TAMIL NADU AGRICULTURAL UNIVERSITY

PROCEEDINGS

11th SCIENTISTS MEET ON NON-CROP SPECIFIC PROJECTS
(11th May, 2023)

Lead Centre

Directorate of Natural Resource Management
Tamil Nadu Agricultural University
Coimbatore – 641 003

Directorate of Research
Tamil Nadu Agricultural University
Coimbatore 641 003

2023

PROCEEDINGS

11th Scientists' Meet on Non-Crop Specific Projects
(11th May, 2023)

The 11th Scientists' Meet on Non-Crop Specific Projects was conducted on 11.05.2023 in which 50 scientists through off-line and more than 250 scientists through on-line participated covering all Colleges, Research Stations and KVKs.

The Director of Research in his opening remarks highlighted the research gaps and action plans required for addressing. He has emphasized the scientists to formulate action plans to resolve emerging problems. The need for developing new generation fertilizers was discussed. It was suggested to document the data available on the number of demonstrations made on PPFM spraying for mitigation of drought. Identification of diverse isolates of PPFM may be intensified. Research on developing stage specific inoculants for other crops may be strengthened.

Dr. P. Balasubramaniam, Director (NRM), Dr. S. Pazhanivelan, Director (CWGS), Dr. M.K. Kalarani, Director (DCM) and Dr. R. Shanthi, Director (CPPS) have presented on the achievements and action taken report on the recommendations of the 10th Non-Crop Specific Projects of respective directorates.

The Prof. & Heads of Departments under DNRM, CWGS, DCM, CPPS have presented the salient outcomes from the research projects for adoption, OFT and Information and new OFT and action plans for 2023-2024.

Based on the discussion, the following recommendations and action plans pertaining to the non-Crop projects of Departments of Soil Science and Agricultural Chemistry and Agricultural Microbiology, Environmental Sciences, Centre for Agricultural Nano Technology, Remote Sensing and GIS, AICRP-IFS, Agricultural Meteorology and CPPS are furnished under the following headings.

A. Decisions made on Adoption / OFT/ Information
B. Action plan 2023 – 24
C. Research projects and remarks on the ongoing Research Projects
D. Remarks
E. List of Participants

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

A1. For Adoption: Nil

A2. For OFT / Validation : 02

OFT / Validation 1. Evaluation of TNAU Micronutrient Mixture for the management of micronutrient deficiency and increasing productivity and starch content in cassava under irrigated condition

Objective

❖ To test verify the recommendation of micronutrient mixture for cassava under irrigated condition

Treatments

T_1 : STCR -NPK

T_2 : STCR - NPK + 20 kg S ha^{-1} as gypsum + 25 kg ZnSO$_4$ ha^{-1} + 10 kg Borax ha^{-1} as basal

T_3 : STCR-NPK + 20 kg TNAU MN mixture as basal (1: 10 ratio as enriched FYM)

T_4 : Farmer's practice

Observations and Analysis

✓ Growth and yield attributes

✓ Tuber Yield

✓ Starch content

✓ Micronutrient content & Uptake

Lead centre & Scientists In-charge

Dept. of SS&AC, TNAU, Coimbatore : Dr. S. Suganya, Assoc. Prof. (SS&AC)

Co- ordinating Centres & Scientists In-charge

✓ TCRS, Yethapur   : Dr. M. Velmurugan, Assoc. Prof. (Hort.)

✓ RRS, Paiyur   : Dr. M. Sangeetha, Assoc. Prof. (SS&AC)

KVK, Dharma

✓ puri   : Dr. K. Sivakumar, Assoc. Prof. (SS&AC)

OFT / Validation 2. Validation of Electrochemical Sensor tool for soil health analysis

Objective

• To validate the efficient, low cost, user friendly electro chemical (EC) based Sensor Kit for assessing soil health conditions.

