 g a.i. ha⁻¹ as pre-emergence spray recorded lesser total weed density (47.19 0.25 m⁻²), total weed dry weight (17.990.25 m⁻²), weed index (6.12) and higher weed control efficiency (85.21%) at harvest without any phytotoxic effect and recorded higher seed yield (2056 kg ha⁻¹) and stalk yield (3449 kg ha⁻¹), which was attributed to higher plant height (171.9 cm), leaf area (3002cm² plant⁻¹), total dry matter production (101.74 g plant⁻¹), capitulum diameter (18.58 cm) and number of seeds capitulum⁻¹ (821). Further, it resulted in higher net returns (Rs.88,603 ha⁻¹) and B:C ratio (3.94) which was on par with treatment Pendimethalin 30% EC @ 1.0 kg a.i. ha⁻¹ as pre-emergence spray, thereby reducing dependence on manual labour for weeding under present labour scarce situation.

Drone Mediated Weed Management in Maize (*Zea mays* L.)

K. BASAVARAJA AND B.S. LALITHA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment entitled 'Drone mediated weed management in maize (*Zea mays* L.)' was conducted during *kharif*-2022, in Agronomy field unit, Zonal Agricultural Research Station, University of Agricultural Sciences, Bangalore. The experiment with six treatments replicated four times in RCBD with factorial concept. The treatments comprised of two different herbicides (H_1 : Atrazine 50 % WP @ 1.25 kg a.i. ha⁻¹ and H_2 : Oxyfluorfen 23.5 % EC @ 0.10 kg a.i. ha⁻¹) as factor one and three spray volumes as second factor (V_1 : 78 l ha⁻¹, V_2 : 52 l ha⁻¹, and V_3 : 26 l ha⁻¹). The results revealed that pre-emergent application of atrazine 50 % WP @ 1.25 kg a.i. ha⁻¹ has recorded numerically higher plant height (174.40 cm), dry matter production (226.90 g plant⁻¹), kernel yield (6644 kg ha⁻¹), stover yield (8337 kg ha⁻¹) and B:C (3.14). Among the spray volumes, pre-emergent herbicide with the spray volume 78 l ha⁻¹ has recorded significantly higher plant height (179.43 cm), dry matter production (230.65 g plant⁻¹), kernel yield (6830 kg ha⁻¹), stover yield (8576 kg ha⁻¹) and B:C (3.23). Among the interactions, pre-emergent application of atrazine 50 % WP @ 1.25 kg a.i. ha⁻¹ with the spray volume of 78 l ha⁻¹ recorded numerically higher plant height (178.50 cm), dry matter production (246.67 g plant⁻¹), kernel yield (7025 kg ha⁻¹), stover yield (8746 kg ha⁻¹), net return (Rs.96976 ha⁻¹) and B:C (3.32) when compared to other interactions.

Bio Efficacy of Pre and Post Emergent Herbicides in Chia Crop (*Salvia hispanica* L.)

KARUNA DAS ADHIKARY AND V. VENKTACHALAPATHI

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted during *Rabi*-2023 at Agricultural Research Station, Chintamani to study the bio-efficacy of pre and post emergent herbicides in chia crop. The experiment was laid out in Randomized Complete Block Design with eleven treatments and replicated thrice. The experiment consisted a total of 11 treatments involving four pre-emergent herbicides (pendimethalin, metribuzin and diclosulam) and five post-emergent herbicides (fenoxprop-p-ethyl, propaquizafop, quizalofop -p- ethyl, ethoxysulfuron and penoxsulam) applied at different doses and were compared against intercultivation at 25 DAS + hand weeding at 40 DAS and weedy check. Among the different herbicide treatments, pre-emergent application of diclosulam 84 % WDG @ 22 g a.i. ha⁻¹ recorded lesser total weed density (19.00 m⁻²), total weed dry matter (7.06 g m⁻²), weed index (5.52) and higher weed control efficiency (80.36 %) at harvest with higher seed yield (839 kg ha⁻¹) and B:C ratio (3.35). Among the post emergent herbicides penoxsulam 2.67% @ 22.5 g a.i. ha⁻¹ recorded lesser total weed density (17.33 m⁻²), total weed dry matter (7.17 g m⁻²), weed index (16.10) and higher weed control efficiency (80.05 %) at harvest with higher seed yield (745 kg ha⁻¹) which was on par with application of ethoxysulfuron 15% WDG @ 12.5 g a.i. ha⁻¹. Considering the current labour shortage and higher weeding costs, the application of the afore mentioned pre and post emergent herbicides effectively controlled the weeds.

Effect of Organic Sources on Productivity of Finger Millet [*Eleusine coracana* (L.) Gaertn.]

SANTOSH ARAGANJI AND B. BORAIAH

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted at Research Institute on Organic Farming, University of Agricultural Sciences, Bangalore during the *Kharif*-2023 to study the 'Effect of organic sources on productivity of finger millet [*Eleusine coracana* (L.) Gaertn.]'. The experiment consisted of eight treatments wherein six different organic nutrient sources applied based on nitrogen equivalent were tested against absolute control and recommended dose of farm yard manure. The experiment was laid in Randomized Complete Block Design and replicated thrice. The results revealed that, application of 100 per cent nitrogen equivalent poultry manure recorded significantly higher plant height (106.40 cm), number of leaves per plant (25), total dry matter accumulation (67.92 g), number of productive tillers per plant (5.68), ear length (9.21 cm), grain yield (3184 kg ha⁻¹) and straw yield (4393 kg ha⁻¹) compared to other sources and absolute control. The same treatment resulted in significantly higher plant nutrient uptake (101.96, 26.64 and 83.75 NPK kg ha⁻¹, respectively), soil available nutrients after crop harvest (248.32, 36.67 and 183.15 NPK kg ha⁻¹, respectively), microbial population viz., bacteria, fungi and actinomycetes, enzymes viz., dehydrogenase, phosphatase and urease. Poultry manure recorded higher gross returns (Rs.1,49,773 ha⁻¹), net returns (Rs.89,761 ha⁻¹) and B:C (2.50), in contrary the absolute control treatment recorded significantly lower values of above mentioned parameters observed under the study. Hence, applying poultry manure at 100 per cent nitrogen equivalent is ideal for higher productivity and economic feasibility in organic finger millet cultivation and followed by 100 per cent nitrogen equivalent urban compost in terms of economic feasibility.

Standardization of Agro-Techniques for Pre-Released Maize Hybrid

H. BARATH GOWDA AND K. PUSHPA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted at 'M' block, Agroforestry unit, GKVK, UAS, Bangalore during *kharif*-2023 for standardization of agro-techniques for pre-released maize hybrid. The experiment was laid out in factorial randomized complete block design consisting of three factors viz., two hybrids (MAH 14-5 and MAH 15-84), two spacings (45 cm × 30 cm and 60 cm × 30 cm) and three nutrient levels (100 % RDF, 125 % RDF and 150 % RDF) with 12 treatment combinations replicated thrice. Among hybrids, MAH 15-84 recorded significantly higher plant height (220.7 cm), total dry matter production (253.6 g plant⁻¹), kernel yield (7738 kg ha⁻¹), stover yield (10290 kg ha⁻¹), uptake of nitrogen (195.8 kg ha⁻¹), phosphorus (34.28 kg ha⁻¹) and potassium (172.4 kg ha⁻¹). Wider spacing of 60 cm × 30 cm recorded significantly higher plant height (221.6 cm), total dry matter production (253.6 g plant⁻¹), kernel yield (8354 kg ha⁻¹), stover yield (11110 kg ha⁻¹), uptake of nitrogen (197.6 kg ha⁻¹), phosphorus (34.19 kg ha⁻¹) and potassium (183.3 kg ha⁻¹). Application of 150 per cent RDF recorded significantly higher plant height (220.4 cm), total dry matter production (254.9 g plant⁻¹), kernel yield (8259 kg ha⁻¹), stover yield (10984 kg ha⁻¹), uptake of nitrogen (198.9 kg ha⁻¹), phosphorus (34.33 kg ha⁻¹) and potassium (176.6 kg ha⁻¹). Higher gross returns (Rs.216744 ha⁻¹), net returns (Rs.163547 ha⁻¹) and B:C (4.07) was observed in MAH 15-84 hybrid with spacing of 60 cm × 30 cm under 150 per cent RDF.

Productivity and Quality of Foxtail Millet (*Setaria italica* L.) under Natural Farming

K. HARSHITHA AND S.B. YOGANANDA

Department of Agronomy, College of Agriculture, V.C. Farm, Mandya

A field experiment was conducted during *Kharif* season of 2023 at College of Agriculture, V.C. Farm, Mandya to study the influence of natural farming practices on productivity and quality of foxtail millet (*Setaria italica* L.). The experiment was laid out in Randomized Complete Block Design with eight treatments and replicated thrice. The treatments comprised of seed treatment with beejamrutha, soil application of jeevamrutha at 20 and 40 DAS, foliar application of panchagavya at 30 and 50 DAS and application of microbial consortia @ 5 kg ha⁻¹ at the time of sowing. The results revealed significantly higher growth, yield and quality parameters viz., plant height (124.13 cm), leaf area (892.09 cm² hill⁻¹), root length (18.75 cm), total dry matter production (15.67 g plant⁻¹), number of panicles m⁻² (43.73), length of panicle (18.07 cm), grain yield (1313 kg ha⁻¹), straw yield (1967 kg ha⁻¹), crude protein (11.85%), crude fibre (8.43%), ash (5.10%) and ether extractable fat (5.62%) content in treatment T₁₂ which received beejamrutha (seed treatment) + jeevamrutha @ 500 L ha⁻¹ + foliar application of 2.5% panchagavya + microbial consortia @ 5 kg ha⁻¹. Similar results were also observed with respect to microbial population (bacteria - 67.68 × 10⁵, fungi - 27.70 × 10⁴ and actinomycetes - 22.97 × 10³) cfu g⁻¹ of soil, nutrient uptake by crop (41.71 kg N ha⁻¹, 16.30 kg P ha⁻¹, 38.48 kg K ha⁻¹), gross returns (Rs.58,111 ha⁻¹), net returns (Rs.38,067 ha⁻¹) and BC ratio (2.90). Hence, treatment T₁₂ was found to be economical in saving external inputs resulting in greater resource use efficiency.

Synthesis and Characterization of Nano Potassium from Green Biomass and its Influence on Growth and Yield of Maize (*Zea mays* L.)

M.V. ANJALI AND H.M. JAYADEVA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment entitled 'Synthesis and characterization of nano potassium from green biomass and its influence on growth and yield of maize (*Zea mays* L.)' was carried out at ZARS, UAS, Bangalore. The synthesized nano potassium from various green biomass was used for seed germination studies to determine the best concentration and duration for maize seed priming. After selecting the best treatment from lab experiment, field experiment was conducted in summer-2024 in RCBD with 9 treatments replicated thrice using the cultivar P3304. Seed priming with synthesized nano potassium @ 20 ppm for 45 minutes + 100 % RDK + foliar application of synthesized nano potassium @ 20 ppm at 30 and 60 DAS recorded significantly higher plant height (267.3 cm), number of leaves per plant (11.9), LAI (4.47), total dry matter accumulation (506.9 g plant⁻¹), cob length (22.1 cm), kernel yield (8519 kg ha⁻¹), stover yield (13563 kg ha⁻¹) and harvest index (0.386) compared to all other treatments. The same treatment resulted in significantly higher plant nutrient uptake (277.1, 60.4 and 212.7 NPK kg ha⁻¹, respectively), nitrogen and phosphorus use efficiency (57 and 114 kg kg⁻¹, respectively), higher gross returns (Rs.2,00,979 ha⁻¹), net returns (Rs.1,39,204 ha⁻¹) and B:C (3.25), whereas, the absolute control recorded significantly lower values for above mentioned parameters under the study. Hence, seed priming @ 20 ppm synthesized nano potassium for 45 minutes + 100 % RDK + foliar application of synthesized nano potassium with 20 ppm is ideal for higher productivity in maize production.

Allelopathic Effect of *Alternanthera philoxeroides* as Bioherbicide in Blackgram (*Vigna mungo* L.)

ASHWINI AGARWALLA AND S. KAMALA BAI

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

THE present investigation was carried out to have a deeper insight of allelopathic potential of *Alternanthera philoxeroides* as bioherbicide in blackgram during the *summer* 2024. Treatments consisted of stem, leaf, root and whole plant of *A. philoxeroides* at different dosages. Laboratory bioassays showed that increasing concentrations of *A. philoxeroides* extracts significantly reduced the germination and seedling vigour index (SVI) of blackgram and major weeds such as *Borreria hispida* and *Echinochloa colonum*. The leaf extract @ 160 g L⁻¹ was most effective in suppressing the germination of blackgram by 64.33 per cent and *Borreria hispida* by 0.00 per cent. The whole plant extract @ 120 g L⁻¹ effectively reduced germination of *Echinochloa colonum* by 16.67 per cent. In the field study, whole plant extract @ 160 g L⁻¹ as both pre-emergent and post-emergent bioherbicide recorded lower total weed density (No.m⁻²), total weed dry weight (g m⁻²), weed index and higher weed control efficiency (%) at harvest without any phytotoxic effect and recorded higher seed yield (kg ha⁻¹) which was attributed to higher plant height (cm), number of branches plant⁻¹ and total dry weight (g plant⁻¹) at harvest and higher yield attributing characters like number of pods plant⁻¹ and number of seeds pod⁻¹ which was on par with whole plant extract @ 120 g L⁻¹. Further it resulted in higher net returns and BC ratio. GC-MS analysis of the extracts identified numerous allelopathic compounds with whole plant extract containing more phytoconstituents than other plant parts.

Studies on Lodging Management in Grain Amaranth (*Amaranthus hypochondriacus* L.)

G.R. SIDDESH AND S.R. ANAND

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted at 'M' block, University of Agricultural Sciences, GKVK, Bengaluru during *kharif*-2023 to study the 'Lodging management in grain amaranth (*Amaranthus hypochondriacus* L.)'. The experiment was laid out in factorial randomized complete block design consisting of two factors viz., different levels of potassium (100, 125 and 150 % Recommended K₂O) and mepiquat chloride (0, 25, 50 and 75 g a.i. ha⁻¹) with 12 treatment combinations and three replications. Among the levels of potassium, application of 150 per cent recommended dose of potassium recorded significantly higher plant height (156.2 cm), total dry matter production (84.88 g plant⁻¹), stem girth (5.01 cm), root length (24.95 cm), root to shoot ratio (0.278), panicle length (42.68 cm), grain yield (1708 kg ha⁻¹), uptake of nitrogen (67.84 kg ha⁻¹), phosphorus (21.69 kg ha⁻¹), potassium (60.18 kg ha⁻¹) and lower lodging percentage (14). Among the levels of mepiquat chloride, application of mepiquat chloride at 75 g a.i. ha⁻¹ recorded significantly lower plant height (143.2 cm), lodging percentage (8.77) and higher total dry matter production (82.37 g plant⁻¹), stem girth (5.06 cm), root length (25.53 cm), root to shoot ratio (0.261), panicle length (43.47 cm), grain yield (1720 kg ha⁻¹), uptake of nitrogen (65.14 kg ha⁻¹), phosphorus (19.96 kg ha⁻¹) and potassium (54.80 kg ha⁻¹). The higher gross returns (Rs.142720 ha⁻¹), net returns (Rs.105537 ha⁻¹) and B:C (3.83) was observed with 150 per cent recommended dose of potassium with mepiquat chloride at 75 g a.i. ha⁻¹.

Study on Deficit Water Stress Tolerance Indicator and Water Productivity of Small Millets on Poor Soils of Semi-Arid Tropics

DHORE ANJALI KAILAS AND B.S. LALITHA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

STUDY on deficit water stress tolerance indicator and water productivity of small millets on poor soils of semi-arid tropics field experiment was conducted at ICAR- National Institute of Abiotic Stress Management, Baramati, Maharashtra during Rabi 2023. The experiment was laid out in split plot design with 28 treatments replicated thrice. The main plot treatments are different levels of irrigation viz., I₁- irrigation at 100% ET₀, I₂- irrigation at 80% ET₀, I₃- irrigation at 60% ET₀ and I₄- irrigation at 40% ET₀ whereas in sub plot 7 small millets were assigned as C₁- finger millet, C₂- barnyard millet, C₃- foxtail millet, C₄- proso millet, C₅- little millet, C₆- kodo millet and C₇- brown top millet. The results revealed that the finger millet irrigated with 100% ET₀ at harvesting recorded significantly higher leaf area (353 cm² plant⁻¹), dry matter accumulation (27.21 g plant⁻¹) and higher SPAD value (24.99) whereas significantly higher PS-II activity (0.78) and significantly lower proline accumulation (17.03 μmol g⁻¹ FW) at 60 DAS, which results in significantly higher test weight (3.90 g), grain yield plant⁻¹ (10.47 g), grain yield (3103 kg ha⁻¹), stover yield (5677 kg ha⁻¹) and higher B-C ratio (2.72) compared to other treatments. The significantly higher water productivity was observed in proso millet (1.13 kg m⁻³) whereas it was significantly lower in kodo millet (0.18 kg m⁻³) irrigated at 40% ET₀. Yield reduction was 22.40, 36.68 and 57.24 per cent in irrigation with 80, 60 and 40 per cent ET₀, respectively and it was least in finger millet (21.09%).

