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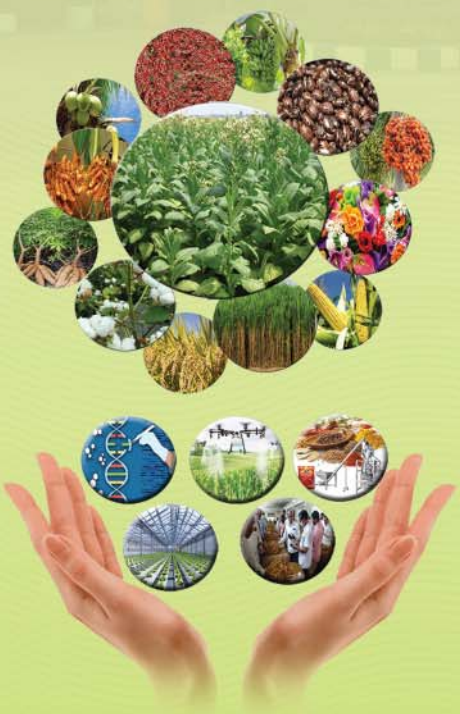
INTERNATIONAL CONFERENCE

Frontiers in Tobacco and Commercial Agriculture
Towards Preparedness for Future Farming

14-16 December, 2023

Venue: Adikavi Nannaya University, Rajahmundry

ABSTRACTS OF VOLUNTARY PAPERS



Organized by

INDIAN SOCIETY OF TOBACCO SCIENCE

and

ICAR-CENTRAL TOBACCO RESEARCH INSTITUTE

(ICAR-NATIONAL INSTITUTE FOR RESEARCH ON COMMERCIAL AGRICULTURE)

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ABSTRACTS OF VOLUNTARY PAPERS

International Conference on
Frontiers in Tobacco and Commercial Agriculture
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NTR Convention Centre,
Adikavi Nannayya University,
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RAJAHMUNDRY

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PROGRAMME

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05:30 PM – 06:30 PM	Panel Discussion on "**Invigorating Indian Tobacco as Global Giant: Problems and Prospects"**
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Student Hackathon on 14 December 2023 (Conference Hall)"**Reorientation of science &Technology for future farming"**

Chairman:	Dr. H Ravi Sankar
Co- Chairman:	Dr. J P Bindu
Convenor:	Dr. Hema B

Abstracts Session - I

- Exploring genetic resources for breeding and pre-breeding
- Classical and molecular breeding for accelerating genetic gains
- Exploiting new biology for enhancing intrinsic value of crops

ABS008: NBD 209: A PROMISING BIDI TOBACCO VARIETY FOR NORTHERN TRANSITION ZONE OF KARNATAKA

P. S. MATIWADE[1], C. D. SOREGAON[1], B. ARUNKUMAR[1], G. DANDIN[1], G. M. SAJJANAR[1], S. A. JAHAGIRDAR[1], P. S. TIPPANNAVAR[1], K. SARALA[2] AND M.SHESHU MADHAV[2].

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Bidi tobacco is an important commercial crop of Nipani area and known for its good quality. The crop is being grown both in rainfed and irrigated situations. Though it is an important commercial crop, tobacco growers are deprived of assured income because of lower/ fluctuating prices, higher cost of cultivation (especially aphid management) and erratic rainfall. Hence to sustain the economy of growers, enhancement of overall productivity and tolerance to aphids without compromising the quality could be an ideal approach. The quality of the produce is also an important feature for traders/ smokers acceptance and for better price security.

Under the current context of growers and traders/smokers requirement, varietal development programmes were undertaken at ARS, Nipani. NBD 209 was developed from hybridization of NPN73 X Anand-2 through pedigree method. The variety is suitable for both rainfed and irrigated conditions with better productivity potential of 16-22 q/ha and 25-35 q/ha respectively over popular check A-119. The quality of the produce is on par with popular check A-119 with additional advantage of aphid tolerance and moderate resistance to brown leaf spot. The physical and chemical quality parameters are also on par with A-119 with yellowish green, moderately sprangled leaves and chemical content (nicotine, reducing sugars and chloride). The variety was also found superior over recently released variety NBD 43 (Vedaganga-1) for both yield and quality parameters. The response to agronomic practices, especially for higher dose of nitrogen is also better like NBD-43. NBD 209 is characterized as tall (110-120 cm), erect habit, long internodal length (8-9cm), bigger leaf size (40-45 cm length and 15-20 cm breadth) thick grainy leaves with medium maturity (160-165 days) having loose inflorescence. The variety was identified for commercial cultivation in the region during 2016 and already it has occupied over 36% area, indicating its acceptability by the growers and traders in the region.

Key words: NBD 209, high yield, aphid tolerance, rainfed

ABS015: EVALUATION OF NEWLY DEVELOPED GENOTYPES FOR POTENTIAL SOURCE OF TOBACCO SEED OIL (TSO) AND YIELD ATTRIBUTING TRAITS IN BIDI TOBACCO (*NICOTIANA TABACUM* L.)

P. PULLI BAI *[1], K. SATHISH BABU[1], S. JAFFAR BASHA[1], S. RAMA DEVI[1], K. PRABHAKAR[1], K. SARALA[2] AND N.C.VENKATESWARLU[1]

[1]Regional Agricultural Research Station, Acharya N G Ranga Agricultural University, Nandyal- 518 502, Andhra Pradesh, India.
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Tobacco (*Nicotiana tabacum* L.) seed oil (TSO), a byproduct of tobacco leaf is a good substitute for diesel fuel in raw or chemically modified form. The oil content of the seed ranges from 36% to 41% of seed dry weight. In the present study the experiment was conducted with 8 genotypes ABD 132, ABD119, NyBD56, NBD290, NBD289, ABD146, A119 & Nandyal pogaku-1 in randomized block design from 2018-19 to 2020-21at Regional Agricultural Research Station, Nandyal with an objective to evaluate the newly developed genotypes for seed yield and yield attributes and to find out oil yield and quality of tobacco seed oil. Results showed that the entries ABD132 (2199 kg/ha), NBD290 (2150 kg/ha), ABD145 (2137 kg/ha) & NBD289 (2067 kg/ha) has recorded significantly higher cured leaf yield and chemical quality parameters nicotine % (1.81), reducing sugars % (1.40) & chlorides % (1.05) are within the permissible limit. Entries ABD 132 (745 kg/ha) & A119 (738 kg/ha) recorded higher seed yield and oil yield potential (234 kg/ha) & (235 kg/ha) respectively. ABD 132 has recorded maximum nicotine yield potential (62.01kg/ha). These genotypes can further be used in breeding programmes to increase the oil yield and to use the by-products.

Keywords: Genotypes, Tobacco seed oil, Seed yield, Cured leaf yield

ABS016: BIOLOGICAL AND MOLECULAR CHARACTERIZATION OF BEGOMOVIRUSES ASSOCIATED WITH TOBACCO LEAF CURL DISEASE BY SEQUENCING THE COMPLETE GENOME

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Tobacco leaf curl virus disease (TbLCVD) is an important viral disease in all the tobacco growing areas in Karnakata. The present investigations on biological and molecular characterization of the begomoviruses associated Tobacco leaf curl virus disease were carried out from 2016 to 2018. Biological characterization of begomoviruses associated with tobacco leaf curl disease of different isolates *via*., TbLCV-MYS, TbLCV-MAN, TbLCV-CHN, TbLCV-SHG, TbLCV-DVG and TbLCV-BEL were successfully transmitted to tobacco, tomato, chilli, datura, goat weed, sunflower, sesamum, and milkweed, whereas TbLCV-MAN and TbLCV-SHG isolates able to infect jatropha and cassava in addition to above plant species. The complete genome characterization of TbLCV-MYS, TbLCV-MAN, TbLCV-CHN, TbLCV-SHG, TbLCV-DVG and TbLCV-BEL isolates were performed by PCR amplification of the complete genome of the TbLCV by using three pairs of specific overlapping primers *viz*., GEMA, MK and OY. All the six TbLCVisolates, and positive control (*Tomato leaf curl virus*) yielded amplicons of 1.1 kb, 1.4 kb and 1.2 kb, characteristic for GEMA, MK and OY, respectively. The amplified products were cloned, sequenced and aligned to get complele DNA-A (~2.7 kb). The nBLAST analysis revealed thatTbLCV-MYS and TbLCV-DVG isolates shared maximum identity with *Tomato leaf curl Karnataka virus*. Similarly, TbLCV-CHN and TbLCV-BEL isolates shared maximum identity with *Tobacco leaf curl Yunnan virus* and *Tomato leaf curl Kerala virus*, respectively. The TbLCV-SHG and TbLCV-MAN isolates shared maximum sequence similarly of less than 87 per cent (less than the threshold) in nBLAST analysis indicated their distinctness from other isolates. Hence, they were renamed as *Tobacco leaf curl Shivamogga virus* (TbLCSV) and *Tobacco leaf curl Mandya virus* (TbLCMV). The phylogenetic analysis revealed that TbLCV-MYS and TbLCV-DVG isolates clustered with *Tomato leaf curl Karnataka virus.* Similarly, TbLCV-BEL isolate clustered with *Tomato leaf curl Kerala virus* and TbLCV-CHN isolate clustered with *Tobacco leaf curl Yunnan virus*, whereas TbLCV-SHG and TbLCV-MAN isolates clustered with the *Chilli leaf curl Multan virus* and *Sri Lankan cassava mosaic virus*, respectively.

Keywords: Tobacco, leaf curl, isolates, DNA-A, Karnataka

ABS017: "GABTH 2" A NEW HIGH YIELDING HYBRID OF *BIDI* TOBACCO

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GABTH 2 (BTH 318) is a high yielding *bidi* tobacco hybrid developed through heterosis breeding (GT 7 × GABT 11) at bidi Tobacco Research Station, Anand Agricultural University, Anand for *Bidi* tobacco farmers of Gujarat, surrounding area of Nipani (Karnataka) and Nandyal (Andhra Pradesh). It was tested in the name of BTH 318 in All India Coordinated Research Project on Tobacco, it consistently performed better in the research station as well as replicated yield trial and recorded 22.4 per cent higher yield over check MRGTH 1. In agronomical trials, it recorded 19.5 per cent higher leaf yield over MRGTH 1. In on-farm trials conducted for three years, the GABTH 2 recorded 18.2 per cent higher yield over check. GABTH 2 produces broad leaves, parrot green in colour with good spangling and puckering ability. GABTH 2 has 27 leaves per plant with leaf length of 55.56 cm, width 24.38 cm and thickness 12.9 mg/cm^2 as compared to its check MRGTH 1. By cultivating this hybrid, *bidi* tobacco farmers will raise a high yielding crop with efficient use of agricultural inputs thereby reducing production costs and increasing net return to the growers.

Key Words- GABTH 2, Hybrids, Bidi Tobacco and Yield

ABS022: ASSESSMENT OF GENETIC VARIABILITY FOR MORPHOLOGICAL CHARACTERS OF FCV TOBACCO (*NICOTIANA TABACUM L.*) GERMPLASM ACCESSIONS

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An experiment was carried out to study the genetic variability and heritability of characters of FCV tobacco during *kharif* 2022 at AINPT, Zonal Agricultural and Horticultural Research Station, Navile, Shivamogga with 28 accessions including checks in a Randomized Complete Block Design (RCBD) with two replications. Analysis of variance revealed significance of variability among the accessions for the characters studied *viz*., plant height, number of leaves, internodal length, green leaf yield per plant, cured leaf yield per plant, number of capsules per plant, capsule length, capsule width, individual capsule weight, total capsule weight per plant and seed yield per plant. Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the studied traits with the narrow difference between them indicating a lesser role of environment in expression of these traits. GCV ranged from 3.18 to 19.21 and PCV was from 4.76 to 22.04, moderate GCV and PCV was observed for the number of capsules per plant, individual capsule weight and total capsule weight per plant, while green leaf yield and cured leaf yield per plant recorded high PCV with moderate GCV. Heritability ranged from 19.26 to 79.53 and GAM ranged between 2.21 to 34.70. High heritability coupled with moderate to high genetic advance as percent of mean (GAM) was recorded for plant height, internodal length, number of capsules per plant, green leaf yield and cured leaf yield per plant. Indicating additive gene action is involved in the expression of these traits and hence simple selection programme will be helpful in further improvement of tobacco.

Keywords: GCV, PCV, GAM, heritability, tobacco

ABS025: MORPHOLOGICAL CHARACTERIZATION IN *PIKKA* TOBACCO

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AINP on Tobacco, CPR, Berhampur, Odisha

Tobacco is one of the important commercial crops of India. India is the third largest producer of tobacco after China and Brazil. Tobacco contributes significantly to the national exchequer through excise duty and foreign exchange earnings. Tobacco provides livelihood security to more than 45 million people in different sectors of society. The presence of genetic variability in the breeding material is the pre requisite for a successful breeding programme. However, variability is depleted rapidly due to use of limited parent material. The possibilities of appearance of transgressive segregants are more when the parents selected for hybridization are genetically more diverse. The present study was conducted to study the diversity pattern among twenty-two tobacco genotypes collected from AINPT Nandyal and Berhampur centresand to identify genotypically divergent parents for hybridization programme. Twenty two pikka tobacco genotypes were evaluated in *Kharif,* 2022 in a Randomised Block Design with three replications for 23 characters and 58 states. Each entry was planted in two rows of 5m length at a spacing of 75 x 50 cm. The crop was fertilized with $N:P_2O_5:K_2O$: @ 80:40:40 kg/ha. The observed twenty three characters were plant habit, topped plant height (cm), internodal length(cm), plant width(cm), stem colour, leaf colour, gummyness, stalk, leaf shape, leaf base, leaf surface, leaf margin, leaf tip, venation, midrib, leaf length, leaf width, days to flowering, inflorescence, flower colour, capsule shape, capsule length(cm) and capsule width(cm). It was observed that No variability was observed for inter nodal length, leaf stalk, capsule length and capsule width, and low variability for topped plant height, plant width, leaf length, days to flowering and flower colour. All other fourteen characters exhibited medium to high phenotypic variability.

Key Words: Tobacco, variability, morphological characterts

ABS033: LINEAR MIXED EFFECT MODEL AND MULTI-TRAIT GENOTYPE-IDEOTYPE DISTANCE INDEX (MGIDI) BASED SELECTION IN CHILLI (*CAPSICUM ANNUUM* L.) FOR YIELD AND STABILITY

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Chilli (*Capsicum annuum* L.) is a globally significant crop that is valued as both vegetable and spice. Its fruits are desired both in green form due to their varying levels of pungency and in ripened form due to their spiciness and peculiar colour. Fruits can be consumed raw, cooked with other vegetables to add taste and heat, dried and powdered, or used to make pastes, chutney, pickles, and sauces. Chilli fruits also contain oleoresin and capsaicin, which have numerous uses in beverage, pharmaceutical, and food industries. India is biggest producer, consumer and exporter of chillies in the world. During 2022-23, India produced 45.83 lakh tonnes of green chillies, cultivated across 4.33 lakh hectares, achieving a productivity of 10.58 t/ha. Similarly, India produced 20.6 lakh tonnes of dry/red chillies, grown on 8.50 lakh hectares, with productivity level of 2.42 t/ha. India exported 5.6 lakh tonnes of dry/red chillies valued at Rs. 10444 crores during 2022-23. Sustainable chilli production is required to meet domestic consumption as well export demands. Development of high yielding and stable genotypes is a major focus of chilli improvement programmes worldwide. Multi-environmental trial (MET) provides plant breeders the chance to assess a genotype's adaptability to a particular environment as well as its stability over a range of sites. Linear mixed effect models are more accurate in predicting performance as well as adaptation of genotypes in MET experiments. Fifteen accessions of chilli (10 advanced homozygous lines, 4 released varieties and 1 hybrid check) were evaluated in Randomized Complete Block Design for five consecutive years (2018-2022). Observations were recorded for 6 key yield traits *viz.* fruit length (FL), fruit width (FW), number of fruits per Plant (NF), ten fruit weight (WF), plant height (PH) and yield per hectare in quintals (YP). Pooled analysis of variance revealed significant GXE interactions for all the traits highlighting importance of MET analysis procedure. Kashi Abha followed by Kashi Gaurav, VRC-14 and IIVRC-18253 were highest yielder and year 2022 was superior environment as observed by mean performance across environments. For YP, Kashi Abha followed by Kashi Gaurav and VRC-14 exhibited the highest BLUP

(Best Linear Unbiased Prediction) index, respectively. Kashi Gaurav also ranked first for BLUP score of FL and FW. Multi-trait-stability-index (MTSI) based on stability only, identified IIVRC-19009 and Kashi Anmol as ideal genotypes whereas MTSI based on both mean performance and stability selected IIVRC-18253 and Kashi Gaurav as best genotypes. MGIDI is used to rank genotypes based on multiple traits and Kashi Gaurav followed by IIVRC-18253 and Kashi Abha were identified as the best genotypes as these genotypes had lowest MGIDI score. In the present study, different genotype ranking evaluation procedures, MTSI, MGIDI, FAI-BLUP and Smith Hazel Index co-selected three ideal genotypes (Kashi Abha, IIVRC-18253 and Kashi Gaurav). These identified genotypes will be utilized in chilli breeding pogramme for developing high yielding and stable varieties/ hybrids in future. MGIDI outperformed the other three techniques, making it a perfect tool for genotype selection based on multiple traits.

Key Words: BLUP, Chilli, LMM, MGIDI, Stability

ABS041: CHARACTERIZATION OF CHEWING TOBACCO (*NICOTIANA TABACUM* L.) GERMPLASM USING DUS DESCRIPTOR

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Chewing tobacco is one of the most commercially important crops of Tamil Nadu being cultivated in an about 13000 ha. In the last 75 years, 10 high yielding varieties and one hybrid have been released and pure seeds are being supplied to the farmers. For development of such varieties, genetically pure and well characterised germplasm are essentially needed and that can be ascertained through characterisation as per DUS (Distinctness, Uniform and Stable) guidelines. Hence, field experiments were carried out to study the DUS characterization of 85 chewing tobacco germplasm at ICAR-CTRI Research Station, Vedasandur, Tamil Nadu, India for two years, 2021-2022 and 2022-2023. As per the DUS guidelines of FCV tobacco, 36 DUS descriptors were recorded besides eight quantitative traits (number of leaves, leaf dry weight, stem girth, stem dry weight, root dry weight, number of inflorescences, number of capsules and seed dry weight). For most of the DUS characters, considerable variability was observed (except fruit shape, where all germplasms had ovate shape). For plant height, number of leaves, and number of economic leaves, all genotypes fall into moderate classes and no genotypes with extreme values were found. For flower traits like expression of tip of corolla, size of corolla, swelling of tube, diameter of flower, and inflorescence compactness, accessions with lower values were not found. Similarly, for development of stem, colour of corolla, 50% flowering, width of blade, leaf tip, leaf blade shape, and colour of main stem, the accessions with extreme values were not there. Germplasm with these missing traits should be developed or augmented from different sources. For the number of economic leaves per plant, 79 were grouped into few (11-20) and 5 into medium (21-30) and one accession (into many (31-40) and there was no accession in the very many (>40) and very few (<10 leaves) catogory. The diversity analysis based on eight quantitative traits, grouped 85 accessions into five clusters with 3,1,11,14 and 29 germplasms accessions, respectively. Accession number V 109 (Maryland Banincosa) was grouped as single cluster and three accessions V3 (Varipatty, V136 (TI 163) and V 139 (HV 2009-3) were the same cluster and there were distinctly different from other accessions. In conclusion, considerable variation was observed among the chewing tobacco germplasm for most of the DUS descriptors and biometrical traits can effectively utilised for the future improvement beside to safeguard the IPR issues and efforts should be made to augment the germplasm with desirable traits that are missing in the present collections.

Keywords- Chewing tobacco, germplasm, DUS descriptors, variability, IPR, diversity.

ABS046: TOWARDS THE DEVELOPMENT OF SAFER TOBACCO THROUGH GENOME EDITING

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Tobacco Specific Nitrosamines (TSNAs) are the nitrosated products of tobacco alkaloids and are considered to be the most important carcinogens in tobacco products. Among the various TSNAs, N-nitrosonornicotine (NNN) and 4-(methyl nitrosamino)-1-(3-pyridyl)-1-butanone (NNK) derived from Nornicoitne are more hazardous with proven carcinogenicity. The global regulations on tobacco exports are getting stringent with respect to the TSNA content in tobacco products. TSNA accumulation was found to be relatively more in burley tobacco compared to other tobacco types. In burley, nicotine is converted into nornicotine by demeyhlase enzyme encoded by *CYP* gene family leading to the accumulation of undesirable TSNAs. Although, three members of the *CYP82E* family encoding nicotine N-demethylase (NND) have been reported to be responsible for the nicotine demethylation, major emphasis was on *CYP82E4*. In the previous studies by different research groups, chemical mutagenesis and transgenic approaches to regulate *CYP82E* genes suffered with the issues associated with the transgenics and yield penalties. Hence, an attempt was made to address the issue of TSNA in burley tobacco.

Initially, a biochemical method was standardized for identification of low converter (LC) burley tobacco plants in a population. Using this method, low converter lines were identified in the burley cultivar, Banket A1 population and multiplied. It acts as a transient measure as LC plants in next generations are going to revert back. Further, in the expression analysis, the transcript accumulation of *CYP82E4* was found to be more in mature leaves than young leaves. *Insilico* expression of CYP genes in *N. attenuata*data hub indicated differential expression of selected genes. Analysis of the sequenced genome for detection of copy number revealed that there are two copies of CYP82E4 with 95% and 93% sequence similarity on Chromosome 9. A similar analysis with other CYP genes viz., *CYP82E5* and *CYP82E10* indicatedthat*CYP82E5* has two copies and *CYP82E10* has single copy on chromosome 9.

Inorder to precisely edit the CYP82E gene involved in the TSNA formation with minimal effect on other traits, CRISPR/Cas9 tools were exploited. Guide RNA targeting the *CYP82E4* was designed and the off-target analysis was carried out and found that they have minimal off targets with in the acceptable range. The gRNA was synthesized and cloned in the binary vector pKSE401 for transformation of the popular burley cultivar. The obtained transformants will be thoroughly screened for edited *CYP82E4* gene and subsequently nornicotine conversion to identify and develop the stable genome edited lines with reduced TSNAs.

Key words: TSNA, Nornicotine, Low Converters

ABS047: BREEDING EFFORTS TOWARDS CULTIVAR DIVERSIFICATION FOR ENHANCED PRODUCTIVITY AND PROFITABILITY OF FCV TOBACCO UNDER KARNATAKA LIGHT SOILS (KLS).

C. NANDA[1], P. NAGESH[1], S. RAMAKRISHNAN[1], K. SARALA[2] AND M. SHESHU MADHAV[2]

[1]ICAR CTRI RS Hunsur, [2]ICAR CTRI Rajahmundry

The productivity of FCV tobacco under KLS region is low owing to various reasons including low genetic potential of existing cultivars. Only three cultivars occupy the entire KLS region of which, Kanchan and CH3 occupies more than 95 percent of tobacco cultivated area. Such acreage domination by very few cultivars is not ideal for sustainable tobacco cultivation in the long run. Therefore, cultivar diversification with newer high yielding varieties is a key to increase profitability. In this direction pedigree and heterosis breeding were used in the development of four high yielding superior lines/ hybrids such as FCH 248, FCH 246, KLSH 26 and KLSH 27. The performance of these lines/hybrids in station replicated yield trials as well as in multi-location trials of AINPT was superior to checks. The elite advanced breeding lines FCH 248 and FC 246 exhibited higher cured leaf yield and bright leaf yield with 15-22% and 16-32% increment respectively over better checks. FCH248 proved its promise and was very well received by the farmers in two years on farm trials. The CMS based hybrids KLSH 26 and KLSH 27 were proved to be promising to show 11-21% increase in cured leaf and 14-34% increase in bright leaf yield over the popular hybrid check CH 3. These lines/hybrids have desirable cured leaf characters such good body, leaf colour, spotting, pliability as well as optimum leaf maturity. Leaf chemistry of these lines/hybrids in terms of nicotine (%), reducing sugars and chloride content (%) were within the acceptable limits preferred by the trade. These lines/hybrids are the potential cultivars for enhancing productivity and profitability.

Key words: Breeding, KLS, FCV tobacco, Cultivars, Enhanced Productivity

ABS048: INFLUENCE OF MALE STERILE CYTOPLASM ON YIELD AND YIELD RELATED TRAITS IN FCV TOBACCO

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Male sterility in plants is determined solely either by cytoplasm or nuclear genes or its interaction with nuclear genes. Cytoplasm Male sterility (CMS) determined by cytoplasm is called cytoplamic male sterility. In tobacco, CMS can be directly deployed without the use of restorers for fertility restoration, as leaf is of economic part. Efforts were made to transfer CMS into the genetic background of popular varieties such as Kanchan and FCH 222. Two CMS lines one each in Kanchan and FCH 222 background were crossed with two male parents to generate four CMS hybrids and their corresponding fertile hybrids were also made using their respective maintainer lines. These eight hybrids were evaluated in a replicated trial over two years to ascertain the influence of CMS on yield and yield related traits. Observations on morphological and yield traits were recorded on five random plants and mean values were used to test the significance of differences using student t test. Results revealed that there were no significant differences among the hybrids for most of the traits studied except for plant height, 7th leaf length and green leaf yield, indicating that sterile cytoplasm had no negative impact on major yield and yield attributing traits and thus can be used in commercial hybrid production.

Key words: CMS, student t -test, fertile hybrids, yield and related traits

ABS051: COMBINING ABILITY ANALYSIS FOR CURED LEAF YIELD AND ITS COMPONENT TRAITS INHOOKAH TOBACCO (*NICOTIANA RUSTICA L.*)

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The present investigation was conducted at tobacco research station Araul, C.S. Azad University of Agriculture & Technology, Kanpur (U.P.) during Rabi 2020-2. The experimental material consisted of eight hookah tobacco (*Nicotiana rusctica L.*) inbrede lines (Azad Kanchan, SK-417, ArR-27, Patyali, Kalibonia, AR-119, SR-35 and LR-58). Combining ability studies were made comprising a half diallel set of eight parents and their 28 hybrids. Ten important attributes *viz;* cured leaf yield per plant (g), days to 50% flowering, number of leaves per plant, plant height (cm), leaf length(cm), leaf width (cm), leaf thickness (mg/cm2), days to maturity, nicotine content (%) and total reducing sugar content (%) were studied. The combining ability analysis exhibited highly significant gca and sca effects for almost all the traits. The magnitude of combining ability variances suggested the prime role of additive gene action for the inheritance of cured leaf yield, days to flowering, a number of leaves per plant, plant height, and leaf thickness whereas, the preponderance of non-additive gene action for leaf width, days to maturity, nicotine content and total reducing Sugar- Parents ArR-27, Azad Kanchan and Patyali were identified as a good general combiner for cured leaf yield while LR-58, ArR-119 and SK-417 were good combiners for earliness. Best cross based on per se Performance for cured leaf yield was ArR-27 x Patiyali followed by AR-119x Kalibonia, Azad Kanchan x LR-58, Azad Kanchan x SR-35 & ArR-27 x Azad Kanchan respectively, also having significant estimates for at least two important yield contributing traits.

ABS058: GENOME-WIDE IDENTIFICATION AND CHARACTERIZATION OF THE FHY3/FAR1 GENE FAMILY AND EXPRESSION ANALYSIS UNDER SALINITY STRESS IN *NICOTIANATOBACCO*

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Understanding the molecular mechanisms underlying plant responses to environmental stressors is crucial for developing resilient crops. In this study, we conducted a comprehensive genome-wide analysis to identify and characterize the FHY3/FAR1 gene family in Nicotiana tobacco, with a focus on their expression patterns under salinity stress. The FHY3/FAR1 gene family plays a pivotal role in various developmental processes and stress responses in plants. Through a systematic bioinformatics approach, we identified and annotated all members of the FHY3/FAR1 gene family in the Nicotiana tobacco genome. Subsequently, we performed a detailed characterization of these genes, including phylogenetic analysis, gene structure examination, and conserved motif identification. This comprehensive analysis provided valuable insights into the evolutionary relationships and structural diversity within theFHY3/FAR1 gene family in Tobacco. To investigate the potential involvement of FHY3/FAR1 genes in salinity stress responses, we conducted expression analysis under saline conditions. Tobacco plants were subjected to varying levels of salinity stress, and the expression patterns of FHY3/FAR1 genes were assessed using quantitative real-time polymerase chain reaction (qRT-PCR). Our results revealed dynamic changes in the expression of specific FHY3/FAR1 genes in response to salinity stress, suggesting their putative roles in the adaptive mechanisms employed by Nicotiana tobacco under adverse environmental conditions. Furthermore, we explored the regulatory networks associated with FHY3/FAR1 genes under salinity stress by identifying potential cis-regulatory elements in their promoter regions. Thus, the analysis uncovered the presence of stress-responsive elements, providing insights into the transcriptional regulation of FHY3/FAR1 genes in response to salinity stress.

Keywords: FHY3/FAR1 gene family, Genome-wide analysis, Salinity stress, Expression analysis.

ABS070: IDENTIFICATION OF MORPHOLOGICAL, PHYSIOLOGICAL AND BIOCHEMICAL TRAITS ASSOCIATED WITH WATERLOGGING STRESS TOLERANCE IN TOBACCO

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Tobacco is an important commercial crop grown in India. In recent times, tobacco crops grown in southern Andhra Pradesh faced series of cyclonic rains leading to waterlogging on one hand and prolonged droughts coupled with high temperatures on the other. There is a possibility of floods and droughts or uneven and untimely rains occurring in future too because of climate change. These changes are causing and will cause productivity loss and quality deterioration in tobacco crops. Though tobacco is known to withstand water deficit condition to an extent, it is very sensitive to stress caused by water congestion (waterlogging) even for short periods. In this context, an attempt was made to assess the response of different tobacco types to abiotic stress induced by waterlogging under field conditions. An experiment was conducted to evaluate the response of 84 released varieties representing different tobacco types (33 FCV, 11 Burley, 22 Bidi, 11 Chewing, Cherroot, Cigar, Hookah) to waterlogging stress imposed at 60 days after transplanting. Based on visual observations (leaf chlorosis and drooping) and number of leaves turning completely yellow, the genotypes were categorized as relatively tolerant and relatively susceptible. Of the 84 varieties evaluated, Virginia gold, CTRI Spl, Hema (FCV tobacco), Banket A-1 (Burley), GT-8, Anand (Bidi) Bhagyalakshmi, Jatipodali (chewing) were identified as tolerant lines, while Gauthami, Swarna, Ratna (FCV tobacco), Burley-21 (Burley), GT-5, Bhagyasree (Bidi), Meenakshi-CR, GC-1 (Chewing) fallen into category of susceptible varieties. Morphological physiological and biochemical characteristics recorded for both tolerant and susceptible varieties revealed further that the leaf chlorosis, internodal length, specific leaf weight, root shoot ratio, Chlorophyll a/b, nitrogen uptake and activity of anti-oxidative enzymes are the key traits that impart tolerance to waterlogging stress in tobacco. Findings of our study suggest the need for considering identified traits in future tobacco breeding programs intended to develop waterlogging-tolerant varieties.

Key words: Tobacco, varieties, waterlogging stress, tolerant, susceptible

ABS072: GENETIC RESOURCES OF GINGER AND TURMERIC IN NORTHEASTERN INDIA: A POTENTIAL SOURCES FOR FOOD, PHARMACEUTICALS AND COSMETIC INDUSTRIES

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Ginger and turmeric are the two most important commercial crops in the northeastern India. The area and production of ginger and turmeric at the national level are 0.176 and 0.291 million ha and 1.89 and 1.06 million metric tonnes, respectively. The region contributes 26.86% and 8.34% of the total production of ginger and turmeric in the country, respectively. Oleoresin and curcumin are the most valued products of ginger and turmeric for the food and cosmetic industries. The region is known for the diverse genetic resources of the commercially cultivated and related species of ginger and turmeric, viz., black and aromatic ginger, mango ginger, black turmeric, etc., for their economic values. The key compounds responsible for the medicinal properties are gingerol and curcumin in ginger and turmeric, respectively. The varieties rich in curcumin and oleoresin content are getting higher market prices. To identify the superior genotypes, 112 genotypes of ginger and 130 genotypes, including improved cultivars, were evaluated for yield and quality traits. The wider variability was observed for different yield and quality traits. In ginger, the plant height ranges from 41.80 cm to 75.80 cm, the number of tillers from 2.0 to 3.2, and the stem diameter from 0.52 to 0.90 cm. Oleoresin content varied from 3.03 to 7.76%; crude fibre: 3.86 to 6.14%; dry matter: 16.80 to 24.50%; and essential oil content: 1.0–2.90%. The high-yielding accessions were identified as IC-584363 (450 g/plant), followed by ACC-391 (416.7 g), Vighinharta (400.0 g), and RCGC-8 (383.3g). The highest oleoresin content was observed in RCGC-17 (6.74%), followed by RCGC-20 and Acc-22 (6.72% each). Similarly, in turmeric, the plant height ranges from 94.6–114.5 cm, yields 183.3–616.6 g/plant, dry matter 18.2-23.2%, and curcumin 4.7–7.6%. The high-yielding genotypes were identified as IC-586774 (616.6 g), IC-586777 (600.0 g), and BSR-1 (516 g). Similarly, curcumin-rich genotypes were Lakadong (7.6%) and Megha Turmeric-1 (6.8%).

Keywords: Genetic diversity, ginger, turmeric, oleoresin, curcumin

ABS073: PIVOTAL ROLE OF AINPT IN ENHANCING THE YIELD GAINS IN INDIAN FCV TOBACCO

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All India Coordinated Research Project on Tobacco (AICRP) was initiated to cater the location specific needs of different tobacco types in the year 1970-71 with a mandate of tobacco improvement through coordinated, multi-disciplinary and multi-location research on different tobacco types (Flue Cured Virginia (FCV), Burley, *Bidi*, *Natu*/*Pikka*, Chewing, *Rustica etc.*) and was later renamed as All India Network Project on Tobacco (AINPT). AINPT evaluates the advanced breeding lines through multi-location trials and assists in release of superior entries for commercial cultivation.

FCV tobacco is a commercial tobacco type with a high export potential. It is cultivated in an area of 1.39 lakh hectares mainly in the states of Andhra Pradesh and Karnataka, with a production of around 212 million kg during 2023. It accounts for 30% of total production and 80% of overall tobacco exports in the country. FCV advanced breeding lines contributed by different Scientists are being evaluated at six AINPT centres*viz*., Rajahmundry, Guntur, Jeelugumilli, Kandukur in Andhra Pradesh, Hunsur and Shivamogga in Karnataka since 1972-73 for their commercial release. In order to estimate the yield gains due to FCV tobacco breeding, an attempt has been made to evaluate the year wise number of FCV entries tested under AINPT, their yield improvement over the years, region wise varieties released through AINPT and their impact on improving the FCV yields in India. A total of 521 FCV entries were tested with a minimum of 3 (1974-75) and a maximum of 35 entries (2019-20, 2020-21 and 2021-22) being tested every year. The yields of tobacco entries tested were low during 1972-73 in different FCV centres. However, a gradual increase was observed at these centres over the years. The potential yields in Rajahmundry centre, as observed from the yields of best entries, found to improve from 1,300 kg/ha to 3,000 kg/ha, Kandukur from 1,365 kg/ha to 2,200 kg/ha, Guntur from 800 kg/ha to 3000 kg/ha, Jeelugumilli from 1,700 kg/ha to 3,300 kg/ha, Hunsur and Shivamogga regions from 1,100 kg/ha to 3,000 kg/ha. The rate of improvement in the cured leaf yields at Rajahmundry centre is 23 kg/ha/year, Jeelugumilli is 15 kg/ha/year, Guntur is 50 kg/ha/year, Kandukur is 36 kg/ha/year, Hunsur is 25 kg/ha/year and Shivamogga is 21 kg/ha/year. Thirty three superior entries

identified in the AINPT trials were released as commercial varieties with their associated agronomy. During the period under study, though the total FCV area being cultivated decreased from 1.69 lakh ha in 1972-73 to 1.38 lakh ha in 2021-22, the production found to increase from 120.1 M. kg in 1972-73 to 189.1 M. kg in 2021-22 and productivity from 710 kg/ha in 1972-73 to 1369 kg/ha in 2021-22. These improvements in yield show the progressive impact of released varieties along with associated good agricultural practices. Phenomenal improvement in yield in various zones of FCV indicates the significant progress in tobacco breeding efforts in India. Thus, in a way, AINPT is instrumental in enhancing the Indian economy by acting as a platform to release improved varieties and other associated technologies.

Keywords: Yield, tobacco, FCV, gains, AINPT

ABS074: BRIDGING THE DEMAND GAP WITH IMPROVED BURLEY TOBACCO BREEDING LINES

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Burley tobacco is air-cured light tobacco used primarily for blending during cigarette manufacturing. India produces around 45 m kg burley in an area of around 20,000 ha. In the recent years, there is an abnormal increase in burley and HDBRG tobacco exports levels in India in contrast to the declining trend in the world. The estimated requirement of Indian burley tobacco may cross 60 M kg with a revenue projection of 600 crores. Burley is mainly cultivated in Andhra Pradesh and the cropped area of burley shifted from Yeleswaram area to Vinukonda. Banket A1 is the burley variety released during 1994 is the only recommended variety grown in this area. Currently, there is a demand for high nicotine (>3%) burley in the international market. In view of the increased demand for burley tobacco for exports and lack of improved varieties, breeding for burley varieties has been undertaken. Evaluation results of advanced breeding lines are presented in the paper.

In a bulk trial conducted with eight lines (Banket A-1, YB-4, YB-19 and YB-22) during 2016-19, two entries, YB-19 and YB-22 with > 2300 kg/ha leaf yield were proved to be superior in terms of morphological and yield characters. However, in the on-farm trials conducted at Vinukonda area (2018-20), YB-22 demonstrated its promise with 12% mean increase in cured leaf yield (2640 kg/ha) over Banket A1. Farmers expressed positive opinion in terms of leaf yield, establishment and net returns. In the bulk trials conducted for four years (2016-20), YB-22 recorded 12% increase in cured leaf yield (2116 kg/ha) than Banket A-1 (control). With this proven superiority, the entry, YB-22 was recommended for release to burley areas of Andhra Pradesh during 2023 in the name of Vijetha. This variety has high yield potential (2900 kg/ha), possess TMV resistant and has the ability to contain higher nicotine than Banket A1.

In a replicated trail conducted with 12 elite breeding lines along with checks, Banket A1, and Burley-21 during 2016-18, the entries YB-27, YB28, YB-29 and YB-31 exhibited superior yields (2260-2540 kg/ha). In another trial, out of eight advanced burley breeding lines (YB-36 to YB-43) assessed during 2019-2022, YB-41, YB-38, YB-37, YB-42 and YB-43 recorded significantly higher

(13-30%) cured leaf (1745-2008 kg/ha), in the order of merit, than control, Banket- A1. YB-37 recorded highest leaf number (36), leaf length (63 cm) and leaf width (34 cm). The line, YB-37 recorded 13% and 19% higher yields than Banket A1 in bulk (3532 kg/ha) and on-farm (3934 kg/ha) trials. Further, to generate variability, the promising tobacco lines viz., Banket A1 and YB-22 were irradiated with various doses (300 Gy, 400 Gy and 500 Gy) of 10 MeV electron beam during 2019-20. Among the 18 M_3 generation selections of these lines evaluated under field condition during 2021-22, three Banket A1 and three YB-22 mutants were found morphologically superior.

The progress made in the burley breeding in recent times is satisfactory and further, renewed emphasis is being given for breeding improved burley genotypes in collaboration with industry partners.

Keywords: breeding, tobacco, burley, varieties

ABS075: TACKLING THE PERSISTENT PROBLEM OF *OROBANCHE*IN TOBACCO THROUGH PRE-BREEDING

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Tobacco is an important commercial crop in India. *Orobanchecernua* (broomrape), a total root parasite is causing considerable yield losses to tobacco crop cultivated in India. Even though it is a historical parasite, *Orobanche* incidence in tobacco is consistently increasing in last few years resulting in the loss of yield and leaf quality. *Orobanche*incidence in tobacco leads to the crop losses of 20 - 50% depending on the time of parasite attack and soil moisture content.