Validation Details

T_1- Analysis of soil samples adopting Standard Method

T_2- Analysis of soil samples adopting Sensor Kit Method

Number of soil samples to be analyzed
- 50 Neutral soil samples
- 25 Acid soil samples
- 25 saline and sodic soil samples

Soil properties to be analyzed
Soil pH, EC, Available N, P & K

Period: 1 Year (2023-2024)
 Lead Centre and Scientist in charge
 Dr. P. Kannan, Assistant Professor (SS&AC), Dept. of S&E, AC&RI, Madurai

Coordinating Scientists and Centres
Location & Scientists
Dr. G. Sridevi, Assistant Professor (SS&AC), Dept. of SS&AC, DNRM, TNAU, Coimbatore
Dr.M. Vijayakumar, Asst. Prof. (SS&AC), AC&RI, Kudumiyanmalai

A3. For Information :
1. Long term fertilization practices on dynamics of low dose herbicides in soil

Under Long term fertilization practices, application of different rates of bensulfuron methyl (45 and 90 g ha^{-1}) and tembotrione (120 and 240 g ha^{-1}) showed significant differences on their leaching and sorption in surface itself in soil. Application of 100% NPK with FYM @ 10 t ha^{-1} is beneficial in reducing the leaching of herbicides to lower depths and increasing their sorption when compared to other practices which is favourable to provide enhanced weed control efficiency and reduce the contamination of ground water. Increased dose of herbicides increased the leaching and sorption and hence these herbicides should be applied only at recommended level to protect the water bodies from contamination and carryover persistence by increased leaching and sorption in soil. However, the ill effect of bensulfuron methyl and tembotrione applied to ragi and maize cropped field soil could be reduced when the soil was applied with FYM 10 t ha^{-1} along with 100% NPK on *Inceptisols*.

2. Development of Geospatial map for Soil Fertility and Crop suitability analysis of RRS, Paiyur

Assessing crop suitability of RRS, Paiyur farm was performed through the pedogenic (vertical distribution) and water quality parameters and it showed that the soils are slightly alkaline and non saline. Geospatial maps were prepared for soil

available nutrients. Based on that the SOC was low to medium and available N, P, K and S were low to medium, medium to high, medium and low to medium, respectively. Adoption of STCR-IPNS approach will provide balanced nutrition to crops which in turn was helpful in maintaining the soil health and enhancing the yield of crops grown in the farm. Irrigation quality of both open well and bore well sources of A, F and H blocks of farm were good and it is suitable for irrigation to all the crops. The crops suitable for the predominant three soil series of RRS, Paiyur farm were grouped and it has been distributed over six mapping units namely Mapping unit 1 (A and H block) and mapping unit 2 (B block) were moderately suitable for growing paddy and marginally suitable for mango; Mapping unit 3 (Field no. 3, 4 ,7, 8 of F block) and mapping unit 4 (Field no. 1,2,5,6 of F block and G block) were moderately suitable for growing finger millet, cowpea, groundnut and not suitable for paddy ; mapping unit 5 and 6 (C,D and E blocks)were highly suitable for growing finger millet and groundnut and marginally suitable for paddy and mango.

3. Identification and mapping of soil constraints for sustained crop production in Red and Lateritic Soils

The soil fertility status, potentials and constraints in the soils were assessed in Pudukkottai district using the Fertility Capability Classification (FCC). Based on the FCC evaluation, several constraints were identified that could impact soil fertility and agricultural productivity. These constraints include low cation exchange capacity (CEC), low K reserve, soil acidity, P fixation capacity, Ustic moisture regime and low organic carbon in the soil. Appropriate management strategies have been identified to improve the soil fertility and productivity.

4. Demonstration of Soil Science Technology for Management of Sub-soil hard pan soils of Coimbatore

Pre-ploughing the field with chisel plough at 0.5-meter intervals in a criss - cross manner with the application of farm yard manure @ 12.5 t ha^{-1} had recorded the highest grain yield (1763 kg ha^{-1}) of red gram which was 14.5% higher than farmer's practice (1540 kg ha^{-1}). By practicing chisel plough technology, the soil physical properties such as bulk density, porosity, hydraulic conductivity and infiltration rate upto 60 cm of soil depth were further improved.

5. Field Scale Evaluation of *Talinum fruticosum* on Sodic Soil

Initial growth performance (in terms of height) of *Sesuvium portulocastrum* was higher in *sodic soil* compared to *Talinum fruiticosum*. Application of fertilizer improved

the growth of both the crops (*Talinum fruiticosum* & *Sesuvium portulocastrum*) in sodic soil.