Effect of Bio-Stimulants on Growth and Yield of Finger Millet (*Eleusine coracana* L.)

J. RAM KUMAR AND D.H. ROOPASHREE

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted at AICRP for Dryland Agriculture, University of Agricultural Sciences, GKVK, Bengaluru during the Kharif-2023 to study the 'Effect of bio-stimulants on growth and yield of finger millet (*Eleusine coracana* L.)'. The experiment consists of ten treatments with various bio-stimulants and a recommended dose of fertilizer. The bio-stimulants were sprayed at 30 and 45 days after sowing. The experiment was laid in Randomized Complete Block Design and replicated thrice. The results revealed that, foliar application of seaweed extract of *Kappaphycus alvarezii* @ 0.5% along with RDF recorded significantly higher plant height (105.36 cm), number of leaves per hill (33.31), total dry matter production per hill (53.90 g), root length (33.50 cm), root volume (49.75 cc), number of productive tillers per hill (4.12), ear head length (7.41 cm), grain yield (3254 kg ha⁻¹) and straw yield (5271 kg ha⁻¹) compared to other treatments. The same treatment resulted in significantly higher plant nutrient uptake (94.08, 27.53 and 84.93 NPK kg ha⁻¹, respectively), microbial population viz., bacteria, fungi and actinomycetes (30.71 × 10⁶, 26.72 × 10⁴, 13.45 × 10³ CFU g⁻¹ of soil, respectively) and gross returns (Rs.130160 ha⁻¹). While application of seaweed extract of *Sargassum crassifolium* along with RDF recorded higher net returns (Rs.87762 ha⁻¹), B:C (3.14) and also on par with the *Kappaphycus alvarezii* in all the growth and yield parameters.

Yield Maximization in Grain Amaranth (*Amaranthus hypochondriacus* L.) through Biostimulants

H.N. ABHISHEK AND K. PUSHPA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment entitled ‘Yield maximization in grain amaranth (*Amaranthus hypochondriacus* L.) through biostimulants’ was conducted at University of Agricultural Sciences, Bangalore during *kharif*, 2023. The experiment consists of eleven treatment combinations which were replicated thrice in RCBD. Treatments comprised of varying levels of RDF (50, 75 and 100 %) and the application of biostimulants viz., microbial consortia as soil application and vermiwash and seaweed extract as foliar spray. Among the different treatments, application of 100 % RDF + Seaweed extract @ 5ml L⁻¹ foliar application at 30 and 45 DAS recorded significantly higher growth, yield and yield parameters viz., plant height (152.8 cm), number of leaves plant⁻¹ (23.45), total dry matter production (104.8 g plant⁻¹), panicle length (42.60 cm), number of fingers panicle⁻¹ (37.21), length of finger (16.62 cm), grain yield (1758 kg ha⁻¹) and stover yield (6100 kg ha⁻¹) of grain amaranth over RDF. Notably, this particular treatment also proved the most financial rewarding, generating higher gross returns (Rs.1,40640 ha⁻¹), net returns (Rs.105283 ha⁻¹) and benefit cost ratio of 3.99 outperforming all other treatment options. These findings emphasize the potential of biostimulants in maximizing grain yield of grain amaranth for higher economic benefit for farmers.

Studies on Laser Spray Irrigation Scheduling in Leafy Vegetable

G.A. VATSALA AND D.C. HANUMANTHAPPA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment entitled ‘Studies on laser spray irrigation scheduling in leafy vegetable’ was conducted during *Summer*-2024 at ‘L’ block, IFS Demonstration Unit, ZARS, University of Agricultural Sciences, GKVK, Bengaluru. There were 12 treatment combinations consisting of four laser spray irrigation scheduling intervals and three depths of irrigation, laid out in randomized complete block design with factorial concept and replicated three times. The results revealed that, irrigation scheduled at every alternate days @ 1.5 cm depth recorded significantly higher palak growth parameters viz., plant height (20.46 cm), total number of leaves (11.62 plant⁻¹), leaf area (266.57 cm² plant⁻¹), leaf area index (1.33) and biomass production (42.0 g plant⁻¹ and 21.08 t ha⁻¹, respectively) and it was on par with the treatment irrigation scheduled at 25 % DASM @ 1.5 cm depth. Irrigation scheduled at every alternative days @ 1.5 cm depth recorded higher cost of cultivation (Rs. 80,200 ha⁻¹), gross returns (Rs. 1,78,700 ha⁻¹), net returns (Rs. 98,500 ha⁻¹) and B:C ratio of 2.22. Whereas, irrigation scheduled once in three days @ 1.5 cm depth recorded higher water use efficiency (173.11 kg ha-cm⁻¹) compared to other irrigation scheduling intervals and depth of irrigation. Hence, scheduling irrigation every alternative days @ 1.5 cm depth is ideal to produce higher productivity of palak.

Standardization of Nano Fertilizers for Higher Growth, Productivity and Profitability of Aerobic Rice

KAVITHA AND C. SEENAPPA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment on standardization of nano fertilizers for higher growth, productivity and profitability of aerobic rice was conducted at Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru during *kharif* 2023. The experiment was laid out in Randomized Complete Block Design with thirteen treatments, replicated thrice and cultivar used was KMP-175. The field experiment consists of thirteen treatments with different doses of RDF and nano fertilizers. The results revealed that application of 100% RDF along with two foliar sprays of nano urea, DAP and potash each at the rate of 6 ml L⁻¹ recorded significantly higher plant height (78.92 cm), leaf area plant⁻¹ (2381 cm²), total dry matter production (107.70 g plant⁻¹), productive tillers hill⁻¹ (22.60), number of grains panicle⁻¹ (240), grain yield (5054 kg ha⁻¹), straw yield (5453 kg ha⁻¹), net returns (Rs.65597 ha⁻¹) and B:C ratio (2.27), which was on par with the application of 100% RDF along with two foliar sprays of nano urea, DAP and potash each at the rate of 4 ml L⁻¹. Thus, application of 100% RDF along with two foliar sprays of nano urea, DAP and potash each at the rate of 6 ml L⁻¹ was found productive and remunerative with 17 per cent higher yield and profit.

Response of Nano Nitrogen Fertilizer on Growth and Yield of Pigeonpea (*Cajanus cajan* L. Millsp.)

H.P. THIMMAIAH AND H.M. ATHEEK UR REHAMAN

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

AN experiment was conducted during *Kharif* 2023 at Zonal Agricultural Research Station, Gandhi Krishi Vigyan Kendra, Bengaluru to investigate the response of nano-nitrogen on growth and yield of pigeonpea. The experiment consisted of 11 treatments involving two levels (75 and 100 %) of nitrogen as basal dose and four concentrations of nano-urea (4 ml, 6 ml, 8 ml and 10 ml per litre) as foliar spray compared with recommended dose of fertilizers and foliar spray of 2 per cent normal urea. The trial was laid out in randomized complete block design replicated thrice. Higher growth parameters such as plant height (169.9 cm), per plant branch number (15.2), leaf area (2856 cm²), and dry matter accumulation (143.6 g) were recorded in treatment receiving 100 per cent RDN + foliar application of nano-urea 4 ml L⁻¹ flowering and pod development stages. The same treatment recorded higher yield attributes *i.e.*, pod length (8.5 cm), per plant pod number (81.1), seeds per pod (4.6) and seed weight (60.6 g plant⁻¹) leading to higher seed yield (1045 kg ha⁻¹) and stalk yield (4102 kg ha⁻¹). However, the treatment with RDN with 2 per cent normal urea spray was on par with the best treatment (1010 and 3893 kg ha⁻¹ seed and stalk yield, respectively). Higher protein content (21.1%), crude protein yield (220 kg ha⁻¹) as well as higher net returns (Rs.38,973 ha⁻¹) and B:C ratio (2.05) was recorded in the same treatment.

Effect of Nano Zinc on Growth, Yield and Quality of Direct Seeded Finger Millet (*Eleusine coracana* L.)

R. CHAITRA AND P.S. FATHIMA

Department of Agronomy, College of Agriculture, V.C. Farm, Mandya

A field experiment on 'Effect of nano zinc on growth, yield and quality of direct seeded finger millet (*Eleusine coracana* L.)' was conducted during *kharif* 2023 at College of Agriculture, V.C. Farm, Mandya. The experiment was laid out in RCBD with eleven treatments replicated thrice. Treatment combinations include varied concentrations of zinc along with seed treatment and foliar application of nano zinc and zinc sulphate at 25 DAS and were compared without Zinc application. Significantly higher plant height (127.47 cm), No. of tillers per plant (4.29), leaf area (1069.26 cm² plant⁻¹), leaf area index (4.75) and dry matter accumulation (29.22 g plant⁻¹) at harvest were recorded with nano zinc application as seed treatment @ 0.50 ml nano ZnO + foliar application @ 0.50 ml nano ZnO at 25 DAS along with the recommended dose of fertilizers (T₁₁). The grain yield (2789 kg ha⁻¹), straw yield (4965 kg ha⁻¹), nutrient uptake (85.14, 27.54 and 95.26 kg ha⁻¹ of NPK, respectively), total zinc uptake (132.20 g ha⁻¹) and total zinc content in grain (19.63 mg kg⁻¹) and straw (15.60 mg kg⁻¹) were found significantly higher with application of nano zinc was applied as seed treatment @ 0.50 ml nano ZnO + foliar application @ 0.50 ml nano ZnO at 25 DAS along with the recommended dose of fertilizers. Higher net returns and benefit: cost ratio (Rs.64,017 ha⁻¹ and 2.06, respectively) was observed with the seed treatment @ 0.50 ml nano ZnO + foliar application @ 0.50 ml nano ZnO at 25 DAS along with the recommended dose of fertilizers.

Response of Interspecific *Bt*-Cotton Hybrid to Nano Fertilizers

GURULINGAPPA NAGAPPA SAJJAN AND C. SHASHI KUMAR

Department of Agronomy, College of Agriculture, V.C. Farm, Mandya

A field experiment was conducted during *Kharif* 2023 at AICRP on Cotton, Haradanahalli Farm, Chamarajanagar. The experiment was laid out in split plot design with three replications comprising three levels of conventional fertilizers in main plot (50, 75 and 100% RDNP, respectively) and four dosages of nano fertilizers in subplot (nano urea @ 2 and 4 ml L⁻¹ and nano DAP @ 2 and 4 ml L⁻¹ sprayed at 40, 60 and 80 DAS, respectively). The results revealed that among different levels of conventional fertilizers, application of 100% RDNP recorded significantly higher growth and yield parameters viz., plant height (172.7 cm), number of sympodial branches (31.8 plant⁻¹), total dry matter production (326.32 g plant⁻¹), total number of bolls (47.3 plant⁻¹), individual boll weight (6.18 g), seed cotton and stalk yield (1453 and 2562 kg ha⁻¹, respectively) and quality parameters such as ginning percentage (36.75 %) and lint index (7.10 g). Whereas, similar trend was observed with nutrient uptake (120.96, 37.27 and 97.48 kg NPK ha⁻¹, respectively) and economics (net returns of Rs.47,048 ha⁻¹ and B:C ratio of 1.56). While, among the nano fertilizers, application of nano DAP @ 4 ml L⁻¹ at 40, 60 and 80 DAS recorded significantly higher plant height (197.4 cm), number of sympodial branches (31.1 plant⁻¹), total dry matter production (369.86 g plant⁻¹), total number of bolls (46.7 plant⁻¹), individual boll weight (6.16 g), seed cotton and stalk yield (1420 and 2497 kg ha⁻¹, respectively) and quality parameters such as ginning percentage (37.07%) and lint index (7.46 g). The nutrient uptake (116.91, 37.37 and 96.57 kg NPK ha⁻¹, respectively), net returns (Rs. 43,049 ha⁻¹) and B:C ratio (1.51) were also higher with the same treatment.

Studies on Time of Application of Zinc in Transplanted Rice (*Oryza sativa* L.)

SHARANAGOUDA AND G.R. DENESH

Department of Agronomy, College of Agriculture, V.C. Farm, Mandya

A field experiment was conducted to study the time of application of zinc in transplanted rice during *kharif*- 2023 at ZARS, V.C. Farm, Mandya. The experiment was laid out in Randomized Complete Block Design with eleven treatments replicated thrice. The treatments comprised of zinc sulphate @ 10, 15 and 20 kg ha⁻¹ applied each at 10, 20 and 30 DAT, these combinations of nine treatments were compared with zinc sulphate @ 20 kg ha⁻¹ as basal application and control (without zinc sulphate). The results revealed that, zinc sulphate @ 20 kg ha⁻¹ applied either at 10 or 20 or at 30 DAT was recorded higher growth and yield parameters at harvest, higher grain yield (6673 to 6797 kg ha⁻¹), straw yield (7745 to 7835 kg ha⁻¹), total nitrogen (140.47 to 153.60 kg ha⁻¹) and potassium (112.31 to 118.39 kg ha⁻¹) uptake as compared to other zinc management practices. Added to this, zinc content in rice grain and straw (16.24 to 17.92 and 35.74 to 41.15 mg kg⁻¹, respectively), nitrogen use efficiency (66.73 to 67.97 kg kg⁻¹), phosphorous use efficiency (133.45 to 135.93 kg kg⁻¹), potassium use efficiency (133.45 to 135.93 kg kg⁻¹), net returns (Rs.84,623 to 87,596 ha⁻¹) and B:C ratio (2.00 to 2.04) was also recorded higher in the above treatments. Further, all these parameters recorded in the former treatments were statistically comparable to zinc sulphate @ 20 kg ha⁻¹ as basal application.

Unmanned Aerial Vehicle Mediated Herbicide Application in Finger Millet (*Eleusine coracana* L.) under Rainfed Alfisols

D.U. YAMUNA AND H.S. LATHA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment entitled 'Unmanned aerial vehicle mediated herbicide application in finger millet (*Eleusine coracana* L.) under rainfed alfisols' was conducted during *kharif*-2023, at the AICRP for Dryland Agriculture, University of Agricultural Sciences, GKVK, Bengaluru. The experiment with eight treatments replicated thrice in RCBD with factorial concept. The treatments comprised of two factors viz., two different herbicides with two levels (PE₁: Isoproturon 75%WP @ 562.5 g a.i. ha⁻¹, PE₂: Isoproturon 75%WP @ 750 g a.i. ha⁻¹, PoE₁: 2,4-D sodium salt 80%WP @ 937.5 g a.i. ha⁻¹ and PoE₂: 2,4-D sodium salt 80%WP @ 1250 g a.i. ha⁻¹) as factor one and two spray volumes as second factor (V₁: 25 l ha⁻¹ and V₂: 50 l ha⁻¹). The results revealed that among the herbicides, application of Isoproturon 75%WP @ 750 g a.i. ha⁻¹ has recorded numerically higher plant height (86.92 cm), dry matter production (59.26 g plant⁻¹), grain and straw yield (2395 and 3288 kg ha⁻¹, respectively). Among the spray volumes, spray volume 50 l ha⁻¹ has recorded significantly higher plant height (88.29 cm), dry matter production (64.07 g plant⁻¹), grain and straw yield (2420 and 3336 kg ha⁻¹, respectively). Among the interactions, Isoproturon 75%WP @ 750 g a.i. ha⁻¹ with spray volume of 50 l ha⁻¹ recorded numerically higher relative weed control efficiency (21.13%), relative weed index (-1.32), plant height (91.46 cm), dry matter production (64.43 g plant⁻¹), grain and straw yield (2473 and 3421 kg ha⁻¹, respectively), net return (Rs.55946 ha⁻¹) and B:C (2.82) when compared to other interactions.

Study on Nano Fertilizer for Enhancement of Yield and Yield Attributes of Field Bean (*Dolichos lablab* L.)