None of the crop management practices suggested is effective in controlling *Orobanche*. Hence, use of resistant or tolerant varieties may be an effective approach for addressing the broomrape problem. However, none of the tobacco varieties released till date in India are resistant to *Orobanche*. Even *Orobanche* resistance was not observed in any of the germplasm lines belonging to cultivated tobacco types. Pre breeding is a conventional tool in redesigning the cultivated gene pool with wild genes. The pre-bred *Nicotiana* hybrid derivative, *Nicotiana umbratica-nesophylla,* for the first time, identified as a resistant source to *Orobanche* by our group. In order to transfer the resistance into cultivated tobacco and to identify candidate genes/regions Orobanche resistance through molecular tools, a susceptible *N. tabacum* cv. CTRI Naveena (FCJ-11) was crossed with *Nicotiana umbratica-nesophylla*. Thus, a series of populations viz., F• , Reciprocal F• , F, , BC, and BC• were developed to understand the mechanism of resistance. The F_1found to be susceptible to *Orobanche*, indicating recessive nature of the *Orobanche*. Further, Segregation was observed for *Orobanche* resistance in F_2 population of FCJ-11 x N. umbratical-nesophylla cross. Selfed seed collected from identified resistant plants. In an attempt to fasten the approach, the developed populations are being utilised to develop markers, identification of candidate genes/regions for *Orobanche* resistance in tobacco and transfer of *Orobanche* resistance to CTRI Naveena.

Keywords: pre-breeding, tobacco, *Orobanche*, resistance

ABS076: EXPLOITATION OF SOMACLONAL VARIATION FOR FCV TOBACCO VARIETAL DEVELOPMENT

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Flue-cured Virginia (FCV) tobacco is an export-oriented tobacco type grown for cigarette manufacturing. Various classical breeding strategies were utilized to breed FCV varieties since 1947 in India. In addition, modern breeding methods such as exploitation of soma clonal variation was utilized at ICAR-CTRI, Rajahmundry for varietal development. Soma clonal variation is the genetic variation created among progeny plants obtained after somatic tissue culture in vitro.

To develop promising lines, leaf curl virus infected VT-1158 and Kanchan varieties were used for creation of soma clonal variation under tissue culture during 2000. Virus pressure in the leaf tissue was assumed to increase the chance of occurrence of mutations in the infected cells. Regeneration of shoots from such cells may result in isolation of commercially useful clones. In order to exploit such mutations, shoots were regenerated from leaf curl infected VT-1158 and Kanchan explants and soma clones thus developed were characterized. A large number ofsoma clones could be generated from the VT-1158 explants whereas very few explants were regenerated from Kanchan. All the clones were systematically screened for yield, quality and chemical characteristics. Though morphological variation observed for leaf and plant characters in VT-1158 soma clones, only three clones viz., VLCR-12-15-14-5, VLCR-25-12 and VTCMV-1-15-14 found promising for yield and quality after the due evaluation and were contributed to All India Network Project on Tobacco (AINPT) for evaluation. Seventeen promising Kanchan soma clones viz., NLCR-5, NLCR-7 (K), NLCR-10, NLCR, NLCR-4, NLCR 7, NM, NLCR-1-11-10, NLCR-4-7-15, NLCR-6-10, NLCR-8-2-2, NLCR-1-9-2-13, NLCR-BT2-P9, NLCR-9-2, NLCR-7-11-1-4, NLCR-BT1-P2 and NLCR-1-11 identified to be promising in the trials were contributed to AINPT. The majority of the contributed lines are being used by the breeders as parents in their breeding programs. The line, NLCR-7 (K) evaluated under the codes Tobios-6 in AINPT trials found promising in the light soils of Andhra Pradesh (irrigated) and Karnataka in all the pre-release trials. Another entry, NLCR-6-10 evaluated under the code FCJ-11 found promising in the irrigated light soils of Andhra Pradesh and released in the name of CTRI Naveena to the Northern Light Soils (NLS) of AP. CTRI Naveena has a yield potential of more than 3300 kg/ha under irrigated conditions of NLS, ~ 3 kg higher partial factor productivity for nitrogen fertilizer and Withstand rain damage to certain extent during crop growth. FCJ 11 can even yield up to 3900 kg/ha under favorable conditions. Thus, soma clonal variation played a substantial role in the FCV varietal development in India.

Keywords: Tobacco, Somaclone, Variation, Varieties

ABS077:IDENTIFICATION OF SINGLE COPY SSR MARKERS OF *NICOTIANA TABACUM*FOR ACCELERATING GENETIC GAINS IN TOBACCO

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Common tobacco (Nicotiana tabacum) is one of the most widely cultivated non-food commercial crops worldwide and stands out as a complex allotetraploid with a large 4.5 Gb genome. In recent times molecular markers became handy tools for developing breeding lines and crop varieties in view of their precision in selection. Among the different markers, Simple Sequence Repeat (SSR)markers are playing a key role because of their reproducibility and easy availability. In the endeavor of identification of SSRs in tobacco, various groups identified more than 8000 SSR's, and assigned them to 24 genetic linkage groups. Several of these SSRs are having multi loci and have many copies. To identify the single copy SSRs, in the present study, the genomic resources of tobacco available at Solgenome networks were exploited utilizing the bioinformatic tools. The sequenced genome of K326 was used as a reference sequence for all the sequence alignment studies of SSRs. The published SSR sequences by the different groups were pooled and searched against the reference genome and coupled with manual curation based on the number of hits and sequence similarity, chromosome specific SSRs with unique loci were retrieved. A total of 965 SSR markers have single hits were physically mapped to the 24 linkage groups of tobacco. The distribution of single copy SSRs ranged from 12-101 per chromosome. Thus, the identified and physically mapped markers are the best genomic resources which can be effectively used in mapping and tagging the several traits of commercial importance in tobacco and provide the acceleration in the development of climate smart/ designer varieties of tobacco.

Keywords: tobacco, SSR, markers, single copy, linkage groups, mapping

ABS078: BREEDING FCV VARIETIES SUITABLE TO IRRIGATED ALFISOLSOF ANDHRA PRADESH

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The tobacco grown in Northern Light Soils (NLS) is of neutral character and blends well with any tobacco. It is considered as flavourful to semi-flavourful tobacco with excellent ageing properties. The efforts made in the direction of breeding tobacco varieties suitable to NLS of Andhra Pradesh in the recent years at ICAR-CTRI, Jeelugumilli are given in this paper.

Thesomaclone, FCJ-11 that showed promise in station trials, bulk and on-trials were released in the name of CTRI Naveena to the northern light soils of Andhra Pradesh in 2023. CTRI Naveena has a yield potential of 3300 kg/ha. The entries SJ-7, TBS 107, NLCR-1-11 are being evaluated in the AINPT trials. In seven replicated yield trials conducted in the recent years, thirteen entries viz., RT-113-2, RT-54-1, RT- 121-1, RT137-2, RT143-2, RT-25-1, RT-118- 1, RT-53-7, RT-83-1, RT-16-3, RT-20-1, SJ 7 and NLCR- 1- 11 were found promising. Out of 10 entries evaluated during 2022-23, the entries SJ-11, SJ-14, SJ-15 and SJ-16 gave significantly higher cured leaf yields (2977 kg/ha - 3201 kg/ha) than the best control. In the row trial conducted along with 27 F5s, 26 F4s and 26 M4 generation entries, 20 promising entries were identified based on the morphological traits. Around 108 breeding lines are being maintained for further use in breeding programs. In addition to these, seventy-three F_3 families and 150 F_2 segregants identified from various populations are also being studied. Among the 18 F_1 raised, seven appear to be promising. Continuous efforts for developing breeding materials indicating higher yield as well as for quality is the priority.

Keywords: breeding, tobacco, NLS, somaclone

ABS079: VARIETAL SCENARIO AND BREEDING EFFORTS TOWARDS FCV VARIETIES SUITABLE TO RAINFED REGIONS OF ANDHRA PRADESH

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FCV tobacco grown as rainfed crop in black soils (BS) and Southern Light Soils (SLS), In BS, tobacco is grown on conserved soil moisture as a post-monsoon crop (*rabi*) in an area of about 20,000 ha in parts of East & West Godavari, Khammam, Krishna, Guntur, Prakasam and Nellore districts. SLS occupying an area of 30,000 ha of red soils and tobacco here is grown during winter on conserved soil moisture from North-East monsoon rains. FCV tobacco produced here is neutral in character and blends well with any tobacco. 'Siri' is the major variety grown in SLS and BS regions accounting for more than 90% of the area in the last decade. Other varieties grown are CTRI Sreshta (FCR-15), Hema, VT-1158 and CTRI Sulakshana. CTRI Sreshta is a high yielding (2400 kg/ha) and TMV resistant FCV tobacco cultivar release for this region and occupies around 40% of the area. CTRI Sulakshana is an aphid tolerant and TMV resistant high yielding (3300 kg/ha) variety developed through Interspecific hybridisation and grown in limited pockets. Hema and VT-1158 (TMV resistant) are the varieties released prior to Siri and are preferentially grown in certain areas.

Further, breeding efforts currently are concentrated to breed climate resilient FCV genotypes including drought &wetfoot with higher yield, better quality, TMV resistance, *Orobanche* tolerance etc. suitable for these regions at both Rajahmundry and Kandukurcentres. FCR-4 is a promising line being tested in on-farm trials. Around 30 entries viz., TBST-112, TBST-113, TBST-114, TBST-115, RS-22, RS-23, RS-24, RS-32, V-5057, V 5058, V-5068, TBST-136, TBST-137, TBST-139, TBST-140, TBST-142, ABL-88, ABL-54, ABL-92, ABL-96, V-5142, V-5144, V-5145, V-5146, V-5139, V-5143, V-5147, RS-36, RS-41 and RS-42 submitted to AINPT in the last five years for testing their suitability to various regions from Rajahmundry centre. Currently, 77 advanced breeding lines, 40 CMS lines, three F2s, and 12 twelve fresh crosses are being evaluated for breeding improved varieties at the centre. Variability generated in popular FCV variety, Siri through various doses (300 Gy, 400 Gy and 500 Gy) of 10 MeV electron beam during 2019-20 and morphologically superior M3 generation materials are being assessed.

From Kandukur, three entries viz., KB 32, KB 50 and KB 67 submitted to AINPT for multilocation testing. Three entries viz., FCR 39, FCR 47 and FCR 63 identified promising bulk trials from this Station. Two drought tolerant advanced breeding lines, KDB 3 and KDB 8, a caterpillar and aphid resistant breeding line, KRB-3 and a high yielding ABL, KB 96 showing their promise in replicated trials and are in the advanced stages of evaluation. 11 F1s, 5 F_2s, 3 EBI and 4 F_4 are being assessed.

The varieties developed by ICAR-CTRI are occupying 100% of the rainfed tobacco area of Andhra Pradesh. The leads in the breeding efforts are quite satisfying to meet the future varietal requirements.

Keywords: breeding, tobacco, rainfed, drought, FCV

ABS084: MORPHOGENETIC CHARACTERIZATION OF SECOND GENERATION COLCHIPLOIDSOF SWEET ORANGE CV. MOSAMBI

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Induction of tetraploidy in citrus is generally meant for the development of triploid seedless cultivars, which are essential for meeting the requirements of the citrus industry. The tetraploids play a vital role for the development of triploid seedless citrus cultivars and only a few significant tetraploid cultivars are available, which can be exploited for the development of triploid citrus cultivars. Suitable tetraploids are not present in Mosambi and must be established for future breeding programmes aimed at developing seedless cultivars. In the present study three-year-old 20 second generation colchiploid plants, developed from the presumed tetraploid branches of the first generation colchiploids of sweet orange cv. Mosambi, budded on *Jatti Khatti* rootstock along with their wild (parent) type, were characterized based on morphological, physiological, molecular and cytological variations. Plant height and canopy volume decreased, but stem girth increased in majority of the second generation colchiploids compared to control. Bark: wood ratio and number of nodes per shoot increased but shoot internodal length reduced in majority of second generation colchiploids compared to control. Leaf thickness, length and width increased in second generation colchiploids in comparison with wild type. Flower length and width increased in second generation colchiploids. Fruit weight, length, width and rind thickness increased in case of second generation colchiploids. The seed number was the lowest in M-3 (7.33) second generation colchiploid. TSS and juice per cent reduced, nevertheless acidity increased in most of these colchiploids. Genetic diversity of second generation colchiploids of sweet orange cv. Mosambi along with their wild type were evaluated by using RAPD markers and out of 30 primers used, 4 exhibited polymorphisms. N-J tree constructed based on RAPD loci displayed genetic diversity, where M-1, M-5, M-8 and M-12 were different colchiploids compared to their wild type. From the overall characterization of second generation colchiploids of sweet orange cv. Mosambibecause of number of attaining desirable traits for tetraploidy, eight putative solid tetraploids of Mosambi were identified.

Keywords: Characterization, Morphological variation, Mutagenesis, Second generation colchiploids, sweet orange

ABS087: MULTI-OMICS APPROACH FOR UNRAVELLING THE GENES ASSOCIATED TO COMPLETE PANICLE EXERTION TO ENHANCE THE COMMERCIAL VALUE OF RICE

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Rice (*Oryza sativa* L.) is an essential staple food crop consumed by over half of the world's population. Breeding for higher-yielding rice cultivars is crucial owing to the world's population expansion and the shrinking quantity of land that can be used for cultivation. In rice, complete panicle exertion is an important trait since it improves grain filling and overall yield. This trait is essential for the production of hybrid seeds because, panicle choking has been identified in many of the cytoplasmic male sterile (CMS) lines that serve as the female parents of rice hybrids. This affects pollination, leading to lower grain yield. A major barrier to the production of cultivars with higher yields in rice breeding is the absence of novel genetic resources with notable agronomic features. A stable mutant, CPE-109 (M_8) of Samba Mahsuri (SM), exhibiting complete panicle exertion was selected based on prior phenotyping of progeny derived from 10,500 ethyl methane sulfonate (EMS) mutant lines of SM. Two consistent genomic regions have been identified through QTL mapping and QTL-sequencing viz. Chr-4 (31.21-33.69 Mb), Chr-12 (0.12-3.15 Mb), and qCPE-4 (28.20-31.22 Mb), qCPE-12 (2.30-3.18 Mb) respectively. Two homozygous SNPs KASP12-12 [chr12:1269983 (T/C)] in the gene *Os12g0126300* encoding AP2/ERF transcription factor and KASP12-16 [chr12:1515198(G/A)] in the gene *Os12g0131400* encoding F-Box domaining containing protein exhibited strong co-segregation with the CPE phenotype in the F_2populations of CPE-109×SM and CPE-109×RPHR 1005, advanced generation lines (BC_1F_6) derived from the mapping populations as well as many *indica* varieties that

display CPE. The gene AP2/ethylene response element binding protein (*Os12g0126300*) has a missense mutation (single nucleotide variation; T'!C) in its sixth exon, which causes a methionine to valine transition (ATG to GTG) at the 385th amino acid position. The F-box family protein gene (*Os12g0131400*) has a mutation (G'!A) at the third exon that causes an early stop codon at amino acid 182. Hence *Os12g0126300* and Os*12g0131400* were considered as candidate genes for CPE in rice. The down regulation of these genes in CPE-109 as compared to SM was validated by gene expression profiles in flag leaves generated from sequencing and qRT-PCR. We proposed that down regulation of ethylene biosynthetic genes, ACC synthase (*Os01g0192900*) and ethylene-responsive factor-2 (*Os05g0497300*) and up-regulation of gibberellic acid synthetic genes, ent-kaurene synthase(*Os06g0569900*) and two cytokinin biosynthesis genes, *Os07g0486700* (cytokinin-O-glucosyltransferase 2), *Os10g0479500* (similar to carboxy-lyase) resulted in CPE.

Keywords: AP2/ERF, Complete panicle exertion, Ethyl methane sulfonate, F-BOX domain, Samba Mahsuri

ABS089: MOLECULAR MAPPING AND DEVELOPMENT OF MARKERS ASSOCIATED WITH ANTHRACNOSE FRUIT ROT RESISTANCE IN HOT PEPPER (*CAPSICUM BACCATUM* L.)

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Anthracnose fruit rot caused by *Colletotrichum spp.* (*C. truncatum,* and *C. gloeosporioides*) is the most serious disease-causing quality yield loss in chilli. It causes both pre- and post-harvest fruit rot. Resistant sources have been identified mainly in *C. baccatum* (PBC80 and PBC81), however there are no much reports of molecular mapping and development of markers for anthracnose fruit rot resistance in general and in particular against Indian isolates. To map the genomic regions associated with resistance, genotyping by sequencing (GBS) approach was employed in 357 F_2 segregating populations of PBC80 x IHR 4491 and PBC81 x IIHR IHR 4491. The GBS data analyzed, aligned with *Capsicum baccatum*_CM008444.1 whole genome sequence data and 8644 SNP markers were identified, and a consensus linkage map was developed. Through genome-wide association studies (GWAS) using Linear mixed model (LMM) and DArT's KD Compute platform, two major genomic regions located on chromosome 2 and 6 as candidate resistance loci associated with anthracnose fruit rot resistance were identified. A total of 19 SNPs (QTNs; Quantitative Trait Nucleotides) significantly associated with fruit rot resistance of which five SNPs located on *chr2* (physically positioned at 12666827bp to 141379584bp) and seven SNPs located on *chr6* (physically positioned at 247161384bp to 252255814) were found highly significantly associated. Several defense related genes were predicted in these regions. Further *In silico* mining of SSRs in the targeted identified genomic regions (Chr 2; 15.12 Mb and Chr 6; 5.09 Mb) was carried out and a total of 192 SSRs were designed. Parental polymorphism survey was carried out and polymorphic markers were extended to F_2 population of PBC81 x IHR 4491 cross and classical QTL mapping was carried out to narrow down the genomic regions on chr 2 and chr 6 associated with resistance. Two best markers, one each on chr2 and chr6 were identified, which were found to be epistatic with inhibitory gene action and showed prediction efficiency of 78% for resistance. Further validation in larger population and fine mapping is in progress. These developed markers will facilitate marker assisted breeding for anthracnose fruit rot resistance in chilli.

Key words: Genotyping by sequencing, markers, QTLs, epistasis

ABS096: IDENTIFYING DROUGHT TOLERANT LINES THROUGH MULTI TRAIT SELECTION INDEX IN TOBACCO (*NICOTIANA TABACUM* L.)

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Tobacco is major commercial crop grown under rain fed conditions in India. The crop is often affected by drought leading to serious reduction in leaf yield. The present investigation was carried out to assess the effect of drought on leaf yield and identification of drought tolerant lines screened under drought conditions. Identifying novel breeding lines for drought tolerance using multitier/multi-trait selection scheme, is an important activity in breeding for drought tolerance in tobacco. A field experiment with two water regimes (stress and no stress) was conducted in a randomized block design with two replications. Various drought tolerance indices including Stress tolerance index (STI), Tolerance (TOL), Mean Productivity (MP), Geometric Mean Productivity (GMP), Stress Susceptibility Index (SSI), Yield Index (YI), Yield Stability Index (YSI) and Harmonic Mean (HM) were calculated based on leaf yield obtained from the two moisture regimes. The analysis of variance showed significant differences among the genotypes. There was a significant reduction in leaf yield under stressful conditions. The mean productivity varied from 4920 to 8611, tolerance varied 6589 to 12519, stress susceptibility index varied 0.94 to 1.05 and yield stability index varied from 0.78 to 1.15. These stress indices showed high and significant correlation under both (Yp) and (Ys) condition. Multiplexing polygenic drought tolerance related traits into a multi-trait index is an efficient system and five drought tolerant genotypes (N 98, FCR 15, KDB 3, KDB 8 and KDB 6) displayed high yield under stress conditions.

Key words: Multi trait selection index, Drought tolerance, Yield stability, tolerance, susceptibility

ABS097: PERFORMANCE OF CHILLI HYBRIDS FOR YIELD AND ITS ATTRIBUTING TRAITS IN SOUTHERN REGION OF ANDHRA PRADESH

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Chilli is one of the important commercial spice crops grown in Andhra Pradesh. The exploitation of heterosis and deployment of high yielding hybrids suitable to different agro climatic regions has become potential tool in chilli improvement. In order to assess the performance of chilli hybrids in southern areas of Andhra Pradesh, 21 hybrids received from ICAR IIHR, Bengaluru were evaluated at ICAR CTRI Research Station Kandukur during 2021. The experiment was laid out in RCBD design with three replications. Analysis of variance revealed that there was a significant difference among chilli hybrids for all morphological and fruit characters. Plant height ranged from 61 cm to 100 cm, plant volume ranged from 72 cm to 116 cm, leaf length ranged from 8 cm to 15 cm, pedicel length ranged from 2.4 cm to 3.3 cm, fruit length ranged from 6 cm to 11 cm, fifty fruit weight ranged from 2.9 g to 8.4 g and dry fruit yield ranged from 571 kg to 1141 kg/ha. The broad sense heritability values ranged from 2.6–93.0% whereas genetic advance as percent of mean was in the range of 1.55 -74.0%. High heritability coupled with high genetic advance as per cent of mean was observed for fruit length, fifty fruit weight and dry fruit yield. Three hybrids (Arka Kyathi, Arka Meghana and Arka Dhriti) showed superior fruit yield (1004 kg/ha to 1141 kg/ha) over check VNR 324 (753 kg/ha).

Key words: Chilli Hybrid, heritability, genetic advance, fruit yield, fruit length

ABS118: EXPLORING GENOME EDITING TECHNOLOGY FOR ENHANCING INDUSTRIAL USE PHYTOCHEMICALS

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Tobacco contains various phytochemicals including Nicotine, terpernoids, polyphenols, polysaccharides, sterols and many others. Among these Solanesol is an industrially important bioactive secondary metabolite that mainly accumulates in solanaceous plants especially in tobacco (Nicotiana tabacum L.). Solanesol, is a non-cyclic terpene alcohol composed of nine isoprene units plays an important role in the interaction of the plant with environmental factors including biotic and abiotic stress in tobacco. It is a key intermediate for the pharmaceutical synthesis of ubiquinone-based drugs such as coenzyme Q10 and vitamin K2, and anti-cancer agent synergizers. In tobacco, it is synthesized by the 2-C-methyl-D-erythritol 4-phosphate (MEP) pathway within plastids and the content varies from 0.05 to 4.5% in different tobacco types. Inview of the importance of the solanesol, its content was analyzed in various tobacco types at ICAR-Central Tobacco Research Institute (CTRI) and found that some of the dark burley entries (HDBRG) has high solanseol content compared to cultivated FCV tobacco types. Inview of its vivid usage and importance, the study was initiated to develop high solanesol lines for cultivation through genome editing approach. In this regard, the transcript accumulation of 1-deoxy-D-xylulose 5-phosphate synthase (DXS), 1-deoxy-D-xylulose 5-phosphate reductoisomerase (DXR) the key gene involved in the solanesol synthesis pathway were studied and found that their levels are relatively high in HDBRG compared to low solanesol yielding FCV entry Siri. Further, the other major genes involved in synthesis pathway isopentenyl diphosphate isomerase (IPI), geranyl geranyl diphosphate synthase (GGPPS), and solanesyl diphosphate synthase (SPS) were enlisted and sequence analysis was done to study their transcript levels in different growth stages and allelic variation in the solanesol contrasting parents to identify the major regulatory gene/genes. Further, analysis of the regulatory sequences of the stated genes are being carriedout to target through genome editing tools viz., promoter activators/regulators for editing the respective gene to develop genome edited line with high solanesol content. Thus, the developed tobacco can be used as a potential source for extraction of solanesol for varied purposes.

Key words: Tobacco, Solanesol, Phytochemicals

ABS122: PRECISION CHILLI BREEDING: PAVING THE WAY FOR INDUSTRIAL ADVANCEMENT

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The targeted and precise manipulation of the plant's genetic material to achieve specific desirable traits is said to be precision breeding. This advanced breeding approach involves using techniques such as marker-assisted selection, genomics, and other molecular tools to identify and modify genes associated with characteristics like increased yield, improved disease resistance, enhanced flavor, or specific adaptations to environmental conditions. The transformative intersection of precision breeding in the context of chilli cultivation, aiming to redefine the role of chilli plants in various industrial applications. Leveraging advanced breeding techniques, the research focuses on optimizing key traits essential for industrial needs, including capsaicin content, disease resistance, and adaptability. The ultimate goal is to craft chilli varieties with precision-tailored profiles, precisely meeting the specific demands of diverse industries such as pharmaceuticals, cosmetics, textiles, and biochemistry. The economic implications of precision chilli breeding are thoroughly examined, highlighting the potential for sustainable agricultural practices, job creation, and the establishment of a robust chilli-centric industrial value chain. This transformative shift goes beyond traditional spice production, positioning chillli as a dynamic contributor to economic growth and industrial innovation.

Collaboration emerges as a recurring theme, underscoring the study's emphasis on unified efforts among chilli breeders, researchers, and industrial stakeholders. Recognizing the collective approach as vital for driving innovation, the research advocates for a shared vision that navigates the intricate intersection of precision breeding, agriculture, and industry. The knowledge of precision chilli breeding not only promises to redefine the agricultural landscape but positions chilli as a key player in fostering industrial advancement. As we navigate this transformative journey, precision chili breeding emerges as a beacon, illuminating the path towards a future where industry, agriculture, and precision breeding converge for mutual benefit and progress.

Key words: Precision breeding, adaptability, and marker-assisted selection.

ABS125: ENHANCING SUSTAINABLE AGRICULTURE: A NOVEL APPROACH WITH HYBRID PESTICIDES

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This study introduces an innovative approach to sustainable agriculture by exploring the development of hybrid pesticides. Traditional pesticides, despite their effectiveness, encounter challenges such as resistance development and environmental persistence. In response, our research focuses on the development of hybrid molecules that synergize the strengths of various chemical classes, providing a comprehensive and environmentally friendly solution to pest management.

Hybrid pesticides incorporate elements from biopesticides, botanical compounds, synergists, and neonicotinoid analogues. The synergistic interactions aim to enhance pesticide formulations, addressing concerns related to toxicity. Neonicotinoid analogues with modified structures strike a balance between efficacy and reduced environmental impact, contributing to sustainable pest control. Integrated Pest Management (IPM) principles guide the incorporation of hybrid pesticides within a holistic framework, alongside biological control, and cultural practices. This ensures a comprehensive and sustainable strategy for pest management.

The anticipated benefits of hybrid pesticides include broad-spectrum pest control, reduced resistance development, and lower environmental impact. This research aligns with the global shift towards environmental conscious and effective pest management practices. The creation of hybrid pesticides represents an innovative step forward, contributing to the development of a more resilient and sustainable agricultural ecosystem.

Keywords: Hybrid Pesticides, Sustainable Agriculture, Biopesticides, Neonicotinoid Analogues, Integrated Pest Management.

ABS132: VARIETAL TRIALS UNDER CTRI GUIDANCE FOR IMPROVED YIELD AND QUALITY IN BURLEY TOBACCO

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Under the guidance of the Central Tobacco Research Institute (CTRI), a varietal trial was conducted during the previous crop season in 2023. This trial included four new varieties (YB-38, YB-41, YB-42, YB-43) in addition to Banket A1 and YB-22. The primary objective was to comprehensively assess the performance of these new varieties in terms of yield, quality, and chemical composition in comparison to existing varieties, with the ultimate goal of identifying the most suitable variety for local conditions.

Following the protocols and norms outlined by CTRI, the varietal trial was implemented in Burley growing areas. The guidance provided by CTRI extended to regular field visits, ensuring the proper execution of the trial. All necessary norms and regulations were meticulously followed throughout the trial process.

The trial results revealed that Banket A1 exhibited the highest yield at 2196 Kg/ha, followed closely by YB-22 with a yield of 2026 Kg/ha. Total Alkaloid (TA %) levels were consistent across all treatments, with slightly higher values observed in VB 01.

This collaborative varietal trial, conducted under the guidance of CTRI, not only provides valuable insights into the performance of different tobacco varieties but also serves as a crucial step in the continuous improvement and adaptation of tobacco cultivation practices in alignment with local conditions."

Keywords: CTRI, Varietal trial, Yield, Quality, Performance of new varieties, Local conditions

ABS133: INDIAN ORCHID GENETIC RESOURCE: CONSERVATION AND UTILIZATION

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Orchidaceae is the second largest family of flowering plants, and the members of this family are valued for their ornamental and therapeutic value. According to recent estimates, there are 26,567 species belonging to nearly 1000 genera. India contributes about 1300 species to this gene pool. Most Indian orchids are showy and bear attractive flowers. They have the potential to be used as parents for structuring new cultivars and restructuring existing varieties according to market demand. Orchids are known to occur here from the coastal plains to an altitude of 4300 m, suggesting that these genetic resources can be used to develop varieties suitable for the tropical to temperate regions of the country. In addition, there are about 150 orchid species that have medicinal importance and offer the possibility of obtaining biomolecules to combat various diseases. Although the country has extensive genetic resources of orchids, very little use has been made of them for the ornamental and medicinal plant industry. Due to various natural and man-made causes, the diversity of orchids in natural habitats is declining very fast and certain species have not been found in their natural habitats for more than 50-100 years. Orchids are among the most vulnerable groups of plants and their vulnerability is due to their specialized life cycle and diverse way of life. Therefore, the conservation and economic use of orchids should go hand in hand.

Keywords: Collection, conservation, genebanks, orchidaceae, genetic diversity

ABS136: A GENOME-WIDE ASSOCIATION-BASED STUDY UNRAVELS THE MAJOR GENOMIC REGIONS FOR EARLY SEEDLING VIGOR TRAITS UNDER WET- AND DRY-DSR CONDITIONS INRICE (ORYZA SATIVA L).

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Rice holds immense commercial and economic importance on a worldwide scale. The conventional practice of transplanting rice requires much labor and water; it utilizes 3000–5000 liters to produce a kilogram of rice. However, this method is becoming increasingly challenging because of global climate change, which is causing water scarcity and posing a potential danger to agricultural productivity in the forthcoming decades. Direct-seeded rice (DSR) is the most feasible alternative to transplanted rice. Early seedling vigor (ESV) traits, including germination index, seedling vigor index I and II (SVI-I and SVI-II), root and shoot length and biomass, are crucial for DSR because they determine seedling stand density and weed competitiveness. A genome-wide association mapping (GWAS) study was carried out in three environments for ESV-related traits by employing a diverse set of rice germplasms. We quantified 15 ESV-related traits on the 7th, 14th, and 21st days under laboratory conditions, wet-DSR (sprouted rice seeds are broadcasted on wet soil), and dry-DSR (dry rice seeds are broadcasted or drilled on dry soil) in field conditions. Our analysis identified several quantitative trait loci (QTL) and markers associated with ESV-related traits. In all three environments, 40 and 35 QTLs were identified under wet-DSR, compared to 68 and 67 QTLs under dry-DSR for SVI-I and SVI-II, respectively. Further, our study also identified common QTLs across the environment for different time periods. For example, we identified three common QTLs under wet and dry-DSR conditions. Among them, one is significant for SVI-I on the 14th day and is located on Chromosome 10 (at 5.10 Mbp). The remaining two QTLs show significance for SVI-II on the 7th day, with one situated on Chromosome 04 (23.3 Mbp) and the other on Chromosome 12 (8.88 Mbp). These common QTLs indicate that certain genetic markers play a role in the performance of the plants under both wet and dry DSR conditions. The identification of these QTLs provides valuable information for breeders and geneticists who are looking to develop rice varieties that can perform well in various environments. Additionally, the identification of QTL hotspots on different chromosomes can help researchers further investigate the underlying genes and pathways responsible for the observed phenotypic differences.

Keywords: Direct-seeded rice (DSR), Early seedling vigor (ESV), Genome-Wide Association Studies (GWAS), Quantitative Trait Loci (QTL)

ABS137: ALLELE MINING AMONG THE KEY GENES OF SOLANESOL BIOSYNTHETIC PATHWAY IN SOLANACEOUS CROPS

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Solanesol, non-cyclic terpene alcohol present in solanaceous plants for providing tolerance against biotic stress like plant pathogen interactions and abiotic stress like high temperature. It is also a high value phytochemical widely used in the pharmaceutical industry as a critical intermediate for the synthesis of ubiquinone drugs. It has many medicinal properties like anti-bacterial, anti-viral, anti-fungal, anti-inflammatory and also used in the treatment of cardio-vascular diseases, osteoporosis and AIDS. Solanesol is synthesized in solanaceous crops like tobacco, potato, tomato, chilli, etc. Among the solanaceous crops, solanesol content is high in tobacco. It is produced in various plant parts like leaves, stems and roots, but accumulation is high in leaves, more precisely during the grand growth stage. It is biosynthesized via 2-C-methyl-D-erythritol-4-phosphate (MEP) pathway within the plastids. Keeping in view of the medicinal importance of solanesol, we have selected key genes involved in solanesol biosynthesis. The key genes are 1-deoxy-D-xylulose-5-phosphate synthase LOC107773391(DXS), 1-deoxy-D-xylulose 5-phosphate reducto isomerase LOC107818871(DXR), Farnesyl pyrophosphate synthase LOC107806551(FPS) and Solanesyl pyrophosphate synthase LOC107776134(SPS). *In-silico* comparison of key genes revealed presence of significant variations in the *cis*-acting elements, exons and also in the length of introns in all these four genes among solanaceous crops. The identified nucleotide changes led to intron length variations and these variations might have a key role in the expression of genes and which influence the solanesol production.

Key words: Solanesol, isoforms, allelic variation and expression.

ABS139: SCREENING OF CROSSANDRA GERMPLASM FOR COMMERCIAL TRAITS

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Crossandra (Firecracker) is an important commercial flower, mainly grown in India, Tropical Africa and Madagascar. The flowers are commonly used for hair adornment and garlands. Though not fragrant, these flowers are very popular because of their attractive bright colour, light weight and good keeping quality. In India, crossandra is commercially grown for loose flowers in Tamil Nadu, Karnataka, Maharashtra and Andhra Pradesh. It is also one of the popular potted plant for home gardens. Although there are several popular varieties like Delhi Crossandra, Orange Marmalade, Soundarya, Arka Chenna, Arka Shravya and Arka Kanaka which are being grown in India. The main limitation for crossandra cultivation in southern states is that many of the varieties available are highly susceptible to diseases like fusarium wilt and nematodes. Systematic and comprehensive work on screening of available germplasm for tolerance/resistance to these pests and diseases was not done. Farmers have to resort to fungicidal and insecticidal sprays regularly to control these diseases which increase the cost of cultivation and are unsustainable. Screening of available germplasm for tolerance/resistance to pests and diseases is to be done so that farmers have options to grow them for sustainable and remunerative production of crossandra. The germplasm of crossandra was screened for yield related traits and tolerance to fusarium wilt and nematodes. The loose flower yield was higher in the varieties Soundarya and Arka Shravya under East Godavari Conditions. The varieties Local Yellow and Soundarya were exhibiting field tolerance to fusarium wilt. The screening of varieties for various commercial traits will help in the development of varieties with desired traits.

Keywords: Crossandra, fusarium wilt, nematodes

ABS142: ENSURING QUALITY TOBACCO SEED FOR RAISING A HEALTHY TOBACCO CROP

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The production of highly valued, quality-conscious tobacco crop begins with the seed, which makes it a crucial component of tobacco farming. Hence, it must be in purest form, healthy and well preserved for optimal germination and further growth of seedlings and plants. Tobacco seed is very light and there are about 10,000 seeds per gram. Hence, farmers tend to use larger quantity of seed for the nursery than actually required. This is also another reason for seed contamination in tobacco. Use of pure seed of recommended varieties ensures higher yields and quality. Keeping this in view, ICAR-Central Tobacco Research Institute (ICAR-CTRI), Rajahmundry is producing and supplying truthfully labeled Flue Cured Virginia (FCV) and lanka tobacco seed of popular varieties to the farmers through dedicated Revolving Fund (RF) Scheme.

Nucleus seed is produced by the breeder who develops a particular variety, or by other associated breeders of the developed variety. The nucleus seed is used as source material and a micro-level screening is being carried out under the supervision of competent personnel and breeder seed of the respective varieties are produced. Thus, the produced breeder seed is used to raise the nursery in the ICAR-CTRI, and the seedlings are supplied to the identified seed plot farmers for production of truthfully labeled seed. During the process the seed-plots are planted directly under the supervision of the Seed Production Unit staff. Adequate isolation distance (3.0 m) is maintained while planting seed plots. The plots are regularly monitored by the scientific personnel and rouged to remove the off types at different growth stages to avoid varietal contamination. The harvested seeds are thoroughly dried to maintain seed moisture level below 4.0% and treated with insecticide. Further, germination, viability and moisture tests are conducted at regular intervals and the seed lots confirming the prescribed seed standards are supplied to the farmers. In any given season, more than 90% of the FCV and lanka tobacco crop area is planted with the tobacco seed supplied by ICAR-CTRI. Through this scheme around 9000-12000 Kg of truthfully labeled FCV and lanka tobacco seeds are being supplied to the farmers. Though the 'RF Scheme' was initiated

with a startup fund of Rs 3,00,000/- in 1990 by ICAR, the average receipts of RF scheme since its inception stands at Rs. 59.3 lakhs per annum and in the last decade it has been elevated to more than Rs. 80 lakh per annum. The seed sale receipts reached a maximum of around Rs. 1.8 crores during 2023-24 season. In a move to higher transparency and traceability, recently seed is being distributed through dedicated Seed portal. The unique service under RF scheme, production and timely supply of FCV and lanka tobacco seed to the farmers in all these years reaped the fruits in terms of qualitative crop, exports and thereby net returns to the farmers and traders.

Key words: Tobacco, seed, truthfully labelled seed

ABS143:A NON-INVASIVE EXTRACTION OF ROOT-EXUDATES METABOLITES TO EVALUATE THE HOST-PATHOGEN INTERACTION(S) [CULTIVATED TOBACCO (*NICOTIANA TABACUM*)-BROOMRAPE (*OROBANCHE* SP.) INTERACTION AS A MODEL SYSTEM]

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Allelopathy is the chemical language of plants wherein certain specific allelochemical(s), a form of bio-active secondary metabolite(s), serves as bio-communicator(s). Till date, natural allelochemicals identified belongs to either non-nutritional primary- (e.g. fatty-acids and non-protein amino acids etc.) or secondary-metabolites [e.g. benzoquinones, flavonoids, terpenoids, triketones, coumarins, strigolactones (SLs), phenolic acids, tannins and lignin etc.].Among these, SLs are carotenoid-derived phytohormone signaling molecules that enables the hemi- or holo-parasitic root-weeds (e.g. *Striga*, *Orobanche* and *Phelipanche* genera) and symbiotic fungi (e.g. arbuscular mycorrhizal, AM) to detect their corresponding host-plants. However, collection and study of SLs and/ root-exudates (REs) from undisturbed plant root-system is difficult because of its low concentrations and high level of contaminants in growth-media such as soil. Considering all these facts, we used one pair of genetic susceptible- and resistant-tobacco germplasm (against broomrape, *Orobanche* sp.) as model system to evaluate the host-pathogen interaction(s). Herein, a laboratory-scale non-invasive hydroponics system, referred to as continuous REs trapping system (CRETS) was established. Briefly, in CRETS, extracellular hydrophobic metabolites from REs will be selectively adsorbed by suitable resin (e.g. XAD4) from nutrient solution continuously circulating through the root system, while inorganic nutrients will be recycled to sustain the plant-growth. Columns will be eluted with suitable solvent. Subsequent qualitative validation of collected SLs and/ REs (*viaInvitroOrobanche* sp. seed germination assay), followed by its quantitative evaluation (*via* LC-MS based approaches) will be useful to dissect the probable diagnostic- and remedial-measures against *Orobanche*infestation. Additionally, the aforesaid established CRETS has also an added advantage of being used for collection of a wide-range of economically important bio-active(s) (*viz.* drugs, dye, pigments, pesticides, food additives, flavor and fragrances etc.) from diverse array of medicinal- and aromatic-plants.

ABS144: INHERITANCE PATTERNS OF POWDERY MILDEW RESISTANCE IN CHILI HYBRIDS THROUGH GENERATION MEAN ANALYSIS

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Research was conducted at College of Agriculture Raichur during kharif and rabi 2019-22. From 14 genotypes 40 crosses were obtained in Line × Tester design and later all the crosses were subjected to screening against powdery mildew percent disease index. Based on the susceptible and resistant reaction of all the crosses we have selected top three hybrids showing resistant and having high standard heterosis in fruit yield trait. Six generations *i.e.* P_1, P_2, F_1, F_2, B_1 and B_2 of cross Sankeshwar × Mattur Local, KA2 Long × GCV111 and JNB1 × GCV111 showed a mean per cent powdery mildew disease index 44.85, 12.41, 13.40, 32.00, 30.24 and 31.21, 41.06, 13.61, 16.16, 40.23, 38.81 and 39.21 and 46.02, 7.95, 9.15, 34.31, 42.48 and 41.80 respectively. Among six generations, P_1 and P_2 had high, and low percent powdery mildew disease index respectively compared to other generations in all three crosses. The estimates of scaling tests were found to be significant in all three crosses for disease index indicating the presence of additive × additive, additive × dominance and dominance × dominance type of non allelic interactions in the expression of the trait. Whereas A, B and C scales were found to be significant indicating involvement of all types of epistatic effects (i, j and l) in expression of the trait in two crosses *i.e.* C2= KA2 Long × GCV111 and C3= JNB1 × GCV111 which was supported by evidence of significance of chi-square value. Powdery mildew resistance was found to be dominant and polygenically controlled. Both additive and non-additive types of gene action were predominant with complementary type of epistasis in all the three crosses studied.