6. Soil resource inventory and Fertility mapping of soils of Vazhavachanur using GIS

Base map of AC&RI, Vazhavachanur was generated using open-source satellite data. The GPS aided surface samples (grid size of 50 x 50 m) were collected covering various blocks of AC&RI, Vazhavachanur. Totally 118 samples were collected and analysed for their physico-chemical properties. Based on the properties, the soils were grouped under *Inceptisol* and *Alfisol*. Nutrient Index values were worked out for the physico-chemical properties. Among the major nutrients, soil available potassium status was medium whereas the soil available nitrogen and phosphorus status were low. As regards the DTPA extractable micronutrients, Zn is predominantly deficient followed by Fe (43.2%), Mn (18.6%) and Cu (26.27%). The soil fertility maps of major, secondary and micronutrients were prepared using GIS. The irrigation water was found to be within the permissible limits for irrigation purposes. Irrigation water quality map for various properties was prepared using GIS.

7. Management of Soil constraints at AC&RI, Eachangkottai, Thanjavur

The different soil amendments chosen under soil breeding experiment *viz.*, heavy clay, coarse sand, FYM and their combinations aimed to alleviate soil physical constraints over the period of three years, registered a significant influence on soil physical properties and rice yield. Among the treatments, a combination of FYM @12.5 t ha^{-1} + Clay @ 50.0 t ha^{-1} + Coarse sand @ 50.0 t ha^{-1} registered the highest reduction in soil bulk density and improvement in pore volume, soil infiltration rate and hydraulic conductivity. In addition, this particular treatment combination recorded 28 per cent enhanced rice grain yield over control.

8. Sustainable soil development for cultivation of groundnut and soil quality of Theri land (Red sand dune)

Tank silt in combination with fly ash @ 20 t ha^{-1} and recommended fertilizer application produced higher plant height (66.1cm), number of branches (7), number of pods (31.0) pod yield (26.8 g plant^{-1}) and haulm yield (33.5 g plant^{-1}). The improvement in textural property of this sandy soil might be the major reason for the yield enhancement under tank silt addition.

9. Profiling Selected Benchmark Soil Series of Tamil Nadu

A training cum workshop was organized at Department of Soil Science and Agricultural Chemistry, TNAU, Coimbatore from 26.09.2022 to 29.09.2022 with the experts from NBSS & LUP, Regional Centre, Bengaluru for demonstrating the preparation, processing and mounting of soil monolith.

A soil profile was excavated at the Department of Pulses, TNAU, Coimbatore and a soil monolith was prepared and horizon wise soil samples were characterized for physical, physico-chemical and fertility properties. Soil texture indicated that decrease in sand content with depth and irregular distribution of silt and increased clay content with depth was noticed. Soil pH was found to be alkaline, electrical conductivity was medium to high and organic carbon content was low. Soil pH and EC increased with depth while organic carbon decreased with depth. The $KMnO_4$ - N was low, Olsen-P and NH_4OAc-K was medium. The available nitrogen, phosphorus and potassium status was found to decline with depth of soil profile.

10. Development of electrochemical sensor tool for soil health analysis

A simple electrochemical sensor kit was developed in collaboration with the Central Electrochemical Research Institute, Karaikudi. The soil pH and EC were found equivalent in both the methods and showed less variance of 5 and 7 per cent respectively. Available potassium was found equivalent in both the methods and showed less variation of 7, 12 and 10 in neutral, acid and alkaline soils respectively. Available phosphorus showed a higher variation of 34 per cent in acid soil and needs to fine-tune the extractant. Available nitrogen showed a higher variation of 33, 22 and 22 per cent in neutral, acid and alkaline soils respectively. The soil sample preparation and extractant need to be adjusted for reducing the variation.

11. Assessing the secondary and micronutrients fertility status in the soils under different crops and cropping systems of selected districts in Tamil Nadu

The assessment of secondary and micronutrient status in the soils under different crops grown in Erode and the Nilgiris districts showed no Ca deficiency and less than 10% deficiency of Fe and Mg with adequate soil fertility rating. The deficiency of B (55.5 & 66.1%), Zn (75.2 & 60.3%) and Cu (84.2 & 42.2%) were predominantly observed in the soils grown with various crops. None of the soil samples collected from the Nilgiris district was deficient in Mn; however, in Erode district considerable extent of Mn deficiency (35.1%) with marginal fertility rating was recorded. Among the crops grown, soils grown with vegetables and flower crops in

Erode district were having very low fertility of Zn, Cu and B while in the Nilgiris district soils under vegetable cultivation had higher deficiency of S, Zn, B and Cu deficiency which warrants attention.