G.M. SHANTHANAGOWDA AND G. GANGADHAR ESWAR RAO

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted at the Agriculture Research Station, Nelamakanahalli, Chikkaballapur, Karnataka during the Summer-2024 to evaluate the effect of nano fertilizers on the yield and yield attributes of field bean (*Dolichos lablab* L.). The experiment consists of eleven treatments with three replications and was laid out in a Randomized Complete Block Design. The results revealed that application of 100 per cent RDF along with two foliar sprays of nano fertilizer at 30 and 45 DAS recorded significantly higher growth parameters viz., plant height (71.03 cm), number of branches plant⁻¹ (6.22), leaf area plant⁻¹ (890.2 cm²) and total dry matter production plant⁻¹ (32.59 g) at harvest. Yield attributes also improved, with increased pod length (5.23 cm), number of pods plant⁻¹ (23.91), number of seeds pod⁻¹ (3.95), test weight (18.12 g), seed yield (1139 kg ha⁻¹) and haulm yield (2114 kg ha⁻¹) as compared to other treatments. This treatment also resulted in significantly higher nutrient uptake viz., nitrogen (60.19 kg ha⁻¹), phosphorus (15.88 kg ha⁻¹), potassium (58.14 kg ha⁻¹) and zinc (0.48 mg kg⁻¹). The same treatment recorded higher gross returns (Rs.93,234 ha⁻¹) and net returns (Rs.56,373 ha⁻¹). In contrast, the absolute control recorded significantly lower values for all above mentioned parameters. Hence, applying 100 per cent RDF with two foliar sprays of nano fertilizers at 30 and 45 DAS is recommended for maximizing growth, yield, nutrient uptake and economic returns in field bean cultivation. This treatment found to be superior over other treatments.

Effect of Different Levels of Nano Urea on Growth and Yield of Maize (*Zea mays* L.)

DODDI HEMANTH AND K.V. KESHAIAH

Department of Agronomy, College of Agriculture, V.C. Farm, Mandya

A field experiment on 'Effect of different levels of Nano Urea on growth and yield of Maize (*Zea mays* L.)' was conducted during the *kharif* 2023 at Zonal Agricultural Research Station, V.C. Farm, Mandya. The experiment was laid out in Randomized Complete Block Design with ten treatments replicated thrice. The treatments included application of urea at 75 per cent and 100 per cent of the recommended dose of nitrogen (N), supplemented by foliar application of nano urea (2, 4 and 6 ml l⁻¹), as well as urea (2%) at 25 and 50 DAS. These were compared with the RDF alone and control (RDF without nitrogen). The results revealed that the highest plant height (220.33 cm), number of green leaves plant⁻¹ (11.82), leaf area (7379 cm² plant⁻¹) and total dry matter accumulation (303.94 g plant⁻¹) at harvest were recorded with the application of 100 per cent of the recommended nitrogen combined with a foliar spray of nano urea at 25 and 50 DAS @ 4 ml l⁻¹. This treatment was statistically on par with the combination of 75 per cent of the recommended dose of nitrogen + foliar application of nano urea at 25 and 50 DAS @ 4 ml l⁻¹. In terms of yield, the maximum grain yield (9256 kg ha⁻¹) and stover yield (11474 kg ha⁻¹) were also recorded with 100 per cent recommended nitrogen dose with nano urea @ 4 ml l⁻¹. Nutrient uptake (192.87, 47.85, and 134.07 kg ha⁻¹, NPK, respectively), along with protein content in grains (8.06%) and stover (4.0%), were also significantly higher. Similar results were obtained with 75 per cent nitrogen + foliar application of nano urea at 25 and 50 DAS @ 4ml l⁻¹ spray, indicating that lower nitrogen levels with nano urea could achieve outcomes comparable to full nitrogen doses.

Effect of Integrated Organic Sources on Growth and Yield of Maize (*Zea mays* L.).

P.R. YASHWANTH AND C. RAMACHANDRA

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

A field experiment was conducted at research and demonstration block of Research Institute on Organic Farming, UAS, GKVK, Bengaluru during *kharif* 2022 to study the influence of different organic source of nutrients on growth and yield of maize. The experiment consists of 13 treatments laid out in randomized block design with 3 replications. The experimental soil was red sandy loam having medium in organic carbon content (0.64 %), available nitrogen (285.90 kg ha⁻¹), available P₂O₅ (28.10 kg ha⁻¹) and available K₂O (230.20 kg ha⁻¹). The experimental results indicated that significantly taller plant (189.94 cm), higher number of leaves plant⁻¹ (10.70), leaf area plant⁻¹ (5634.94 cm² plant⁻¹) and total dry matter accumulation (138.95 g plant⁻¹) was recorded with the application of 125 % N equivalent compost + jeevamrutha (1000 l ha⁻¹) + panchagavya (3%) and was on par with 100 % N equivalent compost + jeevamrutha (1000 l ha⁻¹) + panchagavya (3 %). Whereas, lower plant height (92.87 cm), number of leaves plant⁻¹ (4.65), leaf area plant⁻¹ (2642.27 cm² plant⁻¹) and total dry matter accumulation (68.82 g plant⁻¹) was observed with the application of 75% N equivalent compost. Significantly higher kernel, stover yield and B:C ratio of maize were produced with the application of 125% N equivalent compost + jeevamrutha (1000 l ha⁻¹) + Panchyagavya (3%) (88.59, 119.87 q ha⁻¹ and 1.97, respectively). However, lower kernel yield, stover yield and B:C ratio (58.68, 74.18 q ha⁻¹ and 1.20, respectively) was observed in 75% N equivalent compost.

Studies on Production Technologies for Yield Maximization in Groundnut (*Arachis hypogaea* L.)

G. SAHANA AND K.N. KALYANA MURTHY

Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

Two field trials were conducted at Integrated Farming System demonstration plot, UAS, GKVK, Bengaluru to study the performance of Kadiri Lepakshi groundnut to sowing methods, spacings and nutrient levels. Both the experiments consisted of eight treatments laid out in randomized complete block design and replicated thrice. Experiment I included two groundnut varieties (Kadiri Lepakshi and K-6), sown under two land configurations (Normal method and Raised bed method) and two spacings (30 x 10 cm and 30 x 15 cm). Results revealed that, growing Kadiri Lepakshi groundnut in Raised bed with 30 cm x 15 cm spacing recorded significantly higher dry matter accumulation (66.85 g plant⁻¹), total number of pods per plant (63.33), higher pod yield (2471 kg ha⁻¹), kernel yield (1733kg ha⁻¹) and higher benefit-cost ratio (2.66). Experiment II consisted of different doses of RDF (25-50-25 kg of N, P₂O₅ and K₂O ha⁻¹) with different doses of gypsum and phosphogypsum. Results revealed that application of 100 % RDF + Phosphogypsum @ 750 kg ha⁻¹ + Borax @ 10 kg ha⁻¹ produced significantly higher dry matter production (64.71 g plant⁻¹), nodule count (40.78), total number of pods per plant (59), filled pods per plant (48), pod weight per plant (30.69 g plant⁻¹), shelling percentage (67.88 %), pod yield (2327 kg ha⁻¹), kernel yield (1580 kg ha⁻¹), gross returns (Rs.1,24,615 ha⁻¹), net returns (Rs.69,897 ha⁻¹) and benefit-cost ratio (2.28). Further, significantly higher oil yield (738 kg ha⁻¹), protein yield (414 kg ha⁻¹), higher total nitrogen (85.14 kg ha⁻¹), phosphorous (18.24 kg ha⁻¹), potassium (46.95 kg ha⁻¹), sulphur (19.09 kg ha⁻¹), calcium (42.51 kg ha⁻¹), boron (68.92 g ha⁻¹) and zinc uptake (116.64 g ha⁻¹) were recorded with the same treatment.

Processing and *In-vitro* Studies of Chia (*Salvia hispanica* L.) Value Added Products

JELANG JELKU D. SANGMA AND USHA RAVINDRA

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

THE research conducted between 2020-2023 at the Department of Food Science and Nutrition, University of Agricultural Sciences, Bangalore focused on processing and *in-vitro* studies of chia (*Salvia hispanica* L.) value-added products using standard protocols. Tray drying optimization at 60°C for 8 hours yielded superior sensory attributes for both white and black chia seeds. Germination studies showed increased vitamin C (39.33 to 80.67 mg/100g) and α -amylase activity (1.01 to 1.24 mg/100g), with statistically significant sensory scores observed in germinated white and black chia with distilled water (GWC1 and GBC1). Fermentation treatments demonstrated variations in soluble solids (1.63 to 8.10), pH (1.87 to 3.87) and acidity, with significant organic acid content including lactic acid (0.04 to 0.23), citric acid (0.09 to 0.50), and succinic acid (0.05 to 0.30) observed in fermented chia. Microscopic examination revealed significant differences in size and dimensions among processed chia samples, while functional properties such as water absorption index (WAI) ranged from 6.13 to 9.13 g/ml and oil retention index (ORI) ranged from 1.73 to 3.03 g/ml, with the highest values found in fermented white chia (FWC). Processed chia exhibited significant variations in macronutrient and micronutrient content with germinated chia showing higher calcium (544.80 to 680 mg/100g) and phosphorus (525 to 656 mg/100g) levels. The *in-vitro* carbohydrate and protein digestibility of processed chia was 33.75 to 60.03 and 53.84 to 85.92 per cent, respectively. Antioxidant activities were notable in germinated and fermented black chia. Value added chia energy bars and honey chewy candies received highest acceptance. Cost calculations for the best-accepted chia products ranged from Rs.32 to 139 per 100 g. Hence, processed chia seeds, particularly in value-added products, offer enhanced sensory qualities and nutritional benefits, contributing to dietary diversity and potential health benefits.

Protocol Development for Plant Based Milk Synbiotic Product

D. PALLAVI AND USHA RAVINDRA

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

SYNBIOTICS are one of the functional foods, refer to the combination of probiotics and prebiotics. At present synbiotic products are dairy based, expensive and consumer seek change. The present study was undertaken to developed plant based milk synbiotic beverages from sunflower seeds, little millet and tender redgram. The raw plant based milk *i.e.*, sunflower seed milk, little millet milk and tender redgram milk, were extracted at 1:5 and 1:6, seed to water ratios and 1:6 ratio was the best accepted variation. For prepared plant based milks, honey was added as a natural prebiotic source and probioticated with ABT (*Lactobacillus acidophilus*, *Lactobacillus delbrueckii* sub sp. *bulgaricus* and *Streptococcus thermophilus*) culture and fermented at 41°C for 4 and 5 hours. The synbiotic beverages fermented for 5 hours showed higher viable population than 4 hours of fermentation. The viable population of sunflower seed, little millet and tender redgram synbiotic beverages fermented for 5 hours were 229.00×10^7 CFU/mL, 207.67×10^7 CFU/mL and 135.33×10^7 CFU/mL, respectively. The samples fermented for 4 hours at 41°C, was the best accepted variation. The synbiotic beverages were good source of protein, crude fibre, low in fat and sodium content. These samples were stored at 4°C for 14 days (2 weeks), the pH, titratable acidity (TA), total soluble solids and viscosity of synbiotic products were within the acceptable standards and microbiologically stable from zero to 14 days of storage. Among these synbiotic beverages, sunflower seed synbiotic beverage was more acceptable than little millet and tender redgram. The cost of these synbiotic products were economically feasible and affordable to the consumers.

Development of Indian Pennywort (*Centella asiatica* L.) Based Ready-To-Cook Mixes

H. GAGANA AND D. SHOBHA

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

INDIAN pennywort (*Centella asiatica* L.) is an herbaceous plant being used as a leafy vegetable and more preferred for medicinal properties. It's commonly known as *Ondelaga* or *Gotu Kola*. The present study was undertaken to develop Indian pennywort based ready to cook (RTC) mixes and evaluate their shelf life at ambient conditions in metalized polyester polyethylene (MPP) and low-density polyethylene (LDPE) pouches. In order to develop RTC mixes, the Indian pennywort leaves were subjected to different pre treatments followed by dehydration and further dehydrated powder was analysed for antioxidant and antimicrobial property. Among different variations, blanched shade dried leaves had the highest antioxidant activity (3.04 AAE/g) and shade dried without blanched Indian pennywort leaves powder showed significantly higher inhibition zone against pathogenic bacteria such as *E. coli* (4 mm) and *staphylococcus aureus* (3 mm). The shade dried leaves powder was used to develop three different RTC mixes such as *thalipattu*, *chutney* and *dosa* with different levels of incorporation (0, 5, 10 and 15%). The best accepted Indian pennywort powder added RTC (10%) mixes were analysed for nutrient, polyphenols, flavonoids and antioxidant properties. Five and ten per cent powder added *thalipattu*, *chutney* and *dosa* mix had significantly higher overall acceptability score. Developed Indian pennywort powder added RTC mixes were found to be nutritionally superior in terms of protein, crude fibre, calcium, iron, potassium, magnesium and antioxidant contents. The nutritional qualification found to be maintained throughout storage period and acceptability tested through organoleptic study and microbial load analysis indicated that product are fit for consumption in both the package types until three months.

Product Formulation and Glycemic Index Assay on Pigmented Rice Genotypes

S. SUSHMA AND USHA RAVINDRA

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

PIGMENTED rice genotypes, including black, red and purple rice are abundant in bioactive compounds such as anthocyanins and flavonoids, offering superior nutritional and antioxidant benefits compared to white rice. Gluten-free pigmented rice vermicelli was formulated using four rice genotypes, namely MSN-104, KMP-220, Jyothi and control (*Sona Masuri*). The vermicelli was evaluated for cooking qualities, sensory properties, nutritional composition, polyphenol content, antioxidant activity and *in-vitro* starch digestibility following standard protocols. Significant differences were observed in cooking characteristics and textural parameters. Jyothi vermicelli exhibited the highest total polyphenol content (90.32 GAE per 100g) and antioxidant activity (28.29 AAE per 100 g). The total dietary fibre ranged from 12.78 to 19.88 g/100g, while proximate composition varied among samples: moisture (6.07 to 6.9%), protein (7 to 9.48%), fat (0.11 to 0.62%), crude fibre (0.41 to 0.61%), ash (0.94 to 1.9%), carbohydrates (80.91 to 84.74 g) and energy (365.09 to 368.85 kcal per 100 g). Jyothi and MSN-104 vermicelli received higher sensory scores (7.74 to 8). The gluten-free pigmented rice vermicelli could be stored up to 60 days in aluminium packaging at ambient temperature. With a moderate glycemic index ranging from 60.79 to 63.61, formulated vermicelli caters to individuals with gluten sensitivities while offering additional nutritional and antioxidant benefits. Overall, it is a practical and health-conscious choice for a diverse range of dietary needs.

Development of Dietetic Products from Chia Seeds (*Salvia hispanica* L.)

R.G. MONICA AND M.L. REVANNA

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

THE study titled 'Development of Dietetic Products from Chia Seeds (*Salvia hispanica* L.)' aimed to harness chia seed's nutritional properties to develop dietetic food products with substantial health benefits. The study analysed chia's nutrient composition, which revealed that chia has good amount of fat, protein, fiber and essential mineral content. Three products - Instant Upma Mix (IUM), Masala *Khakhra* (MK) and Chia Premix (CP) were developed, incorporating 5, 10, 15 and 20 per cent chia seeds of which IUM2 (10%), MK3 (15%) and CP3 (15%) received the highest overall acceptability in sensory evaluation. Nutrient analysis confirmed that each product was rich in fat, protein and minerals, highlighting the superior nutrient contribution of chia seeds. Storage studies over 60 days indicated that Metallized Polyester Polyethylene (MPP) packaging preserved sensory qualities more effectively than Low-Density Polyethylene (LDPE). Additionally, *in-vitro* glycemic analysis showed that the products have a medium to low glycemic index, with Chia Premix falling into the low category (55.03) whereas Masala *Khakhra* (56.88) and Instant upma mix (61.99) falling into the medium glycemic index category, making it suitable for diabetic-friendly diets. Among the developed products Masala *Khakhra* received the highest consumer acceptability (84.61%) whereas the cost analysis suggested that the production costs of developed products per 100g were affordable and ranged between Rs.15 to 29. The study concludes that chia seed-based products are nutritionally beneficial, cost-effective and well-accepted by consumers. However, challenges such as chia's high cost and compatibility with various flavours should be addressed in future research.

Nutritional Evaluation of Grain Amaranth (*Amaranthus hypochondriacus* L.) Based Ready To Eat (RTE) Snacks

T.N. RACHITHA AND S. SHAMSHAD BEGUM

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

GRAIN AMARANTH (*Amaranthus hypochondriacus* L.), a nutritionally rich pseudocereal, has gained attention for its high-quality protein, fibre and mineral content, making it a promising ingredient for enhancing food and nutritional security. The present study focused on developing and evaluating Ready to Eat (RTE) grain amaranth based snacks, viz., *nachos*, *chakli*, coconut cookies, salt biscuits, *gulabjamun* and *shankarpoli* that were standardized at 25, 50, 75 and 100 per cent substitution level. The results of sensory evaluation revealed that *nachos* with 75 per cent grain amaranth substitution, *chakli*, cookies, salt biscuits and *gulabjamun* with 50 per cent grain amaranth substitution and *shankarpoli* with 25 per cent grain amaranth substitution demonstrated higher acceptability score. Nutrient analysis revealed higher protein content in grain amaranth *chakli* (11.3 g/100 g) and higher fiber in grain amaranth *nachos* (6.36 g/100 g). Notable calcium (101.3 mg/100 g) and iron (5.43 mg/100 g) contents were observed in 75 per cent grain amaranth *nachos*. The shelf-life study indicated that the products remained acceptable and safe for consumption throughout their respective storage periods (15 - 60 days). Consumer acceptability revealed strong preference for savory and baked products. Increased knowledge and acceptance of grain amaranth based products was observed during popularisation and awareness. The development of cost effective, grain amaranth based RTE products highlights their potential for market viability. Hence, RTE grain amaranth snacks could be a good option for conventional snacks as they significantly contribute to good nutritional quality, supporting consumer health and entrepreneurial opportunities in rural and urban settings.