Keywords: Chilli, Powdery mildew, Generation mean analysis.

ABS153: HETEROSIS BREEDING IN FCV TOBACCO FOR ENHANCED LEAF YIELD UNDERNORTHERN LIGHT SOILS(NLS) OF ANDHRA PRADESH

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Northern Light Soils (NLS) of Andhra Pradesh region is the major contributor of cigarette type tobacco with semi flavorful grade. To sustain farmer profitability coupled with quality parameters suitable for industry demands for development of heterotic hybrids. Cigarette tobacco being highly quality driven crop, breeding for enhanced cured leaf yield and sustaining the leaf quality is a multi-dimensional activity in addition to adaptability to climate change. The stringent quality requirements necessitated conservative breeding strategies and in-turn narrowed down the genetic diversity. The present breeding programme is aimed at achieving the incremental yield of 15 % over popular hybrid CH3, by developing new variants endowed with desired traits using available germplasm. Widening of genetic base was achieved by development of stable Advanced Breeding Lines (ABLs) through hybridization followed by successive selection of desired recombinants with multiple traits of interest. These ABLs were used as parents to derive a hybrid of choice. Simultaneously, to generate an array of female parents to derive experimental hybrid combinations, Cytoplasmic Male Sterility was introgressed in to ABLs with high Specific Combining Ability (SCA). Several new hybrids are evolved on a regular basis to identify suitable ones having superior yield while meeting quality preferences. The traits positively correlated with leaf yield *viz.,*average leaf length, average leaf width and total green leaf weight at harvest were also considered while selection of lines in breeding program. Replicated yield trials were conducted over the years and resulted in development of 2 ABLs and 4 hybrids with good yield potential and acceptable chemical quality attributes. These 6entries were evaluated in Upper and Lower micro-zones of NLS under replicated yield trials for 3 seasons. Based on the productivity (20-25 % increase over checkCH-3), grade out turn (>79% Bright Grade) and desired cured leaf quality, 3 hybrids (CA, *I*ARTH4 and *I*ARTH5with cytoplasmic male sterile background) and 2 ABLs have been identified as potential candidates.

Key Words: Cytoplasmic Male Sterile, HybridVigour, Advance Breeding Line, Yield and Correlation

ABS154: DEVELOPMENT OF CLIMATE RESILIENT FLUE CURED TOBACCO CULTIVARS SUITABLE FOR RAINFED TOBACCO GROWTH ZONES OF KARNATAKA, INDIA

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Flue-Cured Virginia (FCV) tobacco is one of the important commercial crops grown in Karnataka in red sandy loam soils of Southern Transitional Zone (STZ) of the state comprising of Mysore, Hassan, Chikkamagalore and Shivamogga districts, under rainfed conditions. The tobacco is known as 'Mysore style tobacco' classified as superior quality filler in the international market. Erratic rainfall is one of the major environmental factors that limit crop growth, productivity&quality of flue cured tobacco in this region. Availability of climate resilient cultivars with wide adaptability for climate vagaries is the need of the hour to safeguard farmer profitability and sustainability of tobacco cultivation. The present study was undertaken to evaluate productivity& quality performance of 18 Advanced Breeding Lines (ABLs) and 42 Hybrids (derived from parental lines having niche traits for adaptability to rainfed conditions). Popular hybrid CH3was used as check in an augmented design with complete blocks during 2021-22 & 2022-23 crop seasons under recommended package of practices. The data was recorded on Morphological parameters (days to 50% flowering, Number of leaves at Topping, plant height at topping, Leaf dimensions at 5th, 10th& 15th plant positions), Yield (green leaf & cured leaf)&Physical, Chemical leaf quality (Bright grade %, leaf count Chemistry) parameters to compare the treatments under study. Three advanced breeding lines (ABL 18, ABL 25 & ABL 38) and 2 hybrids (*I*ARTH 7 &I*ARTH* 9) found to be superior (21-26%) to check hybrid CH3 in Cured leaf Yield. Elite entries are currently under evaluation in multi-locations (dry, wet, semi-wet) to develop climate resilient cultivars/hybrids for Karnataka region.

Key Words: Leaf quality, Climate resilient, Flue cured tobacco.

ABS171: ASHWAGANDHA BREEDING CURRENT SCENARIO IN INDIA

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Ashwagandha is an important medicinal plant cultivated in India. It holds significant medicinal importance internationally due to its diverse uses in human health management. India is a pioneer in Ashwagandha production and export worldwide. Meeting future demands for Ashwagandha can be achieved through the development of high-yielding varieties and advanced management technologies. Despite being cultivated in India for over 900 years, the systematic breeding works only commenced in 1970 through All India Coordinated Research Project on Medicinal and Aromatic crops. India has introduced several released varieties such as Vallabh Ashwagandha-1, Jawahar Ashwagandha-20, Jawahar Ashwagandha-134, Gujarat Anand Ashwagadha-1 (GAA-1), Arka Ashwagandha, Raj Vijay Ashwagandha (RVA-100), Poshita, Rakshita, CIM-Chetak CIMAP-Pratap and CIM-Pushti. The systematic collection of germplasm, involving around 1200 genotypes, has been carried out by the All India Coordinated Research Project. The National Gene Bank at NBPGR, New Delhi has maintained approximately 426 germplasms in long-term storage. Despite the limited studies on the genetics of ashwagandha, there is great potential for enhancing the production of yield and quality. Future breeding efforts for ashwagandha will focus on developing hybrid genotypes and trait-specific varieties and for that the available ashwagandha germplasm collections are to be augmented with additions from national and international sources and all the available germplasm are to be evaluated for quality, resistance to biotic and abiotic stresses to identify the resistance sources. Similarly using the modern biotechnological tools, path-way genetics are also to be done.

Keywords: Ashwagandha breeding, genetics, biotechnology, germplasm

ABS179: MORPHOLOGICAL CHARACTERISATION OF *NICOTIANA* INTER SPECIFIC CROSS DERIVATIVES

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Germplasm enhancement is required for infusing variability for all traits including resistance useful for further crop improvement programmes. In order to create variability, four interspecific crosses were made and the hybrids were back crossed to *N. tabaccum* viz., (*N. sylvestris* x *N tomentosiformis*) x *N. tabacum*cv. TBST-2; (*N. sylvestris* x *N. otophora*) x *N. tabacum*cv. VT 1158; (*N. tabacum* x *N glutinosa*) x *N. tabacum*cv. Siri, (*N. repanda* x *N sylvestris*) x *N. tabacum*cv. Hema etc. Forty stable derivatives thus developed from these crosseswere advanced and evaluated for various morphological traits. 25 derivatives were having normal plant, one wild, 4 semi wild, 5 NLS type and 7 found to be CMS. Leaf sizes of 5 plants were bigger in size and 37 have mediumsize leaf. 31 entries found to show leaf puckeringand others lack puckering. 12 entries found to be light cast, 18 medium castand green cast based on leaf colour. All the derivatives have been advanced to the next generations. The lines with broad leaves, NLS type, light and medium can be further analysed for testing their suitability to various FCV tobacco growing areas. These selected lines are proposed to be evaluatedin yield trials to confirm their suitability to various zones and yield potential besides resistance/tolerance to important diseases and insect pests.

Key words: Genetic enhancement, inter specific, tobacco, *Nicotiana*

ABS180: GENOTYPING OF CHEWING TOBACCO VARIETY BSR-1 USING SSR MARKERS

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Chewing tobacco is one of the important types among the various tobaccos grown in India and is in cultivation in more than four states in India. The chewing tobacco grown in Tamil Nadu state has its own domestic and exports markets. There are many varieties of chewing tobacco released for this region. Recently ICAR-CTRI has released a variety, BSR-1 which is superior to the earlier varieties VR-2 and Kaviri in many of the morphological and yield characters. BSR-1 is developed through back cross method of breeding [(VR-2 × Beinhart 1000-1) × VR-2], and has an high yield potential (3700 kg/ha) and resistance to black shank. In view of its yielding potential and specific trait of disease resistance, an attempt was made to genotype the variety using molecular markers. Among the various markers, Simple Sequence Repeat (SSR) is known for their polymorphism and repeatability. A total of 60 SSR markers with uniform coverage among all the chromosomes were selected for screening BSR-1 along with its parents VR-2 and Kaviri. Genomic DNA from the leaf samples of all the three varieties was extracted using the standard protocol analysed for the quantity and qualitative Parameters. The good quality DNA was used for Polymerase chain reaction (PCR) with the 60 primers. The PCR amplicon were analysed initially in agarose electrophoresis and followed by Bio analyser for finer resolution. Majority of the markers were found to be monomorphic with similar banding pattern among all the tested entries. The SSR markers, CT0035 (Chr-24) and CT51706 (Chr-2) has shown differential banding pattern between BSR-1 and VR-2 in the amplicon range of 180-200 bp range. Further, the screening with other SSR markers is in progress. Hence, these can be used as candidate markers for identification and further Screening with inclusion of more SSR markers may result in identification of train specific markers that can be used in molecular breeding.

Keywords: chewing, tobacco, SSR, genotyping

ABS182: MOLECULAR MARKERS UNVEILED: INSIGHTS INTO SOLANESOL BIOSYNTHESIS IN *NICOTIANA TABACUM* VARIETIES

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The study aimed to identify molecular markers closely associated with the biosynthesis of Solanesol in different varieties of *N. tabacum*. The genes encoding enzymes involved in Solanesol biosynthesis were identified from the whole genome datasets of three inbred varieties of the allotetraploid *N. tabacum*, namely K326 (Flue-cured), TN90 (Burley), and Basma Xanthi (BX, Oriental). Protein sequences related to the Solanesol biosynthetic pathway were obtained from the Uniprot Database, which was linked with TAIR (The Arabidopsis Information Information Resource).

To identify the genes involved in Solanesol biosynthesis, a homology search was conducted on the three *N. tabacum* genome datasets. The mRNA, CDS and genes were obtained from this analysis. Several genes encoding enzymes involved in Solanesol biosynthesis were identified, including *Dxs1, Dxs3, dxr, IspD, IspE, IspF, IspG, IspH, IDI1, IDI2, IspA/FPPS1, FPPS2, GGPP1, GGPP2, GGPP3, GGPP4, GGPP6, GGPP7, GGPP8, GGPP9, GGPPA, GGPPB, GGPPC, SPS1, SPS2, SPS3, PP2A1, PP2A2, PP2A3, PP2A4,* and *PP2A5.*

The identified molecular markers with their specific identifiers were listed, including *Dxs1* (id=Solyc01g067890.2.1 and id=Solyc11g010850.1.1), *Dxs3* (id=Solyc08g066950.2.1), *dxr*(id=Solyc03g114340.2.1), *IspD* (id=Solyc01g102820.2.1), *IspE* (id=Solyc01g009010.2.1), *IspF* (id=Solyc08g 081570.2.1), *IspG*(id=Solyc11g069380.1.1), *IspH*(id=Solyc01g109300.2.1), *IDI1* (id=Solyc04g056390.2.1), *FPPS1* (id=Solyc12g015860.1.1), *GGPP1* (id=Solyc09g008920.2.1), *SPS1* (id=Solyc07g061990.2.1), *SPS2*, *SPS3*, *PP2A1*, *PP2A2* (id=Solyc01g011340.2.1 and id=Solyc05g006590.2.1), *PP2A3* (id=Solyc01g073650.2.1), *PP2A4* (id=Solyc01g005950.2.1), and *PP2A5*.

To summarize, this study successfully identified molecular markers closely associated with Solanesol biosynthesis in three different varieties of *N. tabacum*. This information can be valuable for further research and applications related to Solanesol production, a compound widely used in the pharmaceutical and cosmetic industries.

Keywords: Solanesol, K326 (Flue-cured), TN90 (Burley), and Basma Xanthi (BX, Oriental), PP2A (Protein Phosphotase 2A)

ABS183: ROGUING: THE ART AND SCIENCE IN PURE SEED PRODUCTION OF TOBACCO

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A homogeneous crop is essential to realize the varietal yield potential and higher production in any crop and is more important in tobacco as it is an export-oriented quality conscious crop. The pure seed of the variety forms the integral part in raising a homogeneous crop. The seed standards were defined and classified as breeders seed, foundation, registered and certified seed based on the genetic and physical purity of the seed. Among these classes, the genetic purity of the seed is maintained by selection and rouging. It is an art of selecting true to type and rejecting the rogue plants. Tobacco is a self-pollinated crop and seeds are very small, about 0.75 mm long, 0.53 mm broad which favours the easy varietal admixture. Hence, in order to maintain the varietal purity and raising a homogenous crop removal of off types at different stages is a must. ICAR-CTRI supplies truthfully labelled seed of FCV, burley and lanka tobacco types to the farmers through a dedicated RF (Revolving Fund) scheme. The seedlings of different tobacco varieties were raised at CTRI and will be supplied to the identified seed plot farmers.In order to ensure the genetic purity of the respective tobacco varieties thorough rouging at the grand growth stage and the second at the flowering stage to avoid varietal contamination will be executed in the farmers' fields. The rouging at grand growth stage will be carried out based on the artistic features of the variety including plant canopy, casting of the leaf, and leaf shape. Lanka tobacco has dark cast leaves with open spreading type of canopy, burley tobacco has conical to cylindrical plant architecture with light cast leaves and FCV tobacco has medium to dark cast leaves. The rouging at flowering stage will be carried out more critically based on the specific candidate DUS traits of the variety including the type of leaf, stem colour, all floral characteristics including colour of corolla, throat size, type of inflorescence and many others. Between the popular FCV cultivars Siri has dense inflorescence with semi erect leaves compared to FCR15. The other FCV tobacco variety CTRI Sulakshana has cylindrical, open type canopy with larger and broader leaves at the base and narrow leaves on the top and flowers with long throat. Further, burley tobacco has creamy white stems and mid rib. These are some of the varietal traits which will be used in rouging for removal of other off types. Similar varietal specific traits will be used in selection of true to type and removal off types to ascertain pure seed production.

Key words: Tobacco, seed, truthfully labelled seed

ABS184: LARGE SUBUNIT (LSU) OF GERANYL GERANYL PYROPHOSPHATE SYNTHASE (GGPPS): A KEY PLAYER IN SOLANESOL BIOSYNTHESIS

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Solanesol biosynthesis is a crucial process in various plant species, including tobacco. Enzymes involved in this biosynthesis pathway play a vital role in the production of solanesol, an important secondary metabolite. The genes encoding enzymes involved in the solanesol biosynthesis were identified from whole genome datasets of three *Nicotiana tabacum* related genomes, namely N. tabacum TN90 Sierro 2014 (Burley tobacco genome), *N. tabacum* BX Sierro 2014 (Flue cured Tobacco genome), and N. tabacum K326 Sierro 2014 (Oriental Tobacco Genome). One such enzyme is the Geranyl Geranyl pyrophosphate synthase (GGPPS), which catalyses the formation of GGPP, a precursor in solanesol biosynthesis. However, it is important to note that there are differences in the large subunit (LSU) of GGPPS among different tobacco varieties. These differences in the LSU of GGPPS are believed to play a significant role in solanesol biosynthesis. Understanding the differences in the LSU of GGPPS among different tobacco varieties can have practical applications in plant breeding and genetic engineering. By identifying and manipulating the LSU sequence associated with higher solanesol production, researchers can develop tobacco varieties with increased solanesol content. This has potential implications not only in the tobacco industry, where solanesol is of interest for applications such as pharmaceutical synthesis, but also in other plant species where solanesol biosynthesis is relevant. Overall, the differences in the LSU of GGPPS provide valuable insights into the complex regulation of solanesol biosynthesis and open avenues for further research and development efforts in this field.

Key words: Geranyl Geranyl pyrophosphate synthase (GGPPS), large subunit (LSU). *N. tabacum* TN90 Sierro 2014 (Burley tobacco genome), *N. tabacum* BX Sierro 2014 (Flue cured Tobacco genome), and *N. tabacum* K326 Sierro 2014 (Oriental Tobacco Genome).

ABS189: GENETIC IMPROVEMENT OF ASHWAGANDHA: CHALLENGES AND WAY FORWARD

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Ashwagandha is an important medicinal plant cultivated in India. It has multiple medicinal properties and plays an important role in ensuring the primary healthcare and economy. Originated in India, Ashwagandha is cultivated traditionally in Rajasthan (Nagori type) and Madhya Pradesh (Mansuri type) in India, of late due to increased demand, the cultivation has moved to southern states such as Karnataka, Andra Pradesh and Tamil nadu. It is being cultivated in about 10,000 ha India for roots, leaves and stem which are used to prepare various medicaments in Traditional and Modern systems of medicine. India owns the monopoly in the trade of Ashwagandha and its products in the world. The global market (500M USD) for Ashwagandha is increasing with 11-15% CAGR and expected to reach 1500M USD by the year 2030.Lack of improved varieties affects the productivity and quality of ashwagandha. Development of stress tolerant varieties, biotic stresses such as parasitic weeds (Cuscuta and Orabanche), pests (*Epilachna* beetles) and diseases (Root rot and leaf spots), and abiotic stresses such as drought, water logging, salinity and heat significantly improve the ashwagandha production. Further, chemotypes and ideotypes in form of varieties and hybrids will significantly contribute to the quality improvement of ashwagandha. Application of genomics, gene editing and next generation advancement technologies contribute the rapid genetic improvement of ashwagandha.

Abstracts Session – II

- Advances in mechanization and energy conservation
- Advances in biotic and abiotic stress alleviation for enhanced produce quality in high value crops
- Strategies for sustaining natural resources and crop productivity
- Innovative approaches for crop diversification and opportunities in secondary agriculture
- Climate change – Impacts on commercial crops

ABS006:RESPONSE OF BIDI TOBACCO TO VARIOUS SOURCES OF POTASSIUM UNDER RAINFED CONDITION

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Potassium is a major mineral element necessary for the growth and quality of tobacco leaves (colour, texture, sugar content, nicotine and combustibility). Higher concentration of K in leaves improve the quality of leaves by increasing the burning rate and heat retention capacity and lower concentration reduces the quality of the tobacco leaves.

Potassium sulphate or sulphate of potash is commonly used in tobacco to get better quality. It is quite expensive because it is made by treating potassium chloride magnesium sulphate. On the other side, it is commonly found in huge piles of Plant Derived Ash (PDAsh) which is not known yet by the farmers, how to make use of it beside the readymade K_2So_4. Many other sources of PDAsh are available such as those from burning waste of rice straw and husk, waste from sugarcane processing, wood tobacco shoot biomass and others. However, in general the content of potash in PDAsh is higher than other nutrients. The objective of this study was to check the response of bidi tobacco to various sources of potash because this material is quiet easily found in and around agricultural farms.

The study was conducted during 2017-18 to 2019-20 at Agricultural Research Station, Nipani. The trial consisted of six treatments i.e. tobacco stem ash, pressmud, pressmud + factory ash, sugarcane trash ash, maize rind ash and Sulphate of Potash as control. Results of the pooled data (2 years) indicated that, the maximum leaf yield was recorded in the crop which was supplied with tobacco stem ash (1039 kg/ha) as compared to the other treatments and the minimum leaf yield (796 kg/ha) produced by tobacco treated with maize rind ash.

As per quality parameters are concerned, high nicotine content (4.31%) was found in tobacco stem ash treatment. Reducing sugar and chlorides were found to be high in sugarcane trash ash treatment. Though the impact of various sources of potash is non-significant in other yield parameters, the trend of results showed the substitution of sulphate of potash can be done through other sources of potash available.

Key words: Bidi Tobacco, Potassium, leaf yield and quality.

ABS007: RESPONSE OF BIDI TOBACCO TO LEVELS OF SULPHUR UNDER RAINFED CONDITIONS

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Sulphur (S) is a necessary element for plant growth, development and plays an important physiological role in the growth and quality of tobacco (*Nicotiana tabacum* L.)

An optimal Sulphur supply leads to efficient nitrogen utilization. If there is a lack of sulfur, the nitrogen taken up cannot be converted into proteins and a signal is sent to the roots to take up less nitrogen. Therefore, the plant's need for sulphur must be met for optimal nitrogen utilization. Optimal utilization of nitrogen in plant metabolism improves leaf quality in tobacco, including uniform maturity. Sulphur enables the plant to maintain its physiological processes optimally balanced, even under drought stress, avoiding or minimizing yield losses. Sulfur is a component of the metabolic product glutathione, which, as an antioxidant, renders oxygen radicals formed during drought stress harmless and therefore prevents necrosis of the leaves, important for quality.

Available S in the soil provides the main source for nutrient S to crops and the S concentration in tobacco leaves is positively correlates with the available S content in the soil. When the S content in the soil is deficient or excessive, the S concentration in tobacco leaves results in deficient or accumulates excessively, respectively, thus affecting the yield and quality of leaves. Therefore, to meet the needs of crops, S application in soil has received an increasing amount of attention in recent years. Therefore, it is very important to determine the appropriate rate of S application for optimal crop yield and quality, S use efficiency and environmental pollution minimization.

Therefore, three-years field experiment was conducted at Agricultural Research Station, Nipani, to study the effects of S levels on tobacco growth under rainfed conditions. The results of the experiments indicated that, bidi

tobacco responds well to sulphur application. With the increasing levels of sulphur from 0 to 20 kg/ ha, there was increase in the tobacco leaf yield. However, further increase in the sulphur level, resulted in the reduced leaf yield. The maximum leaf yield was recorded with the application of 20 kg/ha (1373 kg/ha) as compared to no sulphur application (1088 kg/ha). With regard to quality parameters, no exact trend of impact of sulphur levels on any of the quality parameters was seen. Similarly with regard to sulphur status in soil, except in the treatment 20 kg S/ha (19.7 kg S/ha after harvest), in all the treatments, there was decline in S-status after harvest of crop as compared to initial S-status of soil (18.4 kg S/ha).

Key words: Bidi Tobacco, Sulphur, leaf yield and quality

ABS012: ENHANCING THE PRODUCTIVITY OF BIDI TOBACCO BASED CROPPING SYSTEMS

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A field experiment was conducted at Regional Agricultural Research Station, Nandyal during the *kharif &rabi* seasons from 2020-21 to 2022-23 with an objective to evaluate different bidi tobacco-based cropping systems for higher productivity and monetary returns. The experiment was laid in a randomized block design with three replications. The treatments are *viz.*, T_1: Foxtail millet – Bidi tobacco, T_2: Greengram – Bidi tobacco, T_3: Blackgram – Bidi tobacco, T_4: Sweet corn – Bidi tobacco, T_5: Cluster bean – Bidi tobacco, T_6: Cowpea – Bidi tobacco, T_7: Bajra – Bidi tobacco, T_8: Onion – Bidi tobacco, T_9: Fallow – Bidi tobacco (C). Among the cropping systems, pooled results (2020-21 to 2022-23) concluded that significantly higher plant height (86.0 cm), leaf length (57.0 cm), leaf width (23.0 cm) and bidi tobacco equivalent yield (3119 kg/ha) recorded with Onion followed by bidi tobacco cropping system which is on par with sweet corn followed by bidi tobacco cropping system whereas higher net returns (Rs. 202815/ha) and benefit cost ratio (3.5) was observed in sweet corn followed by bidi tobacco cropping system. However, leaf chemical parameters viz., higher nicotine (6.67 %), reducing sugars (3.90 %) and chlorides (1.21 %) were recorded in onion-bidi tobacco cropping system.

Key words: Bidi tobacco, cropping systems, Bidi tobacco equivalent yield and Economics

ABS018: EFFECT OF TRANSPLANTING DATE AND VARIETY ON GROWTH, YIELD AND QUALITY OF *RUSTICA* TOBACCO (*NICOTIANA RUSTICA* L.)

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An experiment was conducted for three years of 2018-19 to 2020-21 during *rabi* season at Bidi Tobacco Research Station, Anand Agricultural University, Anand to study the effect of transplanting date and variety on growth, yield and quality of *rustica*tobacco.The field experiment was laid out in Factorial Randomized Block Design (FRBD) with four replications comprising eight treatment combinations of two varieties: GC 1 and GCT 3 as main plot andfour transplanting date:43rd Standard week (22-28th October), 45th Standard week (5-11th November), 47th Standard week (19-25th November) and 49th Standard week (3-9th December)as sub plot.The results showed that variety GC 1 recorded the highest leaf width while, variety GCT 3 recorded the highest plant height. *Rustica* tobacco varieties did not show significant effect on cured leaf yield. Significantly the highest nicotine content was registered in GC 1 than GCT 3. Variety GCT 3 was found superior with maximum gross income, net return and BCR.Different date of transplanting had a significant effect on cured leaf yield, leaf width and leaf thickness. *Rustica* tobacco transplanted during 47th Standard week noticed higher leaf width and cured leaf yield. It was found statistically at par with 45th Standard week of transplanting. Maximum leaf thickness was observed during 43rd Standard week of transplanting. It is closely followed by 45th Standard week of transplanting. Differences in leaf length and plant height due to different transplanting date were found to be non-significant. However, numerically higher leaf length and plant height were observed during 47th standard week of transplanting. Transplanting during 43rd Standard week recorded significantly the highest reducing sugar content. Tobacco transplanted during 47rd Standard week was found superior with maximum gross income, net return and BCR. The per cent mosaic and leaf curl incidence could not exert their significant impact on varieties and dates of transplanting. However, minimum per cent mosaic and leaf curl was found during 45th standard week of transplanting. Therefore, it was concluded that *rustica* tobacco variety GCT 3 transplanted during 47th standard week (19-25th November) was found superior with maximum tobacco cured leaf yield and net realization.

Keywords- Rustica Tobacco, Yield, Date of Transplanting, Quality

ABS019: IMPACT OF ROTATION WITH RESISTANT VARIETY FOR THE MANAGEMENT OF ROOT-KNOT NEMATODE IN BIDI TOBACCO FIELD

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The root-knot nematodes represent one of the major biotic stresses in tobacco cultivation particularly for bidi tobacco in Gujarat. Plant-parasitic nematodes control has been mainly based on chemical nematicides. Nonetheless, the number of active substances available has been progressively decreased due to their harmful effects on the environment, human and animal health. The genetic resistance is an effective and economically cost-effective technique against root-knot nematodes. As a result, there is growing interest in alternative methods for the management of root-knot nematode which are economically viable and non-polluting to the environment. Therefore, the main objective of the present study was to find out minimum effective duration of rotation with resistant bidi tobacco variety to minimize root-knot disease on susceptible variety. An experiment was conducted for six years (2017-18 to 2022-23) at Bidi Tobacco Research Station, Anand Agricultural University, in randomized block design. In six consecutive years, A 119 susceptible variety is planted after one, two, three and four year rotation with resistant variety ABT 10. The results revealed that a significant difference among the treatments for yield and root-knot index was observed. Four years of rotation in which first, second, third and four years were transplanted with a resistant variety (ABT 10) followed by susceptible variety A 119 yielded significantly superior cured leaf yield (1548, 1790, 1825, 1604) respectively. A susceptible variety (A 119) transplanted continuously yielded statistically lower cured leaf yield 1188 kg/ha. Maximum index (4.70) of root-knot was registered in a plot where susceptible variety A 119 grown continuously. Variety ABT 10 registered minimum root-knot index where the same variety were raised for last four, three and two years followed by A 119.

Key words- Root-knot nematode, Rotational Crop, Resistant Variety, ABT 10

ABS023: IMPACT OF CLIMATE CHANGE ON FCV TOBACCO PRODUCTION TRENDS IN SOUTHERN TRANSITIONAL ZONE OF KARNATAKA

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FCV tobacco is an important commercial crop predominantly grown in the Southern Transitional Zone (Zone No. 7) of Karnataka in an area of around 0.75 -0.80 lakh ha with an annual production of around 80-90 m. kg.Nearly 70% of the total cultivated area in this zone is mainly under rainfed farming and is typically characterized by dry-sub humid to semi-arid climate. Tobacco being a rainfed production system in this zone, the annual production and cured leaf quality parameters are largely determined by the rainfall pattern and prevailing weather situations during field establishment, crop growth phase and harvesting period. The emerging climate change coupled with decreasing soil productivity factor is greatly affecting the consistency in FCV production and quality in this zone resulting in export & market fluctuations and uncertain farm income. Hence, an attempt was made to analyze the changes in the rainfall pattern and the impact of climate change on FCV tobacco productivity trends/ variations as affected weather parameters during the last 2 decades. The long term rainfall data of 52 years (1971-2022) and the two decades of rainfall and weather parameters (for the period from 2003 to 2022) were collected from the agro- meteorology observatory situated at ICAR-Central Tobacco Research Institute Research farm, Hunsur, Mysore District, Karnataka. The agro-weather station is situated at an altitude of 826 MSL with latitude of 12^0 to 18^0 N and Longitude of 76^0 to 81^0E with a long term average rainfall of around 850 mm. The shift in the rainfall pattern during the last 2 decades (2003-2022) and the variability (C.V. %) in various weather parameters were worked out. The shift in the rainfall pattern indicated that Maymonth showed increasing trend of rainfall to an extent of 23.2%, while the month of July (growth stage) showed decreasing rainfall trend to an extent of 7.5% and August month (harvesting and curing period) experiencing increasing trend (to an extent of 9.5%) necessitating suitable soil and crop management practices to be adopted during the various crop stages. July month rainfall and its distribution pattern showed wide variation with C.V. value of 42.3% and 26.9% respectively reflecting in variation in productivity levels to an extent of 12.0% over the last 2 decades. Regarding the other weather factors analyzed, the photoperiod (sunshine hours/day) showed higher variability (C.V. 13.8%) compared to the average mean

temperature (5.7%) during the crop growing season indicating minimum sun light period for optimum productivity levels.In general, the variability in weather parameters during the crop growing period accounted for variation in FCV tobacco production and quality in the order of Rainfall in July> rainfall during crop season> number of rainy days in July > number of rainydaysduring cropping season (May -Aug) >Sunshine hours > average mean temperature.By and large the leaf quality parameters over the years were still found to be in the normal acceptable range in KLS even though leaf chlorides showed higher year to year variability.The higher coefficient of variation in rainfall and weather parameters observed during the last 2 decades due to climate change phenomena necessitates suitable climate risk management strategies for consistency in productivity and quality of FCV tobacco and assuring sustainable farm economy in this premier tobacco growing zone of Karnataka.

Key words: FCV tobacco, climate change, rainfall variability, productivity and quality

ABS029: EVALUATION OF DIFFERENT MANAGEMENT MODULES AGAINST TOBACCO WHITEFLY, *BEMISIATABACI* IN FCV TOBACCO GROWN UNDER KARNATAKA LIGHT SOIL REGION

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The Tobacco whitefly, *Bemisiatabaci* Gennadius (Hemiptera: Aleyrodidae), is a notorious sap-sucking polyphagous insect pest that causes substantial crop damage and yield loss through transmission of viruses. It is a vector of tobacco leaf curl virus disease (TLCV) and one of the major insect pests of FCV tobacco in Karnataka Light Soil (KLS) region. Evaluation of four pest management modules against *B. tabaci* was carried out for two years during 2020-21 and 2022-23 at All India Network Project on Tobacco, Shivamogga, Karnataka. The modules evaluated include IPM (M1: Maize as a barrier crop + Foliar spray of seedlings with Imidacloprid 17.8 SL 0.3 ml/ lit one day before planting + Yellow sticky traps @ 10/acre + Two sprays of Neem oil 10,000 ppm @ 2 ml/lit at 20 and 30 DAT + need based spray of Imidacloprid 17.8 SL@ 0.3 ml/ lit), Chemical control (M2: Two sprays of Imidacloprid 17.8 SL@ 0.3 ml/lit at 10 and 40 DAT + Two sprays of Thiamethoxam 25 WG @ 0.3 g/lit at 25 and 55 DAT), Bio intensive (M3:Two spray of neem oil 10,000 ppm @ 2 ml/ lit at 10 & 20 DAT + one spray of *Lecaniciliumlecanii* @ 5.0 g/lit at 30 DAT + One spray of *Metarhizium rileyi* @ 3.0 g/lit at 40 DAT) and control (M4). Observations were recorded on whitefly population, TLCV disease incidence, natural enemies population and yield. The results revealed that IPM module (M1) exhibited 62.90% reduction of whiteflies and 76.59% TLCV disease, 6.80% increase of cured leaf yields with incremental benefit cost ratio of 2.61 over untreated control. Whereas, Chemical control module (M2) reduced whitefly 52.41% and TLCV disease by 73.36%, increased cured leaf yields by 8.60% and incremental benefit cost ratio of 2.42 over untreated control. Whereas, Bio intensive module (M3) reduced 41.90% whitefly and 52.42% TLCV, increased 1.30% cured leaf yields with 2.22 incremental benefit cost ratio which was significantly superior over untreated control. Natural enemies population in IPM module plots was 1.93/ plant and in chemical module plots 1.32/ plant, in bio-intensive module 2.28/plant and in control plot 3.07/ plant. The present study helps in reducing pesticide application in tobacco which in turn reduces pesticide residues in the cured leaf and build-up of natural enemies.

Key Words: FCV tobacco, Whitefly, *Bemisiatabaci*, TLCV, IPM module

ABS030: REDUCING WOOD FUEL USAGE THROUGH BARN ENERGY CONSERVATION MEASURES IN FCV TOBACCO PRODUCTION IN KARNATAKA

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Flue Cued Virginia (FCV) tobacco is an important commercial crop grown under rainfed conditions in Southern Transitional Zone (STZ) of Karnataka in an area of 0.75 to 0.80 lakh ha. Unlike other produce, the harvested tobacco (matured green leaf) is basically cured in the specialized structures called 'barns' of specific sizes (13 x 13 x 13' or 16 x16 x 16') with the help of thermal energy inside the barn at farm level before marketing . Fire wood in the state of Karnataka and coal in Andhra Pradesh are normally used for generating heat in the curing process and at presenta majority of farmers (70 percent) cure their tobacco using fuel wood as the single source of energy followed by the coffee husk, which is used by some 16 percent of farmers. The fuel wood required to obtain one kg of cured tobacco leaf varies from 5-6 kgs depending upon the stage of leaf harvest, atmospheric weather conditions during curing, leaf moisture content and barn conditions. The much of the heat generated in the barn is lost through chimneys, roof and ventilation and also due to poor combustion of wood material in the existing furnace structures used by the farmers. Hence , adoption of energy saving methods/ techniques in curing minimizes the use of valuable fuel wood materials and also go a long way in conserving the natural resources and the forest ecosystem's apart from reducing the production expenditure for the farmers. The curing studies were conducted during 2016-17 season at ICAR-CTRI Regional Station, Hunsur in association with ITC ILTD ltd., Mysore. The barn size adopted for the study were of 16'x 16'x16' and 16' x24' x 13' dimension. In 16'x 16'x16' size barns, Roof insulation with paddy straw insulation resulted in a net saving of 13.3% wood fuel while the installation of turbo fan on the roof top resulted in wood fuel saving of around 15% compared to control barn of similar dimension. Similarly Integration of paddy straw insulation in combination with turbo fan technology in a low profile barn (16' x24' x 13') saved around 30 % of fuel wood compared to control. Apart from this there was also reduction the in the total time taken for curing by 22%.These energy saving measures needs to be further popularized in the curing process of tobacco in KLS as curing alone accounts for more than 30% of the total cost of production in FCV tobacco cultivation.

ABS031: SUITABILITY OF DIFFERENT LEGUMES AS INTERCROPS IN SKIP ROWS OF FCV TOBACCO

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A field experiment on crop intensification in FCV tobacco for additional farm income was conducted at All India Network Project on Tobacco, ZAHRS, Navile, Shivamogga during *Kharif* 2021. The study was intended to know the effect of different legumes as intercrops in FCV tobacco. The experiment was laid out in RCBD with 11 treatments which were replicated thrice. The experiment involved greengram, blackgram, cowpea, fieldbean and groundnut as intercrops with FCV tobacco in every alternate row of tobacco as skip row intercropping system and their sole crops for comparison. The results revealed that, plant height of FCV tobacco at 45 DAP, 1st picking and final picking (59.1 cm, 84.6 cm and 116.4 cm, respectively) was found highest when FCV tobacco was intercropped with groundnut. The same treatment recorded more number of leaves per plant at 45 DAP (2.9) and at first picking (16.7). The highest number of leaves (22.2) were harvested in FCV tobacco + groundnut compared to sole FCV tobacco. Higher leaf area of leaf at X position (992.5 cm^2) and leaf at L position leaves (722.1 cm^2) was recorded in the FCV tobacco grown with groundnut as intercrop. FCV tobacco + groundnut recorded significantly higher cured leaf yield of FCV tobacco (1771 kg ha^{-1}) as compared to sole FCV tobacco which accounts to 13.9 per cent higher yield of FCV tobacco. Also, higher tobacco equivalent yield of 2124 kg ha^{-1} was noticed in FCV tobacco + groundnut followed by FCVtobacco+blackgram (1842 kg ha^{-1}). The chemical quality parameters such as nicotine, reducing sugars and chloride contents were under acceptable limits. Significantly lower reducing sugar content in 'X' and 'L' position leaf was recorded under FCV tobacco + greengram (8.08 and 10.83 %) intercropping system, respectively. Among FCV tobacco based cropping systems, FCV tobacco + groundnut was found economically feasible intercropping system as compared to other legumes.

Key words: Legumes, Intercrops, Skip rows, FCV Tobacco

ABS034: OROBANCHE INFESTATION IN TOBACCO: FARMERS' KNOWLEDGE AND ADOPTION LEVEL

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Orobanche is the major production constraint affecting the income of Flue Cured Virginia (FCV) tobacco farmers. In view of the economic importance of FCV tobacco in terms of farmers net income and national economy, the present study was undertaken with a specific objective to analyze the knowledge level and identify the constraints faced by the respondents in *Orobanche* management. *Expost-facto* research design and random sampling procedure has been adopted in selection of respondents. To collect the data from the respondents in totally, 60 farmers from two tobacco growing regions *viz*., Southern Light Soils (SLS) & Southern Black Soils (SBS) in Prakasam district of Andhra Pradesh (30) and Karnataka Light Soils (KLS) region in Mysuru district of Karnataka (30) were sampled. The primary data was collected in the year 2021 based on field survey and interaction with FCV tobacco farmers. Majority of the respondents had low level of knowledge in SLS &SBS of AP (64%) and KLS regions of Karnataka (50%). Most of the farmers strongly felt that knowledge on pests and diseases is more important as they are the major obstacles for crop production than weeds, particularly parasites and it is also felt by the respondents that hand weeding is the only option for parasite control. The biology and complex spread mechanisms are also difficult to understand until the parasite emerges from the underground, but as and when the shoots of orobanche are visible to the farmers, most of the damage already occurred to the host plant. Whereas in case of pests and diseases, the symptoms are distinct and clearly visible on the plants. This results in a low level of adoption behaviour in both the study areas. Correlation studies showed that there is a positive and significant relationship between level of education, farming experience, training attended and information seeking behaviour with the knowledge level of the respondents. Constraints faced by the farmers in parasite management were analyzed with Henry Garrett ranking technique. Results revealed that the most serious constraints perceived by the majority of the farmers among all were problematic soils, favourable weather condition, easy spread of the parasite, physical removal after flowering, low credibility on extension personnel, lack of know-how on biology of the parasite, small and marginal land holdings, tenancy ownership, lack of strict quarantine measures and lack of compensation to the farmers in case of crop failure caused by *Orobanche*.