12. Survey and characterization of Ground water of Coastal districts of Tamil Nadu for Irrigation

A study was undertaken to assess the groundwater quality and seawater intrusion in the Chengalpattu district and totally 250 samples were collected using a GPS. Out of 250 samples analysed for water quality, 45% of the samples comes under alkali category, 31% under marginal alkali, 16% under good quality and 4% each in marginal by saline and highly alkali category as per the CSSRI, Karnal classification. A study was undertaken to assess the groundwater quality in Tiruvallur district by collecting 166 groundwater samples using GPS and analyzed for various quality parameters and thematic maps were prepared using Arc GIS software 10.1. Out of the total 166 samples collected in Tiruvallur district, 34 per cent was characterized under good quality, 2 per cent has been characterized as marginally saline, 41 per cent was characterized as Marginally alkali and 23 per cent has been characterized as Alkali.

13. Metagenomics & carbon pools of Nilgiris Hill region in Southern western Ghats-An Insight to protect Soil Biodiversity and to Combat Climate Change

The Nilgiris Hill Region (NHR), a biodiversity hotspot has been witnessing large-scale destruction in the recent past owing to Land use change. From the study conducted in different ecosystems, the results showed that the total organic carbon (TOC) and carbon stock were higher in Evergreen Forest (EL)and Deciduous Forest (DF) and it decreased with the depth of the soil profile across the pools (carbon) of varying liability. The metagenomics study spotlights the reduced efficiency and the altered diversity of soil microbes in Cropland (CL) and Tea plantation (TP). Coupled with this a higher proportion of active carbon pools eventually resulted in higher carbon dioxide (CO_2) emissions {71.87 t ha^{-1} in Tea plantation, 82.39 t ha^{-1} in crop land)}. The study suggests the reduced potential of Tea plantation and Cropland to sequester and store carbon efficiently. The negative LDI in crop land and Tea plantation showed the most extent of land degradation.

B. New Action Plan

Action Plan 1. Development and evaluation of TNAU Micronutrient Mixtures for major fruit crops

Objective : To develop and evaluate new TNAU Micronutrients mixture for improving yield and quality of major fruit crops

Treatments

- Ratios of TNAU MN Mixtures: 3 (I, II & III)
- Levels: 0, 100, 200, 300 & 400 g tree^{-1}
- Replications: Three
- Design: FRBD

  Frequency of application: Basal & at Critical crop growth stages

  Crops: Mango, Banana, Acid lime, Grapes & Papaya

Observations and Analysis

- Yield
- Fruit quality
- Micronutrients content
- Micronutrients availability
- Economics

Lead Centre and Scientists incharge

Dr. M. Elayarajan, Professor (SS&AC)

Dr. S. Suganya, Associate Professor (SS&AC)

Coordinating Centres and Scientists incharge

Crops	Centres	Scientists In-charge
Mango	HC&RI, Periyakulam	Dr. K. Rajadurai, Professor (Hort.)
	RRS, Paiyur	Dr. M. Sangeetha, ASP (SS&AC)
Banana	TNAU, Coimbatore	Dr. M. Elayarajan, Professor (SS&AC)
	ADAC&RI, Trichy	Dr. S. Meena, Professor (SS&AC)
	HC&RI, Periyakulam	Dr. M.R. Backiyavathy, Professor (SS&AC)
Acid lime	HC&RI, Periyakulam	Dr. S. Shenbagavalli, AP (ENS)
	CRS, Sankarankovil	Dr. C. Rajamanickam, Professor (Hort.)
Grapes	TNAU, Coimbatore	Dr. S. Suganya, ASP (SS&AC)
	GRS, Theni	Dr. A. Subbiaya, ASP (Hort.)
Papaya	TNAU, Coimbatore	Dr. C. Kavitha, Assoc. Professor (Hort.)
	TCRS, Yethapur	Dr. M. Velmurugan, ASP (Hort.)

Action Plan 2. Fortification of TNAU Water Soluble Fertilizers with Micronutrients

Objective

- To fortify TNAU water soluble fertilizers (19:19:19) with Micronutrients

Methodology

- Optimizing the fortification levels and evolving micronutrients fortified TNAU-WSF
- Compatibility studies
- Quality analysis
- Physical properties (Solubility, particle size, density)
- Nutrient composition

Centre : Dept. of SS&AC, TNAU, Coimbatore

Scientists In- charge : Dr. R.K. Kaleeswari, Professor (SS&AC)

        Dr. A. Renukadevi, Associate Professor (SS&AC)