Quality Evaluation and Development of Shatavari (*Asparagus recemosus*) Root Based Food Products

A.B. ASHAKAVYA AND KAMALABAI KOODAGI

Department of Food Science and Nutrition, College of Agriculture, GKVK, Bengaluru

SHATAVARI (*Asparagus recemosus*) belongs to the family Asparagaceae, is native of Southeast Asia. It is underutilized ayurvedic herb rich in protein, minerals, bioactive components like flavonoids, saponins. Hence, the present study was undertaken for quality evaluation and development of shatavari (*Asparagus recemosus*) root-based food products. Shatavari roots were dried for 8 hours at 60°C. The results revealed that the dehydrated root contained moisture of 5.14 per cent, protein of 11.4 g, fat of 0.05 g, ash of 4.50 g, fibre of 2.47 g, carbohydrate of 86.7 g and energy of 397 Kcal per 100 g, respectively. The roots were found to be rich source of magnesium (243.1 mg) and iron (10.17 mg) per 100 g. The antioxidant activity of 77.3 per cent was observed in methanol extract. The roots were also found to be rich in polyphenols (2256.15 mg GAE/100g) and flavonoids (949.12mg RE/100g). Two products were developed viz., shatavari coconut chocolate and shatavari *Kashaya* mix. Chocolates and *kashaya* mix with 5 per cent and 20 per cent level of incorporation respectively were best accepted. The shelf-life study of the best accepted chocolates and *Kashaya* mix were done for 30 and 45 days, respectively. The sensory parameters of products decreased with increase in storage period. However, the microbial counts were within the permissible limits during the storage period. The cost of production of chocolates and *kashaya* mix were Rs.61 and Rs.54 per 100 g, respectively. Thus, from dried shatavari roots shelf stable and acceptable products can be developed that will help us to explore the medicinal benefits of shatavari roots.

Technological Optimization of Fruit-Based Cake Premixes

SHABREEN SABHA AND SAVITA S. MANGANAVAR

Department of Food Science and Nutrition, College of Agriculture, UAS, GKVK, Bengaluru

CAKE premix is a mixture containing all the dry ingredients used for preparation of cakes. Cake premixes are available in different flavours such as vanilla, chocolate, plum, pineapple, strawberry etc. These cake premixes can be enriched with dehydrated fruit flours to improve the nutritional profile of the cakes. Hence, the present study was undertaken to formulate the fruit-based cake premixes with incorporation of the dehydrated fruit flours. Ripe banana fruit flour and ripe jackfruit flour were incorporated to prepare banana flour-based cake premix (BFCP) and jackfruit flour-based cake premix (JFCP), respectively. The study revealed that cakes prepared using BFCP with 15 per cent banana flour and JFCP with 20 per cent jackfruit flour had highest overall acceptability scores. The vitamin analysis of cakes revealed significant differences among the control, banana flour-based cake (BFC), and jackfruit flour-based cake (JFC). BFC and JFC exhibited higher levels of vitamin C (1.01 mg and 2.02 mg, respectively) and β -carotene (8.72 μ g and 4.95 μ g, respectively) compared to the control (0.34 mg and 1.01 μ g, respectively). The total phenolic content of BFC and JFC was 73.68 mg GAE and 113.6 mg GAE, respectively as compared to 2.69 mg GAE for control cake. Total flavonoid content was also significantly higher in BFC (23.04 mg CE) and JFC (32.95 mg CE) as compared to the control (0.94 mg CE). Consumer acceptability survey showed, the highest acceptability of 94 per cent for jackfruit flour-based cake, 82 per cent for banana flour-based cake and 85 per cent for control. Thus, the study demonstrated that dehydrated fruit flours can be efficiently used in cake formulations to improve the nutrient profile of the cakes using cake premixes.

Processing and Development of Value Added Food Products from Air Potato (*Dioscorea bulbifera*)

M. USHA AND B. KALPANA

Department of Food Science and Nutrition, College of Agriculture, UAS, GKVK, Bengaluru

AIR POTATO (*Dioscorea bulbifera*) is a twining herbaceous plant that attain heights of 25-30 meters. It's a nutrient-rich plant with higher carbohydrate and mineral content. Air potatoes are being underutilized, hence the current study "Processing and development of value added food products from Air Potato (*Dioscorea bulbifera*)", was conducted to explore it's potential. Fresh air potato bulbils displayed significant physical characteristics. Various pretreatments were carried out to reduce browning reaction and analyzed for their effects on dehydration and rehydration ratios. Potassium metabisulfite (KMS) pretreatment significantly reduced browning reaction, yielding the highest rehydration ratios. The air potato flour demonstrated favorable physico-chemical, functional properties with notable antioxidant activity. Air Potato Flour (APF) was primarily composed of carbohydrates (84 gm), total ash (3.72 gm) with 355 kcal of energy per 100 gm. APF had minerals such as potassium (338.48 mg), calcium (315.80 mg), magnesium (119.12 mg), phosphorus (138.06 mg) and iron (12.36 mg) per 100 gm. Innovative food products such as crackers, soup mix and gravy premix incorporated with air potato flour were developed. Sensory evaluations indicated that crackers containing 30 per cent, soup mix containing 80 per cent and gravy premix with 10 per cent of air potato flour achieved the highest overall acceptability. The storage period affected moisture, free fatty acids, peroxide value and microbial load but all levels were within permissible limit. The study also evaluated that packaging materials found that metallized polypropylene (MPP) and aluminum (ALM) foil provided superior barrier properties up to 45 days of storage. Overall, the findings revealed the versatility of air potato as a valuable ingredient for enhancing nutritional quality in food products.

Standardization of Honey Coffee through Controlled Fermentation

K.U. SINCHANA AND GOPIKA C. MUTTAGI

Department of Food Processing Technology, College of Agriculture, Hassan

HONEY COFFEE (HC) is a novel modified semi-dry method. HC is processed in few parts of Karnataka, due to varied microbiota during natural fermentation of coffee beans, consistency of quality is not assured. The study was tried to standardize the method to improve the quality of honey coffee with consistent product. Two lactic acid bacteria (*Lactobacillus plantarum* and *Streptococcus cremoris*) and two yeast strains (*Saccharomyces cerevisiae* and *Torulaspora delbrueckii*) at two fermentation durations (48 and 72 h) used for fermentation of coffee berries. The impact of various microbial fermentation and processing conditions on the chemical composition and volatile profiles of coffee beans was studied. Coffee beans exhibited significant ($p \leq 0.01$) variation in Chlorogenic acid (CGA) levels among the treatments, with *Torulaspora delbrueckii* (48 h fermentation) recording the highest (1.88%), suggesting enhanced antioxidant properties, while *Torulaspora delbrueckii* (72 h fermentation) showed the lowest CGA (1.63%) due to possible degradation during processing. Over one hundred volatile compounds were detected by electronic nose (e-nose). The major volatile compounds detected were ketones, pyrazines, furans, esters, thiophenes and aldehydes. HC fermented with *Streptococcus cremoris* (48 h fermentation) and *Lactobacillus plantarum* (72 h fermentation) demonstrated a richer volatile profile, contributing to sweet, nutty, fruity, cocoa and hazelnut flavours. Whereas washed coffee and natural honey coffee showed fewer volatile compounds associated with smoother and less fruity notes. In sensory analysis, Principal Component Analysis 1 (PCA 1) and PCA 2 showed 75.60 per cent and 15.30 per cent cumulative variance, respectively, highlighting the effects of fermentation on the coffee beans. The coffee berries fermented with *Torulaspora delbrueckii* (48 h fermentation) recorded the highest cupping quality score (82.62) classifying it as speciality coffee. The findings suggest that microbial fermentation can enhance specific chemical and sensory attributes of coffee, offering potential avenues for developing unique flavour profiles.

Process Standardization for Development of White Ragi Milk Beverage

RAKESH RUDRAGOUDA PATIL AND BANU DESHPANDE

Department of Food Processing Technology, College of Agriculture, Hassan

THE study on 'Process standardization for development of white ragi milk beverage' evaluated the sensory, nutritional, functional and storage stability of milk beverage developed from white ragi (*Eleusine coracana*) - variety KMR 340. White ragi had moisture ($12.53\text{g} \pm 0.05$), protein ($12.30\text{g} \pm 0.20$), fat ($1.20\text{g} \pm 0.54$), ash ($1.70\text{g} \pm 0.50$), crude fiber ($2.75\text{g} \pm 0.50$), carbohydrate ($69.1\text{g} \pm 0.43$) and energy ($336\text{ Kcal} \pm 0.25$). Grains had thousand grain weight ($2.54\text{g} \pm 0.05$), Geometric mean diameter ($1.39\text{ mm} \pm 0.13$), bulk density ($1.06\text{ g/ml} \pm 0.01$) and hydration capacity ($2.05 \pm 0.02\text{g}$). Three treatments were formulated (T_1 , T_2 and T_3) compared with Control (C), T_2 with white ragi milk (50%) + soya milk (30%) + cashew milk (20%) + sugar (5%) + additives had highest acceptability score of 7.68 ± 0.78 on 9-point hedonic scale. pH of T_2 was 6.41 ± 0.02 compared to the control (7.02 ± 0.02). Color analysis revealed lower L^* (lightness) and a^* (redness) values in T_2 for slightly darker color and INS 122 ($p < 0.05$). Per cent moisture content of T_2 was ($85.51 \pm 0.25\%$), protein ($8.26 \pm 0.15\%$), calcium ($9.13 \pm 0.08\text{mg}$) and iron ($0.69 \pm 0.01\text{mg}$) were higher compared to control. Consumer acceptability ($n=150$) showed that 50 per cent liked most the beverage and 16 per cent preferred to consume it always and 20 per cent opined to consume frequently. The microbial count of T_2 milk beverage increased from 3.23 to 3.56 log^{10} (cfu/ml) on third day but the counts were within permissible limits, however coliforms were not detected. The cost analysis per 200ml of serving indicated that white ragi beverage is affordable (Rs.7.54) and comparable to the control (Rs.7.55). The millet milk processing is easy and cost effective to prepare by small scale food manufacturers nutritious, gluten free and suitable as vegan beverage.

Effect of New Molecules as Seed Treatment against Storage Insect Pests, Seed Quality and Storability in Cowpea (*Vigna unguiculata* L.)

SACHINGOUDA B. PATIL AND R. SIDDARAJU

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

PULSE BEETLE (*Callosobruchus chinensis*) is a major insect pest commonly found in seed storage. As insects develops resistance to existing insecticides, it is crucial to explore new molecules with novel mode of action for effective insect pest management. Laboratory study was conducted in completely randomised design to investigate the effect of new molecules as seed treatment against storage insect pests, seed quality and storability of cowpea seeds. Cowpea seeds were treated with new molecules, broflanilide and dinotefuran along with check (Emamectin benzoate and Deltamethrin). The treated seeds were stored in gunny bags for ten months. The seed quality parameters and insect population were recorded to assess the efficacy of new molecules. The treatment with broflanilide @ 2 ppm (300 SC @ 6.66 mg/kg seed) recorded the highest seed quality parameters viz., seed germination (82.67 %), mean seedling length (39.95 cm), mean seedling dry weight (55.21 mg), seedling vigour index I and II (3302 and 4565), total dehydrogenase activity @ 480 nm (1.95) and protein content (21.36 %). Whereas, broflanilide @ 3 ppm (300 SC @ 9.99 mg/kg seed) recorded least seed moisture content (9.64 %), seed damage (4.25 %), number of live insects (3.00), number of dead insects (5.00), number of single hole damaged seeds (3.42) and C: B ratio of 1: 5.28 after ten months of storage. A successful seed storage management strategy that kept seed quality above MSCS level for up to ten months was the broflanilide @ 2 ppm (300 SC @ 6.66 mg/kg seed) treatment.

Studies on Seed Dormancy Breaking Techniques in Bitter Gourd (*Momordica charantia* L.)

E. NITIN AND B. BASAVARAJA

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

A laboratory experiment was conducted to analyze seed dormancy dissipation during natural storage and evaluate various techniques for breaking seed dormancy in bitter gourd during 2021-22 at the Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, GKVK, Bengaluru and Seed Testing Research laboratory at Ashoka Farm Aids, Bengaluru. During the storage study, significant variations were observed among the genotypes for seed quality parameters. After 90 days of storage genotype Kunchur retained the highest germination (97 %), speed of germination (25.09), mean seedling length (21.27 cm), mean seedling dry weight (81.8 mg), seedling vigour index (SVI)-I (1786) and SVI-II (6832) and lower germination (89 %), speed of germination (28.98), mean seedling length (15.87 cm), mean seedling dry weight (78.4 mg), seedling vigour index (SVI)-I (1412) and SVI-II (6976) were observed in genotype Battikoppa. Seed dormancy-breaking experiment revealed that there were significant differences were observed among treatments. Clipping the seed bottom resulted in the highest seed germination (94 %), speed of germination (26.92), mean seedling length (24.44 cm), mean seedling dry weight (86.54 mg), SVI-I (2296), SVI-II (8130), portray emergence (91 %) and best overall seed quality, while the control consistently showed the poorest results. These results offer valuable insights for optimizing seed storage and dormancy-breaking techniques, contributing to improved bitter gourd cultivation practices.

Studies on Seed Coat Behaviour and Seed Quality Attributes with Response to Foliar Application of Iron and Zinc in Soybean Cv. Karune

S. R. NISHCHALA AND B.N. RADHA

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

THE field experiment was conducted at AICRP on Soybean, ZARS, University of Agricultural Sciences, GKVK, Bengaluru during *Kharif* 2023-24. The experiment consisted of nine treatments in three replications with various concentrations (0.1, 0.2, 0.3 and 0.4 %) each of ferrous sulfate and zinc sulfate including control using randomized complete block design and were sprayed at three different stages *viz.*, bud, flowering and pod formation stages of the crop. The results showed significant differences between the treatments in seed yield and quality parameters and also on seed coat behaviour. Among the treatments imposed, 0.1 per cent zinc sulfate recorded the highest seed yield parameters *viz.*, number of pods per plant (54.47), seed yield per plot (1.12 kg), taking lesser number of days to 50 per cent flowering (33.50) and maturity (95.91) compared to control (37.97, 0.90 kg, 35.80, 99.86, respectively). Higher values were observed in seed quality and seed coat parameters with the foliar application of 0.2 per cent zinc sulfate *viz.*, 100 seed weight (28.92 g), germination per cent (87.67 %), SV-I (2478), SV-II (6832), protein content (44.84 %), seed coat thickness (0.83 mm), seed hardness (69.59 N), total phenolic (0.39 mg/g) and flavonoid content (0.64 mg/g), compared to control (26.52 g, 80.93 %, 1294, 4088, 38.04 %, 0.63 mm, 58.60 N, 0.19 mg/g, 0.10 mg/g, respectively). The study concludes that the foliar application of 0.2 per cent zinc sulfate enhances the physical and biochemical properties of the seed coat, leading to better seed germination, vigorous seedlings and improved crop performance.

Studies on Growth Performance and Evaluation of Cowpea [*Vigna unguiculata* (L.) Walp.] Genotypes for Seed Yield and Quality

ABHA SHRIVASTAVA AND R. SIDDARAJU

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

COWPEA is a nutrient-rich crop providing affordable protein, nitrogen fixation, drought resistance and adaptability to challenging environments. This study aimed to identify high-yielding, disease-resistant genotypes during *Rabi* 2023. ANOVA revealed significant differences across genotypes for most growth and seed yield traits, except days to maturity. Genotype EC-390287 had the highest plant height (179.92 cm), with the highest genetic (31.19%) and phenotypic coefficient of variation (35.83%). Genotype GW HOPE showed the highest branch count (11.60). For yield traits, IC-27749(20) achieved the highest seed yield per plant (55.45 g), with high heritability and genetic advance. Disease screening found two genotypes, GC-1602 and IC-202781, immune to powdery mildew, while GC-3 showed rust immunity, with others exhibiting varying resistance. Seed morphology analyses revealed significant diversity in seed color, shape and eye color. Significant genotype effects were observed for seed quality parameters, genotype V- 578 recorded the highest germination rate (96%) and SUPER-30 exhibited strong root and shoot growth. Controlled deterioration tests showed NBC-14 with superior germination (75.00 %) after 24 hours of stress, indicating its potential for breeding programs focused on seed vigour improvement. Overall, specific genotypes demonstrated promising high yield and enhanced quality traits, supporting their role in cowpea breeding strategies.