Keywords: Constraints, Farmers, FCV tobacco, Knowledge and *Orobanche*

ORAL

ABS035: CUSTOMIZED FERTILIZERS, SECONDARY AND MICRONUTRIENT PRODUCTS FOR FCV TOBACCO

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Imbalanced nutrient application and continuous nutrient mining from native soil led to the nutrient deficiency, declining productivity, and deterioration of soil health. Improper application of straight fertilizers by virtue of their form (granular, powder etc..) also leads to imbalance of nutrients. Balanced fertilization can be possible through a single formulation, which maintains a dynamic equilibrium between nutrient application and nutrient uptake by crops and thereby aims to harness benefits to the farmers. The customized fertilizers have been developed in collaboration with Fertis India Pvt., Ltd., Hyderabad, based on the recommended dose of straight fertilizers being followed for tobacco cultivation. A field experiment was conducted at ICAR-CTRI Regional Station, Jeelugumilli, A.P., during *rabi* 2022-23 to evaluate the effect of customized fertilizers, secondary and micronutrient products on yield and quality of FCV tobacco. Customized fertilizers were developed for the first time for FCV tobacco. Two grades of customized fertilizers *viz.,* Basal grade [12 – 18 - 14 - 4.5 - 2.5 (N:P_2O_5:K_2O:S:Ca)] and Top dress grade [17 – 0 - 17 - 9.5 (N:P_2O_5:K_2O:S)] were developed containing the N, P_2O_5, K_2O, S & Ca of 117.5-36-121.5-61.3-5 based on the 100% nutrient recommendation for Northern Light soil grown FCV tobacco. Trac sure containing Zn, Mg, Cu, Fe, B, Mo and Akre shield containing C, H, N and S were tested along with customized fertilizers in different combinations. The treatments consist of Customized Fertilizer (CF) in 3 splits; CF in 3 splits + secondary & micronutrients proposed by CTRI; CF in 3 splits + Tracs sure (secondary & micronutrients proposed by Fertis); CF in 3 splits + Tracs sure + Akre Shield @ 1 ml/lit at 25th and 45th DAT; CF in 4 splits; CF in 4 splits + Tracs sure; CF in 4 splits + Tracs sure + Akre Shield @ 1 ml/lit at 25th and 45th DAT and recommended dose of NPK through Straight Fertilizers. Total eight treatments were laid out in RBD with 3 replications. The results revealed application of customized fertilizers along with secondary and micronutrient products has recorded significantly higher cured leaf yield over straight fertilizers to an extent of 26 percent and 8.5 percent in 4 splits and 3 splits of fertilizer application, respectively. Customized fertilizers have shown significant improvement in nutrient uptake (NPK) over straight fertilizers.The quality characteristics of FCV tobacco *viz.,* nicotine, reducing sugars and chlorides were not affected with the customized fertilizers and are within acceptable limits. Customized fertilizers are the best option for FCV tobacco to enable balanced application of nutrients.

Key Words: Customized fertilizer, Secondary nutrients, Balanced nutrition, FCV tobacco, Split application

ABS036: BORON FORTIFIED POTASSIUM SCHOENITE AS SOURCE OF POTASSIUM FOR FCV TOBACCO

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Potassium (K) is the key nutrient required in large quantity for optimum yield and quality of Flue Cured Virginia (FCV) tobacco. Tobacco is known as luxury user of potassium. Among various tobacco types, the export quality FCV tobacco requires higher dose of potassium.As the FCV tobacco is sensitive to chloride, the source of potassium used is sulphate of potash (SOP) instead of muriate of potash. The SOP is very costly fertilizer, because its availability totally depends on import from foreign countries. The SOP market has been greatly impacted by the outbreak of COVID-19 in several parts of the world since the pandemic began. In this scenario, the boron fortified Potassium Schoenite, has been evaluated as source of potassium for FCV tobacco and use of Boron fortified Potassium Schoenite supplies readily available supplements of potassium, magnesium, sulfur and boron for growing plants in an ideal ratio. Field experiments were conducted at ICAR-CTRI Regional Station, Hunsur, Karnataka and CTRI Regional Station, Jeelugumilli, Andhra Pradesh during *kharif* 2022 and rabi 2022-23 respectively, to evaluate the effect of "Boron fortified Potassium Schoenite as source of potassium for FCV tobacco under KLS and NLS. The results revealed that potassium schoenite has recorded green leaf yield, cured leaf yield and bright leaf yield are at a par with the Sulphate of potash. The quality characteristics of FCV tobacco *viz.,* nicotine, reducing sugars and chlorides estimated were within the acceptable limits. The results revealed that potassium schoenite has recorded Leaf K uptake at par with Sulphate of Potash. Hence boronated potassium schoenite can act as a source of potassium for FCV tobacco grown under light soils of Karnataka and Andhra Pradesh.

Key words: Potassium Schoenite, SOP, Potassium

ABS037: EFFECT OF MICROBIAL BIO-CONSORTIA FOR NUTRIENT SUPPLEMENTATION AND NEMATODE CONTROL FOR ENHANCING PRODUCTIVITY AND QUALITY OF FCV TOBACCO IN THE KLS REGION

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Inorganic inputs (pesticides and fertilizers) widely used in tobacco cultivation will have an impact on the nutrition and health of the soil. Over the years, the use of microbial consortia has become crucial for determining the condition of the soil, and also as a chemical-free substitute. Hence exogenous application of consortia is an effective strategy to improve soil nutrients, soil health, and quality production of tobacco. The soils of Karnataka Light Soils (KLS) region are sandy or sandy loam in nature with poor organic carbon status and hence application of various Bio-Consortia is likely to help in nutrient supplementation through solubilization and mobilization of soil nutrients and also helps in controlling the soil-borne diseases of wilt and root-knot nematodes which are major concerns in the KLS region. The role of Bio-Consortia on nutrient supplementation, plant protection, and consequently production and quality were evaluated at 100% and 75 % NPK dose. The variety adopted was FCH-222 with normal spacing and other cultural practices. The application of Bio-Consortia involving nutrient solubilizers and PGPR in combination with 100% NPK enhanced the productivity of green leaf yield, cured leaf yield and bright grade by 6.8%, 9.1 % and 4.4 % respectively, over the NPK alone treatment. Even at 75% NPK dose, the use of various Bio-Consortia resulted in around 6.3% and 2.3 % increase in cured leaf yield and bright grade productivity respectively, indicating the possibility of saving 25% NPK fertilizer by applying microbial consortia in the tobacco field. In addition to the productivity enhancement, the application of bio-consortia for disease suppression and nutrient supplementation resulted in suppressing the root-knot nematode infestation by up to 46%. However, no wilt incidence was observed during the experimental season.

The observations on yield parameters have indicated that treatment involving P & K solubilizes along with PGPR and application of Trichoderma or Pochamia performed better in increasing the cured leaf yield and bright grade production compared to other treatments. The treatments involving nutrient solubilizer P & K + PGPR + Trichoderma + Pochamia recorded the maximum cured leaf yield followed by P & K nutrient solubilizers + PGPR + Trichoderma combination. Similar trends were noticed w.r.t. Bright grade leaf productivity. Various yield parameters did not differ much between 100% NPK and 75% NPK when used in conjunction with various microbial bio-consortia. Application of Pochamia and Trichoderma along with P & K Solubilizers + PGPR also resulted in reducing the root-knot nematode incidence compared to nutrient solubilizer P & K alone or PGPR alone. Thus, it may be concluded that the application of Bio-Consortia might possibly influence the quality and productivity of tobacco crops by enhancing yield, available nutrients, and microbial population in the light soils of Karnataka.

Key Words:Bio-Consortia, disease incidence, FCV Tobacco, nematode, nutrient supplementation, productivity and, quality

ABS038: BIO EFFICACY OF DIFFERENT MYCOINSECTICIDES FOR THE MANAGEMENT OF LEAF EATING CATERPILLAR, *SPODOPTERA LITURA* (F) IN TOBACCO NURSERY

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Bidi tobacco, *Nicotiana tabacum* L. is a major crop of middle Gujarat agroclimatic zone. Tobacco leaf eating caterpillar, *Spodoptera litura*(F.) is a regular and polyphagous pest of nursery and transplanted crop.Under favourable conditions, the extent of loss may be about 80% and entire nursery can be wiped out.The use of fungal biological control agents is a rapidly developing field and is increasingly adopted and accepted worldwide management of agricultural pests. A field experiment was carried out for two years (2021-22 and 2022-23) in Randomized Block Design at Bidi Tobacco Research Station, Anand Agricultural University, Anand, Gujarat (India) to evaluate the efficacy of myco-insecticides against Tobacco leaf eating caterpillar, *Spodoptera litura*(F).Two applications of *Metarhizium anisopliae* 1% WP, 2 × 10^8cfu 5 g/lit water and oil formulation of *Metarhizium anisopliae* 1% (2 × 10^8cfu/g) 5 ml/lit water for the management of *S.litura* first at initiation of the pest and subsequent at 10 days interval found effective in bidi tobacco nursery. A demonstration plot was also taken up to for confirmation of an effective insecticides for management of leaf eating caterpillar revealed that chemical insecticide emamectin benzoate 5 SG 0.0025%, found most effective treatment followed by myco-insecticide, *Metarhizium anisopliae* 1% WP in comparison with absolute control. While developing an IPM strategy for the sustainablemanagement of leaf-eating caterpillars in bidi tobacco nurseries, mycoinsecticides become an environmental friendly component.

Key words: Myco-insecticides *Metarhizium anisopliae, Spodoptera litura*, Bidi tobacco

ABS042: ECONOMIC VIABILITY OF VARIOUS CROPS AND CROPPING SYSTEM FOR HIGHER FARM RETURNS UNDER VEDASANDUR CONDITION

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Chewing tobacco is cultivated in an area of 12000 to 13000 ha in Tamil Nadu. Many crops *viz.* Turmeric, annual *moringa*, sesame, gloroisa and chillies were grown in and around the chewing tobacco areas. In recent years the chewing tobacco face market glut due to increased area. keeping this in view, the present investigation was carried out to find out the production potential and economic viability of various crops and cropping system grown in the chewing tobacco growing areas of Tamil Nadu.

A field experiment was initiated during 2020-2022 at ICAR CTRI Research station farm, Vedasandur. Different crops and cropping system viz. *Gloriosasuperba ;* Turmeric(*Curcuma longa*) ; Castor (*Ricinuscommunis*); Gingelly(*Sesamum indicum*) ; Senna (*Cassia senna*); Maize (*Zeamays*) – *Aggregatum*onion (*Allium cepa*var*aggregatum*) ; Ashwagandha (*Withaniasomnifera*)-*Aggregatum*onion ; Tobacco(*Nicotiana tabaccum*)-*Aggregatum*onion ; Chillies(*Capsicum annum*) -Gingelly ; Annual*moringa* (*Moringa oliefera*) were tested for the productivity and profitability in a Randomized block design with 3 replications. The above crops and cropping systems were compared with the recommended cropping system viz. Chewing tobacco+ Annual *moringa* and sole chewing tobacco. The package of practices for non tobacco crops were followed as per the recommendations of TNAU. The first crop in the sequence was raised during *rabi* season and the second crop was raised during summer. The economics was worked out based on the price of the prevailing market rate.

The gross return was higher with *Gloriosa superba*(Rs.631100/ha) followed by Chewing tobacco+ Annual *moringa* (Rs.458300/ha), Chewing tobacco-*aggregatum* onion(Rs.342261/ha).The net return was higher with the chewing tobacco+ Annual *moringa* (Rs.180183/ha) followed by chewing tobacco- *aggregatum* onion (Rs.141514 kg/ha) followed by Ashwagandha-*aggregatum* onion (Rs.99,462/ha) cropping system.The recommended cropping system chewing tobacco+ Annual *moringa* recorded an increased net return of 63% as compared to the sole chewing tobacco .It could be concluded from the study that chewing tobacco+ Annual *moringa*, Chewing tobacco-*aggregatum* onion, Ashwagandha –*aggregatum* onion and chillies were found to the profitable crops.

Key words: Economic viability, Cropping system, Gross returns, Net returns.

ABS044: BIOGENIC SYNTHESIS AND CHARACTERIZATION OF COPPER NANOPARTICLES USING *NICOTIANA TABACUM L.* AQUEOUS LEAF EXTRACT

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Biosynthesizing of copper nanoparticles using microorganisms or various plant parts have proven more environmental friendly, cost-effective, energy saving and reproducible when compared to chemical and physical methods. This investigation demonstrated the plant-mediated synthesis of copper nanoparticles using the aqueous leaf extract of *Nicotiana tabacum* L. UV–Visible spectrophotometer was used to measure the surface plasmon resonance of the nanoparticles at 558 nm. Fourier Transform Infra-Red showed that the glycosidic –OH and carbonyl functional group present in the extract was responsible for the reduction and stabilization of the copper nanoparticles. X ray diffraction, Scanning Electron Microscopy, Transmission Electron Microscopy and Selected Area Electron Diffraction analyses were used to confirm the nature, morphology and shape of the nanoparticles. The copper nanoparticles were spherical in shape with an average size of 18.1 nm. The synthesized copper nanoparticles showed activity against fungal pathogens and bacteria. The zone of inhibition observed in the antimicrobial study ranged between 10 and 20 mm.

Key words: Antimicrobial activity, biosynthesis, copper nanoparticles, leaf extract, *Nicotiana tabacum*

ABS045: DEMONSTRATION ON PRODUCTION AND CULTIVATION OF TURMERIC SEEDLINGS PROPAGAETED FROM SINGLE BUD RHIZOMES

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Turmeric is an important commercial spice crop grown in India and popularly known as Indian Saffron or Golden Spice of India. Turmeric is cultivated in an area of 3.24 lakh ha in India, 31,000 ha in Andhra Pradesh and 400 ha in East Godavari District. Turmeric is commonly propagated through rhizomes. Therefore, large quantity of rhizome is required due to low efficiency of vegetative propagation and also unavailability of good quality planting material during the crop season. Often, a destructive disease rhizome rot also results into low yields and poor quality rhizomes. The Planting material requirement is about 20-25 q/ha and around 30-40 per cent of the cultivation cost goes towards just procuring the seed rhizomes. To overcome this problem TNAU, Coimbatore, has developed and standardized a technology on rapid multiplication of turmeric using single bud rhizome in pro-trays.The KVK (ICAR-CTRI), East Godavari Dt., has demonstrated this proven technology to the farmers through Frontline Demonstration (FLD). The technology, so demonstrated, has been well accepted by the farmers because of the advantages that pro-tray seedling production has reduced seed rate by 70-80 per cent; reduction in cost of planting material and production of disease free planting material; saving huge quantity of rhizome which can be used for commercial purpose;reduction in gestation period by 30-60 days so that land can be used for 1-2 months for any beneficial purpose; weed free condition at early crop growth period has reduced the cost on inter-culture operations.Farmers have reported that no or very less incidence of rhizome rot and about 18% yield increase over conventional method.

ABS050: SOIL INVERSION WITH MOULD BOARD PLOUGH IN CONJUNCTION WITH OTHER INTERVENTIONS FOR IMPROVED POTASSIUM USE EFFICIENCY OF FCV TOBACCO

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Potassium leaching in the tobacco growing light textured soils is becoming a serious concern. In this scenario, investigations on interventions like soil inversion with mould board (MB) plough to replenish the leached potassium from lower layers to surface layers is very much essential and also by keeping in mind the increasing prices of SOP, other potassium management strategies *Viz.,* application of Tobacco stalk biochar (TS Biochar) and Barn wood Ashes (BWA) as supplements of potassium are also taken into consideration. A field experiment was conducted in split plot design considering two main plots as soil inversion treatments i.e., (i) soil inversion with MB plough, (ii) without soil inversion and seven sub plot treatments *viz.,* one without potassium, two sulphate of potash treatments at the rate of 100 % and 75 % of recommended dose of potassium (RDK), two TS Biochar treatments along with SOP at the rate of 100 % and 75 % RDK, two BWA treatments along with SOP at the rate of 100 % and 75 % RDK. Results indicated that yield attributes were improved with soil inversion using MB plough thus, improved the green leaf yield (GLY) and cured leaf yield (CLY) with a mean value of 10449 kg ha^{-1} and 1704 kg ha^{-1}, respectively and among the potassium input management practices, the highest green leaf and cured leaf yields were recorded in 100 % RDK through TS Biochar / BWA along with SOP this may be due to the improved soil properties, nutrient uptake and nutrient use efficiency of FCV tobacco receiving these treatments. Hence, soil inversion with MB plough and potassium management strategies *viz.,* TS Biochar/ BWA can be used as potassium supplements under scarce potassium sulphate situations.

Keywords: Potassium, Tobacco stalk biochar and Barnwood ash

ABS053:EVALUATION OF NEWER NEMATICIDAL MOLECULE, FLUOPYRUM400 SC (VELUM PRIME) AGAINST ROOT KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* IN FCV TOBACCO NURSERY

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FCV tobacco is an important commercial crop grown under rainfed farming situations on red sandy to sandy loam soils in Southern Transitional Zone of Karnataka. Among several biotic stresses, root knot nematode, *Meloidogyneincognita* infestation is a major limitation for successful FCV tobacco cultivation in KLS. It causes significant loss in healthy and root knot free transplantable seedlings needed for timely planting. Carbofuran, an insecticide with some nematicidal properties in it was so far used against root knot nematodes in various crops including FCV tobacco in Karnataka. But it is not so effective and hence there is an urgent need for an alternative to carbofuran. An attempt was made to evaluate newer nematicides, Fluopyrum 400 SC, Fluensulfone 2%G &Carbosulfan in varied doses along with carbofuran 3G as standard check at root knot nematode sick plot with initial root knot nematode population level of 117 juveniles per 100 g soil at ICAR - CTRI RS Hunsur. Experimental results revealed that Fluopyrum 400 SC at all tested concentration were on par with each other and were significantly superior to other chemicals in recording reduced root knot disease incidence in FCV tobacco nursery. Fluopyrum 400 SC @ 0.05% recorded significantly reduced Root Knot Index (RKI) of 1.50 as compared to 3.76 (under 0 – 5 Scale) in untreated check. Similarly, it caused 41.9% reduction in nematode soil population and 25.61% increase in root knot free transplantable seedlings as compared to untreated check. Fluopyrum 400 SC @ 0.05% can be effectively used for the management of root knot nematode, *Meloidogyneincognita* in FCV tobacco nursery.

Key words: Root knot nematode, Fluopyrum 400 SC and FCV tobacco nursery.

ABS060:ASSESSMENT OF SOIL FERTILITY STATUS IN SOUTHERN BLACK SOILS REGION OF FCV TOBACCO USING GEO-SPATIAL TOOLS

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The soil samples of SBS were analyzed for soil fertility assessment. The results indicated that low levels of organic carbon content were found in these soils growing FCV tobacco (0.07 to 0.53 %) with a mean value of 0.33 %. The average available nitrogen content recorded was 123.5 kg ha^{-1} which is rated as low. The available phosphorus of the soils was high with a mean value of 41.2 kg ha^{-1} while available potassium content of the region ranged between 107.0 and 686.5 kg ha^{-1} with a mean value of 405.6 kg ha^{-1} (Rated High). Available Sulphur in the region ranged from 1.9 to 97.6 mg/kg with a mean value of 18.0 mg/kg. with the lowest mean of 13.3 mg/kg under the auction platform 24, respectively. The mean available calcium and magnesium contents of the soils in the region were 23.6 cmol (+) kg^{-1} and 5.10 cmol (+) kg^{-1}, respectively. Nutrient indices of FCV tobacco growing soils of SBS were calculated and the NI of organic carbon (1.00 to 1.11) and available nitrogen (1.00) recorded were categorized under fertility class low in all the platforms of SBS. The nutrient index of available phosphorus was categorized under high fertility class. Nutrient index of potassium categorized under the index class of high except soils under APF *20* (medium: NI value 2.49). The soil chloride content of the soils recorded was below the prescribed critical limit (CL: < 100 mg g^{-1}) and suitable for FCV tobacco cultivation. About 97 % of samples were Below Critical Limit (BCL: < 100 mg g^{-1}) and only 3 % of samples were Above Critical Limit (ACL: > 100 mg g^{-1}). Availability of micronutrients in these soils were in the order of Zn (0.35 µg g^{-1}) < Cu (0.75 µg g^{-1}) < Fe (2.17 µg g^{-1}) < Mn (5.10 µg g^{-1}).

Key words: Soil fertility assessment, FCV tobacco and Geo Spatial Tools.

ABS063: SUSTAINABLE INTENSIFICATION AND DIVERSIFICATION OF TOBACCO-BASED PRODUCTION SYSTEMS TO ENHANCE RESOURCE USE EFFICIENCY, SYSTEM PRODUCTIVITY AND PROFITABILITY IN VERTISOLS OF ANDHRA PRADESH

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Flue Cured Virginia (FCV) tobacco is a major high-value commercial crop grown in India and plays a pivotal role as the second largest tobacco producer (761 M Kg) in global production, with its cultivation in an area of 0.45M ha. Tobacco crops continue to be the main livelihood option for millions of farmers and workers involved in cultivation and postharvest operations. Despite this sizeable contribution to the Indian economy and livelihood security for millions of people, there are some emerging issues that affect tobacco cultivation, such as climate change, resource degradation, biotic and abiotic stresses, and escalating production costs. To overcome these challenges, sustainable intensification and diversification are important strategies for enhancing resource use efficiency, productivity, and profitability in tobacco growing Vertisols of Andhra Pradesh. A field experiment was conducted at the ICAR-CTRI Black Soil Research Farm, Katheru, Rajahmundry to evaluate the performance of different crops and cropping systems (fallow-tobacco, foxtail millet-tobacco, finger millet-tobacco, chilli, and turmeric) during 2019-2022. The experiment was conducted in a randomized block design with four replications. The recommended seed rate, spacing, fertilizers, and all other agronomic interventions were applied to raise these crops. The grain/dry chilli/dry rhizomes yields of foxtail millet, finger millet, chilli, and turmeric were converted into tobacco leaf equivalent yield (TLEY) based on prevailing market prices. In case of cropping systems, system productivity was determined by adding the tobacco leaf equivalent yield of the kharif season crops to their respective rabi crop components. Chilli and turmeric performed well in terms of tobacco leaf equivalent yield (TLEY) and net returns compared with other tobacco-based systems. However, Foxtail millet (korra)-tobacco and Finger millet (ragi)-tobacco registered higher tobacco leaf equivalent yield and net returns compared to existing fallow-tobacco. The benefit cost

ratio values did not show any significant differences between the crops and cropping systems studied.The highest system productivity based on TLEY was recorded in chilli and turmeric crops, which is due to high productivity levels of chilli and turmeric coupled with more price prevailing in the market for chilli and turmeric. Based on this study, it could be concluded that intensification of tobacco with foxtail millet and finger millet is highly remunerative compared to the fallow-tobacco system and sole chilli; sole turmeric crops are highly productive and profitable and enhance farm income in tobacco growing regions of Andhra Pradesh.

Key words: Sustainable intensification, diversification, tobacco, system productivity, profitability

ABS064: IMPACT OF DOUBLE CROPPING SYSTEM IN RAINFED VERTISOLSOF PRAKASAM DISTRICT OF ANDHRA PRADESH

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Among all pulses grown in *rabi* season under rainfed conditions chickpea is the major crop in Prakasam district. It is being grown in an area of 55,379 ha in the district. Generally, farmers keep the land fallow in *Kharif* season and take up sowings of chickpea in Rabi season during the months of October or November based on receipt of rainfall. In order to use the available natural resources, enhance the farmer income and cropping intensity KVK has introduced 60 days duration foxtail millet variety Garuda in *Kharif* season followed by sowing of chickpea in *rabi* season on the same piece of land. This demonstration was conducted in 5 locations for 2 years from 2021-22 and 2022-23 in KVK operational area of Prakasam district. As a result of this intervention farmers have obtained 865 kg of foxtail millet seed/ha which is 346 kg additional equivalent yield of chickpea and obtained additional net returns of Rs. 17,300 per hectare. If this technology is adopted for the entire area of 55,379 ha in the district, then an additional yield of 19,161 tonnes of chickpea with additional net return of Rs. 95.8 crore can be obtained which paves the way for Doubling Farmers Income in rainfed farming system as well.

Key words: Double cropping system, fox tailmillet-chickpea, cropping intensity, DFI.

ABS065: PERFORMANCE ANALYSIS OFTOMATO HYBRIDS IN KANDUKUR DIVISION OF PRAKASAM DISTRICT OF ANDHRA PRADESH

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Tomato is one of the important vegetable crops among other vegetables grown in Prakasam district. It is being grown in an area of 345 ha in the district. With an aim to improve the production, productivity and net income to the farmers KVK, Kandukur has demonstrated latest tomato hybrids Arka Samrat, Arka abed released by ICAR-IIHR, Bangalore for two years from 2021-22 to 2022-23 in 5 locations of KVK operational area. Both the hybrids were found to be resistant to Tobacco Leaf Curl Virus, Bacterial Wilt and early blight diseases. The weight of the fruit in Arka Samrat was 105.4 g and in Arka Abed it was 96.2g. Arka smart has given an average yield of 81.2 t/ha compared to 72.5 t/ha in Arka Abed. The fruit of the Arka Samrat was oblate to high round, large, deep red and firm and found to be suitable for fresh market and processing. In case of Arka Abed the fruit was firm, oblate round & medium large and suitable for fresh market and processing. As far as farmers preference was concerned Arka Samrat was mostly preferred because of good market demand and better price.

Key words: Vegetables, Tomato, Arka Samrat and Arka Abed, Yield, disease resistance.

ABS066: ON-FARM TESTING OF IMPROVED PIGEON PEA VARIETIES IN RAINFED FARMING SYSTEMS OF PRAKASAM DISTRICT OF ANDHRA PRADESH

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Pigeon pea is important pulse crop grown in an area of 34,379 ha in KVK operational area of Prakasam district under rainfed farming system. Farmers used to grow LRG-52 variety. The average productivity of pigeon pea in the district was 504 kg/ha which is lesser than average productivity of India that is 871 kg/ha. In order to improve production, productivity and net income to the farmers improved variety LRG-105 was introduced under On-Farm Testing in 6 locations for 2 years from 2020-21 and 2021-22. LRG-105 variety was found to be resistant to wilt and sterility mosaic disease and erect plant type whereas LRG-50 was found to be partially resistant to above diseases with bold sized seed and spreading type. LRG-52 has given an average yield of 6.8 q/ha whereas LRG-105 has given an average yield of 8.2q/ha which is 20.5% higher yield than the LRG-52 variety. As far as net income is concerned LRG-105 has given a net income of Rs.283,00/ha and LRG-52 has given Rs.19,200/ha.

Key words: Pulses, LRG-105, wilt and SMD, yield, net income.

ABS068: EFFECT OF MULCHING AND NUTRIENT MANAGEMENT PRACTICES FOR HIGHER PRODUCTIVITY, RESOURCE USE EFFICIENCY AND VALUE ADDITION OF TURMERIC (CURCUMA LONGA L.)

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A field experiment was conducted during *kharif/rabi* 2022-23 at ICAR-CTRI RS, farm Jeelugumilli, Andhra Pradesh to study the effect of mulching and nutrient management practices for higher productivity, resource use efficiency and value addition of Turmeric (*Curcuma longa* L.). The experiment was laid out in a factorial randomised block design consisting of 16 treatment combinations of four mulching practices (1.Mulching with shredded tobacco stacks 2. Mulching with green leaves/ crop residue 3. Mulching with sunnhemp*in situ* growing and 4. No mulching) and four nutrient management practices (1. Inorganic (150-50-50 N-P-K kg/ha = RDF), 2. Inorganic + Biocapsule 3. Organic 4. INM). There were significant differences among the different mulching practices with regard to the rhizome yields. Mulching with sunnhemp*in situ* green manuring recorded higher fresh and dry weight of rhizome and curcumin content followed by mulching with green leaves/ crop residue and that was followed by mulching with shredded tobacco stems and no mulching. Nutrient management practices also showed significant differences with regard to rhizome yield. Integrated nutrient management involving recommended dose of fertilizers (150-50-50 N-P_2O_5- K_2O kg/ha), + FYM 5t/ha + *Azospirillum* + Biocapsule (*Trichoderma*) from IISR, Calicut recorded significantly higher green and dry weight of turmeric rhizome and curcumic content. Inorganic fertilizers alone and organic manures alone treatments recoded significantly lower rhizome yields and curcumin content. The treatment combination of mulching with sunnhemp*in situ* green manuring and INM Inorganic (RDF) + Organic (FYM 5t/ha) +Azospirillum + Biocapsule from IISR, Calicut recorded highest fresh and dry rhizome yields and curcumin content of 37.2 and 6.69 t/ha, 3.5% respectively. There were no significant interactions among the mulching practice and nutrient management treatments.

Key words: Turmeric, Mulching practice, nutrient management, yield, cucumin content.

ABS069: CULTURAL MANAGEMENT OF *OROBANCHE* IN TOBACCO

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Tobacco, is one of the important commercial crops grown in India with a cultivated area of 0.45 million ha, producing 760 million kg annually. All types of tobaccos are severely affected by broomrape and two species namely *Orobanchecermua* and *Orobancheramosa* are commonly parasitize tobacco of which former is being most common in India. A review of literature on control measures indicates that there is no single consistent, effective and economical method for complete eradication of broomrape infestation in tobacco. Therefore, the only effective way to combat weedy root parasite like *Orobanche* is through an integrated approach, combining a variety of measures in a concerted manner.

Field experiment was conducted during 2019-20 season at ICAR-CTRI Research Farm, Jeelugumilli (irrigated alfisols). Summer ploughing was done to expose the Orobanche seed to summer temperatures during May in all the treatments. Experimental treatments were 1. Neem cake application at 30 days after planting (DAP), 2. Planting of marigold in between the tobacco plants (intra row) after planting tobacco, 3. Sowing Fenugreek at 30 days of planting on one side of tobacco row 4. Sowing Fenugreek at 30 days of planting on two sides of tobacco row 5. Pre plant incorporation (PPI) of pendimethalin + Neem cake application at 30 DAP and 6. Control (No management methods) in RBD. In all the plots Orobanche were removed, no.of spikes and weights were taken at 70 and 100 days after planting. Tobacco leaf weights were taken and all the data were recorded.

Tobacco was taken up in Rabi by imposing the different treatments for *Orobanche* control. Planting of marigold in between the tobacco plants (intra row) after planting tobacco recorded 2.1 % of the infestation which is less by 14.1% than control. Sowing of Fenugreek on two sides of tobacco row recorded infestation of 3.2% which is 13% less than control. Neem cake application also recorded lower infestation than control. Whereas PPI of pendimethalin recorded 9.4% infestation which is 7.8% lower than control.

Though lowest percentage of infection is recorded by planting of marigold in between the tobacco plants lower yields were recorded because of the competition of marigold with tobacco for nutrients and moisture for massive growth of Marigold and flowering. Neem cake + PPI of pendimethalin also recorded lower yields than control. Sowing of fenugreek on two sides of tobacco recorded higher yield than other treatments. Sowing of Fenugreek two sides of tobacco plant recorded infestation of 3.2% which is 13% less than the control in alfisols. Though lowest percentage of infection is recorded by planting of marigold in between the tobacco plants lower yields were recorded because of the competition of marigold with tobacco for nutrients and moisture for massive growth of marigold.

Keywords: FCV Tobacco, fenugreek, management, marigold, orobanche, summer ploughing

ABS081: EVALUATION OF BIO CONTROL AGENTS AGAINST ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* UNDER LABORATORY CONDITION

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Root-knot nematode, *Meloidogyne* spp. is a ubiquitous soil organism and highly destructive pest that causes severe damage to various crops, especially tobacco, chilli, turmeric and castor of commercially important crops as well. They are interacting with other soil-inhabiting plant pathogens, viz., bacteria, fungi to form disease complexes, providing avenue for these pathogens to enter into the plant system by wounding in which the resulting disease is much more severe than components of the complex would cause alone. Under alarming situation, farmers can go for chemical nematicides an easy option to control nematodes, because of their quick chemical response. Prolonged use of such chemical nematicides to control root-knot nematodes results in toxic to soil biota, human health and safety risks, pollution to agro-ecosystem, development of nematode resistance and the resurgence. Therefore, strategies related to exploit biological organism as a green tool to manage nematodes because of their safer in nature, target specific and environment friendly and cost-effective compare to the costs farmers incur when purchasing broad-spectrum nematicides. Our aim is to evaluate the efficacy of indigenous bacterial bio agents *Bacillus subtilis Bbv*57and fungal bioagents such as *Trichoderma harzianum*(Tr-9), *Pochoniachlamydosporia* (strain 15) and *Paecilomyceslilacinus*(strain 251) against root-knot nematode, *Meloidogyne incognita* under *in-vitro* conditions. At 24h exposure period, cent percent mortality was recorded in the culture filtrate prepared from*B. Subtilis*Bbv 57 Whereas, in case of fungal bioagents 88.66%, 85% and 82.34% mortality of J_2 was recorded at 72 hours after exposure (HAE) period in *Trichoderma harzianum* (*Tr*-9), *Pochoniachlamydosporia* (strain 15). and *Paecilomyceslilacinus* (strain 251) respectively. All bioagents significantly suppressed the egg hatching and it was maximum by *B. subtilis* Bbv 57, (82.33%). Similarly, the maximum suppression by fungal bioagents in egg hatching of nematodes was observed in *Trichoderma harzianum* (*Tr*-9), (84.66%) followed by *Pochoniachlamydosporia* (strain 15). (78.66%) *Paecilomyceslilacinus* (strain 251) (75.78%) respectively.In conclusion, bio control agentsare an alternative tochemical control and they can be a suitable solution toprotect the crops as well as eco system in a sustainable manner.

Keywords: Root-knot nematode, Bio control agents, Evaluation, Management

ABS085: APPLICATION OF ANTIBIOTICS IN AGRICULTURE AND THEIR IMPACTS – A GLOBAL CONCERN

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The input and application of antibiotics in agriculture sector is more or less similar to humans. An annual consumption of 50,000 tons of antibiotics in agriculture is reported on a global scale. A wide range of antibiotics having similar chemical nature are being used in animal husbandry, aquaculture and crop production; their utilization is equivalent to human therapeutics. In some parts of the world, heavy doses of antibiotics are applied in animal husbandry as compared to human-beings. The application of antibiotics is relatively low for crop production in comparison with live-stocks. In the wake of antibiotic/antimicrobial resistance of important microbes, there should be checks on unrestricted and indiscriminate use of antibiotics in agriculture sector. The human pathogenic microbes that are resistant to the commercially available antibiotics are posing life threat to human-beings. The antibiotic residues used for crop production and live-stocks are also becoming a menace for human health. There is a dire need to assess the antibiotic resistance in pathogens causing diseases in plants and live-stocks as it is affecting human population in an indirect manner. The pros and cons of applying antibiotics is discussed for healthy agricultural practices. Advanced analytical techniques like HPLC, UPLC etc. are to be used to determine the antibiotic residue loads in agricultural products as they show impact on food chains and food webs; further may also cause health hazards to the human beings. The present work focuses on the impact assessment of antibiotic residues from agricultural sector.

Key words: Antibiotics, Pathogenic microbes, HPLC and UPLC.

ABS088: COMPATIBILITY OF FUNGICIDES AND INSECTICIDES AGAINST PYTHIUM APHANIDERMATUM, PHYTOPHTHORA PARASITICA F. SP. NICOTIANAE AND CERCOSPORA NICOTIANAE ON TOBACCO

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Studies were conducted to evaluate the efficacy and compatibility of certain new fungicides with insecticides alone and in combination against *Pythium aphanidermatum*, *Phytophthora parasitica*f.sp. *nicotianae* and *Cercosporanicotianae* in Virginia tobacco nurseries and planted crop. Among the recommended fungicides, carbendazim showed higher efficacy against *Cercosporanicotianae* as it recorded cent *per cent* mycelial inhibition. It was followed by pyraclostrobin + metiram (76.39%) alone and in combination with imidacloprid (74.17%) and flubendiamide (72.78%). Cent *per cent* mycelia inhibition was recorded in fenamidone + mancozeb alone and in combination with emamectin benzoate and imidacloprid showing very high compatibility followed by (metalaxyl + mancozeb) + imidacloprid (96%) against *Phytophthora parasitica f. sp. nicotianae*. In case of *Pythium aphanidermatum* 100% mycelia inhibition was recorded in combination treatments i.e. (fenamidone + mancozeb) + emamectin benzoate, azoxystrobin + emamectin benzoate and (metalaxyl + mancozeb) + imidacloprid followed by (metalaxyl- m + mancozeb) + emamectin benzoate (93.33%). Other fungicide and insecticide combinations were also found inhibitory at their respective recommended doses. Jar test results also indicated that all the recommended fungicides against *Pythium aphanidermatum*, *Phytophthora parasitica f. sp. nicotianae* and *Cercosporanicotianae* were physically compatible with recommended insecticides at their recommended doses. All insecticides and fungicides alone and their combinations showed no phytotoxicity in nursery and transplanted crops even after 14 days of spraying.

ABS090: HOST RANGE OF *FUSARIUM* SP. ISOLATED FROM SPATHIPHYLLUM

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Spathiphyllum commonly known as the peace lily, is a popular indoor plant. It is known for its elegant, dark green leaves and striking white spathes and its ability to bloom throughout the year. Besides ornamental characteristics, ithasapotential to remove pollutants from indoor air. They are relatively low maintenance and thrive in indirect sun light and potted plants increases the aesthetic value at office and home premises. Recently occurrence of wilt with an incidence of 80-90% was observed in spathiphyllum plants in nurseries located at Kadiyapulanka village, Kadiyam Mandal, East Godavari, Andhra Pradesh. The pathogen was isolated from the symptomatic plants and identified as *Fusarium* sp. using morphological characters.Pathogenicity of the pathogen was proved by artificial inoculation. The ITS region in rDNA gene of the pathogen was sequenced with universal ITS1 and ITS4 primers and the sequences showed 99.65% similarity with sequences of *F. solani* available in NCBI. Since the species of pathogen identified as *F. solani* based on ITS sequences, the host range study of the pathogen was conducted by artificial inoculation in different solanaceous crops. Result of the host range study revealed that the *F. solani*isolated from spathiphyllum could able to infect the solanaceous crops cultivated commercially such as tobacco, chilli, brinjaland tomato. To our knowledge this is the first report of *Fusarium* sp. which infects pathiphyllum and other solanceous crops.

Keywords: *Spathiphyllum, Fusarium, Fusarium host range*

ABS091: EVALUATION OF INDIGENOUS BIOAGENTS FOR THE MANAGEMENT OF ROOT-KNOT NEMATODE UNDER *IN-VITRO* CONDITIONS

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Abstract: Root-Knot nematode, *Meloidogyne* spp. are the most economically damaging group of plant-parasitic nematodes and causes considerable yield loss in ornamentals. Application of chemical nematicides were effective but in long term and wide scale usage leads to environmental pollution and development of resistance in nematodes. Therefore, there is a need to develop ecofriendly nematode management strategies. One of the best ecofriendly management strategies is use of biopesticides which are environmentally safe and alternative to hazardous chemical pesticides. Keeping in this view, the present study was conducted to evaluate the efficacy of indigenous bioagents against root-knot nematode under *in-vitro* conditions. Isolated indigenous bacterial isolates (C2, C5, C6, and C8) from Crossandra fields and two strains from Tuberose fields (T1, and T4), ICAR-DFR, Regional station, Kadiyam. All these strains were tested against root-knot nematode, second-stage juveniles (J2) and egg-masses. Cell free culture filtrate of these isolates significantly inhibited the egg hatching and caused juvenile (J2) mortality of root knot nematode at 25, 50, 75 and 100% culture filtrate concentrations. Juvenile(J2) mortality and hatching inhibition was found to be directly proportional to the concentration and duration of exposure. Toxic metabolites of bacterial bioagents showed dramatic effect on mortality of second stage juveniles at all different concentrations. At 24h exposure period, cent percent mortality was observed in 100% culture filtrate prepared from C6 and T4 followed by T1 (90%), C5(89%) and C2 (85.66%). Maximum hatching inhibition was observed in 100% culture filtrate of T4 (99.2%), C6 (98%) followed by T1(87.93%), C5(84%) and C2(81.1%). Among five indigenous bioagents, T4 (Bacillus sp) and C6 (Psuedomonas sp.) were found to be effective against root-knot nematode under *in-vitro* conditions. Further studies to be conducted to evaluate the efficacy of these bioagents against root-knot nematode, *M. incognita* under both pot and field conditions.