Action Plan 3. Fertigation of TNAU-WSF for High Value Crops under Protected Cultivation

Objective

- ✓ To assess the efficiency of TNAU-WSF in high value crops under protected Cultivation

 Fertigation scheduling

 Crop : Capsicum & Cucumber

 Levels of TNAU-WSF :

 Capsicum: 0, 50,75,100 & 125 kg ha^{-1}

 Cucumber: 0, 30,40,50 & 60 kg ha^{-1}

 * 100 % RDF (Check) ** Based on 85 % efficiency

Observations

- Growth parameters
- Yield and yield parameters
- Quality parameters
- NUE, Pre and post harvest soil analysis

Period : One year (June 2023 to May 2024)

Co-ordinating centre : Scientists In- charge :

1**.** Dr. R.K. Kaleeswari, Professor (SS&AC), Dept. of SS&AC, TNAU, Coimbatore

Sub-centre :

   1**.** Dr. Sangeetha, Associate Professor (SS&AC), RRS, Paiyur

   2. Dr. K. Sivakumar, Associate Professor (SS&AC), KVK, Dharmapuri

   3. Dr. Srividhya, Associate Professor (Horti), HC&RI, Jeenur

Action Plan 4. Assessment of soil carbon measurement and validation at farm level for facilitating Carbon Farming Initiative in Agriculture

Objectives

- ✓ To assess soil carbon and develop protocol for carbon Measurement Reporting and Verification (MRV) to facilitate Carbon Farming Initiative (CFI)
- ✓ To document climate change mitigation activities as co variables for correlation

Period : Three years (June 2023 to May 2026)

Scientists in-charge

Dr. K. Sathiya Bama, Professor (SS&AC), Dept. of SS&AC, TNAU, Coimbatore

Dr. S. Sangeetha, Asst. Prof. (AGR) , Dept. of Agronomy, TNAU, Coimbatore

Dr. M. Raju, Professor (Agronomy), CWGS, TNAU, Coimbatore

C. Remarks of the individual Non- Crop Specific Projects (NCSP) – 2023

S. No.	Title of the Project	Period	Name and designation of the project leaders	Remarks
Action Plan (5)				
1.	Effect of Long-term fertilization practices on dynamics of low dose herbicides in soil	2021-2023	Dr. P. Janaki Professor (SS&AC) NOFRC, TNAU, Coimbatore -3 Dr. D. Jayanthi Professor (SS&AC) Dept. of SS&AC, AC&RI, Karur - 639001	• Findings may be given for information. • The action plan may be closed.
2.	Development of Geospatial map for soil fertility and crop suitability analysis of RRS, Paiyur	2021-2023	Dr. M Sangeetha Assoc. Prof. (SS&AC), RRS, Paiyur Dr. R. Kumaraperumal Assoc. Prof. (SS&AC), Dept of RS&GIS, TNAU, Coimbatore	• Information to be documented and displayed in the laboratory • The project may be closed and completion report may be submitted for approval.
3.	Identification and Mapping of Soil Constraints for sustained crop production in Red & Laterite Soils	2021-2022	Dr. P.P. Mahendran Dean, AC&RI, Madurai Dr. R. Jagadeeswaran Professor (SS&AC) Dept. of RS&GIS, TNAU, Coimbatore Dr. M. Vijayakumar Asst. Prof. (SS&AC) Dept. of SS& AC AC&RI, Kudumiyanmalai	• Database and report to be shared to the Department of SS & AC, TNAU, Coimbatore. • Findings may be given for information. • The action plan has been completed and may be closed.