Influence of Modified Atmospheric Packaging on Storability of Tomato (*Lycopersicon esculentum* L.) Seeds

G.R. ANUSHREE AND K. VISHWANATH

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

SEED longevity is essential for maintaining superior seed quality during storage and ensuring future agricultural productivity. Modified atmospheric storage is a promising technique for enhancing seed preservation by altering gaseous compositions. This study evaluated the effects of different gaseous combinations on tomato (*Lycopersicon esculentum* L.) seed storage, conducted over ten months in a completely randomized design. Seeds were stored under various gaseous combinations of N₂, O₂ and CO₂ along with check (atmospheric gas). The results revealed that, the seeds stored in aluminium pouches with gaseous combination of 40% N₂ + 00% O₂ + 60% CO₂ showed better seed quality parameters viz., thousand seed weight (2.90 g), moisture content (5.58%), germination (96.63%), root length (6.35 cm), shoot length (6.15 cm), seedling length (13.06 cm), seedling vigour index-I (1262), seedling vigour index-II (1360), dry weight (14.02 mg), total dehydrogenase activity (0.358 OD), catalase activity (2.81 mMol H₂O₂ decomposed min⁻¹ g⁻¹), peroxidase activity (641.38 ΔOD₄₃₀ min⁻¹ g⁻¹), protein content (83.76 μg g⁻¹), lowest conductivity of seed leachate (0.281 dSm⁻¹), zero seed infection and highest C:B ratio of 1:2.04 after ten months of storage. Whereas, the seeds packed in 50% N₂ + 20% O₂ + 30% CO₂ (T₇) incurred a more economic loss when compared to other treatments due to higher investment and lesser net returns. In conclusion, 40% N₂ + 00% O₂ + 60% CO₂ gaseous combination is the most effective in maintaining seed quality and controlling deterioration, making it ideal for long-term tomato seed storage.

Understanding the Variation and Exploring the Role of Phytohormones in Increasing the Frequency of Multi-Kernelled Seed in Rice (*Oryza sativa* L.)

K.P. DHANUSHREE AND N. NETHRA

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

THE global demand for rice is projected to exceed 536 million tons by 2030, highlighting the need for innovative yield-boosting strategies. Typically, rice varieties produce one kernel per spikelet due to their single-ovary floral structure. The unique multi-kernelled trait in the rice variety Jugal, attributed to multiple carpels within a single spikelet, offers a promising avenue for enhancing productivity. Accurately identifying double-kernelled seeds, which resemble single-kernelled seeds externally, required a non-destructive method. Digital radiography X-ray imaging efficiently identified double-kernelled seeds, proving superior to manual inspection. While CT soft X-ray provided higher resolution, its practicality was limited by cost and time constraints. Despite its potential, the frequency of double-kernel seeds declines after panicle emergence due to ovary degeneration. Phytohormones significantly influence floral meristem activity and ovary development. A pot experiment was conducted by spraying phytohormones at the flowering stage in a completely randomized design. Cytokinins, particularly zeatin at 30 μ M, increased double-kernel frequency to 18.95 per cent, outperforming kinetin and other hormones. Auxin (2,4-D) reduced double-kernel formation, while gibberellic acid (GA_3) showed limited efficacy. Double-kernel seeds exhibited higher 1000-seed weight (21.761 g) and vigor indices I and II (3960 and 1839) compared to single-kernel seeds (3619 and 1731, respectively). A germination test revealed that 14.1 per cent of double-kernelled seeds produced twin seedlings, suggesting the potential for reduced seed rates. This study highlights the efficiency of digital X-ray imaging and the role of cytokinins especially zeatin @ 30 μ M in promoting multi-kernelled seed formation in Jugal variety offering insights to increase rice productivity.

Influence of Liquid Biofertilizer on Crop Growth, Yield and Seed Quality of Soybean (*Glycine max* L.)

ABHISHEK MALLIKARJUN HALAGERI AND K. VISHWANATH

Department of Seed Science and Technology, College of Agriculture, UAS, GKVK, Bengaluru

LIQUID biofertilizers play a pivotal role in sustainable agriculture by enhancing soil fertility, reducing chemical fertilizer dependence and promoting eco-friendly farming practices. Soybean (*Glycine max* L.), a key oilseed and protein-rich crop, holds immense importance in India's agricultural economy, serving as a vital source for edible oil and animal feed. The investigation examined the impact of liquid biofertilizers on the growth, yield and seed quality of soybean varieties JS-20-116 and JS-335 treated with eight different liquid biofertilizers conducted in a split-plot design. Irrespective of varieties, seeds treated with *Pseudomonas* @ 20 ml/kg seeds, exhibited the highest field emergence (91.15 %), plant stand establishment (40.64 plants/m²), pods per plant (95.82), seed yield per hectare (29.25 q/ha) and seed germination (96.36%), parallely seeds treated with *Rhizobium* @ 20 ml/kg seeds also showed highest effective root nodules per plant (44.09), seedling vigour index- I (2908), protein content (421.16 μ g/g) and peroxidase activity (0.81 A_{436}). Among interactions JS-335 seeds treated with *Pseudomonas* @ 20 ml/kg seeds exhibited higher plant stand establishment (43.05 plants/m²), seed yield per hectare (30.75 q/ha), germination (98.01%) and B:C ratio (4.85). Similarly, JS-335 seeds treated with *Rhizobium* @ 20 ml/kg seeds showed highest effective root nodules (51.89/plant), seedling vigour index-I (3018), peroxidase activity (0.87 A_{436}). In conclusion, irrespective of varieties seed treatment either with *Pseudomonas* @ 20 ml/kg seed or *Rhizobium* @ 20 ml/kg seeds liquid biofertilizers could be used commercially in soybean seed production to get better seed yield and quality.

Studies on Impact of Nano Nitrogen Sprayed Mulberry Leaves on Incidence of *Bm*NPV Disease

M.R. PAVITHRA AND R. NARAYANA REDDY

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

AN experiment was carried out at Department of Sericulture, College of Agriculture, GKVK during 2022-2023 to assess the impact of nano nitrogen sprayed mulberry leaves on incidence of *Bm*NPV disease. Among all the treatments foliar application of nano N at 0.4 per cent at 200 L/acre on 25 days after pruning (DAP) + 50 per cent N soil application performed better than the rest of the other treatments, in mulberry as well as for silkworms in both healthy and disease conditions. Foliar application of nano N at 0.4 per cent at 200 L/acre on 25 DAP + 50 per cent N soil application has recorded increased plant parameters viz., shoot length, number of branches per plant, number of leaves per plant, leaf area and leaf yield per plant at 30, 45 and 60 DAP. Better silkworm rearing parameters viz., shortest larval duration, minimum disease incidence, less larval mortality, increased larval progression, ERR and increased larval weight and cocoon parameters viz., cocoon yield by number, cocoon yield by weight, single cocoon weight, pupal weight, floss weight, cocoon shell weight, cocoon shell ratio, average filament length, non-breakable filament, filament weight and denier. Whereas, foliar application of 2 per cent urea at 200 L/acre on 25 DAP + 50 per cent N soil application performed as next better. An overview of the study revealed that foliar application of nano nitrogen at 0.4 per cent at 200 L/acre on 25 DAP + 50 per cent N soil application significantly improved the growth of mulberry as well as silkworm and cocoon parameters under healthy and *Bm*NPV disease condition.

Silkworm Chitosan and Pupal Oil - Their Extraction and Physico-Chemical Properties

DUKARE PRADIP GULABRAO AND N. AMARNATHA

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

STUDIES on extraction of silkworm chitosan and pupal oil and their physico-chemical properties were conducted at the Department of Sericulture, UAS, GKVK, Bengaluru. The results revealed that, oil content in silkworm pupae ranged from 26 to 28 per cent on dry weight basis. Notably, female pupae had a higher oil content (27.99%) compared to males (27.03%). The iodine and saponification values of pupal oil was better compared to groundnut and sunflower oils. Similarly, the acid value (1.570 mg KOH/g oil) and peroxide value (2.453 ppm) were found to be lower than three in pupal oil samples which revealed that, pupal oil is good for edible purposes. The chitin and chitosan were significantly higher in male pupae (3.242% and 2.430%, respectively) than females (3.013% and 2.345%, respectively). Among the hybrids, chitosan content was higher in the cross breed (2.526%) than bivoltine hybrid (2.308%). Further, chitin and chitosan percentages were analysed in larval instars, moult exuviae and pupal exuviae. Notably, the bivoltine larval exuviae (after spinning) exhibited a significant increase in chitin and chitosan content (26.02% and 19.37%, respectively) compared to cross breed larval exuviae (25.89% and 19.28%, respectively). The moisture content of larval chitosan ranged between 7.00-8.00 per cent. However, pupal chitosan showed 7.20-7.40 per cent moisture. Viscosity of pupal chitosan was 44-46 cP, while larval/exuvia chitosan ranged from 48-58 cP. Extracted chitosan had ash content below 1 per cent, with pupal chitosan ranging from 0.30-0.38 per cent and larval/exuvia chitosan from 0.50-0.80 per cent. The degree of deacetylation and solubility ranged between 85-96 per cent and 92-99 per cent, respectively. The chitosan extracted from silkworm pupae shows better physico-chemical parameters like solubility (99%), degree of deacetylation (>85%) and ash content (<1%) which indicates high-grade chitosan and which can be utilized as an alternative source of chitosan extraction.

Study on the Performance of Tree Mulberry Applied With Secondary Nutrients and its Influence on Silkworm (*Bombyx mori* L.)

C. HARISH REDDY AND RAMAKRISHNA NAIKA

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

THE study on 'Performance of tree mulberry applied with secondary nutrients and its influence on silkworm (*Bombyx mori* L.)' was carried out in the established V-1 tree mulberry garden at the College of Sericulture, Chintamani during 2022-23. The treatments were formulated based on the existing recommendation for sulphur application in mulberry and recommended ratio of calcium, magnesium and sulphur @ 3:1:0.9, respectively. The results revealed that RDF+Soil application of Ca:Mg:S:: 82.5:27.5:25 kg ha⁻¹yr⁻¹ to tree mulberry garden recorded highest total shoot length (72.15 and 108.65 cm), number of shoots/tree (40.74 and 45.17), number of leaves/tree (796.00 and 1279.74), leaf area (130.09 and 179.30 cm²) and leaf yield (2425.81 and 5426.09 g/tree), respectively on 45th and 60th days after application of fertilizers. The biochemical parameters viz., total carbohydrates (18.28%), total proteins (33.12%), total chlorophyll (2.48 mg/g), ash content (11.75%), leaf moisture content (76.76%) and moisture retention capacity (95.17%) at 60th day after pruning were found higher in the mulberry trees treated with RDF+soil application of Ca:Mg:S:: 82.5:27.5:25 kg ha⁻¹yr⁻¹ followed by RDF+soil application of Ca:Mg:S:: 66:22:20 kg ha⁻¹yr⁻¹. Similarly, RDF+ Soil application of Ca:Mg:S:: 82.5:27.5:25 kg ha⁻¹yr⁻¹ recorded higher values for all major and secondary nutrients in the leaf viz., nitrogen (5.31%), phosphorous (0.440%), potassium (3.47%), calcium (3.34%), magnesium (1.72%) and sulphur (0.235%). Further, the mean larval weight (48.23 g/10 larvae), larval duration (7.26 days) and ERR (97.05 %) was observed in the batches of silkworms fed with mulberry leaves of trees that received RDF+soil application of Ca:Mg:S:: 82.5:27.5:25 kg ha⁻¹yr⁻¹. Also, the cocoon weight (2.54 g/cocoon), pupal weight (1.97g), shell weight (0.55 g/cocoon), cocoon shell ratio (21.66%), cocoon filament length (1356.57m), non-breakable filament length (992.27m), filament weight (0.43g) and filament Denier (2.88) were found significantly higher in the same treatment.

Impact of Reeling Effluent Irrigation on the Performance of Mulberry and its Impact on Cocoon Production

S. ASHRITH AND S. CHANDRASHEKHAR

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

THE research entitled 'Impact of reeling effluent irrigation on the performance of mulberry and its impact on cocoon production' was carried out at the Department of Sericulture, College of Agriculture, GKVK, Bengaluru during 2022-2023. The experiment with five treatment combinations comprising of reeling effluent and borewell water, replicated four times was laid out in randomized complete block design. Results of the research revealed that soil nutrients, mulberry growth, leaf yield, leaf quality parameters, silkworm growth and cocoon parameters were found significantly influenced by reeling effluent irrigation. Among different treatment combinations 100 per cent reeling effluent irrigation recorded higher plant growth, leaf yield (58.07 tonnes/ha/ year) and quality parameters such as leaf NPK (3.54 % N, 0.31 % P and 1.99 % K) and micronutrients (29.11, 94.84, 344.20 ppm Zn, Mn and Fe) compared to 100 per cent borewell water irrigation. Silkworms fed with mulberry leaves from the plot irrigated with 100 per cent reeling effluent showed significantly higher larval weight (33.22 g/10 larvae), lowest larval duration (186.69 h), single cocoon weight (1.67 g), single shell weight (0.30 g), cocoon shell ratio (18.46 %) and higher Effective Rate of Rearing (99.00 %). Similarly, soil pH, EC, OC, N, P, K, Fe, Mn and Zn were significantly higher in 100 per cent reeling effluent irrigated plot. Whereas, irrigation with 75 per cent reeling effluent + 25 per cent bore well water was next best. An overview of the study revealed that 100 per cent reeling effluent significantly improved the growth and development of mulberry as well as silkworm and cocoon parameters.

Field Evaluation of Bivoltine Silkworm Double Hybrids Tolerant to High Temperature and Muscardine Disease

NIKITA KANKANAWADI AND MANJUNATH GOWDA

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

EVALUATION of high temperature and muscardine disease tolerant silkworm foundation crosses viz., $B1 \times B2$, $B1 \times B4$ and $B6 \times B8$ and their double hybrids viz., $(B1 \times B2) \times FC1$, $(B1 \times B4) \times FC1$ and $FC2 \times (B6 \times B8)$ was done in the farmers field, covering Tumakuru and Chikaballapura districts. Parental rearing was carried out in the Department of Sericulture, University of Agricultural Sciences, GKVK, Bengaluru, to obtain 50 dfls each of $B1 \times B2$, $B1 \times B4$ and $B6 \times B8$ foundation crosses. Fifty dfls of each foundation cross were distributed to five farmers of Tumakuru district along with the control FC1 and FC2 and assessed their rearing and grainage performance. The results revealed that, out of 16 traits assessed, $B1 \times B4$ was superior for 12, while $B1 \times B2$ for seven traits. Further, the cocoons from the above rearings were used to produce 100 dfls each of the double hybrid viz., $(B1 \times B2) \times FC1$, $(B1 \times B4) \times FC1$, $FC2 \times (B6 \times B8)$ and control $FC2 \times FC1$. Twenty dfls of each double hybrid were provided to fifteen farmers of Tumakuru and Chikaballapura districts and assessed their rearing performance. The double hybrid $(B1 \times B4) \times FC1$ was superior for ten out of thirteen traits while $(B1 \times B2) \times FC1$ for four traits. Further, the reeling assessment of cocoons of these double hybrids revealed that $(B1 \times B4) \times FC1$ and $(B1 \times B2) \times FC1$ exhibited better performance for most of the reeling and raw silk quality parameters assessed, indicating their dual tolerance and raw silk quality advantages to sericulture industry.

Stability of Elite Mulberry (*Morus* Spp.) Genotypes for Growth and Fruit Yield

A.S. TEJASWINI AND CHIKKALINGAIAH

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

INVESTIGATION on stability of eight elite mulberry genotypes was carried out during winter, summer and rainy seasons of 2023-24 at Department of Sericulture, UAS, GKVK, Bengaluru. Analysis of variance for stability revealed that significant differences were recorded among mulberry genotypes for most of the vegetative, reproductive and fruit traits. Significant $G \times E$ interaction was observed for the traits across the three seasons. Based on the environment index rainy season of 2024 was considered as favourable season as it favoured good expression of most of the traits studied. Mean performance of eight elite mulberry genotypes indicated that ME-0006 exhibited superior performance for most of the traits studied viz., inflorescence length, breadth, fruit traits like, width, length, weight and yield per plant. Similarly, ME-0220 recorded more number of fruits per plant and number of fruits per branch. Whereas, MI-0014 and ME-0067 genotypes recorded superior performance for both vegetative and reproductive traits. Based on the stability parameters Mean, bi and S^2di indicated that genotypes ME-0006 and ME-0220 were considered as best and stable in terms of fruit yield and its attributing traits. The genotypes MI-0014 and ME-0067 are stable in their consistent performance in leaf yield and vegetative traits, although they are less fruit yielder. Fruit yield per plant was significantly positively correlation with number of branches per plant, number of leaves per plant, single leaf area, leaf yield per plant, fruit traits like, number of fruits per branch, number of fruits per plant, weight, width and length.