Keywords: root-knot nematode, biocontrol agents, culture filtrate, bacteria

ABS095: EVALUATION OF DIFFERENT WATER SAVING TECHNIQUES IN CASSAVA FOR INCREASED TUBER YIELD AND QUALITY

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The cassava crop is widely grown as staple food and animal feed and it has moved from being a subsistence crop to a fully commercial crop, due to its income generating capacity and enormous potential for industry, animal feed and human consumption. Nowadays, some farmers prefer to plant cassava at the end of rainy season to avoid weed competition and to reduce the cost of cultivation. However, cassava planted at the end of rainy season will be exposed to prolong drought in the dry season, influencing various physiological processes resulting in depressed growth, development and economic yield so that, there is a need to develop the water saving technology to increase the tuber yield and quality. Therefore, an experiment was conducted with eight treatments *viz.* Drip Irrigation at 50 % CPE+ Ground cover sheet (120 gsm) (T1), Drip Irrigation at 50 % CPE + * Mulching with crop residues (T2), Drip Irrigation at 50% CPE + Coir pith @ 1 kg per plant (T3), Drip Irrigation at 50% CPE + **Anti transparentspray (T4), Drip Irrigation at 50% CPE + Pusa hydrogel @ 0.5 g per plant (T5), Drip Irrigation at 50% CPE + Synthetic SAP (T6), Drip Irrigation at 50% CPE (T7) and Drip Irrigation at 100% CPE (T8) in Randomised Block Design with three replications during 2021-22 at Dr. YSRHU – HRS, Peddapuram. The results revealed that the performance of growth and yield parameters were good under T_6 (Drip Irrigation at 50% CPE + Synthetic SAP) and T_1 (Drip Irrigation at 50 % CPE + Ground cover sheet (120 gsm)) respectively. Therefore, it is concluded that drip irrigation along with ground cover sheet and spraying of synthetic SAP has proved to be a successful in terms of water usage and increased yield as well as improved product quality.

Key words: Cassava, Water Saving, Yield, Quality, Drip Irrigation

ABS102: INTEGRATED APPROACH FOR THE MANAGEMENT OF WHITEFLIES, *BEMISIA TABACI* (GENNADIUS) IN FCV TOBACCO

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Tobacco whitefly, *Bemisiatabaci*(Gennadius)is one of the major insect pests of FCV Tobacco in traditional black soil area of Rajahmundry. The whitefly population was recorded on FCV tobacco under prevailing weather conditions. Three pest management modules evaluated against *Bemisiatabaci*was carried out during *rabi* 2020-21 and 2021-22 at BSR farm, Katheru. *viz*., Chemical module with spraying of chemical pesticides, bio module with spraying of biological pesticides and integrated module with sorghum barrier along with spray of low residue pesticides. Field observations were recorded on whitefly infestation and yield in all the plots. Integrated module (85.71% and 83.33%) and chemical module (80.05% and 85.90%) recorded significant reduction of whitefly population over the untreated check. Higher cured leaf yield was recorded in Integrated module (2030 Kg/ha and 1885 Kg/ha), followed by chemical module (2000 Kg/ha and 1876 Kg/ha). It is evident that the integratedmodule can be useful for effective management as well as for getting higher yields. Both integrated module and chemical were on par and significantly reduced whitefly population over untreated check. Therefore, this module can be employed and utilized for successful management of whiteflies in FCV tobacco which in turn would aid in development of suitable management strategies as part of good agriculture practices.

Keywords: Integrated,Management,*Bemisia*, *tabaci* and FCV Tobacco.

ABS105: COST EFFECTIVE AND EFFICIENT PITFALL TRAPS FOR COLLECTING ARTHROPODS IN TOBACCO

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Arthropods are important life forms contributing to the enhancement of the structure, texture of soil and its chemical composition. They are more diverse in structure and function, and are quintessential for sustainability of agro-ecosystems. It is essential to assess arthropod species richness and abundances to resort to conservation measures. However, their collection by other manual and physical methods is difficult, time consuming and skewed. Pitfall traps used for obtaining arthropods especially those soil dwelling, nocturnal arthropods etc are unbiased and very efficient. To study the arthropod species composition in tobacco crop ecosystem, special pitfall traps were fabricated with plastic containers and associated components innovatively using an exceptionally efficient killing agent. The traps are not only efficient, but also cost effective and easy to install and easy to collect the trapped samples.

Keywords: Pitfall, trap, soil, arthropod, abundance, collection.

ABS106: UNVEILING THE UNDERGROUND WEALTH: A COMPREHENSIVE REVIEW ON CARBON POOLS AND SEQUESTRATION

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The drastic increase of atmospheric CO_2 concentrations and depletion of soil organic carbon (SOC) have prompted interest in exploiting the sink potential of soil to sequester carbon. Carbon, a fundamental element of life, plays a central role in regulating Earth's climate and supporting ecosystems. The review explores the dynamic nature of carbon pools, encompassing soil organic matter, vegetation, and aquatic systems. It delves into the factors influencing carbon storage and turnover rates, considering both natural and anthropogenic drivers. Special emphasis is placed on the importance of soil as a significant carbon reservoir and the roles of microbial communities in mediating carbon cycling processes. Furthermore, the presentation investigates contemporary challenges to carbon sequestration; Human-induced alterations to these carbon pools have far-reaching consequences for climate regulation, biodiversity, and ecosystem services. The poster highlights the urgency of adopting sustainable practices to preserve and enhance carbon sequestration, identifying challenges, innovative strategies and land management practices that promote carbon sequestration. Ultimately, this poster serves as a valuable resource for researchers, policymakers, and practitioners. By fostering awareness of the intricacies surrounding carbon pools, and contributing to the ongoing dialogue on sustainable resource management and climate change mitigation. As we collectively strive to address the challenges of a changing climate for a more resilient and sustainable future.

Keywords: carbon sequestration, climate change, soil, sustainable agriculture

ABS107: ADVANCED AGRONOMIC APPROACHES FOR CLIMATE RESILIENT FARMING

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Nearly 30% of the earth is covered with agricultural crops, which is closely related to environmental quality. The key issue of environmental quality includes how agriculture affects the environment and improving agricultural management to look up the quality of the air, soil, and water. A variety of techniques and the assessment of climate risk are necessary for successful adaptation initiatives. Climate change poses a threat to global food and nutritional security. The increase in greenhouse gas emissions in the atmosphere causes a rise in temperature, which is attributed to the greenhouse effect. If the average world temperature were to rise there would be enormous economic losses on a global scale. Inadvertently, rising temperatures also increase pest and disease infestation, crop respiration rate and evapo-transpiration, crop duration reduction, and weed problem, even though they have boosted photosynthesis and plant growth and productivity.Climate change also affects the microbial population and their enzymatic activities in soil. Crop susceptibility rises with greater weather variability. The two most frequent stresses that plants face in the field are heat and drought, both of which have a significant effect on the plants. It looks at the possible causes of the phenomenon, its expected effects, its implications for the near future, how it affects plant physiology and metabolism, how it may affect plant growth and productivity, how mitigation measures have been proposed, and how it affects the economy.

Key words:Agronomic approach, Climate risks, climate resilient crops, Ideotype.

ABS114: CLIMATE RESILIENT AND SOIL HEALTH IMPROVING PRACTICES FOR SUSTAINABLE FLUE-CURED TOBACCO PRODUCTION IN SOUTHERN REGION OF ANDHRA PRADESH

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Tobacco is an important commercial crop cultivated under varied agro-climatic conditions in India. Of the different tobacco types, flue-cured tobacco has high export potential and is mainly grown in the states of Andhra Pradesh and Karnataka. In southern region of AP, Flue cured tobacco is cultivated on light textured red loamy soils (Alfisols) and heavy textured black soils (Vertisols) during rabi season relying on both stored soil moisture and North-East monsoonal rains. The crop grown on light textured soils often faces multiple abiotic stresses due to erratic rainfall and unpredictable weather conditions attributable to climate change. Long term rain fall data showed decreasing trend in numbers of rainy days and increase trend of one-day maximum rainfall and frequency of extreme rain events. The soils of this region are mainly characterized with moderate quantities of clay, neutral to slightly alkaline, limited drainage, low organic carbon, low in P and medium to high in potassium. In order to circumvent these production constraints, several evidence-based climate resilient and soil health improving practices for sustainable production were identified for adoption. Application of organic inputs *viz*., Farm yard manure/vermicompost/green manures/agri-industrial waste etc. has the potential to improve soil organic carbon and thus soil health. The problem of crusting and/or hardening on drying in light textured sandy loam soils can be managed by maintaining adequate soil moisture through in situ green manuring and by light and frequent irrigation with intercultural operations. Staggered planting can help mitigate unpredictable weather conditions to some extent. The deficit and excess moisture stresses occurring back to back in the same season can be overcome by life-saving and micro irrigations with harvester drain water (farm ponds) and by deploying soil moisture conserving practices (hydrogel, biochar), soil mulching, shallow intercultural operations and foliar application of potassium nitrate @ 1% for faster recovery from stresses. When monsoon is delayed the best mitigation strategy is dense planting (increasing plant population by reducing the plant to plant spacing to half). Under excess moisture situations, the measures

such as draining out excess water off the field,post-rain intercultural operations, immediate nutrients supplementation (soil application of 10 kg N/ha and or foliar nutrition of Potassium nitrate @ 1%) to compensate for leached nutrients are beneficial. Other climate change mitigation strategies include: timely topping and sucker control to avoid fast maturity, timely harvesting of leaves to avoid over ripening, removal of excess water from the harvested leaves and providing sufficient aeration during yellowing colour fixation to avoid barn rot. Further, development of climate resilient varieties, advanced efficient resource use technologies, mechanization etc. can help to overcome the adverse impacts of climate change in future.

Key words: Flue-cured tobacco, climate resilience, soil health, sustainable production

ABS119: SIX DECADES OF LONG-TERM NUTRIENT MANAGEMENT ALTERED SOIL PROPERTIES AND IMBALANCED DOSE PREDISPOSED TOBACCO PLANTS FOR HIGHER DISEASE INCIDENCE

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Agriculture is facing exponential societal demands to supply foods, fibers and fuels. At the same time urging forreduction of negative environmental impacts and maintains all vital ecosystem services.Thistriggersfor long-term agricultural field experiments designed to investigate the impacts of long term application of inorganic and organic sources of nutrients to soil. Tobacco as a bonanza crop provides huge returns to India's economy and especially the tobacco farmers strongly stick to cultivate this crop as their bread and butter from ancient times with non-judicious application of fertilisers. Thus, a long-term experiment was established way back in 1962 at Dinhata, West Bengal to see the possible long term effects on soil and tobacco crop response. The objective of this 'Rothamsted style' long term experiment was to improve our fundamental and holistic understanding about soil and crop response. The experiment comprised ten different nutrient treatments with different doses of NPK and organic manures. We observed interactions between nutrient management factors and the soil properties on crop yields, disease incidence. Nutrients applied in the form of inorganic @ 112 kg N+ 112 kg P_2O_5+ 112 kg K_2O/ha plus 10t FYM/ha (NPKF) recorded highest cured leaf yield 3198.14 kg/ha, first-grade leaf yield 955.33 kg/ha and a quality outturn of 29.87%. Maximum seed yield (114.8 kg/ha) was observed in T9 (25 ton FYM/ha without inorganic inputs) followed by 111.11 kg/ha in T10 (50 kg/ha without inorganic inputs). The soil pH ranged from 4.2 to 6.87 and T5 (NPK) showed to have highly acidic (4.2) soil reaction. Pearson correlation coefficient between disease incidence and soil physic-chemical parameters depicted about highly significant negative correlation between 'Hollow stalk 'and 'Bacterial wilt disease incidence' and soil pH, dehydrogenase activity, soil available K but a significant positive correlation observed between 'Hollow stalk and Bacterial Wilt disease incidence' and soil available Nitrogen and Boron. Although, Tobacco mosaic virus and Leaf curl is vector mediated, yet a significant negative correlation observed between soil pH which may be because of indirect effect of plants biochemical properties which helped in predisposing the tobacco plant for the pathogen to flourish.

Key words: Long term nutrient management; Tobacco; Bacterial wilt; Hollow stalk; Leaf yield; soil properties

ABS121:STUDIES ON CUSTOMIZED FERTILIZER BASED PRORISE SOLUTION ON GROWTH, YIELD AND QUALITY OF BURLEY TOBACCO

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Tobacco is an important commercial crop that fetches high foreign exchange, multiple medicinal benefits and used for oil extractions. Numerous challenges are faced by the tobacco growers due to climatic changes causing biotic and abiotic stresses, leading to negative impact on yield and quality. With an objective of creating environmentally safe and profitable farming, Fertis developed an integrated sustainable model for Tobacco as a ProRise solution, which were evaluated in the Vinukonda regions of Andhra Pradesh, India.

A series of field experiments were conducted from 2020-21 to 2022-23 in Vinukonda regions of Andhra Pradesh to achieve better yield and quality on burley tobacco. Customized Fertilizer based Prorise solution was developed based on soil test nutrient values by analyzing>2500 soil samples from farmers' fields of M/s Godfrey Phillips India Limited command areas viz., Vinukonda, Darsi, Giddaluru and Chilakaluripeta areas of Andhra Pradesh. Prorise solution includes customized fertilizer grades specific to tobacco, which supplied a nutrient delivery of 70.6 N, 22.5 P2O5 and 27.5 K2O with calcium, magnesium and sulphur. A plant defense elicitor (Akre Shield), micronutrient formulation (Tracs sure), soil & nutrient activator (Imphact), water soluble fertilizer (Zetol sure) and soil microbial consortium (Actin) were used at different stages of growing period.

Two field experiments on burley tobacco were conducted during 2020-21 with RBD design consisting of 5 treatments and 4 replications. Among different treatments, ProRise solution with Intensiv (CFG), Actin, TracsSure, Zetol Sure and Akre Select vegetative gave the highest leaf yield (3004 kg/ha) with 9.3 % increase over farmer's practice (2749 kg/ha). The quality in terms of bright leaf (A Grade) in ProRise solution was 86% as compared to 71% in Farmers practice. Low grade of tobacco leaf was highest (29%) in farmer's practice.

Another two proof of concept field trials were conducted in 2022-23 in Vinukonda region with two treatments viz., Prorise and Farmer's practice. Plant growth parameters and yield attributes (fresh and dry string weight) were consistently increased in prorise plots. The highest dry leaf yield was

recorded with prorise solution (2003.2 kg/ha and 1610.58 kg/ha), which was 11.86 % and 13.79% increase over farmers practice (1790.7 kg/ha and 1415.38 kg/ha) in trial 1 and 2, respectively.

Nicotine content was found higher in ProRise plots in both the trials. In trial 1, nicotine content in ProRise solution was found higher (1.61 %) than farmer's practice(1.53 %). In trial 2, the nicotine content was 2.50% with ProRise solution as compared to 2.01% in farmer's practice. The highest marginal benefit cost ratio of 3.64 and 4.01 in trial 1 and 2, respectively was obtained with Prorise solution as compared to Farmers practice. Based on the trial results, adopting customized fertilizer based ProRisesolution will be helpful for tobacco industry for sustainable tobacco production and higher net income to tobacco growers.

Key words: Customized Fertilizers, Burley Tobacco, ProRise Solution, Yield, Quality

ABS126: CROP DIVERSIFICATION STRATEGIES FOR RICE-RICE CROPPING SYSTEM IN GODAVARI DELTA

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Rice (*Oryza sativa* L.) is the staple food crop for more than half of the world's population and plays an important role in food security of many rice growing countries. In Andhra Pradesh, rice is grown in an area of 2.1 m ha with an annual production of 12.0 mt and a productivity of 5.70 t ha^{-1} (Anonymous, 2018) and Godavari delta is the Rice bowl of the state, which is one of major contributors of rice production in the country. The production and productivity of rice growing areas are fluctuating every year due to different biotic and abiotic constraints. Besides climate change, continuous cultivation of rice for longer periods with low system productivity, and often with poor crop management practices, results in loss of soil fertility due to emergence of multiple nutrient deficiency (Dwivedi et al., 2001) and decline in factor productivity and crop yields in high productivity areas (Yadav, 1998). In recent years, due to lack of Godavari inflows and shortage of canal water *rabi* rice could not be taken up on time and there is immense need to develop viable rice- based cropping system modules. Generally, the *kharif* rice plantings are delayed (up to mid-August), now a days and the growing season extends up to December/January months. The next crop (rabi) is planted during January month and its duration extends up to April/ May. Therefore, sowing window of *rabi* crops play a great role in deciding the performance and yield potential of rabi crops. Productivity and profitability of various cropping systems could be enhanced by intensification and diversification of predominant cropping systems through inclusion of crops to meet the soil health improvement, income generation and livestock nutrition. Intensification generates more employment, better land use efficiency, higher productivity per capita profitability could be achieved. An inclusion of legumes helps in building soil fertility (Sharma *et. al,* 2001).Keeping this in view, different cropping systems modules has been tested to assess the rice-based cropping system performance for wider adaptability in view of soil health improvement, income enhancement as well as household nutritional security.

Field experiments were conducted consequently for four years from *Kharif*, 2018 to *Rabi*, 2021 at Regional Agricultural Research Station, Maruteru under Deltaic alluvial soils under canal irrigated conditions with an objective to identify the best suitable and viable crop diversification modules for different farming systems. The experiment site is located at 16.38^0 N latitude, 18.44^0 E longitude with an elevation of 5 m MSL altitude. Productivity and profitability of ten cropping systems were tested under randomized block design and replicated thrice. The entire experimental plot was divided into 10 treatment blocks by allotting 2 plots for soil health improvement concept, 2 plots for meeting household nutrition, 2 plots for meeting Livestock nutrition and 2 plots for income enhancement concept along with 2 regional check cropping systems blocks.

Pooled analysis over four years clearly shows that, system yield of different cropping systems showed significant difference. Rice-rice cropping system recorded poor system yields of 6.46 t/ha and highest system yields were realized with Rice-Sweet corn cropping system (18.51 t/ha) followed by rice -marigold (11.54 t/ha). Among tested different cropping systems for crop diversification to rice-rice cropping system, under income enhancement objective Rice – Sweet corn (1: 6.79) followed by Rice- Marigold (1: 4.46) cropping systems got the highest net returns as well as B:C ratio. Under soil health improvement objective Rice-Black gram (1: 4.68) and under livestock nutritional objective rice-fodder jowar (1: 3.16) cropping systems proved better results. Rice-Black gram cropping system module is the best alternative by virtue of soil health improvement besides meeting the requirements of house hold nutrition.

Key word: Crop diversification, cropping system, productivity and profitability

ABS128: ENABLING SUSTAINABLE AGRICULTURE AND CROP DIVERSIFICATION

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In pursuit of enhancing farmer income and promoting sustainable agricultural practices, a strategic initiative- crop diversification has been implemented from the past 3 years. This initiative focuses on introducing alternative/complementary crops such as Guar, Okra, Cowpea, Tomato, and Cucumber to tobacco-dependent farmers. The primary objective is to elevate farmers' living income conditions while mitigating the risks associated with dependence on a single crop, in this case, tobacco. By diversifying the crop portfolio, farmers gain access to additional sources of income, reducing their vulnerability to market fluctuations and uncertainties. The cultivation of alternative crops not only contributes to economic resilience but also fosters sustainable farming practices. Additionally, this diversification strategy aligns with broader agricultural goals, promoting environmental sustainability and enhancing the overall well-being of farming communities.

This initiative is for a holistic approach to transforming agricultural practices, ensuring economic stability, and fostering resilient livelihoods among farmers. Over the past 3 years this initiative has taken in 560 ha benefitting 673 farmers.Farmers gained an additional income of INR 25000 to INR 32000 per ha with a profit margin ranging from 19% to 26%. Apart from generating additional income, this initiative has also facilitated in achieving decent living income to all IPS farmers which is one of the 17 SDGs, which major companies across the globe are striving to achieve this objective through ESG.

Key words: Sustainable Agricultural Practices, Diversification, Living income,

ABS129: AFFORESTATION TO ACHIEVE A SUSTAINABLE SOURCE OF WOOD

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Traditionally, the construction of barns for Burley tobacco involved the use of unsustainable wood, posing environmental risks. Even if farmers source wood from social forests, sources are unknown. This raised concerns among global manufacturers who are sourcing tobacco from India. In response to these challenges, an afforestation initiative has been started in the Vinukonda region to in collaboration with PMI, establish a reliable and sustainable wood source for barn construction. The primary goal is to eliminate the use of wood from native forests, mitigating the adverse impact of deforestation on the environment. To ensure compliance with sustainable practices, a survey is conducted for every crop season, meticulously tracking the wood's source and ensuresustainable wood is used for barn construction. Over a decade, transplanted 23,69,149 (23.6 Lakh) seedlings under the afforestation project with 91% survival rate. This significant success has translated into the construction of 19,250 air-cured barns, all constructed from a sustainable wood source. This initiative not only addresses the environmental concerns associated with traditional barn construction but also aligns with the expectations of global manufacturers for responsible sourcing. As per the PWC risk assessment study in Vinukonda Burley crop has stated 100 % compliant for Zero Net Deforestation. Farmers in the Vinukonda region actively contribute to transforming their agricultural practices positively, ensuring a secure and environmentally friendly future for Burley tobacco cultivation."

Keywords: Sustainable wood, Barn construction, Afforestation, Deforestation, Environmental challenges

ABS130: BIODIVERSITY CONSERVATION PARK IN TOBACCO GROWING REGION

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Biodiversity parks serve as critical sanctuaries for preserving and promoting the rich tapestry of life on Earth. These parks stand at the intersection of conservation, education, and recreation, offering a holistic approach to environmental sustainability. The primary objective of biodiversity parks is the conservation of diverse flora and fauna within a controlled ecosystem. These parks act as living laboratories for understanding ecological processes, fostering research, and promoting the conservation of endangered species and also contribute to the protection of both endemic and exotic species. Habitat re-creation is one of the multiple faces of biodiversity restoration and encompasses the attempts to reconstruct an ecosystem on severely disturbed sites with little to restore. Biodiversity parks provide multiple environmental services including carbon sequestration and educational and recreational benefits to society. Biodiversity parks serve as invaluable repositories of Earth's biological diversity, linking conservation with education and recreation.

Over the past five years, we have developed four biodiversity parks spanning 24.25 hectares, growing 9,146 plants aimed at conserving 31 native and endangered species. Within this initiative, our focus is on preserving species with palatable, medicinal, and aromatic properties, as well as those valuable for forest timber, edibility, avenue landscaping, fodder crops, and ornamental purposes.Biodiversity drives the natural systems that support all life on the planet. This life provides us with clean air and water, food and natural resources. Greater biodiversity benefits agriculture through such effects as an increase in pollinators, the presence of species that reduce pests and better soil quality. Biodiversity loss endangers human well-being by affecting soil and water, which are fundamental to food production.

Key Words: Bio Diversity, Conservation, Recreation, Ecosystem.

ABS131: MECHANISATION IN BURLEY TOBACCO

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Introduction of mechanization in tobacco cultivation is to bring down the dependency on labor thereby helping farmers to conduct timely operation resulting in yield increase, improving quality and to maximize farmer profitability.Apart from the immediate benefits, mechanization is going to be the order of the day in view of the increasing labour scarcity. Keeping in view of the challenges and an objective of overcoming the same, M/s Godfrey Phillips India Limited in collaboration with our global partner M/s Philips Morris International has tried much equipment to reduce labour dependency and reduce labour costs.

Among the equipment tried seeder machine, fertiliser cum cultivator, battery operated sprayer cum suckercide applicator and sewing machines have given good results in terms of reducing dependency on labour and labour cost and taking up timely agricultural operation to enhance operational efficiency. GPI and PMI are working relentlessly working with farmers to enhance their awareness of the strengths and advantages of mechanization and bolster their capacity to own the equipment by lending support by heavily subsidizing the equipment.

Key Words:Mechanization, TimeSaving, Cost Saving, Operational efficiency.

ABS138: AWARENESS REGARDING PESTICIDES AND PRACTICES FOLLOWED BY TOMATO GROWERS OF PLAINS OF NAINITAL DISTRICT OF UTTARAKHAND

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In developing countries, the ill effects of pesticide overuse are lesser known. Most of the sprayed pesticides reach a destination other than their target species and resultantly become pollutants of air, water, and soil. Sole dependence on chemical pesticides for pest control does not align with the concept of sustainability. The study was conducted in the plain areas of Nainital district of Uttarakhand. From the 3 plain region blocks of Nainital district, Haldwani and Kotabag block, having maximum area and production of tomato were selected purposively. From each block, 3 villages were selected randomly. From each village, 5 farmers belonging to each farm category; i.e. marginal, small, medium and large were selected randomly. Hence, a total sample of 120 farmers was chosen for the collection of primary data pertaining to rabi season of the year 2018-19. Use of tabular analysis and percentages was done to examine the extent of awareness and practices followedby tomato growers of plains of Nainital district across farm size groups. The level of awareness was found to be low among marginal and small farmers as compared to medium and large farmers. Use of protective measures during pesticide application was found to be low across all farm categories. Other pesticide handling practices of the sample farmers were also found to be flawed.

Key words: Pesticides, awareness, tomato

ABS140: IMPACT OF FCR-15 TOBACCO VARIETY IN PRAKASAM DISTRICT OF ANDHRA PRADESH

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Tobacco is important commercial crop grown in an area of 63,482 ha in southern region of Andhra Pradesh. Generally, farmers were growing Siri variety which has some of the drawbacks like early leaf maturity, low leaf weight, cannot with stand to heavy rains, susceptible to TMV and uneven ripening and gives average yield of 15-20 q/ha. In order to overcome these problems KVK, Kandukur has conducted On Farm Testing (OFTs) with newly released FCV tobacco variety FCR-15 released during the year 2020 which is high yielding (22.5 to 30 q/ha), can withstand to heavy rains, leaf weight is more, it slowly matures and takes 12 days for complete ripening which makes farmers task easy in curing and subsequent cuttings. OFTs were done in 15 locations for two years from 2020-21 to 2021-22 in KVK operational mandals of Prakasam district. FCR-15 variety had given an average yield of 18.4 q/ha compared to traditionally grown Siri variety which gave 16.0q/ha (15% higher yields). Net returns of Rs. 58,750/ha was obtained in FCR-15 variety compared to Rs.47,558/ha in Siri variety. As far as perceived attributes of innovation of farmers are considered majority (>89%) have expressed that this variety was having more relatively advantageous, compatible, flexible to use, no complexity and the end results were clearly beneficial and visible to them as result of which this verity had spread up to 31,921 ha within 2 years of its release and is further spreading to other areas very fast and expecting to achieve 100% adoption within next 3 years.

Key words: Commercial crop, Tobacco, FCR-15, High yielding, area spread.

ABS146: ADVANCE BREEDING STRATEGIES FOR MANAGING CHILLI LEAF CURL VIRUS DISEASE IN CHILLIPEPPER (*CAPSICUM ANNUUM* L.) IN INDIAN SUBCONTINENT

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Chilli pepper or hot pepper (*Capsicum annuum* L.) is an important spice and vegetable crop of family Solanaceae. India is the largest producer of chilli with an annual estimated 1.2 MT followed by China with 0.25 MT (FAOSTAT 2020). Chilli is susceptible to various pathogens involving viruses mainly chilli leaf curl virus which caused by begomoviruses (family Geminiviridae), has emerged as a major threat to chilli production in global as well as India, causing severe yield losses and economic harm. Begomoviruses are a highly successful and emerging group of plant viruses that are primarily transmitted by whiteflies belonging to the *Bemisia tabaci* complex. Chilli leaf curl virus is a highly destructive plant disease that severely retards plant growth and development, producing symptoms, such as chlorosis and curling and reduction of leaf and fruit size, eventually rendering the fruit unmarketable. Disease severity is manifested due to various reasons, such as climate change (erratic dry spells, relative humidity and temperature) affecting whitefly (vector) population, faulty agricultural practices and inoculum load in primary and secondary hosts present in the surrounding areas. Host plant resistance is an attractive disease management strategy against viruses because it involves in disease control, and thus is beneficial for the environment and human health. Precise molecular markers tightly associated with traits of interest will accelerate breeding programs to develop resistant breeding lines/ F1 hybrids to farmers for sustainable production. Mapping of chilli leaf curl disease resistant loci and development of associated SNP markers for marker assisted selection. Simultaneously resistant loci from different sources will be pooled to develop more stable resistant lines. Management of Chilli leaf curl virus is more challenging due to the vector-borne nature of the virus, therefore integrated disease management strategies need to be followed to contain the spread and heavy crop loss. CRISPR/Cas-mediated virus resistance has gained importance in disease management of DNA and RNA viruses due to certain advantages over the conventional approaches. Therefore, CRISPR/Cas system-mediated resistance needs to be explored in chili against Chilli leaf curl virus. Recently, the concern about viral DNA methylation, activation of gene silencing machinery and ubiquitination-mediated defence against begomoviruses has been reported.

Keywords: Chilli pepper, ChiLCV, Begomoviruses, CRISPR/Cas, Marker assisted selection

ORAL

ABS148: SPECIFICITY OF BOWMAN-BIRK AND KUNITZ INHIBITORS SEPARATED BY TCA EXTRACTION IN THE MANAGEMENT OF ACHAEA JANATA AND HELICOVERPA ARMIGERA

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Controlling insect pests is a major challenge in crop production as they are highly proficient in overcoming both host plant's defence as well as chemical pesticides that are harmful to human health and environment. The lepidopteran insect pests *Helicoverpaarmigera* and *Achaea janata* are in fore-front to devastate major commercial crop plants (cotton, tobacco, groundnut, brinjal, bendi, capsicum, castor etc.) and they possessed serine type of trypsin-like proteases in their midgut tissue.The Bowman-Birk inhibitor (BBI) and Kunitz inhibitor (KI) are different serineprotease inhibitors (PIs), abundantly found in storage organs (seeds and tubers) of plants and can function at a wide range of temperature and pH conditions. They play a significant role in defence against invading pests and pathogens andhave greater specificity towards trypsin-like proteases of lepidopteran larvae. Both BBI and KI showed variation not only in their structural features but also in their insecticidal properties. Therefore, isolation of BBI and KI is beneficial to exploit them as biopesticides. Thus, the current study on which patent was granted focused on two distinct features. The first one is the separation of Bowman-Birk and Kunitz inhibitors which are generally inseparable using conventional purification methods and the second is fetching the time required for their independent purification from approximately 10 days to < 24h by applying mild TCA extraction followed by trypsin-affinity chromatography. The mature seeds of *Rhynchosiasublobata* (a wild relative of pigeon pea)is used as a model to purify BBI and KI using this protocol. The BBI and KI purified from the seeds of *R. sublobata*are labelled as RsBBI and RsKI, respectively. These PIs are confirmed by immunodetection and MALDI-TOF studies and further characterized for their structural (CD & fluorescence spectroscopy) and functional properties (temperature & DTT stability). The BBI and KI purified using this quick protocol exhibited specific activity, biochemical and biophysical properties comparable to those purified by ammonium sulphate fractionation method while being highly cost effective and efficient technology. Besides, BBI purified using the above process is effective in the management of castor semi-looper '*Achaea janata*', while KI is effective in the management of pod borer '*Helicoverpaarmigera*'. Thus, both BBI and KI are farmer friendly and can be translated from laboratory to field in the form of nano-biopesticides to control lepidopteran pests.

ABS150: CHALLENGES AND OPPORTUNITIES IN MANAGEMENT OF SUCKING INSECT PESTS AFFECTING IMPORTANT COMMERCIAL CROPS

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Insect pests are most important factors in deciding the purity and quality of the high value commercial crops like chillies, turmeric, castor, aswagandha and tobacco. A total of six species of thrips have been reported on chilli in India. *Scirtothrips dorsalis* is the common chilli thrips. However, the invasion of exotic pets, *T.parvispinus* during 2021-22 onwards became dominant species over *S. dorsalis* on chilli crop. Castor is harboured by leaf hopper *Empoascaflavescens* and is widespread in South India with peak infestation during September-December in Andhra Pradesh and November-January in Tamil Nadu. Thrips *Retithripssyriacus*s are prevalent all over India, and of late the damage caused by thrips to castor is on the rise. Whitefly *Trialeurodesricini* incidence on castor is high during summer months of March – June, although it prevails throughout the year. Tobacco crop is infested by aphid *Myzyspersicaenicotianae*, which transmits cucumber mosaic virus. Whitefly *Bemisiatabaci* on tobacco transmits Tobacco leaf curl virus.

These high value crops have characteristic alkaloids primarily nicotine, capsaicin, curcumin, withnaloids, ricinine and other flavanoids. The insect pests survive, reproduce and cause/spread diseases and viruses in these crops avoid, adapt, excrete or detoxify the alkaloids in the host specific mechanisms which are of paramount importance in managing IPM programs. The sucking insects transmit potyviruses, begomoviruses and tospo viruses in a specific manner. It is not known, how the vector of viruses survive on the plants inspite of having alkaloids which have insecticidal properties like nicotine. Chemical Ecology methods are useful in identifying the volatile communication between sucking insects and their host plants and further the host-pest-natural enemy interactions. Different techniques and methods are available to understand the interactions like Gas chromatography-coupled-electroantennogram detection (GC-EAD), GC-single sensillum recording (GC-SSR) and the olfactory receptor responses to the volatile compounds emitted by the plants in response to pest infestation. Understanding these interactions, will help developing plants devoid of a particular compound which is attractive to pest or inducing a compound that is more toxic to pest, through genome editing approaches.

Advances in electronics and electrical engineering have enabled successful studies of flight behaviour in a large variety of insects, ranging

from bumble bees and honeybees, to smaller insects like mosquitoes and Drosophila. The simultaneous, multi-object detection system enables efficient use of tracking in large-scale studies suited to quantifying flight behaviour in response to a wide range of stimulus conditions.

Thrips show preferences to specificcoloursand have colour discrimination capabilities, having a high response to blue and yellow and sometimes to UV-A light. From the few electroretinogram (ERG) studies conducted on thrips eyes, sensitivity peaks are found at~360–365 (UV-A light), and at~500–540 nm (green light) which is consistent with the presence of UV-A and green photoreceptors. Behavioural studies suggest a blue photoreceptor is present, which would increase the number of colours athrip is able to perceive and discriminate. 'Lure-and-kill' and 'lure-and-infect' are two insect pest management strategies that combine an insect lure with a killing agent that works over a short time period (e.g., an insecticide), or a lethal disease that can be transmitted to the wider population e.g., an entomopathogenic fungus (EPF) respectively. Identifying theoptimal colour to use as an attractant is fundamental for monitoring purposes as an early warning.It is not clear whether the traditional blue or yellow stimuli, or some other blend of colours, are the best to increase thrips captures. A more systematic approach is needed to understand the fundamentals of thripscolour vision so that we can identify the optimal stimuli for attracting pest species for monitoring and mass trapping. With new technologies such as micro-computed tomography, serial block-face electron microscopy and environmental light field measurement standards becoming increasingly available, it will be easier to tackle the challenge of working with such minute insects such as thrips.

Key words: Pest Management, sucking insect pests, commercial crops

ABS156: PRODUCTIVITY ENHANCEMENT DRIVERS IN NLS REGION

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The FCV tobacco grown in Northern Light Soil (NLS) region is acclaimed as semi-flavoured styles and compete with other well-known origins like Brazil and Zimbabwe. The desired flavour characteristics not only influenced by the soil type, selection of seed material but also influenced by agronomical practices followed in the region. The productivity achieved by NLS farmers is global benchmark in comparison with other contemporaries in the tobacco world. The key novel agronomic practices followed in NLS are 1) Green manuring, 2) Tray seedling production, 3) Deployment of high yielding varieties, 4) Drip irrigation coupled with fertigation 5) Smart spraying & smart irrigation solutions

1) Green manuring: Tobacco being N hungry crop, in situ green manuring with sunnhemp will replenish/meet 15 to 25 Kg. equivalent N requirement of the crop, along with enhancing soil organic carbon and improving soil physical characters. 2) Tray seedling production: Tobacco seedlings are grown under semi controlled environment (under shade net) in High Impact Polystyrene trays with cocopeat as media. Seedlings produced by this method have better establishment, tray seedling production system results in improved seed use efficiency, weather and disease resilient and uniform crop. Tray seedlings contributes to enhanced productivity of 2.5% as compared to conventional seedlings. 3) Deployment of high yielding varieties: Approved high yielding varieties in NLS are nutrient responsive and deliver better yield up to 10%. 4) Drip irrigation coupled with fertigation: NLS being irrigated crop, traditional practice of flood irrigation demands higher labour, electric power and accounts for indiscriminate use of water. Adoption of drip irrigation gave over 50% saving in water usage, 30% saving in power consumption and 80% reduction in labour deployment over traditional irrigation practices. Channelizing fertilizer

through drip system improved the fertilizer use efficiency, reduce and labour dependency by 70% in fertilizer application. Currently, 51 % of NLS area is under drip and 48% under fertigation. Both these techniques improve overall yield by 15% compared to conventional method and accrued tangible benefits like water saving, lower infestation of weeds, better grade out turn and labour saving to farmers. 5) Smart spraying and smart irrigation solutions: Timely spraying of pesticides through drones with right dosage and right chemical leads to effective way of managing pest & diseases. Soil moisture sensor enabled smart irrigation scheduling leads to significant drop in water usage compared drip as well positively impacted yield because of reduced physiological stress with uniform crop growth. With the both the stated smart solutions, yield can improve up to 4.0%.

Ensured deployment of customised extension activities to address farm and farmer specific low productive issues thus addressed array of factors/ variables Viz., productivity enablers and productivity disablers. Implementation of all the above productivity drivers in NLS region has resulted in significant jump in productivity over the years from 2018 Kg/ha (2012-13) to 2650 Kg/ha 2022-23) which is up by 30%.

Key words: - Flue Cured Virginia, hybrids, drip irrigation and fertigation, Smart solutions

ABS159: WEATHER RESILIENT TOBACCO PRODUCTION SYSTEM IN FLUE CURED TOBACCO OF PRAKASAM AND NELLORE DISTRICTS OF ANDHRA PRADESH

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The changes in weather patterns across tobacco producing regions of the country are intensifying dealing severe blow to the crop production, productivity and quality. Further, the occurrence of extreme weather events that are difficult to predict well in advance has been significantly impacting farmer profitability. Post 2014-15, tobacco producing areas of Andhra Pradesh and Karnataka experienced severe impact of climate change leading to either severe droughts or excessive rainfall during harvesting period leading to significant crop and farm losses. Further, the climate change induced weather vagaries are denting competitiveness of Indian tobaccos impacting the crop quality and scale, even as the global opportunity for Indian tobacco exports is strengthening. Cigarette tobaccos are grown in Andhra Pradesh and Karnataka in impoverished soils and under rainfed conditions except for NLS region which is the only irrigated crop. Thus, tackling the impact of shifting weather patterns and extreme climate events is most critical in maintaining crop competitiveness and farmer profitability.

A comprehensive approach to overcome the challenge of changing weather patterns and extreme events has been conceived as Weather Resilient Tobacco Production System and has been piloted in southern light soils (SLS), southern black soils (SBS) and Mysore regions of Flue Cured tobacco production. The approach targets adaptation to climate change and encompasses a multi-sectoral engagement with all the stakeholders and institutionalizing strategic measures and tactical interventions. The strategic and long-term measures

include development and deployment of varieties that are tolerant to biotic & abiotic stresses apart from strengthening them with micro-zone-specific agronomy and introduction of climate smart agriculture including drip irrigation and drone technology. The tactical measures comprise of micro-zone-specific weather forecast, recommendation of suitable package of practices and need based supply of specific agri-inputs.

By implementing the principles of Weather Resilient Tobacco Production System for the year 2022-23, the farmers of Prakasam and Nellore districts could overcome devastating impact of Mandous cyclone – an extreme weather event that impacted nearly 50% of the planted crop by the time of incidence. Meticulous execution of various long term and short term measures like – coverage of area under stress tolerant variety – FCR 15 to an extent of 62%, preparation of farmers with micro-zone specific forecast on the extent of rainfall and supply of 48 Tons of K Based Water Soluble Fertilizers across the region for supplemental nutrition not only aided in crop recovery but also improved the yield over the previous year in SLS from 1360 Kg/Ha to 1723 Kg/Ha and in SBS from 1983 Kg/Ha to 2177 Kg/Ha. Further, training the farmers and extension staff apart from interest free financial assistance of Rs. 10,000/ grower from Tobacco Board motivated the farmers to source seedlings and other necessary agricultural inputs. Thus, the comprehensive approach helped in preparing the farming community to adopt them holistically to face intense impact of extreme weather while protecting the crop competitiveness and farmer profitability.

Key words: -Flue cure tobacco, FCR 15, Drought, Excess rainfall, Climate change

ABS160: RESPONSIBLE CROP NUTRITION A NEED FOR SUSTAINABLE BURLEY PRODUCTION

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Vinukonda Burley (VB) region is an air-cured tobacco producing area in light soils of Prakasam and Guntur districts. Soils of Vinukonda burly region are sandy loams to sandy clay loams to sandy clays. Most of the soils are shallow in depth and stony with low water and nutrient holding capacity. These soils are low in organic carbon, moderately alkaline, low in nitrogen and medium fertile in P & K. Alkaline nature of soils impacts the nutrient availability particularly micronutrients like Fe, Zn, Cu & Mn. A study was conducted to increase the productivity and nutrient use efficiency by adopting principles of balanced nutrition in Vinukonda Burley tobacco growing region. This field experiment was conducted for two burley crop seasons (2020-21 and 2021-22) in representative soil (Black soils and sandy loams) at Sivapuram and Kurchedu villages of Guntur and Prakasam districts.