4.	Demonstrations of Soil Science Technology for the Management of Subsoil Hard Pan soils of Coimbatore	2021 - 2023	Dr. N. Chandra Sekaran Professor (SS&AC) ICAR, KVK, Sandhiyur Dr. G. Sridevi Asst. Professor (SS&AC) Dept. of SS&AC TNAU, Coimbatore-3	• Findings may be given for information. • The action plan has been completed and may be closed.
5.	Field Scale Evaluation of *Talinum fruticosum* on sodic soil	April, 2022 to March, 2024	Lead Centre and Scientist in charge Dr. K. Manikandan Assistant Professor (SS&AC), TRRI, ADT Coordinating centre & Scientists incharge Dr. S. Suresh Professor (SS&AC) KVK, Thirupathisaram Dr. V. Dhanuskodi Asst. Professor (SS&AC) ADAC&RI, Trichy Dr. T. Balaji Asst. Professor (SS&AC) KVK, Ramanathapuram	• The field performance and biometric observations are to be monitored • The action plan is to be continued as per the technical programme. • Findings may be given for information.
Research Projects (4)				
a.	**University Research Projects**			
6.	**NRM/VAZ/SSAC/2021/001** Soil resource inventory and Fertility mapping of farm soils of AC&RI, Vazhavachanur using GIS.	June, 2021 to May, 2023	Dr. V. Arunkumar Asst. Prof. (SS&AC), AC & RI, Vazhavachanur	• Information to be documented and displayed in the laboratory. • The project may be closed and completion report may be submitted for approval. • The copy of the Completion report to be shared to the Department of Soil Science and Agricultural Chemistry, TNAU, Coimbatore.
7.	**NRM/ECK/SSAC/2021/OO2** Management of Soil constraints at AC&RI, Eachangkottai	January, 2021 to December 2024	Dr. S. Mohandas Professor & Head Dept of SS&AC AC&RI, Eachangkottai	• The project may be closed and completion report may be submitted for approval.
8.	**NRM/CBE/SAC/2020/002** Effect of K fertilization on K^+: Na^+ homeostasis, K acquisition efficiency and grain quality of crops in saline and alkali soils under rainfed condition.	January, 2021 - December, 2023	Dr. P. Janaki Professor (SS&AC) Dept. of SS&AC NOFRC, TNAU, CBE-3	The project is to be continued as per the technical programme.
9.	**NRM/KKM/SAC/2020/003** Sustainable soil development for	April, 2021- March,	Dr. M. Paramasivan Asst. Professor (SS&AC)	The project may be continued as per the

	cultivation of groundnut (*Arachis hypogea* L.) and soil quality of Theri land (Red sand dune)	2024	Dept. of SS&AC, AC&RI, Killikulam	technical programme and the Field experiments may be taken up at the earliest.
b. TNAU Funded Project (RS&GIS - RF) (1)				
10.	Profiling selected bench mark soil series of Tamil Nadu	September 2022-March 2024	Dr. K.M. Sellamuthu Professor (SS&AC) TNAU, Coimbatore-3 Dr. R. Jagadeeswaran Professor (SS & AC) Dept. of RS&GIS, TNAU Coimbatore-3 Dr. R. Santhi Prof. and Head (SS&AC) Dept. of SS&AC, TNAU, Coimbatore-3 Dr. D. Selvi Professor (SS&AC) Dept. of SS&AC, TNAU Coimbatore-3 Dr. K. Sivakumar Assoc. Prof. (SS&AC) KVK, Papparapatty	• The project is to be continued as per the technical programme
c. Externally Funded Projects (2)				
11.	**NASF/ACRI/MDU/DSE/2020/R007** Development of electrochemical sensor tool for soil health analysis	February 2020 to January, 2023	Dr. P. Kannan Asst. Prof. (SS&AC) Dept. of Soils and Environment AC&RI, Madurai	• Validation of Sensor tool to be continued and completed. • Completion report may be submitted.
12.	**NASF/NRM/CBE/ SSAC/R001** Hyperspectral reflectance and multi-nutrient extractant based rapid assessment of soil properties for sustainable soil health in India	September 2022 to August 2025	Dr. S. Maragatham Professor (SS&AC) Dept. of SS&AC, TNAU Coimbatore-3 Dr. R. Santhi, Prof. and Head (SS&AC), TNAU, Coimbatore Dr. M. Gopalakrishnan Associate Professor (SS&AC), HC&RI, Jeenur	• The project is to be continued as per the technical programme.
c. All India Coordinated Research Projects (AICRP)				
13.	**AICRP/NRM/CBE/SAC/004** ICAR - AICRP on "Micro and Secondary Nutrients and Pollutant Elements in Soils and Plants" Program No.1: Delineation and reassessment of micro and secondary nutrients deficient areas and updating soil fertility maps of Tamil Nadu	2020 – continuous	**Dr**. T. Chitdeshwari Professor (SS&AC) Dept. of SS&AC TNAU, Coimbatore Dr. S. Suganya Assoc. Prof. (SS&AC) Dept. of SS&AC TNAU, Coimbatore	• Findings may be given for information. The research work is to be continued as per AICRP technical programme.
14.	**AICRP/NRM/TRY/005** Survey and characterization of ground water of Coastal districts of Tamil Nadu for	01.04.2022 to 31.03.2023	Dr. M. Baskar Professor and Head Dept. of SS&AC ADAC&RI, Trichy-620	• Findings may be given for information. The research work is to