Development of Mulberry Herbal Tea with different Flavours

VEENITA M. KURI AND S. CHANDRASHEKHAR

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

MULBERRY is a perennial woody plant belongs to family Moraceae and genus *Morus*. Apart from feed for silkworm, leaves are being used for many other purposes. The present research was conducted to develop and evaluate flavour blended mulberry herbal tea. The nutrient content, consumer acceptability and cost economics of the developed products were analysed. Mulberry herbal tea with different flavours was prepared by incorporating 4 g of mulberry leaf powder with varied 0.5 g, 1 g and 1.5 g each of ginger, lemongrass, *jeera*, *pudina*, cardamom, vanilla and cocoa powder. Sensory evaluation of mulberry herbal tea with different flavours revealed that adding 1 g of each *pudina*, *jeera* and ginger showed highest overall acceptability. Based on these findings, FBMT was developed using 4 g of mulberry leaf powder, blended with *pudina*, *jeera* and ginger at 0.4 g, 0.6 g and 0.8 g, respectively. The results indicated that 0.6 g each of *pudina*, *jeera* and ginger showed highest overall acceptability. Nutritional composition of FBMT powder indicated 7.8 per cent of moisture content, 23 g of protein, 5.8 of pH, 1.66 per cent of titratable acidity, 8.10° Bx of total soluble solids, it also contained 1-Deoxynojirimycin (0.132 mg/g), tannins (2.34 mg TAE/g) and flavonoids (32.56 mg RE/g). Consumer acceptability of FBMT showed highly acceptable for colour, flavour and freshness parameters. The production cost of FBMT powder was Rs.74 per 100 g. FBMT has another herbal tea option with strong consumer appeal.

Assessment of Bioefficacy of Abamectin 1.9 % EC on Thrips and Mites in Mulberry and its Impact on Rearing and Grainage Performance of Silkworm, *Bombyx mori* L.

G.V. SHWETHA AND K.S. VINODA

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

THE studies on Assessment of bioefficacy of abamectin 1.9 % EC on thrips and mites in mulberry and its impact on rearing and grainage performance of silkworm, *Bombyx mori* L. were carried out at the Department of Sericulture, College of Agriculture, GKVK, during 2023-2024. Maximum mortality of thrips (95.56 %) and mites (97.12 %) were recorded in abamectin 1.9 % EC sprayed plot without any phytotoxic symptoms. Treatment with abamectin 1.9 % EC showed highest leaf area (159.34 cm²) and leaf yield (58355.36 kg⁻¹ha⁻¹yr) at 60 days after pruning. Feeding the mulberry leaves harvested from treated plants at 20 days after spray (DAS) found safer to the silkworms, which recorded zero per cent mortality and better rearing parameters (shortest larval duration, maximum larval weight and effective rate of rearing) and cocoon traits (cocooning percentage, cocoon weight, cocoon shell weight, cocoon shell ratio, longest filament length, non-breakable filament length and maximum filament weight) among parental breeds. Further, the grainage performance of the tested parental lines of *B. mori* were found better in the treatment with 20 DAS that depicted maximum pupation rate, pupal weight, fecundity, weight of 100 eggs, egg recovery, hatching percentage, minimum egg retention in the ovary, least dead and unfertilized eggs. Among the breeds subjected for performance the multivoltine pure breed, PM has performed better with respect to larval, cocoon and grainage parameters for both 15 and 20 DAS, reflecting its sturdiness and the bivoltine parental breeds (CSR2, FC1 and FC2) performed well at 20 DAS.

Interspecific Hybridization to Assess Combining Ability and Heterosis for Growth Parameters at Seedling Stage in Mulberry (*Morus* spp.)

KAVERI ARAMANI AND CHIKKALINGAIAH

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

AN investigation on interspecific hybridization was conducted to assess combining ability and heterosis for seedling growth parameters in mulberry, using six females and four males crossed in line $\times$ tester mating design at the Department of Sericulture, UAS, GKVK, Bengaluru during 2023-24. Seedling traits were evaluated using a completely randomized design (CRD) with three replications. The study revealed that *Morus cathayana* (ME-03) expressed good general combining ability (GCA) for seedling height (60 and 90 DAS), number of leaves/plant and fresh leaf weight/plant. Among the testers, *M. indica* (MI-0308) excelled in GCA for seedling height (60 and 90 DAS), number of leaves/plant, internodal distance and fresh leaf weight/plant. Specific combining ability (SCA) of crosses indicated that *M. latifolia* (ME-0185) $\times$ *M. indica* (MI-0173) excelled in germination percentage, *M. bombycis* (ME-18) $\times$ *M. indica* (MI-0308) for seedling height (60 and 90 DAS), *M. multicaulis* (ME-06) $\times$ *M. alba* (MI-0423) for number of leaves/plant, single leaf area and fresh leaf weight/plant expressed high positive SCA. Heterosis estimation of the crosses revealed that *M. bombycis* (ME-18) $\times$ *M. indica* (MI-0308) recorded significant high positive heterosis over better parent for germination percentage and seedling height (60 DAS). Similarly, *M. cathayana* (ME-03) $\times$ *M. laevigata* (MI-0079) for seedling height (90 DAS), *M. multicaulis* (ME-06) $\times$ *M. alba* (MI-0423) for number of leaves/plant, *M. cathayana* (ME-03) $\times$ *M. indica* (MI-0308) for single leaf area and *M. sinensis* (MI-0025) $\times$ *M. laevigata* (MI-0079) for fresh leaf weight/plant have recorded significant heterosis over better parent.

Assessment of Bio-Efficacy of Diafenthiuron 50 % WP on Thrips and Mites in Mulberry and its Impact on Rearing and Grainage Performance of Silkworm, *Bombyx mori* L.

S. GAGANA SINDHU AND R. NARAYANA REDDY

Department of Sericulture, College of Agriculture, UAS, GKVK, Bengaluru

AN experiment on assessment of bio-efficacy of diafenthiuron 50 % WP on thrips and mites in mulberry and its impact on rearing and grainage performance of silkworm, *Bombyx mori* L. was conducted at the Department of Sericulture, College of Agriculture, GKVK, during 2023-2024. A significant reduction in the population of thrips (93.41 %) and mites (95.72 %) was recorded in diafenthiuron 50 % WP sprayed plot. Additionally, diafenthiuron 50 % WP caused no phytotoxic effect on mulberry. The leaf area (153.10 cm²) and leaf yield (57826.68 kg⁻¹ha⁻¹yr) recorded significant increase at 60 days after pruning. The silkworms fed on leaves harvested from pesticide sprayed plots showed zero per cent larval mortality, improved rearing parameters (shorter larval duration, greater larval weight, enhanced effective rate of rearing), cocoon traits (higher cocooning percentage, cocoon weight, cocoon shell weight, cocoon shell ratio, longer filament length, non-breakable filament length and maximum filament weight) and superior grainage performance (pupation rate, pupal weight, fecundity, egg recovery, weight of 100 eggs, hatching rate, minimum egg retention in the ovary, least dead and unfertilized eggs) at 20 days after spray (DAS) schedule. Among parental breeds, Pure Mysore, the multivoltine breed performed better with respect to larval, cocoon and grainage character for both 15 and 20 DAS, reflecting its sturdiness and the bivoltine parental breeds (CSR2, FC1, FC2) performed well at 20 DAS.

Characterization of Soils and Composition of Leaf in Selected Coffee Growing Areas of Hassan District

P. BHAIRESH KUMAR AND S. CHANNAKESHAHA

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, GKVK, Bengaluru

THE study was carried out on characterization of soils and composition of leaf in selected coffee growing areas of Hassan district. Soil and leaf samples were collected from different regions of arabica and robusta plantations. Results revealed that the coffee plantations featured suitable bulk density and total porosity, ideal for coffee growth. Additionally, the surface soil exhibited higher total porosity and water-holding capacity compared to sub-surface soil. Soil pH levels in the study area were slightly acidic, while electrical conductivity was ideal for coffee cultivation, organic carbon content varied, with a significant proportion featuring high levels, enhancing nutrient availability. However, phosphorus and potassium deficiency were observed. Micronutrient content, particularly iron and manganese, approached toxic levels. The yield of arabica and robusta coffee was positively correlated with various soil properties, including pH, organic carbon, nitrogen, potassium and calcium. Correlation studies indicated that soil and leaf nutrient content is directly related to yield variations. Soil Quality Index (SQI) data demonstrated statistically significant positive correlations between elevation and coffee yield potential. The maximum Arabica yield was recorded at > 1100 m elevation while the Robusta yield maximum at 800-1000 m. Understanding the complex interplay between soil characteristics, elevation and coffee yield is vital for sustainable coffee cultivation.

Studies on Soil Carbon Fractions in Long Term Fertilizer Experiment on Rice-Cowpea Cropping System under Southern Dry Zone of Karnataka

KHUSHWANT SINGH AND T. BHAGYALAKSHMI

Department of Soil Science and Agricultural Chemistry, College of Agriculture, V.C. Farm, Mandya

A field experiment was conducted at ZARS, V.C. Farm, Mandya during *Kharif* 2022-23 to study the impact of long-term integrated nutrient management (INM) practices on soil carbon fractions under a rice-cowpea cropping system. The experiment was laid out in Randomized Complete Block Design with seventeen treatments replicated twice which includes imbalanced, balanced, INM practices and only organic manures forms of fertilization. Among different oxidizable soil carbon fractions, T_7 which received 100%NPK+Zn+S+FYM@5t/ha recorded higher mean values of VLC, LC, LLC and NLC (3.38, 1.53, 1.83 and 5.51 g kg⁻¹, respectively) for consecutive three years 2020-21, 2021-22 and 2022-23, respectively. Order of mean values of SOC fractions (g kg⁻¹) over the three years was in SOC(7.65) > MAOC(2.12) > POC(1.55) > KMnO₄-OC(1.08) > DOC (79.26 mg kg⁻¹). Improved SOC stocks (14.79 Mg ha⁻¹) and CMI (376.20) were observed in T_7 100%NPK+Zn+S+FYM@5t/ha compared to chemically balanced and only organic manure treatments. Higher grain and straw yield (57.76 and 64.88 q ha⁻¹, respectively) of rice, haulm yield of cowpea (2257 kg ha⁻¹) and nutrient uptake by rice were also observed in T_7 and found on par with T_{15} (50%NPK+25%FYM-N+25%GM-N). At both depths (0-15 and 15-30cm), significant changes in available nutrient content (kg ha⁻¹) viz., N (337.95 and 309.79, respectively), P₂O₅ (71.25 and 69.47, respectively) and K₂O (269.31 and 241.32, respectively), secondary and micronutrients were also noticed in T_7 . Conjoint usage of inorganic and organic sources of nutrients had profound effect in enhancing different fractions of soil carbon under long-term INM practices.

Potassium Management in Paddy under Sodic Soils of Cauvery Command Area

S. VARSHA AND K.R. ASHOKA

Department of Soil Science and Agricultural Chemistry, College of Agriculture, V.C. Farm, Mandya

A field experiment was carried out during *Kharif* 2023 at 'B' Block, Zonal Agricultural Research Station, V.C. Farm, Mandya, to assess potassium management strategies on rice in sodic soil. The experiment comprising of twelve treatments which replicated three times using RCBD. The treatments included soil applications of potassium at three different levels, either in two splits along with or without foliar application of KNO_3 or K_2SO_4 or in three splits application. The application of potassium in three splits at the rate of 62.5 kg ha^{-1} (T_8) resulted in significantly higher in growth and yield parameters, including plant height (89.71 cm), root length (20.03 cm), tillers per hill (19.63), leaves per hill (117.76), leaf area (893.97 cm^2), dry matter production (55.10 g per hill), panicle length (22.01 cm), panicle weight (2.71 g), panicles per m^2 (242.35), test weight (24.24 g) and lower chaffiness (16.04%) as compared to two split application. Further, recorded higher grain (58.19 q ha^{-1}) and straw yield (72.80 q ha^{-1}), with B:C ratio of 1.93. However, soil application of potassium in three splits at rate of 75 kg ha^{-1} (T_{12}) recorded higher viz., water-soluble K (10.49 mg kg^{-1}), available K ($119.95 \text{ mg kg}^{-1}$) and exchangeable K ($107.08 \text{ mg kg}^{-1}$) content at harvest. Whereas, variations in non-exchangeable, lattice and total potassium among the treatments were not significant. The distribution of potassium fractions in the soil followed the order: total K > lattice K > non-exchangeable K > available K > exchangeable K > water-soluble K. The study showed that three split applications of potassium at the rate of 62.5 kg ha^{-1} as basal dose, 30 and 50 DAT is most effective in enhancing yield and net profit in addition to in alleviating salt stress in paddy cultivated under sodic soil.

Developing Pedo and Spectro Transfer Functions to Predict Bulk Density and Soil Moisture Constants

A.N. VINAYKUMAR AND S. DHARUMARAJAN

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, GKVK, Bengaluru

BULK DENSITY (BD) and soil moisture constants (SMC) are crucial physical parameters in soil science, particularly towards agriculture, as they significantly influence on soil quality assessment, carbon sequestration studies, precision farming applications and land use planning. These soil properties are difficult to measure in laboratory due to time-consuming, tedious, expensive and labour-intensive, but can be easily assessed through Pedo-transfer functions (PTF's) and Spectro-transfer functions (STF's). The present study was carried out in Chamarajanagar district, Karnataka with the objectives to characterize the soil resources of Yelandur, Chamarajanagar and to develop pedo and spectro transfer functions to predict BD and SMC. Soil profiles were identified based on landform and cropping patterns, and studied for morphological and physico-chemical properties through field and laboratory analysis, and identified six distinct soil types. PTF's developed using basic soil properties predicted field capacity (FC) and permanent wilting point (PWP) with an R^2_{val} of 0.81 and 0.90 respectively. STF's developed using spectroscopy-based models predicted FC, PWP and BD with R^2_{val} values of 0.82, 0.83, 0.32 and an RMSE_{val} of 5.23%, 3.28%, 0.15 Mg m^{-3} respectively. In a nutshell, both PTF's and STF's offered reliable, cheap and time efficient alternatives in estimating these soil properties. So that, it serves as a tool for predicting bulk density and soil moisture constants over a geographical area, thereby providing the development strategies to improve overall soil condition.

Assessment of Heavy Metals in Soil and Finger Millet due to Long-term Nutrient Management Practices

A. FATHIMA AND R. KRISHNA MURTHY

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, GKVK, Bengaluru

CONTINUOUS application of chemical fertilizers results in the accumulation of heavy metals in soils and plants; hence the study was conducted in an ongoing long-term fertilizer experiment in AICRP on dryland agriculture, GKVK, Bengaluru to assess the total and available heavy metals in soil and finger millet. The experiment was initiated in 1978, consisted of eight treatments and three replications with monocropping of finger millet. Soil samples were collected at two depths (0-15 and 15-30 cm), before and after sowing and these samples were analyzed for total and available arsenic, cadmium, chromium and cobalt. Finger millet roots, stems, leaves, grains and straw were collected at 30, 60 and 90 DAS and at harvest, to analyze macronutrients and heavy metals. The results revealed that macronutrients, total and available heavy metals were highest in FYM @10 t ha⁻¹ + 100% RDF, followed by FYM @10 t ha⁻¹ + 50% RDF. In finger millet, the uptake of all nutrients and heavy metals was higher in the treatment with FYM @10 t ha⁻¹ + 100% RDF. Among different parts of finger millet, the root accumulated the highest concentration of heavy metals, followed by leaves, stems, straw and grains. The surface soil in all treatments showed relatively higher heavy metal accumulation than the subsurface. The BCF values exceeded 1 in all parts of the finger millet except the grains. Non-carcinogenic hazards were high (>1) in all treatments except the control. However, DTPA-extractable heavy metals in soil and heavy metals in grains, were within permissible limits.