The experiment was conducted with 4 treatments and these treatments are a) Customized fertilizer (20-10-10, 22-0-11 and Ammonium sulphate), b) Fortified customized fertilizer (20-10-10, 22-0-11, Ammonium sulphate, Calcium Nitrate, Magnesium nitrate and commercial micronutrient mixture), c) Fortified straight grade fertilizer (DAP, Ammonium Sulphate, SOP, Calcium Nitrate, Magnesium nitrate and commercial micronutrient mixture) and d) Control - Straight grade fertilizer (DAP, Ammonium Sulphate and SOP).

Fortified customized and fortified straight grade fertilizers produced higher productivity of 18.7% (2582 Kg/Ha) and 9.8% (2390 Kg/Ha) respectively over Control - Straight Grade Fertilizers without fortification (2175 Kg/Ha) in sandy loam soils, where as in black soils the same treatments resulted in improving the productivity by 16.1% (3253 Kg/Ha) and 15.1% (3226 Kg/Ha) respectively over control (2803 Kg/Ha). Customised fertilizers provide balanced nutrition to tobacco and aid in improving productivity and quality.

Key words: -Burley tobacco, Customized fertilisers, Secondary, Micro and Nutrient management.

ABS161: WEED MANAGEMENT IN FLUE CURED TOBACCO THROUGH NOVEL HERBICIDES

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Weeds are one of the biotic factors that reduce the productivity and quality in agricultural crops. Weed infestation recorded an estimated yield drop of 33% in many crops in addition to health and environmental hazards. In tobacco, the yield reduction due to weed infestation is up to 77% and quality reduction is by 10% at different densities of weed species. Weed management in flue cured tobacco is an important production practice to mitigate the crop weed competition and to enhance productivity and quality. Tobacco is a wide spaced crop and propensity to weed growth is immense, especially under irrigated conditions in Northern Light Soils of Andhra Pradesh. Current practice of weed management is through mechanical /manual weed control which increases the cost of cultivation and also impact soil physical structure. The weed emergence after earthing up (after 45 DAT) is most critical, as the crop enters in to grand growth stage. The weed management through earthing up practice leads to more dependency on man power and recurring weed management add to cost of cultivation. As flue cured tobacco is a regulated crop and cognise for CPA residues, choosing a chemical weed control option should also fulfil all the compliance requirements. Screening of herbicides with broad spectrum and season long control is the need of the hour for flue cured tobacco production. Novel herbicides and their combinations like Sulfentrazone 39.6 %SC, Clomazone 36% CS, Sulfentrazone 28% + Clomazone 30 % WP, Quizalofop ethyl 5% EC along with Farmer's practice (Manually by Spade) were evaluated in flue cured tobacco during *Rabi,* 2020-21 and 2021-22 crop seasons in Northern Light Soils of Andhra Pradesh. The treatments Sulfentrazone and Sulfentrazone in combination with Clomazone

resulted in higher weed control efficiency (80.2% &87.3 %) with broad spectrum (Grasses, Broad leaved weeds and Sedges) season long weed control withrecorded less residues (<0.09ppm) in lamina samples. The treatment Quizalofop ethyl was effective in controlling grassy weeds only. Protected spray of Sulfentrazone at 40 DAT alone resulted in saving of more than ¹ . 3000 /ha bycontrolling the weeds, while reducing dependency on labour. This chemical weed control option in NLS enhanced the crop productivity in the range of 5-9% over control.

Key words: - Flue cure tobacco, weed management, Sulfentrazone and Clomazone

ABS162: IMPACT OF BOTTOM LEAF REMOVAL AND ADDITIONAL FERTILIZER APPLICATION ON FLUE CURED TOBACCO IN NORTHERN LIGHT SOILS, ANDHRA PRADESH

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Flue cured tobacco is one of the major commercial crops of India in which productivity and quality play equally importance role in realizing the farmer returns. Steady balance between productivity and quality is a daunting task in today's agriculture. The flue cured tobacco production always results in 45% of upper stalk grades that are bodied with high nicotine and 55% of lower stalk grades which are thin with low nicotine in Northern Light Soils of Andhra Pradesh. There is a global demand and felt need to improve leaf grade production as the economic value of lower leaf grades is relatively low. Among the flue cured growing zones of India, NLS region is known for semi flavorful tobacco production with more leaf grades and desirable nicotine levels. In the present context, there is a need to further increase the leaf grade production through agronomic practices like removal of bottom leaves and additional application of Nitrogen and Potash fertilizer. With this background, an experiment was laid out during rabi, 2020-21 and 2021-22 crop season with the treatments designed based on bottom leaf removal (4 & 6) and additional N (10 & 20 N kg/ha) & Potash (15 & 30 Kg K_2O /ha) at 45 DAT with control (No leaf removal and no additional fertilizer). Removal of four bottom leaves along with additional application of fertilizer (10 N & 15 K_2O kg/ha) enhanced the leafy grade production (6%) and recorded increase in nicotine from 2.84-3.10 (9% increase). There is no significant difference in cured leaf yield among the treatments.

Key words: - Flue cure tobacco, leaf grade production, higher nicotine

ABS168: PRESENT SCENARIO OF CHILLI IN AP AND SUSTAINABLE CROP MANAGEMENT PRACTICES FOR INCREASING YIELD AND QUALITY

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Chilli is one of the important commercially cultivated vegetable spice crop grown all over the world. India is not only the largest producer but also the largest consumer and exporter of chilli in the world. Chilli alone contributes 42% of the total spice export quantity of the country and is predominantly exported to countries like China, Vietnam, Thailand, Sri Lanka, Indonesia and Malaysia. It is cultivated in almost all the states and union territories of the country. Andhra Pradesh stands first in India with 49 percent of acreage under chilli cultivation in the country with a production of around 6.3 lakh tones. Chillies account for 20–30 % of India's total spice exports, worth about 60–75 million. As the leading producer of chilli in the world, India is also the largest exporter of chilli in the world. It contributes one-fourth of the total quantity of chilli exported in the world. There is lot of scope for increasing chilli exports by meeting quality demands of the international market. Indian chilli exports are facing problems of quality in terms of pungency, colour value as well as pesticide residues, aflatoxins and residues of artificial colours used during processing.

Although, the crop has got great export potential besides huge domestic requirement, there are several factors that limit its productivity. In order to achieve higher yields, farmers are cultivating this crop incurring huge chemical inputs. The excessive use of chemicals not only leads to proliferation of pests and diseases, resulting in increased cost of cultivation, but also adversely affects the quality of the produce leading to consequent health hazards, with very low net returns. The highly intensive pesticide usage is not sustainable and the yield levels are also stagnating in recent years coupled with viral epidemics in the farming area. Faulty agronomic practices have brought a plethora of environmental problems resulting in declined productivity and reduction in soil fertility. Indiscriminate use of chemicals in this crop leads to pest resurgence, insecticide resistance besides destruction of natural enemies, affecting domestic consumption and export of chilli which necessitates production of quality chillies devoid of contamination of pesticides, chemicals, and aflatoxins. Besides the pesticide residues in dried chilli, the artificial colours like Sudan - I used for colouring the ripe chillies during drying and processing is also leaves residues limiting the exports.

The Integrated Crop Management practices to realize better yields with less cost of cultivation result in increased yields with better quality and it also helps to reduce the residue problems. The ICM practices include crop rotation, soil health improvement, use of organic fertilizers, growing of suitable varieties, seed treatment, better nursery management techniques, along with proper upkeep and crop management practices with INM, IWM, IPM practices and finally care to be taken during harvesting and post harvesting operations which will further help in reducing cost of cultivation with better quality produce.

Key words: Chillies, ICM, IWM, INM, IPM.

ABS170: WEATHER FACTORS INFLUENCE CHILLI PRODUCTION AND STRATEGIES FOR IMPROVEMENT OF PRODUCTIVITY

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Though India leads the world in production, consumption and export of chilli, the productivity levels are reported to be far below the actual potential of this crop. Of the many reasons attributed for low yields in chilli, vagaries of weather, pest and disease incidence are the most important. In Andhra Pradesh, the leading producer of the crop Guntur district ranks first in production of chilli. A study was conducted for assessing the influence of weather parameters on the chilli production and productivity in Guntur district. The study revealed that, the mean minimum temperature and annual rainfall had significant positive correlation whereas the variables mean maximum temperature and mean sun shine hours had negative correlation with production and productivity of chilli. Unfavourable climate conditions like excess/low rainfall, high humidity coupled with wide diurnal variations in temperature predispose the crop for pest and disease incidence. Hence, there is need to work out the strategies to sustain the productivity of the crop. Development of prediction models based on weather conditions for forecasting pest and disease incidence will go a long way in helping the farmers to protect their crop. Further there is need to motivate the farmers on adoption of improved package of practices such as IPM/IDM, INM,IWM technologies to minimize indiscriminate use of chemicals and maximize the efficient utilization of available resources leading to increased benefit cost ratio. Strategies to improve quality and minimize post harvest losses are also to be adopted to get premium price.

Key words: chilli, climate, weather forecast, prediction models

ABS172: SEED PRODUCTION OF IMPROVED RICE VARIETIES DURING RAINY SEASON UNDER VERTISOLS OF ANDHRA PRADESH

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Rice is one of the most important food crops and *feeds more than 60 per cent population of India,* contributing approximately 40 % of the total food grains production of the country. In India, rice is grown in around 43 million hectares area and second largest producer in the world. However, productivity wise it is far behind other countries. Considering the growing population and food demand, country will have to produce the additional quantity of rice from the same available area with improving the productivity of rice. Rice is mainly grown in rain-fed areas that receive heavy annual rainfall. That is why it is fundamentally a kharif crop in India. Availability of good quality seed is vital for achieving higher yields in rice crop which can enhance production by 20%; and without quality seed, other inputs and technologies are of little value. Keeping these points in view, ICAR-Central Tobacco Research Institute in collaboration with ICAR-Indian Institute of Rice Research has taken up Rice seed production activity in the low lying area of Black Soil Research Farm Katheru Rajahmundry, Andhra Pradesh with four rice varieties of ICAR-IIRR viz., DRR Dhan-48, DRR Dhan-53, DRR Dhan 58 and RP Bio-226 were during 2022 kharif season. Rice seed production plots were maintained in large area with recommended seed rate, spacing, fertilizers and all other agronomic practices were followed from sowing to harvesting of the crop. Roughing was done in all the plots from transplanting of seedlings up to harvesting. Among the different varieties RP Bio 226 recorded highest seed yield (4770 kg/ha) followed by DRR Dhan 58 (4355 kg/ha) and the lowest yield was recorded in DRR Dhan 53 (2877 kg/ha) in seed production plots.

Key words: Rice, Seed production, Vertisols, Variety

ABS175: BIOTIC STRESS IN ASHWAGANDHA (*WITHANIASOMNI FERA*DUNAL L.) THROUGH WEEDS ON THE GROWTH AND ROOT YIELD

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Ashwagandha is a potent medicinal plant species used worldwide and India is the major exporter. To develop a good agricultural practice (GAP) for ashwagandha for every geographical area, experiments on different management practices are essential. In the present study, a field experiment was conducted during 2022-23 at ICAR-CTRI Research Station, Vedasandur farm to find out the effect of biotic stress (weeds) on the growth and root yield of ashwagandha. The treatments tested were, weed free up to 30 days, weed free up to 60 days, weed free up to 90 days, weed free up to 120 days, weed free up to harvest, weedy up to 30 days, weedy up to 60 days, weedy up to 90 days,weedy up to 120 days, weedy up to harvest. The experiment was conducted in a Randomised block design with 3 replications. The soil of the experimental site was sandy gravelly with a pH of 8.1.The crop was sown during the second fortnight of September in ridges and furrows. The seeds of ashwagandha were sown as paired row in the ridges. A spacing of 20 cm between the paired rows and 10 cm between plant to plant were followed. The crop was grown organically, without fertilizers and pesticides. The weeds were removed as per the treatments. Harvesting was done at 180 days by pulling the entire plants. The roots were removed from the plants and dried in the sun for a week to get around 8% moisture and marketed.

The plant height significantly increased with weed free up to harvest (72 cm) as compared to the weedy (34 cm).The no. of berries significantly increased with weed free up to harvest as compared to the weedy check. The no. of berries with weed free up to harvest and weed free up to 120 days and 90 days are comparable. The lowest no. of berries was recorded with weedy up to harvest. The dry matter production (DMP) significantly increased with weed free up to harvest over the weedy check. The DMP recorded was 513 kg/ha. The root fresh weight significantly increased with weed free up to harvest (1277 kg/ha) as compared to the weedy check. The root yield was significantly higher with weed free up to 90 days over the weedy check. The root yield with weed free up to 90 days, weed free up to 120 days and weed free up to harvest recorded a comparable root yield. The net return was higher with weed free up to harvest followed by weed free up to 120 days.

Key words: Ashwagandha, biotic stress, Weeds, root yield, berries.

ABS176: CASTOR SEED YIELD AS INFLUENCED BY MULCH WITH DRIP IRRIGATION

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Castor *(Ricinus communis* L.) is a non-edible vegetable oil seed crop cultivated all over the world. India is the largest producer and exporter of the castor oil (*www.statista.com*). Castor oil is an important feedstock for the chemical industry which is mostly utilized for biodiesel production and pharmaceutical application because it is the only commercial source of hydroxylated fatty acid. It is also used for the production of lubricants, hydraulic and brake fluid, polymer materials, coating, fertilizer, soaps, waxes, and greases. Physical and chemical properties of castor oil established, it as a good source of lubricant and biofuel and to be used for industrial purpose. Field experiment was conducted at ICAR-CTRI Rajahmundry nursery area with aim of improving the productivity of castor with black plastic mulch and no mulch during 2019-20. Mulch sheet was spread after drip lines were laid out at 90cm apart. On the mulching sheet holes were prepared and castor sowing was done at 60 cm spacing on 24th October 2019. The hybrid grown was DCH 519 from ICAR-IIOR and recommended package of practices were followed and harvesting was done in the first week of May, 2020.

The results revealed that under black plastic mulch sheet 50% germination was observed on 7th day but only 19% germination in no mulch may be due to uniform moisture availability with mulch. Two hand weedings were given under no mulch where as in mulch no weeding was done due to very low weeds intensity. The treatment with black plastic mulch recorded higher yield of castor seeds by 43% (1328 kg/ha) as compared to the treatment without mulching (927 kg/ha). Mulching saved irrigation water (38.4% over no mulch) and enhanced the growth and yield attributes and finally resulted in higher yield of castor. The castor crop with low water requirement can be grown in low fertile soils with sustainable farm income. In recent years the demand for castor oil is increasing, hence there is scope to increase the area in different parts of the country for improved exports.

Keywords: castor, drip, mulch, yield, yield attributes

ABS177: SOIL FERTILITY STATUS OF FCV TOBACCO GROWING LIGHT SOILS OF ANDHRA PRADESH

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Six hundred and fifty five surface soil samples (0-15 cm) from tobacco growers of Koyyalagudem, Jangareddygudem-1, Jangareddygudem-2, Devarapalli and Gopalapuram auction platforms of Tobacco Board, Guntur, Andhra Pradesh were analyzed for Soil properties during 2020-21 crop season. Soil fertility parameters *viz.,* pH, EC, organic carbon, chlorides, soil available nitrogen, soil available potassium and soil available phosphorus were estimated using standard methods. Analytical data was interpreted and statistical parameters like range, mean and standard deviation, soil test summary in terms of percentage were calculated. Results revealed that soils were acidic to moderately alkaline (4.4-8.7) in reaction, non-saline (0.01-0.84 dS m^{-1}) and low to medium (0.10-0.72 %) in organic carbon. The soils were low to medium in available nitrogen (38-489 kg ha^{-1}) and low to high in available phosphorus (1.0-668.0 kg P ha^{-1}) and available potassium (74-2391 kg K ha^{-1}).

Koyyagudem platform soil data clearly indicated that 71.3% samples were acidic in soil reaction, majority of the soils are low in organic carbon and available N. Available P was high in 94.78% soil samples. About 46.08% soils were medium in available K status and 49.56 % soil samples were high in available K status. Jangareddy gudem-1platform soils revealed that 40.83% soil samples were acidic and about 44% soil samples showed moderately alkaline soil reaction. These soils were predominantly low in soil organic carbon and soil available nitrogen. About 84.16 % soil samples were high in available P status. Available K statuses of 35 % soil samples were medium and 64 % of soil samples were high. Jangareddygudem-2 auction platform soils data clearly indicated 65.83 % were acidic and 24.1 % were neutral in soil reaction, low in low in organic carbon and available nitrogen. About 43.33 % soil samples were low in available P and about 51.66 % soil samples were high in available P. Available K status of 52.5 % soil samples were medium and 33.3 % soils were low. Devarapalli auction platform soil data revealed that 38.8 % soil samples and 41.6 % soil samples were acidic and neutral in soil reaction, respectively, low in organic carbon and available nitrogen. About 98.8 % soil samples were high in available P. Most of these soils (80 %) are rich in available K. Gopalapuram platform soils data revealed that, 65.83 % of soil samples were slightly alkaline in soil reaction, low in soil organic carbon and soil

available nitrogen. Soil samples were high (100%) in available P and 75.8 % soil samples were medium in available K status.

The fertility status in northern light soils revealed that available N and organic carbon were the important soil fertility constraints and soil available phosphorous is high and is alarming. Soil chloride content was within acceptable limits. Six hundred and fifty five soil health cards with fertilizer recommendation were distributed to the tobacco growers.

Key Words: Soil fertility, Soil Health Card, Tobacco.

ABS178: SEASONAL INCIDENCE AND MANAGEMENT OF THRIPS PARVISPINUS (KARNY) IN CHILLI ECOSYSTEM

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Chilli black thrips, *Thrips parvispinus* population incidence and dynamics were monitored at ICAR-CTRI RS, Guntur during *Rabi* 2022-23. Chilli is an important vegetable crop commonly used in Indian food to add spiciness to dishes. Guntur district in Andhra Pradesh is traditionally a chilli growing district with high input usage under monocropping conditions. The crop is ravaged by many insect pests right from nursery till harvest. The seasonal incidence of black thrips was recordedat weekly intervals during the crop growth period. The population of black thrips on chili plants attained a peak during 70 days after planting. The experiment was laid out using Randomized Block Design (RBD) with eight treatments. Each treatment schedule comprised of three to four sprays, except treatment eight where untreated check was taken. The management of *T.parvispinus* revealed that all treatments are significantly superior over untreated control in reducing the black thrips population. The treatment with chemical pesticides are comparatively more effective in management of black thrips population, whereas, integrated management treatment with reduced the black thrips population followed by botanical and microbial pesticides treatment respectively. Therefore, integrated management schedules could be employed and utilized for the successful management of black thrips in chillies.

Keywords: Management, black thrips, population, *parvispinus*, chillies.

ABS185: NEMATODES AS RELIABLE AND CONVENIENT BIOINDICATORS OF REGIONAL AND GLOBAL CLIMATE CHANGE AND RELEVANCE TO AGRICULTURE

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Nematodes are a diverse group of multicellular microscopic organisms that play crucial roles in soil ecosystems. Many nematode species are despised as serious parasites of all kinds of plants and animals, including humans. Often ignored is the fact that over 80% of the nematode species are not harmful to agriculture but are vital to nutrient cycling, decomposition, and maintaining soil health. Nematodes are an integral part of a complex food web. Due to their small size, countable large numbers, short life cycles, ontogeny, organ systems and physiology nearly similar to other animals, their quick responses to the changes in the environment in their vicinity, and absence of ethical restrictions regarding them, nematodes can serve as near perfect biological models. Nematodes have served this role in much of biotechnological and pharmacology research. They can also serve as very useful ecological model organisms to understand measure and forecast the impact of climate change.

The intricate interplay between nematodes and climate change has significant implications for soil ecology, agriculture, and overall ecosystem stability. Nematodes being ectothermic organisms, climate change impacts nematodes through alterations in temperature and precipitation patterns. As global temperatures rise due to climate change, soil temperatures are also affected. Thus, warming can have profound effects on nematode physiology, behaviour, and life cycles. There is diversity among nematode species regarding their temperature, moisture and osmotic preferences. The rates of various metabolic processes, rates of development, duration of life cycle, fecundity, survival and thus their numerical abundance are closely dependent upon how suitable the temperature, moisture, gaseous composition, and rates of chemical and biochemical reactions in their habitats. This can have cascading effects on the entire soil food web, impacting other organisms that depend on nematodes for food.

Changes in precipitation patterns associated with climate change can also influence nematode populations. Nematodes are highly dependent on

soil moisture for their survival and movement. Altered precipitation patterns, including more intense rainfall events or prolonged droughts, can directly impact nematode habitats. Some nematode species may be more resilient to changes in soil moisture, while others may struggle to adapt, leading to shifts in community composition. Soil moisture content and osmotic pressure are interrelated.

The relationship between nematodes and climate change becomes even more complex when considering their role in nutrient cycling. Nematodes contribute to the decomposition of organic matter in soils, releasing nutrients that are essential for plant growth. As climate change affects the rate of organic matter decomposition, the balance between nutrient availability and demand in ecosystems may be disrupted.

In agricultural systems, nematodes are both beneficial and detrimental. Changes in climate conditions also influence the prevalence and impact of these plant-parasitic nematodes. On the contrary, certain nematode species contribute to natural pest control by parasitizing insects and other harmful organisms. Understanding how climate change influences the delicate balance between beneficial and harmful nematodes is crucial for sustainable agricultural practices.

Keywords: Nematodes, Climate change, Bioindicators, Soil health, Global warming

Abstracts Session – III

- Emerging technologies in extraction, detection and characterization of bioactive compounds
- Innovative technologies in diversified value added products
- Issues of addressing post-harvest product deterrents
- Advances in packing and packaging technologies

ABS024: NOVEL APPROACH FOR NEW GENERATION PESTICIDE DETECTION IN TOBACCO MATRIX BY MASS SPECTROMETRY

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Tobacco (*Nicotiana tabacum*) is an important commercial crop, which is grown across the world. The pesticides applied during its cultivation may gain entry into and remain in leaves even after curing and other post-harvest processing treatments [1]. One of the prerequisites for promotion of exports is that residues of the crop protection agents should be below the Guidance ResidueLimit (GRLs). Multiclass pesticide residue analysis in a complex matrix like tobacco is often challenging from the point of view of sample preparation, analysis and overall method performance [2]. The previously reported methods mostly involved extraction with acetonitrile or ethyl acetate. Among various mass analysers, the Quadrupole-Orbitrap technology provides the highest mass accuracy followed by gas chromatography tandem mass spectrometry (GC-MS/MS) and liquid chromatography tandem mass spectrometry (LC-MS/MS). Till date limited reports exist on simultaneous qualitative-screening and quantitation of multi-class pesticides in tobacco. In this background, an UHPLC-Q-Orbitrap MS system operated in FS-vDIA based method performance was established on a mixture of pesticides which is time- and cost effective and would be fit-for-purpose for the regulatory analysis of pesticides belonging to multiple chemical classes. The screening detection limit (SDL) was set at 5 ng/g for 159 compounds (86.41 %) based on their detection with 95% confidence, e.g., aldicarb, cyazofamid and cyproconazole. These compounds complied with the criteria of detection of precursor ion with <5 ppm of mass error and within the retention time threshold of ±0.1 min. For few compounds SDL was reported at 10 ng/g, e.g., ethiofencarb, ethion, flonicamid etc. The remainder of the compounds in each matrix were detected at the SDL of 40 ng/g, e.g., boscalid, chlorsulfuron, fenoxycarb, parathion-methyl-oxon, phorate sulfoxide, phosalone, propargite and tolcofos methyl. Among the various classes of compounds, false negatives were mainly recorded for organophosphates (OP) e.g., phosalone. Although, it was identifiable in solvent standard, it appeared as a false negative in matrix at 10 and 40 ng/g. This

might have happened due to high signal suppression or due to the interaction with co-extracted matrix compounds. The performance was validated initially in KLS tobacco type. The optimised method was verified for its screening performance in other tobacco types. The method performed similar in other matrices too except for a few compounds which were found to be as false negatives at 40 ng/g. These include pendimethalin, pyrithiobac, parathion-methyl-oxon, and propanil. However, they were detected at higher levels >40 ng/g. Similarly, GC-MS based novel analytical techniques were also developed which overcomes the limitation of cumbersome extraction method and run time to monitor chlorantraniliprole, pendimethalin residue in understanding its residue levels for regulatory analysis. The LOD and LOQ value obtained through this precise method is 0.02 mg L^{-1} and 0.04 mg L^{-1} respectively. The optimised sample preparation and analytical workflow improved the efficiency of the high resolution accurate mass analysis by minimising the false negatives. The sensitivity of the mass spectrometric based technique was adequate to comply with the regulatory analysis of tobacco matrices for pesticide residues to promote the Indian tobacco exports

Keywords:*mass spectrometry, GC-MS, export, detection, pesticides*

ORAL

ABS027: MECHANIZATION PACKAGE FOR FCV TOBACCO LEAVES - STRINGING AND CURING

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Tobacco holds a significant position in India's international trade. Curing, the drying process for FCV tobacco leaves, involves crucial transformations such as starch hydrolysis, chlorophyll degradation, achieving a desirable yellow hue, and preserving the flavor, aroma, and overall quality of the tobacco leaves. Traditional curing methods involve stringing of leaves before curing, which is labor-intensive, painstaking, and time-consuming. Soon after that the barn is loaded with these stringed tobacco leaves sticks in different layers on the wooden poles and the flue curing process is done with constant supervision to feed firewood into the furnace for six consecutive days, with flue pipes installed in the barns. Wet and dry bulb thermometers are typically employed within the curing setup. This study investigates a labor-saving and easily maintainable approach to tobacco leaf Stringing and curing by developing a power-operated stringing machine consisting of a sewing and conveyor assembly with a 0.5 HP electric motor, chain, drive, and ratchet mechanism chain stitches to hold the leaves properly and prevent the dropping of even dried leaves. It has been provided with three sets of loading trays to make the operation faster and more continuous. This unit can produce 1 stick per 20 sec (@ 4 kg of fresh tobacco leaves/stick) with a stringing capacity of 730 ± 100 kg/h (i.e. 180 ±10 number of sticks/h) using an oval-shaped (3 mm) needle and yarn (34 counts) made of viscose material. Developed a heat pump dryer by standardizing temperature, humidity, and duration parameters using a remote-control system. The moisture content of the tobacco leaves progressively decreased from 80% to 4% (wb) within 90 hours (equivalent to four days) using the heat pump dryer. Quality assessments revealed that cured leaves from the heat pump dryer exhibited the following parameters: chlorides (15.25%), and levels of reducing sugar (2.38%) and nicotine (0.66%)—whereas in the indigenous barn, these figures were 0.66%, 11.52%, and 1.49%, respectively.

Keywords- *Tobacco, Stringing, Curing, Dryer, Flue-cured, Heat Pump*

ABS028: ASSESSMENT OF AGRICULTURE INFRASTRUCTURE FUND SCHEME AS A TOOL FOR POST HARVEST MANAGEMENT

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In India large proportion of population (54.6%) depends on agriculture for their livelihood and it contributes 17.4% of the country's Gross Value Added (GVA). The country has achieved sufficiency in foodgrain production with 310.74 million tonnes in 2020-21 and has recorded growth of 2.13% during the period of 2011-21. Similarly, the horticulture production has reached 334.6 million tonnes in the year 2020-21 and has recorded significant growth of 2.74% since the last decade. However, the country is striving hard to achieve food and nutritional security. The major reason behind this is lack of infrastructural facilities in rural areas as investment in such areas is unattractive. The prevalence of poor infrastructural facilities is the major cause of huge amount of post-harvest losses witnessed in the study by NABCONS (2022) for various agricultural commodities i.e., Cereals (3.89-5.92 %), Pulses (5.65-6.74 %), Oilseeds (2.87-7.51 %), Fruits (6.02-15.05 %), Vegetables (4.87-11.61 %), Plantation Crops & Spices (1.29-7.33 %). The poor infrastructure in rural areas also has a bearing on processing of food products. This is reflected by the low level GVA (Rs 2.37 lakh crores) of Food Processing Industries contributing to 1.88% of total GVA (2020-21). There is a gap of basic agriculture infrastructures like storage houses, pack houses, absence of proper supply chain etc. In view of above, Government of India has formulated a Central Sector Scheme of financing facility under 'Agriculture Infrastructure Fund (AIF)' on 9th August 2020. The AIF scheme has provisions for providing medium/ long term debt financing facility till 2025-2026 through 3% interest subvention and credit guarantee support on loans for creation of post-harvest management infrastructure and community farming assets. So far 39846 number of applications is sanctioned for an amount of Rs 24402 crores which is Rs 61.24 lakhs per applications. The amount of fund allocated under AIF scheme across different zones of India is Rs 33069 crores for North zone (33.07 %) and is followed by Rs 25172 crores for West Zone (25.17 %), Rs 22650 crores for Southern states (22.65 %), Rs 15185 crores for Easter zone (15.19 %), Rs 3516 crores for North-Eastern states (3.52%), Rs 408 crores for others (0.41 %).

Thus, there is inequity in allocation of funds across different parts of the country. The scheme benefits could be availed by the farmer groups such as FPOs, PACS, SHGs, JLGs, Cooperatives, FPOs federations, federations of SHGs etc. who are eligible for following activities i.e., Hydroponics farming, vertical farming, aeroponics, polyhouse. greenhouse, etc. The utilization of funds along with number of applications received for availing the benefits under the AIF scheme is observed to be very low. In order to promote the AIF scheme, the alignment of schemes across the ministries is also being given importance and already much headway has been made by aligning the schemes of Ministry of Food Processing Industry with AIF scheme. Much more needs to be done so that the benefit of such a novel programme is reaped by the agriculture sector in general and small holder farmers in particular.

Keywords: Post-harvest loss, Rural Infrastructure, AIF Scheme

ABS059:CHARACTERIZATION OF SMOKE AND CHEMICAL PARAMETERS IN VARIOUSLOCAL BRANDS OF BIDIS IN SOUTH INDIA

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Bidi smoking occupies a major portion of overall tobacco consumption in India, which was originated in this subcontinent. The present study was conducted with seven popular bidi brands collected in the south Indian market to characterize the smoke parameters, viz., tar, nicotine, and carbon monoxide in bidis, and the chemical parameters, viz., nicotine, reducing sugars, solanesol, and potassium in bidi leaf. Tar, or NFDPM, nicotine, and carbon monoxide (CO) were determined by using a 20-port linear smoking machine, the SM 450 (CERULEAN, U.K.), and the GC-TCD/FID (HP, U.S.A.). Nicotine, reducing sugars, and chlorides in the leaf were determined by using the Auto-Analyser AA-III (BRAN+LUBBE, Germany), solanesol by HPLC (Shimadzu, Japan), and potassium by the Flame Photometer (SYSTRONICS, India). Mean values and ranges for all the parameters were expressed as 'milligrams per bidi' for all the brands. The mean value of tar was 43.31 (33.53-59.70); nicotine in smoke condensate was 2.74 (2.26-3.32); and carbon monoxide was 22.66 (16.96-29.22). The mean value of leaf nicotine was 4.95 (3.41-6.66); reducing sugars was 3.74 (1.84-6.07); solanesol in smoke condensate was 0.09 (0.07-0.15); leaf solanesol was 0.47 (0.27-0.90); and leaf potassium was 3.44 (1.56-6.11). It infers that the value of CO increases as the value of tar increases. The values of smoke nicotine and smoke solanesol increase with the values of leaf nicotine and leaf solanesol increases, respectively. The study provides imperative information to researchers in the tobacco field.

Key Words: NFDPM, CO, Nicotine, Reducing sugars, Solanesol and Potassium.

ABS061:LEAF CHEMICAL QUALITY INDEX (LCQI) FOR ASSESSMENT AND SEASONAL MONITORING OF FCV TOBACCO QUALITY

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FCV tobacco is grown in an area of 1.46 lakh hectares in India, a countryglobally known for its production and exports in international market. The tobacco leaf especially FCV tobacco is a commercial product that is marketed in the national and international market under stringent quality norms which always influence the Indian exports. High quality FCV tobacco is generally influenced by soil types and climatic set up in which it is grown geographically. Being a highly commercial crop regional level monitoring of production and quality is done by concerned organizations and research departments to ensure better market for the leaf tobacco. Analysing chemically tobacco leaf grown in different seasons especially for nicotine, reducing sugar and chloride contents and studying their ratios for assessing its quality spatially and temporally is a key activity. However, the parameterswisecomparison across regions and seasons over a period is complex and difficult to envisage. A single index-based method of assessment of quality of tobacco leaf involving critical quality parameters, varying time, and space as a tool to help in visualizing the spatial and temporal dimensions of leaf quality.

Hence, a chemical quality index was developed to know the quality of FCV tobacco leaf growing in different regions of Andhra Pradesh and Karnataka. It was calculated by assigning weights to quality parameters based on their contribution towards quality assessment: Parameter weights (Wx): a) 0.8 for Reducing Sugars to Nicotine ratio and b) 0.2 for Chlorides., The weighted values of each parameter are added to get a single value and square root of the same for obtaining the index i.e. CLQI = SQRT (((RS/Nic *0.8) + (Cl *0.2)).The range of index values is categorized to five classes are Poor, Medium, Good, High and very High. The colour coded gradation was given to each class to know the variation between the samples. Seasonal monitoring of leaf quality of FCV tobacco grown under different soil types and climatic

conditions assists in improving the leaf quality by means of implementing recommended interventions/ strategies through the concerned agencies and institutes.This tool assists in monitoring the leaf quality parameters spatially and temporally which are essential for marketing and obtaining a better price.The LQI based analysis showed that the leaf quality of KLS region was high to very high. The NLS region recorded medium to good quality while the other two regions i.e SBS and SLS regions recorded medium quality index class. It is first of its kind quality-based index developed for FCV tobacco.

Key words: Leaf quality index, FCV Tobacco.

ABS062: CHEMOMETRIC APPROACH BASED CHARACTERIZATION OF CHILI FOR BIOACTIVE COMPOUNDS, SHELF LIFE FOR POTENTIAL USE IN NUTRACEUTICAL INDUSTRY

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Chilli is considered as one of the most important commercial vegetables cum spice crops, named as *wonder spice.* There is a vast export potential for fresh as well as different processed products of chilli. The plant resources employed in this study comprised of 58 diverse accessions of chilli including commercial varieties as well as wild accessions. Chilli fruits at ripened stage were oven dried and analysed for capsaicin, capsanthin and SHU spectrophotometrically as per standard protocol. Sensory evaluation for pungency and colour was carried out at mature stage on a 4 point scale rating. A total 10 freshly harvested red ripe fruits in each line were kept in perforated LDPE pouch in ambient condition for storage study. The mean value of capsaicin, total carotenoid content and SHU was determined and data was analyzed using R Studio. The results significantly varied among the lines as observed from the mean values. The highest capsaicin content found in Sikkim 2 (3744.50 µg g^{-1}) followed by IRCM 73 (3538.50 µg g^{-1}). The highest SHU (56167.50) was obtained in Sikkim 2. The carotenoids content was found to be highest in IRCM 73 (182.78 µg g-^{1}). Two novel lines Dinhata Local 1 and Kakchai (KC) were identified for black and orange colour respectively. The line Tufan Ganj Local had lowest PLW value (32%) and can be stored for longer time. Heat map showing clustering of chilli lines showed Sikkim 2, IRCM 72 and selection 2 as potential lines for these traits and suitable for nutraceutical industry.

Key words: Chilli, capsaicin, colour, pungency, storage

ABS067: DEVELOPMENT AND FORMULATION OF IMMUNITY BOOSTING MIX - A NOVEL TURMERIC BASED FOOD PRODUCT

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Turmeric is a significant cash spice crop grown in India. It has a long history of usage as a spice and medicine in Indonesia, China, and India. Turmeric has been given "Generally Recognized as Safe" (GRAS) certification by the FDA in the United States.Turmeric has many medical benefits, including anti-protozoal, anti-viral and anti-carcinogenic activity. It is also high in natural antioxidants. (Tuba et al., 2008). There is research evidence of intake of turmeric products improving the immunity level for human beings. However, the people do not prefer turmeric products as it tastes bitter on addition of turmeric powder. Hence, the main aim of the study is to develop value added formulations and products that are either ready to eat or that can be mixed with water, milk and can be recommended for people of all age groups, hence prepared a value added product called, Immunity Boosting Mix. Nutrient analysis was carried for three different formulations of the immunity boosting mix. It has protein (4.45g),fats (2.86g), crude fibre (1.13g), Iron (162 mg), Zinc (10.55mg), and calcium (0.17g) Vitamin C (2.18g) Vitamin D (612mg) and found to have good nutritive value. The daily recommendation is about 3-4 gm per day as per the calculations based on recommended dietary guidelines of NIN.

The acceptability trials were conducted by semi trained and trained panelists consisting of 20 numbers from different fields. Scoring was done on 9-point hedonic scale andratedas highly acceptable. The results of the sensory evaluation test revealed that the formulation-2(ratio of turmeric, aswagandha, cardamom, cinnamon, pepper, ginger as 1:1:2:2:2:2 by keeping jaggery constant)and formulation-3 (Turmeric, AswagandhaCardamom, Cinnamon, Pepper, Gingeras 3:3:4:4:4:4 by keeping jaggery constant) were highly acceptable than formulation-1(equal ratio of Turmeric, Aswagandha, Cardamom, Cinnamon, Pepper, Gingerby keeping jiggery as constant) as judgedby the trained panelists. About 150 respondents were tested for sensory evaluation for its appearance, taste, texture, aroma and overall acceptability. The appearance was extremely attractive, tasted grate, wonderful texture, wonderful aroma and extremely acceptable. The shelf life of the developed

immunity booster was studied by storing them in different packaging materials at room temperature for a period of three months. The study was conducted on different type of packaging materials in prevention of spoilage and increasing theshelf life of the product. The materials viz. plastic and glass containers have stored the product without spoilage and loss of the quality parameters of colour, aroma and taste for 90 days. The product is being under registration of FSSAI. Hence, the developed innovative boosting mix is identified as supplementary nutritive formula for human beings.

Keywords- Curcuma Longa, Food Formulation, Nutritive Value, Value addition, Sensory evaluation

ABS080: SYNTHESIS AND STUDY OF BIOACTIVE OF TRYPTANTHRIN COMPOUND FRAMEWORKSANALOGUES

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Quinazolinone frameworks are commonly observed in a diverse range of natural compounds, including vasicinone, mackinazolinone, tryptanthrin, phaitanthrin, candidine, cruciferane, penipanoid C, luotonin, febrifugine, rutaecarpine, and evodiamine, among others. These entities are recognised for their diverse range of biological activities, which encompass anticancer, antibacterial, anti-diabetes, hypnotic, sedative, analgesic, and kinase inhibitory action. Hence, the advancement of straightforward and effective techniques for the production of extensively functionalized quinoxaline derivatives holds significant significance. As a result, a plethora of techniques have been devised for the fabrication of quinazolinone frameworks.A method was devised to synthesise spiroisoindolines with high rigidity, achieving favourable yields by the development of C-C and C-N bonds in a single-step process. The structures of these scaffolds bear a resemblance to the biologically active tryptanthrin frameworks.

Keywords: Bio-Active Compounds, Ortho-C-H bond functionalization, 2-Arylquinazolin-4(3H)-ones, 1,4- Quinones, Spiro-quinazolinones

ABS083: STUDY ON MINI REVIEW OF PRINS/ENE CYCLIZATION'S CONSUMING THEIR BIOACTIVITY

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The Prins/ene cyclization method is highly advantageous in the synthesis of fused compounds, as well as in the formation of spirocyclic compounds like tetrahydropyrans or furans. This current evaluation primarily focuses on the advancement of synthesising heterocyclic compounds by the use of prins/ene cyclization.Thisone of the most important synthetic methods for producing several natural compounds in their whole, particularly pyran and furan units. Benzosultams hold significant importance in the field of drug research due to their high effectiveness in exhibiting biological actions. Currently we are engaged in producing more potent bioactive via Prins/ene cyclization reaction pathway.

Keywords: Bio-Active Compounds, Prins/ene cyclization reactions, Hetero cyclic compounds.