			027	be continued as per AICRP technical programme.
e. Student thesis				
15.	**Ph.D. Thesis** Metagenomics and Carbon Pools of Nilgiri Hill Region in Southern Western Ghats – An Insight to Protect Soil Biodiversity and to Combat Climate Change	2019-2023	Student Dr. M. Jagadesh Dept. of SS&AC TNAU, Coimbatore Chairperson Dr. Mrs. D. Selvi Professor (SS&AC) Dept. of SS&AC TNAU, Coimbatore	• Findings may be given for information.

AGRICULTURAL MICROBIOLOGY

A1. Technologies for Adoption: 01

1. Soil respiration indicator (SRI) gel probe for Soil health assessment

A rapid soil biological health assessment kit in the form of a color-based gel probe was developed to monitor the soil respiration rate (amount of CO_2 evolved per unit of soil per unit of time), and thereby the soil health. This gel probe will turn its color from violet to magenta (low), orange (medium), and yellow (high) depending on the amount of CO_2 evolved within 8 hours of incubation, which is positively correlated with soil biological attributes and actual measures of soil respiration. The kit discriminated the farmers' soils as low, medium, and high health based on the color codes and recommended proper management strategies to improve the soil health. This method does not require many scientific skills, quick and straightforward to set up the device; interpreting the results would be simple and can be performed by the farmers.

A2. Technologies for OFT: Nil.

A3. Technologies for Information: 15

1. Amylase-producing probiotic lactic acid bacteria(LAB) for rice-based food formulations

The culture *Enterococcus durans* Afm50 with efficient amylolytic action can be mixed with antifungal strain *Lactobacillus plantarum* and bacteriocin strain *Lactococcus lactis* to improve the safety of rice-based food formulations

2. Development of thermotolerant plant growth promoting *Bacillus* sp

Of 15 gram-positive thermophilic bacterial isolates, 4 isolates from compost (ComB2, ComB3, ComB4 and ComB10) and other 4 from rice rhizosphere (RRBN2, RRBN3, RRBPK1and RRBPK2) were identified as plant growth promoters based on their potential to produce IAA, accumulate phosphorus and solubilize insoluble phosphate.

3. Exploring antimicrobial secondary metabolites from agriculturally important microbes as next-generation weedicide

Isolated and identified actinobacteria such as *Streptomyces griseorubens, Streptomyces avendulocolor, Streptomyces diastotochromogenes, Streptomyces griseocarneus, Streptomyces variabilis* and *Streptomyces althioticus* based on 16S rRNA gene sequences.

4. Influence of AM fungal association on growth and root biomass production of Ashwagandha (*Withania somnifera* L.) in sodic soil

Rhizosphere samples of maize, brinjal, tomato, lab lab, green gram, hibiscus, sapota, cowpea, banana and bhendi that grew in sodic soil were found to harbor six different AM fungal species namely *Glomus geosporum, Glomus mosseae, Glomus* sp. *Glomus multicaule, Acaulospora* sp. and *Gigaspora* sp) in larger proportion.

5. Assessing the performance of Quantitative Color-based Probes in Farmers' fields for monitoring the soil biological health

Evaluation of the performance of Color-based Probe kits was carried out in 125 farmers field with help of microbiologists in Ten centers of TNAU (Coimbatore, Periyakulam, Madurai, Kovilpatti, Killikulam, Vazhavachanur, Tindivanam, Vridhachalam, Aduthurai, and Trichy). It was found to be effective in monitoring soil biological health. The color score values were found to correlate with values of soil pH, EC, organic carbon, available N, P, K, microbial biomass carbon, respiration rate and dehydrogenase activity.

6. Bio-capsule/Pellet formulation of NPK bio-inoculants and testing its bio-efficacy

Talc, compost, oil-based degradable polymer and cyclodextrin, based bio pellets prepared with beneficial bacteria (*Azospirillum brasilense* Sp7, *Bacillus megaterium* PB1 and *Rhizobium pusense* KSBKKM1) were found to support the bacterial load in the biopellets for eight months and the formulation was found to support a total bacterial count of $6x10^{10}$ cfus's per gram dry weight of the biopellet.