Spatial Assessment of Soil and Water Quality in Mining Area of Muddakkanahalli Micro-Watershed in Sira Taluk of Tumkur District for Sustainable Development

AJAY ABHISHEK AND A. SATHISH

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, GKVK, Bengaluru

THE study aimed to characterize the soil and water properties of the Muddakkanahalli micro-watershed in Sira taluk, Tumkur district, with a focus on assessing the spatial variability of heavy metals using geospatial techniques and providing strategies for sustainable development. Ten soil pedons, representing various physiographic units near granite quarries, were examined for their physical, chemical and biological properties. The soils were classified into nine soil series. Eighty-eight surface soil samples were collected and analyzed, alongside groundwater samples from 22 borewells. Statistical and geo-statistical analyses were conducted using ArcGIS 10.8.2 software. The bulk density of soils in the micro-watershed varied from 1.25 to 1.54 Mg m⁻³, increasing with depth, while the maximum water-holding capacity was highest in the Sirur series (46.05–61.91%). Soils were non-saline (EC: 0.11–1.15 dS m⁻¹), with pH ranging from slightly acidic to slightly alkaline and low to medium organic carbon. Groundwater was alkaline (pH: 7.39–8.24), with EC ranging from 510 to 825 µmhos cm⁻¹ and heavy metals like Ni, Pb, Cd and Cr were below permissible limits. Soil microbial activities varied with adequate calcium, magnesium and sulphur but deficiencies in iron, zinc, copper and boron were observed. Geostatistical analysis revealed the spherical model as a best fit for nickel (608.96 m), cadmium (1963.86 m) and chromium (2126.53 m), while the Gaussian model was found to be best fit for lead (1403.06 m). Land suitability was assessed for crops like maize, finger millet, groundnut, redgram, soybean, mango, sapota, lime, custard apple and pomegranate.

Revising Land Suitability Criteria for Arecanut (*Areca catechu* L.) in Davanagere District, Karnataka

N. YOGESH AND R. SRINIVASAN

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, GKVK, Bengaluru

THE study assesses land suitability for arecanut cultivation in Davanagere district using remote sensing and GIS techniques. Temporal changes in Land Use Land Cover (LULC) from 2013 to 2023 were analyzed using Landsat-8 satellite data, identifying six major land cover categories: agriculture, arecanut, coconut, settlement, vegetation and water bodies. Results showed a significant decrease in agricultural land with increases in vegetation and arecanut plantations. Ten soil profiles were collected from areas where arecanut cultivation expanded over the past decade. The soils were predominantly gravelly clay, with moderate to neutral pH levels and organic carbon content decreased with depth. Nutrient deficiencies including nitrogen, potassium, sulphur, zinc and boron were observed, with lower levels in deeper layers due to leaching, emphasizing the need for soil management practices. Land suitability for arecanut was assessed using the Analytical Hierarchy Process (AHP) based on nine criteria influencing arecanut cultivation. The weightage of each criterion was determined, with clay, AWC, sand, bulk density and potassium being the most significant factors that were included in the revised land suitability criteria. Suitability values for all the collected soil profiles were calculated and categorized into highly (S1), moderately (S2) and marginally suitable (S3) classes. The suitability values for the district are derived from 17 soil series, with areas classified into four suitability classes: S1, S2, S3 and N. The final suitability map indicated 58,694 ha as highly suitable, 172,022 ha as moderately suitable, 127,030 ha as marginally suitable and 90,221 ha as not suitable for arecanut cultivation.

Impact of Different Levels of Coconut Shell Biochar on Bioavailability, Phytotoxicity of Heavy Metals and Productivity in French Bean (*Phaseolus vulgaris* L.)

JYOTSNA PRIYAMBDA AND B. MAMATHA

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, GKVK, Bengaluru

A pot experiment was conducted to study the application of Coconut shell biochar on the bioavailability of heavy metals in soil and the productivity of French Bean. The soil was artificially contaminated with Cd, Cr, Pb and As at 10, 20 and 30 mg kg⁻¹. Biochar was applied to the pots at 1, 3 and 5 per cent, before sowing. Biochar at 5 per cent increased soil pH from an initial pH 6.73 to 7.47 due to its alkaline nature in post-harvest soil. The study revealed the greatest reduction in the bioavailability of heavy metals in soil with biochar at 5 per cent where the concentration of heavy metals reduced from 10 to 1.39, 1.19, 0.99 and 1.70 mg kg⁻¹ for Cd, Cr, Pb and As at harvest, respectively. The phytotoxicity of heavy metals was found to be higher in haulm as compared to pods. The minimum concentrations of the heavy metals were found in the treatment with 10 mg kg⁻¹ heavy metals contamination and 5 per cent biochar application with concentrations of 0.62, 0.43, 0.38 and 0.18 mg kg⁻¹ of Cd, Cr, Pb and As, respectively in the pods. The growth parameters like plant height and pods plant⁻¹ were higher in the treatments where 5 per cent biochar was applied. The yield increased from 6.87 t ha⁻¹ in control to a maximum value of 13 t ha⁻¹ when 5 per cent biochar was applied. So, coconut shell biochar was effective in remediating heavy metals in soil, reducing phytotoxicity, enhancing soil pH and boosting crop productivity.

Studies on Nutrient Management Practices on Growth and Yiled of Small Onion (*Allium cepa* L. var. *aggregatum*)

G.N. GAGAN AND G.S. YOGESH

Department of Soil Science and Agricultural Chemistry, College of Agriculture, V.C. Farm, Mandya

A field experiment was conducted during *Rabi* 2023 at Krishi Vigyan Kendra, Haradanahally Farm, Chamarajanagara to evaluate the nutrient management for Small onion. The experiment comprised of nine treatments replicated three times using RCBD. The treatments included application of 100, 75 and 50% RDF, in comparison to 100, 75 and 50%. RDN:K:S by varying RDP at 125 and 150%. Application of 100% RDN:K:S with 150% RDP (T_7) were recorded higher yield (21.64 ton ha⁻¹) and B:C ratio (4.10). Which was on par with application of 100% RDF with plant height (48.74), polar diameter (3.53cm), number of bulbs per clump (8.92), yield (20.76 ton ha⁻¹), TSS (14.32 °Brix) ascorbic acid, (14.78 mg 100 g⁻¹) phenols, (0.49 mg g⁻¹) and B:C ratio (3.99). Significantly higher nitrogen (72.01 kg ha⁻¹), phosphorous (22.71 kg ha⁻¹), potassium (83.04 kg ha⁻¹) and sulphur (14.11 kg ha⁻¹) uptake were recorded in T_7 treatment which was on par with T_4 and T_1 treatments. The soil available nitrogen (189.38 kg ha⁻¹), potassium (391.57 kg ha⁻¹) and sulphur (31.13 mg kg⁻¹) after harvest were recorded higher in T_1 treatment with the application of 100% RDF. Higher soil available phosphorous (117.76 kg ha⁻¹) was recorded in T_9 treatment with the application of 50% RDN:K:S with 150% RDP, high buildup of phosphorous were observed. Thus, the study revealed out that application of 100% RDF (150:75:150:30 kg N: P₂O₅:K₂O and S ha⁻¹) found better for *Rabi* grown small onion.

Effect of Seed Treatments and Potting Media on Seed Germination and Nutrient Management in *Melia dubia* Cav.

C.R. ABU DAWOOD AND J. MAHADEVA

Department of Forestry and Environmental Science, College of Agriculture, UAS, GKVK, Bengaluru

THE present investigation explores the impact of seed treatments and potting media on the germination and nutrient management of *Melia dubia* Cav. The study conducted at the GKVK campus, University of Agricultural Sciences, Bangalore, employed a completely randomized design with twenty-two treatments replicated four times. Various germination parameters and seedling growth attributes were measured at intervals of 30, 60 and 90 days after seedling emergence. Noteworthy variations were observed across multiple parameters, including germination percentage, days to initial germination, germination speed and capacity, as well as seedling height, leaf numbers, leaf area, collar diameter, sturdiness quotient, biomass and relative growth rate. Seed treatment with H₂SO₄ resulted in early germination (26 days) with the highest germination percentage (63.88%), speed (0.97) and capacity (75.50%), surpassing the control. The application of soil, vermicompost and farmyard manure led to the tallest seedlings (30.82 cm), highest leaf area (151.14 cm²) and highest biomass (33.91 g/plant) at 90 days after emergence, while the control (only soil) exhibited the lowest. Furthermore, the study highlighted that combining 100% N and K with 50% P, mycorrhiza and PSB significantly promoted seedling height (36.63 cm), leaf area (165.23 cm²) and biomass (54.14 g/plant). The findings underscore the positive impact of H₂SO₄ seed treatment, the soil + vermicompost + farmyard manure potting medium and the synergistic effect of biofertilizers (mycorrhiza and PSB) with specific nutrient combinations on *Melia dubia* seed germination and seedling growth. These insights are valuable for optimizing seedling production practices and promoting sustainable cultivation of *Melia dubia*, a species of economic importance.

Characterization of Groundwater Quality Using Water Evaluation Indices in GKVK Campus

H.R. KAVYASHREE AND R. KRISHNA MURTHY

Department of Forestry and Environmental Science, College of Agriculture, UAS, GKVK, Bengaluru

GROUNDWATER is vital for living organisms for their survival and is used for domestic, agricultural and industrial purposes. A study was conducted at the GKVK campus, UAS, Bangalore to characterize groundwater for drinking and irrigation purposes. The collected groundwater samples were analyzed for physicochemical properties and the results were evaluated against the Indian standards. All the parameters were within the acceptable limits except pH, which was highest in post-monsoon. The concentration of cations and anions increased during the monsoon and post-monsoon periods due to the leaching of rainwater and weathering of parent material. Heavy metals in groundwater samples were within the standard guidelines and concentrations were higher during the post-monsoon season. The Piper plot reveals higher concentrations of strong acids and strong alkaline earth elements in groundwater. Most samples in the diamond plot are in zone 7, indicating a high concentration of saline water dominated by sodium and chloride. The USSL diagram indicates that all groundwater samples in the region are in the S1 sodicity category, indicating no sodicity hazards. All samples are suitable for irrigation based on their Residual Sodium Carbonate values. Based on the Hortons assessment groundwater samples were suitable for drinking purposes in all the seasons. The region's groundwater samples showed lower levels of heavy metal contamination, as indicated by the heavy metal pollution index and heavy metal evaluation index. The groundwater in the study area was in good condition and suitable for different proposes as per the test results.

Development and Validation of Stoichiometric Model in Pigeonpea

V.G. JAYANTH KUMAR AND M.H. MANJUNATHA

Department of Agricultural Meteorology, College of Agriculture, UAS, GKVK, Bengaluru

PIGEONPEA is an important legume crop grown in tropical and subtropical regions around the world. The research was conducted to study the influence of weather parameters on total dry matter production and grain yield of pigeonpea. Regression equations were developed for two dates of sowing using weather data and crop data of 20 years (2002-21 and 2023) to understand the influence of weather parameters and their combined effect on total dry matter production in pigeonpea. The influence of combined weather parameters was higher at initial vegetative and harvest stage with a coefficient of determination value of 0.52 to 0.56, respectively than other combinations at first date of sowing. The stoichiometric model was developed using weather data of 14 years (2002- 2016). The developed model showed good agreement between observed and predicted values with higher (0.89) and lower (0.63) coefficient of determination at harvest and initial vegetative stage, respectively for first date of sowing. In the second date of sowing, the model showed higher coefficient of determination at late vegetative stage (0.79) and lower at initial vegetative stage (0.61). Further the model was validated for two dates of sowing over six years (2017-2021 and 2023), showed good fit in all the years. The model helps in the prediction of total dry matter production at the end of each stage and grain yield well before the harvest of the crop with accuracy level ranging from 63-89 per cent.

Comparative Study of Runoff and Soil Loss Estimation through Musle Equation and TD Diver Sensors for a Micro-Catchment under Dry Land Condition

M.S. THEERTHA AND H.G. ASHOKA

Department of Soil and Water Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

A comparative study of runoff and Soil Loss Estimation through TD diver sensors with SCS-CN method and MUSLE with field-collected runoff samples for a Micro-Catchment under dryland conditions was conducted from August 2023 to June 2024 at GKVK, UAS, Bangalore. The results highlighted significant differences in soil physical properties, infiltration rates and crop cover between the plots, influencing runoff and soil loss. During the study period, 14 runoff causing events were observed with rainfall intensities ranging from 8 to 108 mm h⁻¹. Higher runoff and soil loss in T₁, attributed to greater slope. Conversely, T₂ exhibited better water retention due to higher porosity and crop cover. Runoff values from TD Diver ranged from 0.32 to 30.12 mm in T₁ and 0.19 to 10.12 mm in T₂. Statistical analysis confirmed no significant differences between runoff measured by TD Diver and the SCS-CN method. The highest runoff volume was recorded 168.99 m³ in T₁ and was 62.47 m³ in T₂. Soil loss estimates, derived from MUSLE and validated with field-collected samples, showed sediment yields between 11.96 and 367.64 kg ha⁻¹ in T₁ and 10.72 to 329.51 kg ha⁻¹ in T₂. T₁ exhibited significantly higher sediment yield, particularly during high-intensity rainfall events. T₂ demonstrated higher erosion resistance due to better soil structure and crop cover. The study confirms the effectiveness of TD DIVER sensors and MUSLE for real-time monitoring of runoff and soil loss in micro-catchments. These findings reveals soil conservation strategies for improving watershed management under arid and semi-arid conditions.

Impact of Tillage and Compartmental Bund Former on Soil Moisture Dynamics, Growth and Yield of Crops in Pre-Monsoon Season

H.J. DURGAPOOJA AND K. DEVARAJA

Department of Soil and Water Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

THE study conducted during pre-Kharif season of 2023 at AICRP for Dryland Agriculture, UAS, GKVK, Bengaluru, aimed to evaluate the effects of different tillage practices and compartmental bunding on soil moisture dynamics, growth and yield of crops. The tillage methods assessed included conventional tillage (M₁), duck-foot cultivator (M₂) and compartmental bund former (M₃) with crops such as green gram, field bean and sesamum. Soil moisture content was recorded at weekly intervals from 15 to 90 DAS. At 15 DAS, soil moisture at 0–15 cm depth was 5.99 per cent under M₃, followed by M₂ (4.79 %), while M₁ recorded the lowest soil moisture of 3.31 per cent. Similarly, at 15–30 cm depth, higher soil moisture 14.61 per cent was in M₃, followed by M₂ (14.08 %) and lower soil moisture of 12.78 per cent was in M₁. Soil temperature exhibited an inverse relationship with soil moisture across all treatments. Plant height at 60 DAS was highest under M₃ (79.53 cm), compared to M₁ (73.21 cm). Among tillage methods, seed yield was highest under M₃ (874 kg ha⁻¹) compared to M₁ (657 kg ha⁻¹). Among crops, field bean recorded the highest seed yield (983 kg ha⁻¹). Among different interactions, M₃ with field bean recorded highest seed yield (1,094 kg ha⁻¹) and was associated with higher net returns, B:C ratio and lower soil temperatures. In conclusion, the study demonstrated that compartmental bunding method (M₃) was the most effective tillage practice for enhancing soil moisture, plant growth, and improving crop yields.

Identification of Suitable Site for Water Harvesting and Soil and Water Conservation Structures Using GIS and RS for Niragantipalli Micro Watershed of Chikkaballapura District

B.N. PAVITHRA AND K.S. RAJASHEKARAPPA

Department of Soil and Water Engineering, College of Agricultural Engineering, UAS, GKV, Bengaluru

GEOSPATIAL techniques were employed for developing a land and water management action plan for the Niragantipalli micro-watershed, situated between 13° 46' 17.36" N latitude to 13° 44' 51.06" N latitude and 77° 51' 56.44" E longitudes to 77° 53' 19.97" E longitude in Bagepalli taluk, Chikkaballapura district, Karnataka. ArcGIS software was utilized to assess the micro-watershed morphological characteristics, revealing a dendritic drainage pattern with a trunk order of 3. The micro-watershed spans 632 ha., with a maximum length and width of 4.83 km and 2.63 km, respectively. A mean bifurcation ratio of 2.5 suggests high relief and steep ground slope with elongated shape in nature, while a drainage density of 1.3 km/km² indicates that the streams are coarse texture nature. The elongated shape of the micro-watershed is evident from its form factor. Runoff volume for harvesting was computed using the Modified Infiltration method, yielding values of 0.62 MCM and 1.09 MCM for 2019 and 2021, respectively. Conversely, sandy loam and loamy sand exhibited negligible runoff, while impervious surfaces such as habitation and hard rock terrain demonstrated maximum runoff generation. Thematic maps illustrating land use/land cover, soil types, slope and drainage were produced using a projected Digital Elevation Model (DEM). While Google Earth Pro and GPS visualizers can offer foundational data, creating accurate and detailed DEMs for such thematic mapping typically necessitates higher-resolution elevation data and specialized GIS software for processing and analysis. This study aids in identifying suitable locations for various soil and water conservation structures. Results indicate that 8.70 per cent of the area is ideal for check dams, 40.2 per cent for farm ponds, and 10.0 per cent for percolation ponds, contributing to the sustainable development of the micro-watershed's natural resources through the implementation of proposed action plans.