ABS149: CHEMICAL INVESTIGATIONS ON NEUTRAL VOLATILE COMPOUNDS IN FCV TOBACCO*

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As a part of comprehensive investigations on the chemical constituents responsible for smoke flavour in Indian tobacco, particularly flue-cured Virginia (FCV) tobacco, the present study was taken up with the objective of assessing the status of neutral volatile compounds (NVCs) in FCV tobacco ruling varieties. About 41 compounds are found having the desired levels to enable the smoker to perceive the smoke flavor (Roberts, 1988). Hence, smoking quality of flue-cured tobacco can be evaluated by the relative abundance of the volatiles that are dependent on variety, crop-husbandry and stalk-position. With the objective of analyzing neutral volatile compounds (NVCs) responsible for smoke flavour in FCV tobacco grown in the three important agro-ecological situations in the country, 46 samples were subjected to steam distillation, the distillate was extracted with dichloromethane, concentrated and GasChromatography (GC) - Mass Spectrometry (MS) analysis was carried out using nitrobenzene as internal standard. It is inferred from the mean values of samples analysed that the 42 compounds listed contribute significantly to FCV tobacco smoke flavour: Benzaldehyde (1.7 ppm), 2-Methyl-2-hepten-6-one (1.1 ppm), 2-trans-6-cis-Nonadienal (0.6 ppm), Safranal (1.0 ppm), Furfural (2.9 ppm), Benzyl alcohol (10.3 ppm), Phenylacetaldehyde (7.5 ppm), 2-Acetylpyrrole (2.3 ppm), Linalool (2.2 ppm), Phenethyl alcohol (7.9 ppm), 4-Ketoisophorone (2.2 ppm), Geraniol (1.3 ppm), á-Citral (0.9 ppm), Solanone (89.0 ppm), â-Damascenone (64.7 ppm), â-Damascone (6.6 ppm), Neryl acetone (14.6 ppm), 1,3,7,7-Tetramethyl-9-oxo-2-oxabicyclo[4.4.0]dec-5-ene (5.7 ppm), Norsolanadione (22.3 ppm), Dihydroactinidiolide (7.8 ppm), 1,3,7,7-Tetramethyl-9-oxo-2-oxabicyclo[4.4.0]decane (1.4 ppm), Megastigmatrienone isomers (98.8 ppm), 3-Oxo-á-ionol (5.1 ppm), â-Tumerone (10.1 ppm), Palmitic aldehyde (4.5 pm), Farnesol (2.7 ppm), Solavetivone (26.8 ppm), Neophytadiene (320.2 ppm), Hexahydrofarnesyl acetone (10.8 ppm), DL-6,7-Dihydro-2-cis-farnesol (4.3 ppm), 3-Hydroxysolavetivone (34.2 ppm), Farnesyl acetone A (20.4 ppm), Cembrene (106.2 ppm), Isophytol (3.1 ppm),Thunbergol

(142.2 ppm), Duvatrienediol (511.8 ppm), Phytol (15.0 ppm), Epiglobulol (23.4 ppm) and Globulol (42.1 ppm).

It is concluded that Cembrene + Thunbergol + Duvatrienediol (~50%), Neophytadiene (~21%), Megastigmatrienone isomers (~6%), Solanone (~6%) and â-Damascenone. (~4%), accounted for ~90% of the NVCs identified. Apart from these compounds, Indole, c-Elemene, Nerolidol, Hexahydrofarnesol, Valencene, Geranyl isovalerate, Caryophyllene oxide, Viridiflorol, and Dehydrolinalool were also identified in some of the samples at lower concentrations. A comparison of data of samples from the three regions revealed differences in the levels of NVCs: 1) higher levels of Solanone (61.4 ppm) and â-Damascenone (49.0 ppm) in NLS samples; 2) higher levels of Neophytadiene in NLS (214.6 ppm) and KLS (225.3 ppm) samples; 3) higher levels of Megastigmatrienone isomers in NLS (61.5 ppm) and SLS (73.5 ppm) samples; 4) higher level of 3-Hydroxysolavetivone (91.9 ppm) in KLS samples and 5) higher levels of Globulol (41.6 ppm), Cembrene (83.7 ppm), Thunbergol (106.3 ppm) and Duvatrienediol (377.6 ppm) in SLS samples. These differences could be attributed to the variety cultivated, climatic conditions and agronomic practices.

To sum up, GC-MS analysis of neutral volatile compounds in Indian FCV tobacco followed by statistical analyses – Principal Component Analysis, Hierarchical Cluster Analysis, Estimation of Communalities and Correlation coefficients – helped in an objective appraisal of the samples on the basis of the content and composition of the volatiles.

Keywords: Neutral Volatile Compounds, Gas Chromatography-Mass Spectrometry, Principal Component Analysis, Hierarchical Cluster Analysis

ABS155: ASSESSMENT OF LOOSE-LEAF BARNS FOR ENERGY EFFICIENT CURING TECHNOLOGY

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In FCV Tobacco, the harvested green leaves are dried by flue curing process inside a barn, where the moisture in the green leaves is removed by convection. The traditional barns are primitive in nature and demand higher fuel to generate required heat energy. Further, it is essential to have skilled work force to tie, load and cure the green leaves. To improve the fuel use efficiency and to reduce dependency on skilled labour, Loose leaf barn technology was introduced. The Loose-Leaf Barn (LLB) is a metal structure, resembles the cargo container with dimension of 11.5 Ft (W) X 44 Ft (L) X 10 Ft (Height @Front end) &6.5Ft (Height @ Rear end). The LLB structure contains two chambers; 1) **Heating chamber** that houses efficient furnace and air turbine to assist in forced air circulation and misting assembly to condition leaf after curing. 2) **Curing chamber,**contains two tiers of metal mesh trays, to position green leaves loosely in upright position without tying. Each LLB isequivalent to two conventional barns in terms of curing capacity. Working principle remains the same as the conventional barn, but the LLB is more efficient in terms of energyand labour savings. Fuel combustion takes place in the furnace and heat circulates in the flue pipes attached to it on the top. The fresh air enters through the inlet damper and gets heated up. The axial fan/turbine positioned in the heating chamber forcefully pushes the hot air into the curing chamber through the bottom inlet ventilator. The forced hot air circulates inside thecuringchamberandreturn backtotheheatingunit once it cools downthroughtheuppervent.Theentireprocess is automated through PLC (Programmable Logic Controller) basis Temperature and Humidity to be maintained for different stages of curing. Manual control options have also been provided to suit individual farmer requirements. There is inbuilt misting

assembly in the barn which conditions the cured leaf with in the barn after the completion of curing process.

Trials were conducted for the last three consecutive seasons shows that the Specific Fuel Consumption in Loose Leaf Barn is 40% lower than the conventional curing structures. Additionally, it saves nearly 50% of labour requirement in Tobacco post-harvest operations and minimal handling of Tobacco resulted in reduced scrap generation over traditional curing barns. Quality of the cured Tobacco is same as that of conventional barns. The farmers are benefitted with more than INR 150,000 savings per season with Loose Leaf Barn Technology.Further, this LLB not only serves tobacco curing but also support drying of other agricultural produce like Copra, Ginger, Moringa, Arecanutand etc. as per the individual studies taken up by progressive farmers. Hence, this system can be used as multipurpose farm drier in addition to tobacco curing and plays an important role in reducing postharvest losses.

Key words: - Flue cure tobacco, forced air circulation, energy efficient curing technology, PLC, Convection

ABS158: ROLE OF GLASSWOOL & TURBO VENTILATOR IN ENERGY CONSERVATION DURING CURING PROCESS

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FCV Tobacco is being cultivated in nearly 20,000-hectare area in West & East Godavari districts (Northern Light Soils) and nearly 70,000-hectare area is under cultivation in Prakasam and Nellore districts (Southern Black Cotton Soils & Southern Light Soils) in the state of Andhra Pradesh. FCV Tobacco is the main remunerative crop for the farmers of these regions. In FCV Tobacco, curing process involves careful management of temperature and humidity across four different stages i.e., Yellowing, Colour fixing, Lamina drying and Midrib drying. The temperature inside the barn is gradually increased up to 160°F to convert the green leaf into cured leaf. However, in the existing conventional barns, heat loss through the roof of barns is the most significant component contributing to the inefficiency in curing process. Roof insulation with glass wool/ mineral wool is identified as a solution to reduce the heat loss from roof and facilitating forced convection using turbo-ventilator at the outlet vent on the roof which is identified as low-cost solution. The turbo-ventilator is also provided with a flap to suit the requirements of the vent opening and closing during different stages of curing. The improvement in Specific fuel consumption (SFC) in roof insulation with Turbo-ventilator has been tested and compared with the control barn. Trials conducted in NLS region revealed that Specific Fuel Consumption (SFC) in Roof insulation and Turbo-ventilator barn is 3.6 Kg as against control barn of 4.8 Kg i.e., 25% savings in fuelwood consumption. The difference in SFC between barns with combination of Roof insulation and Turbo-ventilator vs. control barn is reported as the benefit to the farming community. Hence, the installation of glasswool and turbo-ventilator is a cost-effective solution, as it saves Rs. 12600/- per season. Turbo ventilator also helps in containing excess temperature inside the barn thereby minimises production of Caramelized leaf. The material used in Roof insulation is fire resistant with service life of 10 years. Hence, the total benefits derived from this energy conservation initiative are significant and can lead to long-term savings upto Rs. 1.25 lakh per barn. To date, 14,538 number of barns in SBCS, SLS and NLS region were covered under Energy Conservation initiative, which is also enabling the farmers to decarbonize tobacco farming.

Key words: - Flue cure tobacco, energy efficient curing process,specific fuel consumption, Decarbonization

ABS173: INTEGRATING MUSHROOM CULTIVATION INTO RAINFED ECOSYSTEM OF SOUTHERN A.P. FOR SUSTAINABLE FARMING

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Milky Mushroom *(Calocybeindica)* has become 3rd commercially grown mushroom in India after button and Pleurotus mushrooms. Being tropical in nature, this mushroom is grown commercially in many parts of the country particularly in southern parts of India. In the changed climatic scenario the rainfed agriculture is facing lot problems due to unpredictable weather conditions. In order to overcome the uncertainty of weather farmers need to integrate farming with allied sectors. One such sector is mushroom cultivation which can provide regular income to farmers.Mushroom cultivation is a great opportunity for men as well as woman farmers. It will not only generate employment but also helps in socio-economic development of farmers and landless laborers.Mushroom cultivation has gained attention as a sustainable approach to agriculture due to minimal waste & carbon emissions. This approach can contribute in promoting resource efficiency, soil health and biodiversity conservation, aligning with sustainable farming. In this context KVK Kandukur had conducted skilled development training programme for the farmers for sustainable farm income. Based on the skill imparted & technology transferred to participants so far KVK Kandukur has developed three entrepreneurs named P.Madhava, Sk.Seyaz and V.Subbarao who are practicing mushroom cultivation as a part of conventional farming and earning sustainable farm income regularly. On an average they are earning 15,250 /- net income by selling 10 kg/day @ 200/- per kilogram. Furthermore P.Madhava is also active as resource person for the institutions like DWCRA, Velugu, DRDA & conducting training to other men & women farmers, rural youth on mushroom production technology and promoting them to start an enterprise for self employment generation. On the other hand value addition to mushroom increased its storage life, enhanced the quality and addressed the demand for ready-made or ready to cook products which in return provides more income to farmers.

Key words: Mushroom production, Sustainable income, employment generation

ABS174: ENHANCING FARMERS INCOME THROUGH PROCESSING AND VALUE ADDITION TO MILLETS

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Millets are climate-resilient crops and can be grown in dry land agriculture farming systems with little water and are inherently tolerant to pests and diseases and very well known to yield when other staple crops fail in extreme weather conditions. Despite increasing demand for millets, the area under cultivation for millets is gradually decreasing due to low productivity, low income and lack of awareness among farmers about millet-based value addedproducts.In order to create awareness about health benefit of consumption of millets and millet-based products,the United Nations declared year 2023 as the 'International Year of Millets (IYOM).Value addition plays a pivotal role in transforming raw millets into processed and value-added products. Techniquessuch as milling, fortification, extrusion, and fermentation not only extend the shelf life of millet-based products but also enhance their nutritional profile.The socio-economic impact of promoting millet value addition is also addressed, emphasizing the potential to increase the income of the farmers. In this context KVK Kandukur has been conducted skill development training programme to farmers on processing and preparation of value-added millets rice and millet products like millet vermicelli, millet bakery products and other traditional snacks like Jonna murukulu, Korra payasam, Multigrain laddu, Ragi burelu and murukulu etc.By utilizing the knowledge gained from the training, one of the participants, Sk. Dilshad from Sameerapalam village, has started selling value-added millet products. Due to high demand in the local market, she has expanded her business to a medium-scale operation and earning a net profit of Rs. 15,250 per month. This income is being used to further expand her business and meet the educational needs of her children. This success story highlights the empowerment of women through income generation from the value-addedmillet products.To conclude, farmer who can earn a net income of rupees 10000/- by selling korra grains/foxtail millet from one acre of land, withprocessing korra grains to rice farmer income enhances by 3.2 times and by the preparation of value-added products net income enhanced by 4 times.

Key words: IYOM, Value addition, Millets, Net returns, Processing

ABS 195 : HIGH VALUE COMPOUNDS FROM IMPORTANT MEDICINAL PLANTS AND THEIR PRODUCTION INTENSIFICATION THROUGH EFFICIENT EXTRACTION TECHNIQUES

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Plants with therapeutic properties are highly esteemed all over the world due to their immense role in prevention and cure of different diseases like- cancer, cardiac problem, diabetes, arthritis, obesity and other infectious diseases. These particular properties are mainly attributed by presence of various secondary metabolites having specific biological functions. The herbal or ayurvedic sector is established utilizing these plants either in raw form or in extract as potential therapeutic agents. Even at global level, their demand is on rise and people are looking towards alternative medicine and products with high natural ingredients. The market revenue was 199.07 billion USD in 2023 globally that is growing at a CAGR of 7.7%. India being a treasure trove of plant species, and one of the world's richest medicinal plant heritages; plays a significant role in production, sale and export of herbal products. The extracts contain secondary metabolites or quality associated biomarkers (QABMs) that are solely responsible for bioactivity. Based on the chemical nature and biological properties of specific compounds present in plant extracts, their therapeutic applications are ascertained. For example, tulsi (*Ocimum sanctum*) and basil (*Ocimum basilicum*) extracts contain several polyphenolic compounds that are useful in curing cold, cough and other respiratory ailments. Ashwagandha (*Withania somnifera*) contains steroidal lactones like- withanolides, withaferin etc. that have several health promoting effects including antiviral, antibacterial, antioxidant, immunomodulatory etc. Similarly, steroidal glycosides or saponins are present in different medicinal plants that possess diverse health benefits. Altogether, these bioactive compounds have immense potential for different industrial applications and the benefit can largely be obtained by preparing extracts enriched with such compounds.

The extraction process involves four sequential steps *i.e.*, desorption of bioactives from active site in the sample matrix, diffusion of extraction fluid in the matrix, movement of solute from matrix towards extraction fluid and analysis of the solute *via* appropriate techniques. The process should be economically viable as well as environmentally sound. This can be accomplished through implementation of various extraction techniques where high-quality enriched extracts can be prepared by providing lesser inputs that be energy intensive too. Conventional extraction processes are there like- infusion/decoction, maceration, percolation, Soxhlet etc. to obtain herbal extracts from various plant matrices. In one of our studies, phytosteroids enriched extract from giloe (*Tinospora cordifolia*) was prepared with UAE. Using microwave technique, higher extraction of withanolides (withaferin A) were possible from *Withania somnifera* root where approx. 6 times higher yield was obtained than conventional Soxhlet method. Application of appropriate efficient technology can provide bioactive rich extracts that is useful for both nutraceutical and pharmaceutical purposes. This is important to ascertain the quality of certain extracts *i.e.,* the concentration of particular bioactive compounds present in the extract that primarily governs their array of applications. Analytical techniques such as, gas chromatography, gas chromatography mass spectrometry, and liquid chromatography mass spectrometry are commonly used to characterize the QABMs present in different herbal extracts. Nevertheless, there remains great opportunity and scope of further investigation on green approaches for chemical standardization of medicinal plants and their preparations.

Keywords: Medicinal plants, High value compounds, Ayurvedic, Extraction

Abstracts Session – IV

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- **Agri-business Incubators for entrepreneurial FPOs in commercial agriculture**

ABS009: SOIL TEST CROP RESPONSE BASED ONLINE FERTILIZER RECOMMENDATION SYSTEM FOR OF FCV TOBACCO YIELD TARGETS IN NORTHERN LIGHT SOILS OF ANDHRA PRADESH

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Soil testing as a tool for judicious fertilizer application is a recognized practice all over the world which takes care of too little, too much, or disproportionate applications of nutrients. The concept of Soil Test Crop Response (STCR) and targeted yield approach is aiming at precise quantitative adjustment of fertilizer doses under different soil test values for a given yield targets. FCV tobacco leaf quality is very much influenced by the inherent soil fertility and applied fertiliser nutrients especially nitrogen and potassium. In view of the above, an online software was developed to provide site specific balanced fertiliserrecommendation for a yield target of FCV tobacco through STCR based prescription equations developed for Northern Light Soils of Andhra Pradesh. Using this software, farmers can get fertiliser recommendation for their fields based on soil test values for a desired FCV tobacco yield target.

The software was developed in the form of a web portal for global accessing through internet with two main modules *viz.,* 'Administrator' and 'User'. Administrator module is an authenticated module which allows the administrators / programmers to view / edit the target yield equations, view the list of users (farmers) data which was entered into this software for computations. The 'User' module allows the user to enter the data such as farmer details and soil test data. Once the 'submit' button is selected, report will be generated for the selected yield target. Provision is also made to print the hard copy of the same. 'Contact' option allows the user to give their suggestions in the 'Message' box which includes their name, email and mobile number.

The software was created using 'Bootstrap' a front-end development framework for faster and easy accessing, Code was developed using Personnel Home Page (PhP) and database in 'MySql' with an interface for accessing data and performing computations. The software is developed in such a way that it can be upgraded to provide fertiliser recommendation to the FCV tobacco farmers of the other regions in the country. It is a versatile, easy and accessible form of fertiliser recommendation software which will assist the FCV tobacco farmers in getting an efficient, balanced and profitable fertilizer recommendation for specified yield target and also helps in sustainable FCV tobacco production by maintaining the soil fertility.

Keywords: Database, Farmer, FCV Tobacco, STCR, Software.

ABS052: A VISIONARY APPROACH TO AUTOMATED IDENTIFICATION AND SOLUTIONS FOR CHILLI LEAF DISEASES USING CONVOLUTIONAL NEURAL NETWORKS (CNN)

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Chilli plants (Capsicum annuum) will continue to play a pivotal role as essential crops on a global scale, making significant contributions to culinary and agricultural practices. However, the cultivation of chillies is anticipated to face ongoing challenges posed by various leaf diseases, potentially adversely impacting yield and quality. The imperative for future agricultural practices lies in the timely and accurate identification of these diseases to ensure effective management. This research introduces a forward-looking automated solution by harnessing Convolutional Neural Networks (CNNs) for the classification of chilli leaf diseases, coupled with the provision of corresponding solutions.

The study will utilize an expansive dataset comprising images of both healthy chilli leaves and leaves affected by prevalent diseases, including bacterial wilt, anthracnose, and leaf curl. A state-of-the-art CNN architecture will be designed and trained on this dataset, aimed at acquiring the ability to discern discriminative features for disease identification. The model's performance will be assessed using future-oriented metrics such as accuracy, precision, recall, and F1 score.

Anticipated results are expected to showcase the effectiveness of the CNN-based approach in accurately classifying chilli leaf diseases. The model is projected to exhibit high accuracy in distinguishing between healthy and diseased leaves, presenting itself as a swift and reliable tool for future farmers and agricultural practitioners. Furthermore, the trained model is envisioned to facilitate the identification of specific diseases, thereby supporting targeted disease management strategies.In addition to disease classification, the research will integrate a forward-looking recommendation system that suggests appropriate solutions based on the identified disease. This holistic approach is intended to empower future farmers with timely information for effective disease control and crop management, contributing to sustainable agricultural practices by mitigating potential yield losses and promoting resource-efficient solutions.

The project's comprehensive uses will extend across various agricultural sectors. Firstly, it will equip farmers with a user-friendly tool for disease identification and offer actionable recommendations. Secondly, it will aid agricultural researchers by providing a benchmark for disease classification models. Thirdly, it will facilitate governmental agencies in implementing efficient disease control measures, thereby contributing to food security. Lastly, the model's scalability will enable integration into smart farming systems, fostering a tech-driven approach to agriculture in the future.

Keywords: Bacterial wilt, Anthracnose, Leaf curl, Cultivation, CNN, F1 score, Recall.

ABS086: A PARAMETRIC AND NONPARAMETRIC APPROACH FOR TOBACCO YIELD PREDICTION BY USINGDIFFERENT SPECTRAL VEGETATION INDICES

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Remote sensing technology has been essential in studying the relationship between tobacco canopy spectral characteristics and biomass yield. The research, conducted at Garnepudi, Andhra Pradesh, employed satellite imagery obtained between 2012 and 2022 to extractvegetation indices. These included various vegetation indices such as normalized difference vegetation index (NDVI), soil-adjusted vegetation index (SAVI), green normalized difference vegetation index (GNDVI), modified soil-adjusted vegetation index (MSAVI), normalized difference water index (NDWI), moisture stress index (MSI)and leaf area index (LAI).Utilizing these remote sensing-derived indices, the study formulated multiple empirical yield prediction models through parametric (simple and multiple) and nonparametricregression analyses. These models established robust correlations between computed indices (NDVI, SAVI, GNDVI, MSAVI, NDWI, MSI, and LAI) and actual tobacco yield values, particularly during the optimal growth stage. Performance evaluations were conducted using standard metrics such as root-mean-square error (RMSE), coefficient of determination (R^2) and mean absolute error (MAE).This investigation illuminates the efficacy of remote sensing technology in delineating crop development patterns and accurately predicting tobacco yield. By combining remote sensing data with regression analysis, this study not only advances our understanding within Garnepudi but also extends its implications across diverse agricultural landscapes and crops. These findings hold scientific significance for precision agriculture, resource optimizationand the development of predictive models for agricultural practices.

Key words: Tobacco; yield prediction; vegetation indices; remote sensing; regression analysis

ABS104: A REVIEW ON PLANT DISEASE DETECTION BY ADOPTING THE MACHINE LEARNING ALGORITHMS

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Agriculture is a mainstay to a country. Agriculture plays a vigorous role in the economy of a country. Farmers are mainly converging on the new-fangled varieties of crops in all general and commercial aspects. Cultivating a crop is dependent on the soil density of the agricultural land. Owing to the abrupt increase of the commercial crop cultivation, farmers are directing furthermost towards the mixed farming. Plant disease is a communal mode to diminish the productivity of a crop. Identifying and detecting a type of disease in plants, is a generic manner is a crucial task to the farmers. To overcome the extant set-up, adopting the expertise technology may yields the well smear in the agronomy. Leaf based image classification is the key technique to identifying the nature of disease. In the direction of obtain the expectant results of identifying the plant diseases, machine learning is an asset to the arena of agriculture. Data set creation, retrieving, extracting the dataset, training the dataset is mainly possible by adopting the techniques of machine learning. Classification, clustering, random forest, reinforcement and support vector machines are types of sub techniques to find the optimistic generic classification of type of disease. In this tabloid, we are primarily focusing gaze on the types of machine learning algorithms, which were peculiarly identifying the category of disease in plants.

Keywords:cultivation, plant disease, mixed cropping, machine learning, machine learning techniques

ABS127: IMPLEMENTATION OF FARM DIGITIZATION TO ACHIEVE SUSTAINABILITY IN TOBACCO PRODUCTION

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Farm digitization drives sustainable tobacco production, ensuring a consistent supply of compliant product that meets user expectations and regulatory standards. Custom made for the tobacco farming, the app employs geo-tagging for farms, complete digitalization of records, and optimization of operations. Artificial Intelligence facilitates satellite-based risk reduction, enhancing decision-making, increased predictability leading to increase tobacco productivity.

Empowering agronomists, field officers and farmers through application based crop calendar, real-time data sharing, timely crop advisories, resulting in reduced losses and lower input costs. Digital farming creates awareness to farmers on weather conditions and enables farmers to respond proactively to climate-related challenges. It establishes a digital connection between farmers and the company, ensuring 100% traceability through geo-tagging for the implementation of sustainable tobacco programs. Farm digitization streamlines data collection, offering field-level task management schedules for effective and error-free processes. This facilitates to establish link between farm practice and documentation and show cause the level of compliance to global customer. Since ESG compliance is the order of the day higher compliance resulting in building trust to stake holders and make tobacco a sustainable and profitable proposition to all stake holders including enhancing the brand image of Indian tobacco.

Beyond data collection, the app serves as a tool for data analysis, which in turn helps to guide tobacco farmers with precision agriculture, timely decision-making, resource optimization, and continuous improvement. This data-driven approach fosters better farming practices, reducing losses, and enhancing overall sustainability. This comprehensive solution stands as a model

for sustainable and technologically-driven farming practices, poised to make a significant impact on a global scale.

Farm digitization benefits both tobacco industries and farmers. For farmers, it offers precise guidance on planting, harvesting, and resource management, reducing losses and optimizing yields. Tobacco industries gain through increased traceability, compliance, and decision-making, ensuring a sustainable and profitable supply chain. This digital transformation fosters a mutually beneficial relationship, enhancing productivity and strengthening the overall tobacco industry.

Keywords: Sustainable Tobacco Programme, Farm digitization, ESG Compliance, Farm traceability.

ABS141: A NOVEL HYBRID APPROACH BASED ON MULTI FEATURE CNN FOR AGE INVARIANT FACE RECOGNITION

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Significant challenge for automatic facial recognition systems is ageing variance. Face recognition has achieved great achievement, but still it is difficult to recognize human faces with large age gaps. Furthermore, due to age disparities, it is challenging to extract precise hand-crafted traits that are closely tied to changes in age. Due to the fact that some aspects are strongly correlated with changes in the face that impact the system's overall accuracy, it is still difficult to create an effective feature extraction and matching framework for Age Invariant Face Recognition (AIFR).A unique hybrid method based on weighted Multi Feature CNN (MFCNN) is proposed for automatically extracting the features for effective AIFR. Local Binary Pattern (LBP), Speeded-Up Robust invariant Features (SURF), and CNN are all included in MFCNN. In order to extract high level features and record structural information from the image, an upgraded CNN based on VGG-Net is first proposed. Next, weighted feature fusion is formed in the final fully connected layer combining these hand-crafted features and high-level features extracted by the enhanced CNN to produce discriminative feature representation. The results of weighted fused features for feature recognition are superior to those of single feature recognition. Numerous tests on the two-benchmark cross-age datasets (Morph Album 2 and CACD) have demonstrated that MFCNN outperforms the currently used AIFR methods.

Key words: Age Invariant Face recognition, multiple feature extraction, Speeded up robust invariant feature transform, Local Binary patterns, Convolution neural network.

ABS145: EMERGING TECHNOLOGIES FOR THE DISSIMINATION OF FERTILIZERS IN AGRICULTURE

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The global agricultural landscape is experiencing a transformative shift with the integration of emerging technologies in the dissemination of fertilizers. This review article aims to provide a comprehensive overview of the recent advancements and innovations in the field of fertilizer application, highlighting their potential to enhance agricultural productivity, sustainability, and resource efficiency.

The traditional methods of fertilizer application have often been associated with inefficiencies, resulting in environmental degradation and economic losses. Against this backdrop, emerging technologies such as precision agriculture, smart irrigation systems, and drone technology are increasingly being adopted to optimize fertilizer use and distribution.

Precision agriculture, enabled by technologies like GPS, sensors, and data analytics, allows farmers to tailor fertilizer application based on real-time data pertaining to soil conditions, crop health, and weather patterns. This targeted approach minimizes overuse of fertilizers, reduces environmental impact, and enhances overall crop yield. Additionally, smart irrigation systems contribute to efficient fertilizer utilization by ensuring precise delivery of nutrients to crops while minimizing water wastage.

Unmanned Aerial Vehicles (UAVs) or drones have emerged as powerful tools in agriculture, offering the capability to monitor large agricultural landscapes and disseminate fertilizers with unparalleled precision. Drones equipped with advanced sensors can assess crop health, identify nutrient deficiencies, and subsequently apply fertilizers in a targeted manner, thereby mitigating excess usage and associated environmental concerns.

The integration of Internet of Things (IoT) devices and connectivity further enhances the efficiency of fertilizer dissemination by enabling real-

time monitoring and control of application processes. Automated systems driven by artificial intelligence algorithms facilitate adaptive and responsive fertilizer application strategies, optimizing resource utilization and minimizing ecological impacts.

In conclusion, the adoption of emerging technologies in fertilizer dissemination represents a pivotal step towards sustainable agriculture. The synergistic integration of precision agriculture, smart irrigation, drone technology, and IoT-driven automation holds the key to unlocking greater efficiency, productivity, and environmental stewardship in the agricultural sector. As these technologies continue to evolve, it is imperative for stakeholders, including farmers, policymakers, and researchers, to collaborate in navigating the challenges and harnessing the full potential of these innovations for a resilient and sustainable agricultural future.

Key Words: Emerging Technologies, Drones, IOT device, Fertilizers, agriculture

ABS181: DRONES FOR COHERENCE OF CROP MONITORING AND PROTECTION IN HIGH VALUE COMMERCIAL CROPS

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Drones or Unmanned Aerial Vehicles (UAVs) are a rapid, easy and economical solution for the practical issues of labour, time, precision and accessibility in field mapping, monitoring crop health through multispectral imagery and pesticide application. Drones are not only economical, but also environment friendly, with huge prospects in agriculture, dairy and forestry. The Government of India launched the *Namo Drone Didi* or *LakhpatiDidi* scheme in 2023 as an employment opportunity to the women of self-help groups, to operate drones, which is a unified solution for labour problem, unemployment and poverty alleviation. Such initiatives can empower women financially and socially, answer the labour availability and human capacity and skill development concerns.

In agriculture, drones have multifaceted approach for mapping, diagnosis, crop protection etc. It is very much useful in crops like tobacco and chillies where operation with UAVs can protect the crop from damage of pests and diseases and prevent mechanical transmission of viruses. According to the tobacco export trade norms, cured leaf has to comply with GRLs (Guidance Residue Levels) established by CORESTA. To produce residue free tobacco, precise application of pesticides is quintessential, which could be easily achieved using UAVs. Pesticide application technology has to be given impetus, to produce healthy crop with minimal residues and to safeguard the environment by using low volume of pesticides and by reducing chances of runoff and drift after effective calibration and validation of UAVs. Coherence of multispectral remote sensing and decision support systems through involvement of drones and other sensors for adopting timely pest management actions could pave the way for precision pest management in all high value commercial crops *viz*., tobacco, chillies, turmeric, castor and aswagandha.

Keywords: Drone, pest management, pesticide, tobacco, chillies

ABS186: ICAR-CTRI INITIATIVES ON TECHNOLOGY COMMERCIALIZATION THROUGH INTELLECTUAL PROPERTY RIGHTS

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Importance of Intellectual Property rights in India, there are 7 types of intellectual property rights *viz* copyright, trademarks, design, patents, geographical indications, plant varieties,Semiconductor integrated circuit layouts and Plant varieties are the ownership of intellectual property rights affords various rights for protection and commercialization of such assets (which are protected by the law of intellectual property).The Indian Central Tobacco Committee (ICTC) established Central Tobacco Research Institute (CTRI) in Rajahmundry (Andhra Pradesh) in 1947 ICAR-CTRI took Initiatives on technology commercialization through Intellectual Property rights such as Tobacco Bale Pressing Unit, Medium pressing tool, Topping tool are few technologies commercialized by ICAR-CTRI in 2023 *viz*.

Tobacco Bale Pressing Unit: Low-cost Bale Pressing unit was designed and developed by ICAR-CTRI. This machine is a modified version of the previous machine to reduce the cost for easy portability and assembling. ICAR-CTRI licensed this technology for widespread use by the farmers. Baling of graded cured leaf through bale pressing machine reduces the Labour, drudgery and improves the efficiency. This machine reduces 25% Labour charges apart from improving uniformity in baling It minimize the leaf area loss during the process of bailing and save time and energy of tobacco farmers in making bales. Which Ease the transportation and handling of bale in storage and transit by tobacco traders and reduce in manpower involved in bale making bales. It minimizes the handling and drayage loss during storage in warehouses. Such bales will be more appealing to buyers, hence may fetch higher price. License agreement for use of bale pressing unit with RJ Technoquips having its registered office / Head Quarter Hunsur represented by its Proprietor, Mr.N.D.Suresh have been done for commercialization of the unit. This technology was widely popularized by ICAR-CTRI in various platforms.

Among several technologies & software developed by ICAR-CTRI 10 Copyrights granted by government and many other copyrights, technologies,

designs, trademarks, and patents are filed.In order to provide for the establishment of an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants ICAR-CTRI has developed and released 109 Tobacco verities and many new Identified for release under plant protection. A unique Tobacco Seed Portal website is developed for distribution of seed digitally with 100% transparency for NLS - Northern Light Soils of Andhra Pradesh; SLS - Southern Light Soils of Andhra Pradesh; KLS -Karnataka Light Soils and all Tobacco farmers. This portal generated 179 lakhs revenue a year through seed portal. Several technologies were developed for commercialization by ICAR-CTRI through Intellectual Property rights. As a part of institutional mandate many MoU, MoA, are made with many collaborators *viz* Research Institutes, Universities, Private companies and Industries etc.

Key words: MoU, Technologies, Commercialization, Intellectual Property rights, Tobacco, Seed Portal, Copyrights, Patents.

ABS157: EVALUATION OF ARTIFICIAL CONDITIONING THROUGH HUMIDIFIERS IN FCV TOBACCO

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Flue Cured Tobacco curing process involves four distinct stages namely yellowing, colour fixing, lamina drying and midrib drying. During final stage i.e., midrib drying, tobacco leaves are cured up to a temperature of 160°F in a barn, in which the leaves become dry and brittle due to moisture loss. This is posing a challenging problem to farmers during the bulking process due to scrap generation. Leaf conditioning is a process where farmers stack the cured leaf with sticks on a conditioning rack and allows the leaf to gain moisture from the outside atmosphere. To combat the conditions of low humidity and scrap generation, it is essential to develop a humidifier (to increase humidity levels) for leaf conditioning. Typically, conditioning of tobacco leaf is a natural process and takes few hours to few days depending on humidity levels in the atmosphere. In general, leaf conditioning occurs at around 2-3 AM. This is a challenging time for farmers to arrange labour for bulking process at early hours. Additionally, farmers possess single conditioning rack and any postponement in conditioning will put pressure on harvesting process as they are cyclical in nature. Delay in harvesting will directly affect the leaf quality and productivity. Proper conditioning of leaves is critical for leaf handling and post-curing operations.

To overcome all these issues, sensor enabled Humidifiers were developed for artificial conditioning. During the crop seasons 2019-20 to 2021-22, various research trials were conducted on humidifiers to study the impact on leaf conditioning on different pickings. These Humidifier consists of nebulizers/ mist makers which atomizes the water into mist particles. After attaining

optimum moisture levels, sensors will automatically turn off the machine and maintains standard moisture levels. The study revealed that a humidifier takes 4-5 hours for conditioning cured leaf of one barn. Discharge is 30 litre per hour and it takes around 120-150 litre of water to condition one bulk (around 400 Kg cured Tobacco). There was no impact on quality of Tobacco (conditioned in humidifier) during the storage period and quality remained in line with control samples (naturally conditioned Bulk). In normal condition, farmers are forced to pay additional labour wages around Rs 3000/bulk as they undertake this activity in odd hours (mid night/early morning). With deployment of artificial humidifiers, farmers can operate as per the convenient time Viz., morning hours or early evening without delaying the regular harvesting and curing operations. Saving of additional labour expenses around Rs 3000 per bulk was also recorded. Potential to condition the bulk using humidifiers is 2 cycles per Day which accounts for savings of Rs 10000/ha. Hence, humidifiers are a suitable solution for artificial conditioning and help in planning the regular harvestings even during the low ambient humidity conditions & also reduces scrap generation (up to 50Kg/ Barn/Season) which is more evident during March & April months in which humidity levels significantly drops. Hence, humidifiers are suitable for artificial conditioning of tobacco leaf and reduce the pressure on leaf harvestings while saving the handling cost.

Key words: - Flue cure tobacco, artificial leaf conditioning, protects from delayed harvestings

ABS187: "TRANSFORMATIVE IMPACT OF DR. YSRHU'S 'VICE-CHANCELLOR TO VILLAGE' A NOVEL PROGRAM FOR RURAL EMPOWERMENT

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The "Vice-Chancellor to Village" programme, launched by Dr. Y.S.R. Horticultural University (Dr. YSRHU) on the occasion of Mahatma Gandhi's 150th birth anniversary, represents a flagship initiative aimed at transforming rural communities. This endeavour involves all the 44 institutes under Dr. YSRHU each adopting a village every year.

During 2021-2022 phase of the programme, a total of 84 villages/RBKs were adopted, and a series of impactful interventions were implemented. These interventions included the organization of "Grama Sabhas" in adopted villages, offering technical support to RBKs, conducting skill training programs for women in village organizations (Self Help Groups) and Anganwadi workers, specifically focusing on Kitchen/Nutri Gardening. The initiative also facilitated the transfer of cutting-edge Horticultural technologies to farmers through training programs, demonstrations (FLDs), Farmers' Field Days and On-Farm Trials (OFTs). Moreover, students of Rural Horticulture Work Experience Program (RHWEP) and National Service Scheme (NSS) were actively involved. An impact analysis using random sampling in the adopted villages revealed significant positive outcomes. Farmers demonstrated improvement in knowledge levels, resulting in enhanced horticultural practices. This translated into increased crop yields, subsequently boosting revenue for the farming community. The adoption of recommended technologies by the farmers showcased the effectiveness of the program in bridging knowledge gaps and promoting sustainable farming practices.

The "Vice-Chancellor to Village" programme not only symbolized the commitment of Dr. YSRHU to rural development but also served as a model for university-led community engagement. The collaborative efforts of the institutes involved have contributed to the socio-economic upliftment of the adopted villages, embodying the spirit of "Mana Gramam - Mana Viswavidyalayam."

Keywords: Vice-Chancellor to Village, Adopted Villages, Impact Analysis

ABS190: TECHNOLOGY EVALUATION AND DEMONSTRATION FOR ACHIEVING HIGHER PRODUCTION EFFICIENCY IN TOBACCO

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Profitability of FCV tobacco cultivation depends on availability and adoption of improved cultivars suitable to a given tobacco growing situation. In Southern Light Soil area of Andhra Pradesh, the popular FCV tobacco variety, Siriand in Vinukonda burley growing region, available burley tobacco variety, Banket – A1 are not giving targeted returns to the growers. To address this issue, breeding programmes have developed Advanced Breeding Lines (ABLs) of superior performance viz., FCR 15 in FCV tobacco and YB 22 in burley tobacco. The performance of such ABLs in respect of its production potential, profitability and preference wasevaluated and attempted to refine relevant agronomical practices to make it suitable to situational resources , farmer's needs and for enhancing yield, quality and net returns in tobacco farming.

Advanced Breeding Lines viz., FCR 15 (FCV type) and YB 22 (Burley type) were evaluated through On Farm Trials (OFTs) during the period 1019-21 in their domain areasi.esouthernlight soils of FCV and Vinukonda burley tobacco growing areas of Andhra Pradesh. In the On Farm Trials, the ABLs FCR 15 recorded 15.60% mean increase in cured leaf yield over popular existing varietySiri. Also, superior cured leaf yield was recorded in burley ABL YB-22. The yield improvement over check Banket - A1 was 16.20 % in YB-22. Examination of pest and disease incidence and leaf quality parameters indicated that there are no perceptible variations between FCR- 15 and its check Siri and YB 22 and its check Banket-A1. Both the ABLs recorded higher net returns than that of check varieties as depicted through Benefit Cost Ratios and preferred by the farmers for its commercial cultivation.

Front Line Demonstrations (FLDs) conducted in FCV Tobacco growing areas of Andhra Pradesh revealed the superiority and suitability of identified varieties to a given situation .In Northern Black Soils (NBS) area, new Variety Sulakshana gave 13.57 percent additional cured leaf yield over check Siri and recorded B.C Ratio of 1.41 as against 1.32 in check (Siri).In Southern Black Soils (SBS) area, new Variety Sulakshana gave 14.00 percent additional cured leaf yield over check Siri and recorded B.C Ratio of 1.31 as against 1.22 in check (Siri) .The cultivation of demonstrated variety found beneficial to the FCV tobacco farmers of that region.

Key Words:FCV and Burley Tobaccos, Technology Evaluation and Demonstration

ABS191: POST HARVEST MANAGEMENT OPPORTUNITIES FOR ENHANCING PROFITABILITY IN TURMERIC

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Turmeric is an important high value commercial crop (spice) of India. Exclusive focus on enhancing production is a traditional one. Instead, post harvest management avenues like value addition, export promotion and stakeholders' linkages are identified as priority areas to enhance farmers' profitability and income. Hence, ascertained the opportunities for value addition and export promotion in turmeric through identified stakeholders, farmers, traders, and scientists of the study domain.

Priorities for value addition in turmeric:

- Curcumin. Oleoresins, turmeric powder, dried rhizome slices, turmeric jaggery, turmeric soap- body cream are desired products of value addition and products of commercial acceptability and elevating demand.
- Analysis of evolving consumer preferences and manufacture of products of commercial acceptability and elevating demand are to be considered for value addition

Priorities for export promotion in turmeric

- Developing infrastructure in compliance with international standards, linking farmers and exporting firms through FPOs and farm gate processing, mapping of export centric farming systems, training on quality crop production and high scale value addition are preferences
- Focus on European buyers in general and western European countries in particular, making a product worthwhile to lifestyle abiding by the regulations and use of PM Formalisation Micro food processing Enterprises (PMFME),
- The responses from stakeholders showed a consensus on reducing cost of cultivation and making the produce available at cheaper rate in the global scenario and creating more awareness about the medicinal value of the Indian turmeric within and outside country. The initiatives may facilitate for more demand and accordingly more exports. in the medium to long run.

Preferred export determinants in Turmeric:

- Good length of fingers, clean produce free from pesticide residues, aflatoxins, heavy metals , high percent of curcumin – oleoresin- essential oil, quality processing and packing and competitive price
- Framed a strategy for the promotion of value addition and exports in turmeric with an added focus on processing, value chain,FPOs, TOT,entrepreneur models andincubation centres.

ABS192: FUTURISTIC TECHNOLOGIES IN COMMERCIAL AGRICULTURE FOR ENHANCED PRODUCTIVITY

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Commercial agriculture needs to be quick and efficient with their operations to meet sustainability requirements and production goals in the currentand futureenvironment. Due to high demand and market value, commercial crops like Tobacco, Turmeric, and Cotton *etc.,*are cultivated in vast area byadoptingadvanced technologies which help the farmers to improve yields, reduce costs, and protect the environment. Nowadays,Drones equipped with sensors capture high - resolution imagery, allowing farmers to monitor crop health, detect diseases and optimize irrigation. Similarly Geospatial techniques, including satellite imagery and GPS, help in precise field mapping, enabling farmers to apply resources more efficiently. This targeted approach minimizes waste and enhances overall yield, leading to increased production of commercial crops. Additionally, Statistical tools like Regression Analysis will help in analyzing historical data to identify relationships between crop yield and various influencing factors like soil nutrients, water availability and weather conditions can aid in making informed decisions for crop management, while cluster analysis helps by grouping similar regions based on certain characteristics can help tailor crop management practices to specific needs, optimizing resources. In contemporary, Artificial Intelligence (AI)plays a pivotal role in boosting marketing efforts for commercial crops by using advanced analytics and predictive modelling. Through the analysis of vast datasets, AI can provide precise insights into crop yields, market demand, and pricing trends. This enables farmers and agribusinesses to optimize their planting strategies, ensuring a more efficient supply chain. Additionally, AI-driven algorithms can personalize marketing campaigns and promotions based on individual farmer needs and regional market dynamics. By harnessing AI, the agricultural sector can make informed decisions, streamline marketing processes, and ultimately contribute to the sustainable growth of commercial crop production.

Keywords: Drones, Geospatial techniques, Statistical tools, Artificial Intelligence.

ABS 193: THE EFFECT OF POST-HARVEST MANAGEMENT ON THE STABILITY OF PHYTONUTRIENTS IN CHILLI PEPPER (*CAPSICUM SP.*)

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Chilli pepper is an important horticultural crop cultivated for nutritional and pharmacological purposes. Fresh pepper is highly susceptible to spoilage in less than three (3) days and may suffer chilling injury when refrigerated for about 4-5 days. The use of various post-harvest treatments, mainly drying and further processing using gamma irradiation reduces the activity and multiplication of enzymes and microorganisms that induce food spoilage and prolong their shelf-life. This research highlighted the various post-harvest treatments used to preserve the phytonutrients in red chilli peppers. The pepper seedlings were cultivated under open field conditions and irrigated using a drip irrigation system. Physiological parameters (relative chlorophyll content expressed asSPAD values; leaf chlorophyll fluorescence Fv/Fm; canopy temperature ! and soil moisture) were measured on the field at the growth stage to ensure plants were healthy. The plants were managed well against common insects and pests' attack for high yield. The peppers were harvested and dried (oven drying, room drying and sun drying) under optimal temperatures. The dried peppers were irradiated (2.5kGy, 5.0kGy and 10kGy) and processed into powder and analysed for phytonutrients (Vitamin C, capsaicinoids, carotenoids and tocopherols) using HPLC and HPLC MS/MS. The examined phytonutrients differed significantly in their response to the various drying methods and irradiation treatments.

Abstracts Session – V

- Market intelligence and avenues for expanding new markets
- Climate resilient value chain models
- Policy interventions for profitability, exports/export promotion for improved livelihoods
- Industry preparedness for export and import substitution

ABS020: PERFORMANCE AND PROSPECTS OF MANGO IN INDIA: A CASE STUDY ON PRODUCTION AND EXPORT DYNAMICS

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Mango (Mangifera indica) is considered as "King of Fruits" in India as it is the most favoured fruit in India because of its delicious taste, flavour, pleasant fragrance, and nutritional value. It is the chief commercial fruit in India, and it plays a prominent role in Indian Economy. The current study is undertaken to assess the trends in area, production, productivity, and exports of mango and to examine the sources of growth in mango production from 1991-92 to 2021-22. Compound Annual Growth Rate, Coppock's Instability Index, and Decomposition Analysis tools are used in the present study. The study revealed that there is significant growth in area and production but there is no significant growth in productivity. The growth rate was found highest in production (3.18 %) followed by area (2.76 %) and productivity (0.46 %). The instability was found highest in production (33 %) followed by area (30 %) and productivity (16 %). The growth in exports of fresh mangoes (7.88 %) and mango pulp (9.76 %) was positive and significant during 1991-2005. However, the export of fresh mangoes and mango pulp decreased by -5.58 and -4.48 percent per annum respectively from 2006-07 to 2021-22. The instability in exports of fresh mango (48.41 %) and mango pulp (64.93 %) is very high indicating the need for stabilization measures to promote exports. The decomposition analysis to assess the sources of growth in mango production revealed that area is the major factor contributing to the increase in mango production. Though India isthe leading producer of mango in the world, there is no significant positive change in the productivity and exports of Mango. So, more emphasis should be given to Good Agricultural Practices, Sanitary, and Phyto Sanitary measures through the institutional framework to boost the productivity and exports of mangoes from India which in turn lead to the development of the mango economy.

Keywords: Growth, Instability, Decomposition, Exports.

ABS026: THE IMPACT OF GHERKIN GRADES ON FARMERS' INCOME IN KARNATAKA: A CASE OF GHERKIN CONTRACT FARMING

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India, the world's second-largest producer of fruits and vegetables, faces challenges linked to price fluctuations, risks of quantity and quality losses, and uncertainties in marketing. To address this, contract farming, particularly in Gherkin cultivation, has gained traction in Karnataka. Despite existing studies of gherkin contract farming on farmers, a nuanced understanding of the specific conditions influencing its effectiveness is lacking. This study investigates the key factors influencing gherkin grades and examines their implications for economic outcomes using primary data collected from 80 contract farmers cultivating gherkins in the Tumkur and Haveri districts of Karnataka. The research employs tabular analyses, benefit-cost analysis, and Data Envelopment Analysis (DEA) to present socioeconomic profiles, costs and returns, and technical efficiency. Additionally, an ordered logit model is employed to analyze the marginal effects of variables on the grades of gherkins produced by the farmers. The findings reveal that Karnataka significantly contributes to global cucumber and gherkin exports, accounting for 49.02% in terms of quantity and 46.94% in terms of the value of the share from India. Gherkin grades were found to vary based on count/kg and length, with smaller ones fetching higher prices and being considered superior grades. Average costs and returns were observed to be higher in higher-grade gherkins, followed by lower grades. The benefit-cost ratio for high, medium, and low-grade gherkins was 1.77, 1.66, and 1.27, respectively, representing the return on investment, while inversely the yield per acre was 3.91, 4.09, and 6.90 tons/acre for high, medium, and low grades, respectively. DEA results indicate efficiency disparities among high, medium, and low-grade producers, with efficiencies of 81%, 80%, and 59%, highlighting higher efficiency in higher-grade gherkins. The ordered logit model identifies determinants influencing gherkin grades, emphasizing factors such as household size, total operational area, access to training, cost of production, and income, which positively impacted the cultivation of higher-grade gherkins. Conversely, the area under gherkin and yield showed a negative impact on cultivating higher gherkin grades. The study highlights the importance of gherkin grades in influencing farmers' economic outcomes and emphasizes the need to cultivate higher grades for increased income and efficiency.

Keywords: Contract farming, Gherkin Grades, Data Envelopment Analysis (DEA), Technical efficiency

ORAL

ABS032: CROP SIZE FIXATION IN FCV TOBACCO: A PROFICIENT POLICY INSTRUMENT TO ENSURE SUPPLY-DEMAND BALANCE AND PRICE STABILITY IN COMMERCIAL CROPS

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FCV tobacco is a commercial crop that plays a vital role in the Indian economy. It is valued for potential farm returns, provides livelihood to a sizeable population, and contributes significant export revenue (INR 9740 Cr, 2022-23) to the national exchequer. In the recent past, commercial crops like tomato, chilli, and onion observed a high imbalance in demand and supply and a high degree of price volatility, which created a crisis-like situation in India. Conversely, FCV tobacco farming, regulated by the Tobacco Board through a crop size fixation policy, is a highly vibrant production and marketing system that operates in an organized environment.Against this backdrop, an attempt has been made to evaluate and assess the effectiveness of crop size fixation policy to regulate production and e-auctioning system for marketing of FCV tobacco in India. The trend analysis and instability index were employed by using time-series data. It was found that the difference between the average crop size fixed (143.5 M kg) and the average production realized (142.2 M kg) in Andhra Pradesh during the last decade is very insignificant i.e. 0.7 M kg, while in Karnataka, there was a slight difference (3M kg) between the annual average of crop size fixed (99.3 M kg) and the average of actual production realized (96.2 M kg) during the last decade. In the marketing and price front, it was found that price instability has significantly decreased from 40% to 13% in Andhra Pradesh and 38% to 8% in Karnataka during the manual action period (2002-2012) compared to IT-enabled e-auctioning period (2012-2022) of marketing. Thus, it is proved that the kind of regulation mechanism for the production and market ecosystem operating in FCV tobacco has led to the vibrant and stable functioning of the production and marketing system and price discovery in India. This indicates that the policy of crop size regulation in accordance with domestic and international demand and the e-auctioning system would aid as a potential device to ensure supply-demand balance and price stability. However, such a policy for regulation was not in place for other commercial crops such as chilli, turmeric, tomato, and onion which experience high price volatility. Thus, there is an immediate need for such crops to have a similar kind of policy intervention to ensure supply-demand balance, better prices, and augment farmers' income to protect farmer producers and consumers from violent price fluctuations.

Keywords: Crop size regulation, Commercial Crops, FCV Tobacco, Price Stability

ABS055: MARKET INTELLIGENCE FOR COMMERCIAL FARMING OF TURMERIC AND CHILLI

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Commercial farming is a form of agribusiness in which producers grow large farms to gain profit from their market sales. Chilli and turmeric are two significant commercial spices that have been cultivated in India extensively since ancient times. India is the world's biggest producer, consumer, and exporter of both turmeric and chilli. In India during 2022-23, Andhra Pradesh tops the list in dry chili production with 14.63 (75 %) lakh tonnes covered under 2.59 lakh ha with 5649 kg/ha productivity whereas turmeric occupied 5.5 % of the Indian area and 16 % of India's production. In this article, an attempt is made to study the seasonal variations of arrivals and prices of turmeric and chilli in major agricultural markets, the cost return structure, and the impact of market price-related advisory in Andhra Pradesh. The Seasonal indices show that turmeric prices were high in the months of January (116.69) and February (112.50), whereas arrivals were high in the months of May (198.26) and June (189.25). In the case of chillies, prices were high in the months of October (131.04) and November (125.63), whereas arrivals were high in the month of February (121.89). Prices and market arrivals show an indirect relationship. From the sample of 62 farmers of turmeric and 101 farmers of chillies, the study revealed net returns as Rs. – 26665 and Rs. 90988 per hectare respectively. The authenticity of seedlings, heavy usage of plant protection chemicals, and a labour shortage are the production constraints expressed by the farmers. To provide market information, ANGR Agricultural University established the Agricultural Market Intelligence Centre (AMIC) at Lam, Guntur. AMIC releases price forecast bulletins at regular intervals and achieves an accuracy of 86.54 to 96.38% for principal crops of Andhra Pradesh. The impact assessment study revealed that on average, turmeric and chillies farmers who adopted the AMIC advice benefited with an amount of Rs. 1276 and Rs. 1568 per quintal of sale proceeds.

Keywords: Chilli, Turmeric, Seasonal Indices, Impact, Forecast

ABS071: HOW PROFITABLE IS THE CULTIVATION OF REGULATED COMMERCIAL CROP? SOME INSIGHTS FROM COST OF CULTIVATION IN FCV TOBACCO IN ANDHRA PRADESH

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FCV tobacco is a regulated commercial crop, valued for its high farm income, provides livelihood to a sizeable population, and contributes significant export revenue (Rs 9740 Cr, 2022-23) to the national economy. It is believed that FCV tobacco, a commercial crop, with regulated production and marketing, generates more profit than other commercial crops cultivated in the country. How far does this perception hold true at a time when the farmers across the country have been groaning at the rising cost of cultivation and inadequate profit from commercial crop cultivation? Hence, the cost of cultivation studies is highly significant for policy formation, and planning price support measures in commercial crops such as FCV tobacco in India. Using the cost of cultivation data collected through field surveys during 2022-23, this paper has studied the economics of FCV tobacco in the West Godavari district of Andhra Pradesh. A multistage random sampling technique was used to provide a representation of all the registered FCV tobacco growers in each auction platform in the region. Further, a sample of 10 farmers was selected based on the number of barns registered by the growers. The study found that the productivity level was 1078kg/acre, with an average price of Rs 245/kg, and the gross income was Rs 2,64,110, the cost of cultivation recorded was Rs 1,46,203/acre, arriving at a net income of Rs 1,17,907. The cost of production was Rs 136/kg and profitability was Rs 109/kg during the year 2022-23. However, in the NLS region, the breakdown of total cost into major cost components in FCV tobacco cultivation revealed that the share of curing cost was 43%, the share of labour cost was 31% whereas the remaining 26% was incurred on material cost. Thus, the policy implications suggest that to sustain the profitability of FCV tobacco farming, there is a need for fuel-saving and labour-saving technological interventions to reduce the cost incurred on curing and labour in the NLS region of Andhra Pradesh, and the cost of cultivation needs to be factored in price determination in addition to demand-supply factors in FCV tobacco to ensure remunerative price and augment farmers' income for the farmers and opulence of rural economy in the region.

Keywords: FCV Tobacco, Andhra Pradesh, Cost of cultivation, Income, Price

ABS092: INDIAN CASTOR-SCOPE AND OPPORTUNITIES FOR VALUE-ADDED PRODUCTS

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India ranks first in the production and export of castor oil in the world and enjoys virtual monopoly in the global castor market. The area under castor (*Ricinus communis* L) seed crop is about 16.9 lakh hectares in India and it accounts for about 76percent of its global area and 88percent of global production. In India, the crop is cultivated principally in Gujarat, Rajasthan, Andhra Pradesh, and Telangana. To a lesser extent, it is produced in states like Karnataka, Tamil Nadu, Maharashtra, and Orissa. India consistently exports over 6.9 lakh tons of castor oil annually, with an export value exceeding Rs 7805 Crore. The intercropped vegetables with castor not only survived but performed better and fetched higher rates due to good quality and early harvesting. This was due to favorable microclimatic conditions in castor fields. Farmers are quite happy, and enthusiastic and see scopes for other vegetables like coriander (leaf), radish, and carrot as well in this system. Castor seeds have a non-edible oil content of 45-75 percent. Castor oil will be used in house consumption, industry,andthe medical sector. In the borders of the nursery, the castor plants are grown for natural control of insects. Dry castor leaves contain 24 percent crude protein and the toxic ricin alkaloid. Castor cake and seeds are extremely harmful to both humans and animals since theycontain the toxic alkaloids ricin and ricinine. That castor cake contains 4.5 percent nitrogen, 1.75 percent P_2O_5, and 1.5 percent K_2O and it is a good source of organic manure. In Andhra Pradesh castor is primarily grown during the kharif season. In the districts of Ananthapuramu, Prakasam, and Kurnool, it is widely cultivated. Together these districts accounted for 94.80 percent of the total area under this crop in the state during 2021-22 and Ananthapuramu district alone shared 61.14 percent of the total area under this crop.

Keywords : Castor, Exports, value-added, India

ABS099:FROM TRADITION TO TECH: NAVIGATING THE DIGITAL REVOLUTION IN COMMERCIAL AGRICULTURE FOR CUTTING-EDGE MARKET STRATEGIES AND SUSTAINABLE GROWTH

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Commercial agriculture plays an important role in Feeding the expanding world's population and maintaining food security. Commercial agriculture is a shift from traditional farming methods to growing crops for market sale, aiming to maximize yields and resource utilization. It requires advanced technology, mechanization, agribusiness companies, global supply chain integration, specialization, and crop selection based on market demand, making it a significant aspect of today's agricultural landscape. As the world population is growing, the demand for food and agricultural produce increases, thereby propelling commercial agriculture into the forefront of economic significance. In response to this critical demand for food security and the growing need for efficient resource utilization, the strategies within commercial agriculture have evolved dramatically over time. The historical context reveals the early foundations of marketing strategies grounded in traditional methods. These conventional approaches, while effective in their time, gradually faced challenges rooted in scalability, transparency, and adaptability to a rapidly changing market landscape. The earlier marketing strategies in commercial agriculture were primarily entrenched in age-old practices, relying heavily on localized distribution networks, intermediary traders, and limited market access. However, as technological prowess and digital innovations surged forward, these strategies began undergoing a fundamental transformation. The advent of innovative market interventions marked a turning oint in the agricultural landscape, making use the digital technologies capabilities, blockchain applications, and precision agriculture techniques. These interventions marked a new era in marketing strategies, promising revolutionary solutions to the sector's persistent challenges.

The applicability of these innovative market interventions spans across the entire spectrum of commercial agriculture. Digital technology stands as a cornerstone for facilitating market penetration through online platforms

and mobile applications. Digital platforms have democratized market access, ensuring a level playing field for farmers and facilitating efficient trade. Its transformative impact is evident in establishing direct farmer-to-consumer connections, bypassing middlemen, earning fairer prices for their produce while consumers benefit from a traceable, quality product. Blockchain's integration has instilled confidence in consumers, guaranteeing product authenticity and quality. Its application in supply chain management ensures transparency at every stage, preventing fraud, counterfeiting products, and providing traceability from farm to fork. This not only builds trust but also aids in fostering long-term relationships between producers and consumers.The evolution from conventional marketing strategies to innovative market interventions signifies a pivotal shift in commercial agriculture. Embracing digital technology, blockchain integration, and precision agriculture techniques fostered ot only modernized market access but has also paved the way for a more transparent, efficient, and sustainable agricultural ecosystem. As these interventions continue to evolve, their impact on commercial agriculture remains instrumental, reshaping the sector and ensuring its resilience in meeting the world's escalating food demands.

Keywords: Commercial agriculture, precision agriculture, digital technology, blockchain technology.

ABS108: TRADE DETERMINANTS AND OPPORTUNITIES FOR INDIAN MAIZE- A DYNAMIC PANEL GRAVITY MODEL APPROACH

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This study examines the trade determinants and opportunities for Indian maize using a Dynamic panel gravity model,spanning a 25-year period (1997-2021) and encompassing 29 major importing partners to estimate by Generalized Least Squares (GLS), Poisson Pseudo-Maximum-Likelihood (PPML) and Heckman Sample Selection models. India's agriculture sector is currently flourishing and actively contributing to global trade. Maize has become a key export commodity, playing a significant role in India's trade relationships with other nations. India holds the 5th position globally in terms of maize cultivation area, covering 9.86 million hectares. In maize production, the country ranks 7th with an output of 31.65 million tonnes, and it also stands at the 7th position contributing 2.71 percent to the global supply. The results reveal that the total quantity of maize exports from India to partner countries is positively influenced by the previous year's import quantity from partner countries, the overall import quantity from the world by partner countries, the product of Gross Domestic Products (GDPs) of India and partner countries, and the product of per capita incomes of India and partner countries. Additionally, factors such as exchange rate and WTO membership have a positive impact. On the other hand, the absolute per capita incomes of India and partner countries, the distance between the countries, and the recession (2008) in partner countries have a negative influence on the total quantity of maize exports from India to partner countries. These findings contribute valuable insights for understanding and optimizing India's position in the global maize market.

Keywords: Dynamic panel gravity model, Generalized Least Squares (GLS), Gross Domestic Products (GDPs), Maize, Per capita incomes, Poisson Pseudo-Maximum-Likelihood (PPML).

ABS111: EXPLORING TRADE DETERMINANTS FOR INDIAN WHEAT: INSIGHTS FROM THE DYNAMIC PANEL GRAVITY MODEL

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Wheat is a staple food for a significant proportion of the world's population. Wheat is one of the most widely cultivated food crops in the world, as it covers a vast land area of approximately 220.7 million hectares of land as of 2021. In the world, India stands in the ninth position in the quantity of wheat exports, at 6.09 million tons with a value of 1.7 million USD (2021). To identify the major factors influencing Indian wheat exports, an application of the dynamic panel gravity model framework estimated by the Generalized Least Square (GLS), the Poisson Pseudo-Maximum likelihood (PPML) and the Heckman sample selection models were used. For the present study, panel data spanning a period of 25 years (1997–2021) of major wheat-importing partner countries (29 countries) of India was collected. The results revealed that the lagged total quantity import of partner countries, product of gross domestic product and product of per capita income of India and partner countries, the total import quantity of partner countries from around the world, the exchange rate and the WTO membership of partner countries were positively influencing the total quantity of wheat exported from India to partner countries. Whereas absolute per capita income, distance, and recession (2008) showed negative influence on the total export quantity of wheat from India to partner countries. These findings contribute to a more robust comprehension of the economic and geographical determinants shaping the wheat-import landscape among the selected nations over the studied period.

Keywords: Dynamic panel gravity model, Generalized Least Square (GLS), Heckman sample selection model, Poisson Pseudo-Maximum Likelihood (PPML), Wheat

ABS113: SMALLHOLDER TURMERIC FARMERS' PARTICIPATION IN ELECTRONIC NATIONAL AGRICULTURAL MARKET (E-NAM): EVIDENCE FROM INDIA

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India is a leading producer and exporter of turmeric in the world.The Government of India introduced e-NAM in 2016 with the aim of networking the existing mandies on a common online platform as '**One Nation One Market'** for agricultural commodities. Accordingly, the same was introduced in 2017 in the Duggirala market in Andhra Pradesh to ensure competitive prices for turmeric farmers. The study applied Probit and Tobit analyses to analyse the e-NAM participation decision of smallholder farmers ($MPD_{e\text{-}NAM}$) and the extent of turmeric transacted through it in the Duggirala market respectively. The relevant data are collected from 500 smallholder farmers (< 2 ha land) in turmeric. They are broadly categorized into e-NAM participating farmers (178) and farmers selling turmeric in the physical market (322) and the sample is drawn based on probability proportion to size. The findings revealed that the quantity of turmeric produced, selling price, education, and training imparted to sample farmers are the major factors that promote the $MPD_{e\text{-}NAM}$ and the extent of turmeric transacted through e-NAM in the study area. The findings also highlighted that the non-e-NAM participants were constrained in terms of low access to institutional credit, lack of off-farm income, low-scale production, dependency on local commission agents and traders for financial requirements, etc., thereby, making them inflexible to commercialize the marketing transactions of turmeric. Thus, to ensure more $MPD_{e\text{-}NAM}$ of turmeric farmers, boosting the productivity and production of turmeric, capacity building on the importance and benefits of e-NAM, lowering transaction costs through networking of market players in the supply chain, liberal disbursement of institutional credit, etc., should deserve special attention. A close look at these results further indicates that the Government should focus on enabling the environment, institutional roles and functions, and management instruments to popularize e-NAM transactions for turmeric in the State.

Keywords:e-NAM, Probit, Tobit, Turmeric, Andhra Pradesh

ABS117: DETERMINANTS OF ADOPTION OF IMPROVED COTTON VARIETIES AND THEIR IMPACT ON YIELD AND INCOME IN INDIA

SEEMA ARYA, T. K. IMMANUELRAJ, K. VISWANATHA REDDY, P. VENKATESH, ASHA DEVI, AKRITI SHARMA

This study examined the adoption of improved cotton varieties among farmers in India. Its objectives were to examine the determinants of the adoption of improved cotton varieties and the impact of adoption on yield and income. Data for the study were obtained from the NSSO 77th round with a sample size of 588 farmers who were cultivating only cotton. The factors determining the adoption of improved varieties were obtained using the Logit model. The impact was assessed by employing the Regression Adjustment treatment effect model on STATA. The findings revealed that the level of adoption of improved cotton varieties was very high (90.57%) which is driven by a host of socio-economic factors.The results of the logit regression analysis showed that the farm size, access to irrigation, membership of farmer organizations, and Kisan credit card had a significant positive impact while the social group (SC&ST) had a negative influence on the adoption of improved cotton varieties and was statistically significant. The findings showed that the improved cotton varieties have higher yields (578 kg/ha) compared to local varieties (428 kg/ha). The impact on the yield and income was significant at a 1 percent level of significance. The adopters' yield was 578 kg/ha (34.91 percent) higher than non-adopters i.e., 428 kg/ha. The adopter earned Rs 29995 /ha (37.54 %) more gross income compared to the non-adopter i.e., Rs 21807/ha. In conclusion, the study highlights the importance of improved cotton varieties in enhancing farm productivity, generating income, and providing employment opportunities in India. To promote their adoption, addressing socio-economic disparities, fostering farmer-producer organizations (FPOs), enhancing credit accessibility, and promoting irrigation facilities are recommended.

Keywords: Improved Varieties Adoption, Adopter and Non-Adopter, Determinants, Impact, Income, Yield

ABS123: DETERMINANTS OF OILSEED SUPPLY: PROSPECTS TO BRIDGE THE SUPPLY-DEMAND IMBALANCE THROUGH AUGMENTING PRODUCTION IN INDIA

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Edible oil forms an important component of Indian cuisine. With the burgeoning population, food basket diversification and increasingly changing food consumption patterns, demand for edible oils is growing at a faster pace with a growth rate of 6 percent per annum while the domestic supply is creeping at a slower growth rate of 2 percent per annum. Consequently, there exists a huge supply-demand gap in the oilseed economy. In India, nearly 56 percent of the edible oil requirement is met through imports. Over the years, India has been striding in its pathway to attain self-sufficiency in the production of oilseeds thereby it can reduce the imports and the outflow of foreign exchange. To achieve India's dream of self-sufficiency, production must be augmented as there is less scope for area expansion. In this context, an attempt has been made to study the major determining factors affecting the farmers in the production and supply of oilseeds in India. A double-log Neronian lagged adjustment model in a dynamic panel data framework was employed to identify the determinants of oilseed supply. From the empirical analysis, it was found that, in most of the Indian states, the growth rate in area and production of major edible oilseeds is showing a declining trend while in the case of soybean, the growth is exorbitant. Factors such as price, price risk, productivity growth, previous year's production, and cost of production were found to be the most important factors in deciding the production decision of the farmers. Further, the rainfall and irrigated area under cultivation were found to be affecting production positively. Therefore, any adverse change in the weather pattern will have a significant impact on production. In the case of any external shock, adjustment towards the desired production is relatively rapid in ground nut as well as in rapeseed and mustard but slow in the case of soybean. In the long run, the production of soybean is more responsive to price followed by rapeseed and mustard and then groundnut. Farmers are highly responsive to the price and the associated price risks. Therefore, it is suggested that the farmers should be given a

price incentive and price stability for their produce, which not only increases the area but also diverts the area under water-guzzling crops (paddy and sugarcane) for oilseed cultivation. There is a need for farm mechanization to reduce the cost of production in pre and post-harvest operations. Nevertheless, productivity growth forms one of the important factors in deciding the supply, policies, and R&D support needs to be given high priority to augment productivity, boost production, and minimize the supply-demand gap in the oilseed economy.

Keywords: Dynamic panel data, Double log Neronian lagged adjustment model, supply decision

ABS134: UNVEILING THE DYNAMICS OF BASMATI RICE EXPORTS: TREND AND DETERMINANTS

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The sophisticated distribution networks facilitating global commodity dispersion have made agricultural outputs widely accessible across continents. This extensive reach is achievable through active participation in value chains. India has notably excelled in exporting a diverse range of agricultural products in recent years of which rice stands out, constituting a significant portion of the country's overall agricultural exports due to India's comparative advantage in its production, being identified as a lucrative "opportunity value chain". With Indian basmati rice gaining momentum in the global market and fetching higher returns, the production level has also shown steady growth in the past years. The comprehensive details about the export performance of basmati rice from India by virtue of growth and instability and understanding the factors that drive outcomes help policymakers enhance a country's export potential. The study utilized the multiple linear regression technique employing Ordinary Least Squares (OLS) and the growth rates were computed by exponentially fitting the time series data of the sub-periods identified through structural break analysis against time and instability indices employing the Cuddy Della Valle index. Though the growth in the quantity of basmati rice export displayed varied patterns, the movement of basmati rice in value terms has flashed a different picture with a higher growth rate of 15.02 percent during the overall period of the study. It registered a consistent increase until 2014. The volume and monetary worth of basmati rice exports displayed significant volatility throughout the study period, registering CDVI values of 47.35 and 71.26, respectively. The fluctuations in the exported quantity from India directly correlate with the variability observed in the earnings from these exports. The sky-high instability index in the value of basmati rice exports calculated are in line with the wider fluctuations in domestic and international prices and full-fledged competition during the whole period. The lagged value of basmati rice production, export price of basmati rice, and exchange rate of India influence the export of basmati rice positively and significantly at 1 percent level of significance implying the crucial role played by these variables in influencing the same. The inflation

rate was found to significantly influence basmati rice export (value) positively though at a 10 percent level of significance. The negative and significant impact of terms of trade on basmati rice export at a 10 percent level of significance implies the negative effect of trade openness up to a certain extent on the basmati rice trade of India. Since the growth rate for basmati rice export increased over the period and it appeared as the product with a competitive advantage in the global market, efforts in relation to its surplus production is required for basmati rice is required Since the export of basmati rice appeared as sensitive to several macroeconomic parameters viz. inflation, terms of trade and exchange rate. Therefore, a distinct long-term export policy aiming at strong macroeconomic fundamentals to absorb the external shocks must be framed.

Keywords: Exports, Basmati rice, CDVI, OLS

ABS135: UNRAVELLING MARKET DYNAMICS: A CASE OF SUNFLOWER CROP IN INDIA

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The study delves into the dynamics of market integration among five major sunflower markets in India against the backdrop of diverse agroecological conditions and huge import dependence on edible oils. To address the oil supply gap, this study endeavors to examine the status of market integration among five major sunflower markets in India using monthly price data from January 2010 to December 2019. The findings of Johansen's test reveal a long-term relationship among selected markets while the vector error correction model (VECM) underscores the substantial impact of price variations in Gadag and Yemmiganur markets on Raichur prices. Interestingly, short-term disequilibrium shocks in the Raichur market prompt adaptive adjustments toward long-term equilibrium. Expanding the focus, this study focused on investigating market integration among five major sunflower oil markets in India – Bengaluru, Vijayawada, Mumbai, Chennai, and Kolkata. Johansen's co-integration analysis reveals a sustained relationship among the selected markets, while the vector error correction model (VECM) underscores the significant impact of market price changes in Chennai, Mumbai, and Kolkata on Bengaluru. Granger causality tests uncover bidirectional and unidirectional causality between markets, emphasizing the urgency of policy interventions. To tackle the identified dynamics, promote market stability, and reduce import dependence, suggested interventions include improved strategic price stabilization measures, the establishment of a market intelligence system, and capacity building for market participants.

Keywords: Edible oil, sunflower, market integration, VECM, market intelligence

ABS163: MARKETING OPPORTUNITIES FOR AGRIANDALLIED PRODUCTS IN THE COASTAL ECOSYSTEM OF ANDHRA PRADESH

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Andhra Pradesh has the second longest coastal line in the country, stretching up to 974 km, and a continental shelf area of 33,227 km^2 distributed over nine districts. The state contributes 6% of food grains to the national share. Oil seeds, cash crops, fruits and vegetables, animals, and fisheries account for 3.5%, 0.75%, 11%, 29%, and 27% of total national output. Andhra Pradesh has risen from seventh to fourth place in the 2019-20 fiscal year, accounting for 5.8% of total Indian exports. Since a decade, the growth rates of export earnings for rice, maize, and marine in Andhra Pradesh have been 39%, 3%, and 12%, respectively, while groundnut and cashew have been -35% and -8%, respectively. By computing India's, Revealed Comparative Advantage (RCA) Index for major commodities over the last ten years, this study identified rice, groundnut, pulses, cashew, maize, and marine products have significant comparative advantages in the international market, those products have strong production base in Andhra Pradesh. Out of 680 mandals in the state, 60 mandals are directly connectedto the coastal line. In Srikakulam, 9 of the 38 mandals lie along the coast. Paddy and cashew nuts account for 22% and 32% of the crops grown in this region, respectively. In Vizianagaram 02 mandals are in line with the coast, and major crops are paddy and maize with a share of 2% and 9%. Out of 43 mandals in Visakhapatnam, 9 are along the coast; important crops include paddy and cashew nut, with a share of 12% and 18%, respectively; and marine catch is one of the key livelihoods in this region, with the highest proportion. East Godavari has 10 mandals that run parallel to the coast, and the principal crops are paddy and cashew nut, which account for 12.35% and 2.65% of the total. In West Godavari, two mandals are aligned with the shore, and the principal crops are paddy and mango, with a 3% and 10% share, respectively. Marine catch is also a key source of income in this region. In Krishna 04 mandals are in line with coast, major crops are Paddy and aquaculture with a share of 11.6% and 90%. In Guntur 04 mandals are in line with coast, major crops are Paddy and aquaculture with a share of 15.75% and 9.05%. In Prakasam 06 mandals are in line with coast, major crops are

groundnut and Bengal gram with a share of 38% and 21%. In Nellore 13 mandals are in line with coast, major crops are paddy and Mango with a share of 36% and 32%. Aquaculture is also one of the major livelihoods in this region with maximum share. This study also identified the present supply chains of major commodities in the state and suggested an FPO mode marketing strategy. There are 622 active FPO in Andhra Pradesh, of these 80 percent are involved in procurement operations only. By identifying the cluster-based product and by forming FPOs, are well suited for the facilitation of exports through the right education and training of farmers.

Keywords: Andhra Pradesh, Coastal mandals, Exports, FPOs

ABS151: ECONOMIC ANALYSIS OF FCV TOBACCO IN RAINFED REGION OF ANDHRA PRADESH: A CASE STUDY OF SOUTHERN LIGHT SOILS AND SOUTHERN BLACK SOILS

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This study investigates the economics of FCV tobacco farming in the southern region of Andhra Pradesh, India. The Southern Light Soils (SLS), and Southern Black Soils (SBS) were selected to analyze the cost structure and income generated by the farmers involved in FCV tobacco cultivation. The data collection involved detailed surveys and interviews with farmers across a network of auction platforms located in SLS and SBS to gather comprehensive information on the cost of cultivation. In the study, we collected data on the cost of cultivation from 40 farmers from each platform in both SLS and SBS during 2022-23. A multistage random sampling technique was used to provide a representation of all the registered FCV tobacco growers in auction platforms (6 each in SLS and SBS regions). The comparative analysis of FCV tobacco cultivation in light soil and black soil revealed that productivity was low in SLS (607kg/acre) compared to SBS (756kg/acre), whereas the average price of FCV tobacco has not shown much variation in SLS (Rs 216/kg) and SBS (Rs 218/kg) during 2022-23. However, the gross income was high (Rs 1,63,936) in SBS compared to SLS (Rs 1,31,112), which was mainly due to high productivity in SBS. Further, the cost of cultivation incurred by the farmer in SLS was Rs 1,06,597/acre, and in SBS, it was Rs 1,10,504/acre, which implies that there was not much variation in the cost of cultivation in SLS and SBS. The most important indicator, the net income realized by the FCV tobacco farmer in SBS was high (Rs 53,432/acre) compared to SLS (Rs 24,515/acre) during the year 2022-23. Nevertheless, in SLS, the breakdown of total cost into major cost components in FCV tobacco cultivation revealed that the share of curing cost was 40%, the share of labour cost was 36% whereas the remaining 24% was incurred on material cost. In the SBS region, the share of curing cost was 40%, the share of labour cost was 37% whereas the remaining 23% was incurred on material cost. Thus, understanding the cost of cultivation in FCV tobacco production is instrumental for policymakers in formulating supportive agricultural policies. The implications suggest that to sustain the profitability of FCV tobacco farming, there is a need for fuel-saving and labour-saving technological interventions to reduce the cost incurred on curing and labour in the southern region of Andhra Pradesh and augment farmers' income and enhance the prosperity of the rural economy.

Keywords: FCV Tobacco, Southern Andhra Pradesh, Cost of cultivation, Income, Price

ABS 194 RESEARCH STRATEGIES TO ENHANCE TOBACCO PRODUCTION AND INCREASING FARMER'S INCOME

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Tobacco is a drought tolerant, short duration and most economically significant agricultural crop across the globe. In India, tobaccois cultivated in about 0.45 M ha producing ~761 M kg of leaf and second largest producer and exporter after China and Brazil.It provides livelihood security to 36 million people including 6 million farmers and 20 million farm labour engaged in tobacco farming besides 10 million people working in processing, manufacturing and exports, in India. The following research strategies are to be adopted by the tobacco growers to increase the yield as well as for their own income. The emphasis must be laid outin breedingfor improving to conserve and evaluate germplasm for effective utilization, maintenance and evaluation of genetic resources. The breeding of tobacco varieties with agronomically superior traits*viz.,* climate resilience, resistance to biotic and abiotic stresses, analysis of genetic diversity and effecting crosses with selected parents for high yield potential and quality is highly essential. Crop diversification is an efficient resource for production stability and high farm returns. The cropping intensity in tobacco growing regions is very low; it needs to be improved by including short duration pulses and other commercialcrops. Therefore, there is an urgent need for the intensification of tobacco cropping system by introducing pre and post tobacco crops and crop diversification with high value commercial crops.The resources such as soil, water and nutrient play a key role in enhancing the yield and quality of tobacco. The strategies like, soil resource characterization and development of agro techniques (balanced fertilization, Integrated Nutrient Management, crop residue recycling etc.) for improving soil health, crop productivity and water productivity are highly essentialfor reducing cost of cultivation andtimely cost effective farm operations.Therefore, the emphasis should be laid out on Rational and efficient use off-farm inputs (fertilizers, pesticides etc.) and also for developing small farm mechanization.(C) There is a need for reducing the dependency on wood fuel and mitigating environmental pollution, alternative energy sources and developing efficient techniques for post harvest management system.The efforts also must be made for producing tobacco seed oil for human consumption as well as diversified use oftobacco which will create additional income for the tobacco farmers.(D) There is a

needto develop value chain of commercial commodities to enhanceproduce value and profit making.As the creation and updating of database of commodities is indispensable for formulating the policy inputs, there is a need for creation of database on demand, supplyand exports of tobacco for providing key inputs for formulation of policy.It is also important to estimate/ predict the market opportunities for high value tobacco for enabling value chain players to get fair prices/profits. This highlights designing of Online Analytical Processing model (OLAP) and development of software using AI techniques to estimate/predict the market. The functional linkages are crucial for addressing the needs of the stakeholders and to achieve the goals of the enterprise. Hence, extension and trainings facilitate technology adoption and effective implementation is required.Therefore, all the above mentioned research strategies must be followed to enhance thecrop yield and tobacco farmers income.

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