Development of Crop Management Factor (C) for Universal Soil Loss Equation Model in different Crops under Alfisols of Eastern Dry Zone of Karnataka

ASHOK AND K. DEVARAJA

Department of Soil and Water Engineering, College of Agricultural Engineering, UAS, GKV, Bengaluru

THE study on development of crop management factor (C) for universal soil loss equation model in different crops under Alfisols of Eastern Dry Zone of Karnataka was carried out at the AICRP for Dryland Agriculture project, UAS, GKV, Bengaluru. The experiment was conducted in six plots with five crops *i.e.*, field bean, cowpea, groundnut, green gram, finger millet and control plot (No crop). During the crop growth period there was nine rainfall events which caused runoff. The rainfall of 62.4 mm recorded on 31st July, caused runoff for the first time in the experimental period with rainfall intensity of 21.20 mm/h. Highest rainfall intensity which caused runoff was observed on 14th October (32.53 mm/h) with rainfall of 60 mm. Among different treatments, the treatment with higher canopy cover T₃ (Groundnut) resulted in lesser per cent runoff (13.38 m³), soil loss (959.96 kg/ha), nutrient loss (N-15.41 kg/ha, P- 0.64 kg/ha, K- 1.90 kg/ha). and substantially higher average moisture content was recorded at 0-15 cm and 15-30 cm depth (16.46 and 22.67 %, respectively) and exhibited lower particle density, bulk density and higher porosity, water holding capacity, rapid infiltration rate and better crop growth attributes resulted in higher grain yield (3132.81 kg/ha), and B:C ratio of 2.6 as compared to other treatments which have lesser canopy cover (T₁ Field bean, T₂ Cowpea, T₄ Control, T₅ Green gram and T₆ Finger millet). Lower Crop management factor (C) was observed in groundnut plot 0.04 followed by finger millet (0.11) indicating good gross cover and erosion resistance. Overall groundnut and finger millet crop having higher crop canopy and extensive root system are realized as the best crops which can be grown in dry zone with greater the ability to protect the soil from erosion.

Development of Solar Power Operated Automatic Cleaning and Sieving Machine for Domestic Purpose

REVANSIDDA AND DRONACHARI MANVI

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

IN food processing, cleaning and sieving are important operations to remove impurities, broken kernels and insects during post-harvest processing. Currently, household peoples, small farmers depends on manual method which are labour intensive and drudgery. While industrial machines are expensive and unsuitable for domestic scale. To address this, solar-powered automatic cleaning and sieving machine was designed and developed. machine consists of frame, DC motor with eccentric weight, four interchangeable sieves, solar panel, charge controller, battery, UPS and speed regulator, measuring 490 × 464 mm (H × W). It operate on principle of eccentric mass vibration. The machine performance was evaluated using wheat, rice and wheat flour with speed (1900–2300 rpm), feed rate (500–1000 g) and eccentric weight (20–25 g) as independent parameters. The parameters assessed included cleaning efficiency, machine capacity, cleaning performance index (CPI), losses and specific power consumption (SPC). The highest cleaning efficiency was observed for wheat flour (100%), followed by rice (98.39%) and wheat (97.64%). The machine demonstrated a maximum capacity of 60.12 kg/h for wheat flour, 28.70 kg/h for wheat and 25.25 kg/h for rice. SPC ranged from 0.41 to 0.51 Wh/kg, losses varied between 0.01 and 0.18 per cent and the CPI ranged from 0.97 to 1.0. The optimized conditions were 2300 rpm, 734 g feed rate, 22 g eccentric weight for wheat, 2300 rpm, 870 g feed rate, 21 g eccentric weight for rice and 2116 rpm, 583 g feed rate, 21 g eccentric weight for wheat flour. Developed machine is highly useful for small-scale farmers, domestic users and small-scale food industries. Machine design is compact and ability to work on renewable energy and cost-effective solution for the operation.

Optimization of Process Parameters for Pulse Based Protein Drink Powder

SACHINKUMAR AND G.S. KRISHNA REDDY

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

MOTH BEAN is rich in nutritional value, having higher protein content and kodo millet is recognized for its exceptional dietary fiber content, highest among cereals. The study was conducted to optimize the process parameters for pulse based protein drink powder. The grains of moth bean and kodo millet underwent series of processes, including soaking, sprouting, drying, dehulling, roasting, pulverizing and blending. Slurries ranging from 0 to 100 per cent were prepared and the protein drink powder with the most favorable formulation (60 % sprouted moth bean flour and 40 % sprouted kodo millet flour) was selected based on sensory evaluations. Various parameters of formulated protein drink powder such as bulk density, moisture content, water activity, protein, fat, fiber, ash and carbohydrate were determined, resulting in values of 0.416 g/mL, 5.16 %, 0.33, 17.15 %, 1.48 %, 5.12 %, 2.40 % and 62.76 %, respectively. The best-formulated protein drink powder was subjected to a spray-drying process with varying temperatures (140, 150 & 160 °C) and feed rates (9, 10 & 11 rpm). The optimized protein drink powder obtained from this process (temperature of 149 °C and feed rate of 10 rpm) resulted in 11.32 per cent of protein, 0.42 per cent of fat, 4.66 per cent of fiber, 2.59 per cent of ash and 70.56 per cent of carbohydrate. From 1000 mL of slurry, 120 g of protein drink powder was produced through spray drying. In daily routine, this product could serve as a healthy and refreshing alternative to coffee and tea.

Optimization of Process Protocol for Producing Extruded Products from White Ragi (*Eleusine coracana*)

R. NAGENDRA BABU AND G.V. MOHIT KUMAR

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

THE contemporary food industry is actively seeking food products that combine exceptional taste with a high nutritional value to meet the demands of consumers. By incorporating nutrient-dense ingredients into various food items, the industry aims to enhance the overall health and well-being of a significant portion of the population. The present study was carried out to develop cold extrudates from white ragi and wheat flour. Cold extruded products were developed by incorporation of white ragi flour and wheat flour at varying levels. The blend was cold extruded at optimized extrusion conditions and the resultant pasta products were assessed for their sensory and cooking characteristics. Pasta and vermicelli incorporated with composite blend (100 %) containing (60 %) parboiled white ragi flour and (40 %) wheat flour incorporation was found to have optimum cooking characteristics and more acceptance than other combinations. These products were packed in metalized polyester (90-120 µm) packaging material and kept at ambient conditions for three months storage studies. The quality parameters *i.e.*, moisture content, sensory evaluation and microbial analysis, free fatty acids, peroxide value were observed after every 15 days interval for a storage period of three months. Significant findings revealed that the quality parameters of cold extrudates were influenced by the duration of storage, suggesting that pasta and vermicelli maintained their acceptability for up to two months under ambient conditions without the need for preservatives.

Study of Milling and Biochemical Characters of Selected Paddy Varieties

SUNKARI ARCHANA AND V. PALANIMUTHU

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

STUDY was conducted to determine physical, physico-chemical and biochemical properties; milling and cooking characteristics of both raw and parboiled rice of 10 paddy varieties namely, *JAYA*, *THANU*, *KMP-220*, *BPT-5204*, *RNR-15048*, *BR-2655*, *JYOTHI*, *MTU-1001*, *RAKSHA* and *IR-64* that were released for cultivation in Karnataka. Paddy samples were parboiled by CFTRI method. For paddy varieties (raw), length was 7.51 to 8.26 mm; breadth was 2.26 to 2.87 mm; and the length and breadth of dehulled (brown) rice were respectively 5.33 to 7.07 mm and 1.69 to 2.35 mm. The L/B ratio of raw rice of tested varieties ranged from 2.68 to 3.51 and based on FCI classification, all fall under category Grade A (Fine). Peak gelatinization temperature (GT) of brown rice flours of different varieties ranged from 71.70 to 76.33!, elevated GT associated with higher amylose contents. For various paddy varieties (raw), milling yield was 76.11 to 79.84%; head-rice yield was 61.41 to 92.98% and broken were 7.01 to 38.58%. However, the head-rice yields of parboiled paddy were quite high (97.36 to 99.56%) due to increased kernel hardness. Varieties like *JAYA*, *KMP-220* and *IR-64* yielded elevated levels of broken when milled raw, suggesting necessity of parboiling pretreatment. Proximate analyses indicated slight variation in the composition of tested rice varieties. Gel consistency for *RAKSHA* and *RNR-15048* was 'soft'; *JYOTHI*, *BPT-5204*, *IR-64* and *THANU* exhibited 'medium'; and *JAYA*, *KMP-220*, *BR-2655* and *MTU-1001* showed 'hard'. Cooking studies indicated that cooking time of raw rice ranged from 21 to 26 minutes which increased to 24 to 29 minutes for parboiling rice. Solid loss during cooking was considerably higher for raw rice (2.73-3.26%) when compared to parboiled rice (0.56 to 1.78%). Swelling power of parboiled rice of different varieties ranged from 2.57 to 3.05 which was individually higher (2.38 to 2.96) than the corresponding raw rice.

Development of Processing Techniques for the Production of Wood Apple (*Feronia limonia*) Value Added Products

SAMPATH TEGGI AND BABU RM RAY

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

THE wood apple (*Feronia limonia*), a neglected fruit grown in dry, barren or wastelands, provides an opportunity for value addition due to its organic and nutritive properties. This investigation focused on the development of processing techniques for the production of wood apple-based value-added products. The study revealed that the fruit consists moisture (74.03 %), protein (3.40 %), ash (3.50 %), fiber (4.30 %), and carbohydrates (84.23 %). Wood apple drinks fresh RTS and carbonated drinks, were optimized and assessed for sensory acceptance. The RTS drink contained 12 °Brix TSS, (0.20 %) acidity, reducing sugar (9.00 %) and total sugar (14.00 %). Both drinks exhibited an increase in TSS and sugar levels during 90 day storage period, while ascorbic acid decreased. Refrigeration extended the shelf life and maintained acceptability. Additionally spray-dried wood apple juice powder, was produced under optimized conditions (155°C inlet air temperature, 5 % gum arabica and feed flow rate 9 ml/min). Proximate analysis revealed the presence of protein (1.73 %), fat (0.139 %), carbohydrate (89.69 %), fiber (0.15 %), and ash (3.24 %). The powder remained self-stable for over 90 days in metalized polyester pouches at ambient conditions. The sensory acceptability of powder declined from 8.20 to 6.80 over 90-day storage period. The microbial load was reported to be within the safe and permissible limits till the 90th day of storage. The study concluded that these neglected fruits can be processed into fresh RTS and carbonated drinks by adding natural colours. The spray-dried juice powder enhances its usability, minimizes fruit wastage, and makes it available throughout the year and commercially viable.

Development of Process Technology for Instant Blossom Coffee Powder

CHITRA MOHANTY AND C.T. RAMACHANDRA

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

COFFEE blossoms, often overlooked, are now gaining recognition for their potential health benefits and as a new food source. However, research in this area is limited. This study aimed to develop a process for producing Instant Blossom Coffee Powder using spray drying technology. The study was conducted with two main objectives of optimizing spray drying conditions at inlet and outlet air temperature of 120, 140, 160°C and 70, 80, 90°C, respectively and analyzing the quality parameters of instant blossom coffee powder. Overnight soaking of coffee blossoms with water (1:5 ratio) and pneumatic pressing (5MPa, 10 mins) was chosen as the extraction method. Whey protein concentrate (10%) was used as the carrier agent for spray drying. Reconstitution and flow properties such as solubility, dispersibility, wettability, Carr's index and Hausner's ratio; Biochemical properties such as moisture content, total polyphenols, antioxidant content, caffeine content, chlorogenic acid content; Physical properties such as water activity, color (L^* , a^* and b^*) and pH values were analyzed to determine the optimum conditions for the production of instant blossom coffee powder. Aromatic compounds were identified using E-nose technology which yielded in 54 aromatic compounds, temperature combination (Inlet temp. 140°C, Outlet temp. 80°C) had maximum identified aromatic compounds. Numerical optimization process was carried out using Response surface methodology and experiments were performed under randomized central composite design in Design Expert software. Optimized instant blossom coffee powder (Inlet temp. 145°C and Outlet temp. 71°C) showed desirable reconstitution, possible flow properties and high-quality biochemical properties (moisture content-5.11%, total polyphenols-116.56 mg GAE/100 g, antioxidant capacity-79.42%, caffeine-0.23%, chlorogenic acid content-0.32%). It was also analyzed for proximate composition (protein-46.07%, fats-0.12%, carbohydrates-47.21%, ash-4.95%, energy-374.20 kcal/100 g). The benefit cost ratio for the production of one kg instant blossom coffee powder was found to be 1.58:1.

Development of Process Technology for Production and Accelerated Storage Conditions of Instant Watermelon Sweetening Powder

G. NIKITA AND DRONACHARI MANVI

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

THE present study on production of instant watermelon sweetening powder (IWSP) was carried out using spray drying technology at different inlet air temperatures (IT-120, 130 and 140°C) and watermelon sweetener concentrations (TSS- 40, 50, 60 °Brix). Gum arabica was used as the carrier material for microencapsulation. Reconstitution and flow properties such as solubility, dispersibility, wettability, Carr's index and Hausner's ratio, biochemical and nutritional properties such as total sugars, antioxidant content, protein content, lycopene content, l-citrulline and moisture content and physical properties such as water activity, colour (L^* , a^* and b^*) values were analyzed to determine the optimum conditions for the production of IWSP. In order to analyze the particle shape of the powder, scanning electron microscope (SEM) was done. The optimized IWSP (TSS=49.9 °Brix, IT=132.23 °C) had desirable reconstitution, possible flow properties and high-quality biochemical properties (moisture content, 4.43 %; total sugars, 946.67 mg/g; lycopene, 26 µg/g; L-citrulline, 0.29 mg/g; antioxidants, 35.46 %RSA; protein, 0.791 %). Moisture sorption isotherms of IWSP was studied at temperatures (37, 50 and 60°C) and water activity (0.2 to 0.6) through static gravimetric method maintained at 90 % RH. The IWSP was packed in aluminum foil laminated pouches with water vapor permeability (K) of 8.2×10^{-6} , 7.4×10^{-8} and 3.9×10^{-7} kg/m²/day/Pa. Equilibrium moisture content of IWSP were 0.08, 0.078 and 0.076 (Kg water/Kg dry solids). GAB model was fitted to experimental data and isotherm curves showed type II sigmoid shape curves. Monolayer moisture content in the GAB model showed decreasing values (0.072, 0.0707 and 0.061 g/100g) at respective temperatures and 90 % RH. Shelf life was predicted on the basis of powder properties under accelerated storage conditions are 303.36, 59.44 and 9.13 days, respectively.

Storage Studies on Pulp of Tamarind Genotypes

B.M. SPANDANA AND M.S. SREEDEVI

Department of Processing and Food Engineering, College of Agricultural Engineering, UAS, GKVK, Bengaluru

TAMARIND (*Tamarindus indica* L.) is a versatile tropical fruit highly prized for its pulp, which is consumed both raw and processed as a spice. This study evaluated the physical, engineering, and biochemical properties of fruit, pulp and seeds of four tamarind genotypes: NFN-6, NFN-7, red tamarind and a local variety. The storage behaviour of deseeded tamarind pulp was also examined after being pre-treated with salt (10 %), ascorbic acid (5 %) and untreated sample. The pulp was packed in LDPE, MPP and PP packaging material and stored under refrigerated ($4 \pm 2^\circ\text{C}$) and sub-baric (650 Hg) conditions for four months. Key biochemical parameters such as moisture content, pH, total soluble solids (TSS), titratable acidity, total sugars, and colour were analyzed at monthly interval. The results revealed significant differences between the genotypes studied, NFN-7 exhibiting the highest pulp weight of 445.83 g/kg, NFN-6 and red tamarind demonstrating superior physical traits, such as geometric mean diameter and fruit length. Red tamarind recorded the highest TSS (17.77 °B) and sugar content (19.30 %), while NFN-7 had the highest protein (5.04 %) and fibre content (8.32 %). Storage conditions impacted moisture content, with refrigeration maintaining lower moisture levels (17.98 % after 120 days) compared to sub-baric storage (19.08 %). Ascorbic acid-treated pulp showed the best moisture retention and MPP packaging consistently recorded the lowest moisture levels. Sub-baric conditions resulted in higher pulp pH, while ascorbic acid pre-treatment helped to preserve the total TSS content. Refrigeration was more effective in maintaining titratable acidity (15.15 %), total sugars (14.09 %) and sensory quality. NFN-7 emerged as the top-performing genotype among most metrics. The ideal storage method for preserving tamarind pulp involves treating it with ascorbic acid, packaging in MPP pouch and storing in the refrigerated condition at 4°C.