7. Development of process for simultaneous laccase production by *Hexagonia hirta* MSF2 using coconut industry wastes and recovery of biochemicals

Hexagonia hirta MSF2 produced 1585.24 U/g db (dry biomass) of laccase using coir pith as substrate in optimized solid-state fermentation conditions. Maximum activity and stability of laccase were achieved at pH 4.0 and temperature of 40 °C. Organic solvents like DMSO and methanol, and metal ions like $BaCl_2$, $CaCl_2$, $CuSO_4$, and $MnCI_2$ stimulated the laccase activity. Inhibitors like sodium azide and thiourea strongly inhibited the enzyme activity. Besides, the laccase production through solid-state fermentation using coir pith substrates simultaneously delignified the lignin present in the coir pith which was confirmed through SEM and FT-IR analysis. Further, metabolic profiling of the coir

pith spent medium using GC-MS revealed many aromatic compounds like vanillin, vanillic acid, phenol, catechol and 4-Hydroxy Benzaldehyde.

8. Bioprocessing of Natural Fibres and Agro residues for Production of Oligo-saccharides and lignin-dived aromatics

Novel EnZolv process for biodelignification of biomass substrate pretreatment was optimized for maximum cellulose recovery in Banana fibre. From the optimized Enzolv pretreated hydrolysate of banana fiber, industrially important lignin-derived aromatic compounds like Vanillin, 4-Hydroxy Benzaldehyde and Butylated Hydroxytolune were identified via GC-MS analysis. Novel enzolv process for maximum lignin reduction in cotton waste was pre-optimized and statistically optimized to focus on the lignin-derived aromatic compounds.

9. Nano-formulation of plant probiotic, *Bacillus altitudinis* FD8 and their metabolites for induced drought protection, plant defence and enhanced productivity in rice

Compatible polymers and surfactants such as pectin, glygerol, and Tweet 20 were optimized for the preparation of suitable nano-formulation for FD48. Prepared nano-formulation was assessed for their stability and characterization which revealed a particle size of 198.2 nm and PDI of 0.986 and it maintained stability. Further, the nanoformulation characterized in Fourier Transform Infrared (FTIR) Spectroscopy evidenced the chemical interaction between the functional group of FD48 cells and the polymer altered the surface of the nano-formulated FD48 cells. Besides, the film-forming capability of the developed formulation ensures the controlled or sustained release of microbial cells at the target site. The developed nano-formulation increased the survival viability of FD48 cells. It maintained a population of 10^{10} CFU.mL^{-1} for up to 6 months of storage. The plant growth-promoting traits such as nutrient solubilization and IAA production were preserved in FD48 when ensconced in nano-emulsion. Seeds bacterized with nano-formulated FD48 improved seed germination (17% increase over control) and root length (53% increase over control) in rice plants with an osmotic potential of -0.46 Mpa (PEG 6000).

10. Dissemination of Arbuscular Mycorrhizal fungi (AM fungi) production technology to enhance and empower the livelihood of farm women in the Aspirational district (Ramanathapuram) of Tamil Nadu

Training and demonstrations were given to the farm women for mass production of AM fungal biofertilizer and ensure their livelihood and ecominc status of farm women.

11. **Synthesis and tailoring of novel degradable plastics using blue-green algal and tree oils for application in smart agriculture**

Hydroxylated oil prepared by the mixture of 100 ml of *Hydnocarpus wightiana* oil, 100 ml of 97% formic acid and 55 ml of 30% hydrogen peroxide was found to be very good binding material. The addition of 15-20% of the oil-based polymer along with base materials like talc, and compost facilitated the preparation of pellet-based biofertilizer formulation. The beneficial microbes were found to sustain in the oil-based bio pellet for about 8 months period. The oil-based polymer thus could be used as the binder in biofertilizer formulation.

12. **Effect of root exudates on germination of AMF spore under *in vitro* condition**

This study demonstrated that minimal media supplemented with a combination of root exudates and root extracts of the respective host (maize and onion) along with 12-methyl tetradecanoic acid and coconut oil could support AM fungal spore germination (20-25 days). This indicates the possibility of induction of heterotrophic mode of growth of AMF spores and paving the way for axenic development of AMF on large scale.

13. **Utilization of pesticide degrading *Lactobacillus plantarum* Pb3 to decontaminate the chemical pesticide pollutants on food matrices**

The strain *L. plantaram*, pb3 developed for decontamination of pesticides *viz.*, chloropyriphos, imidochloprid and chlornitriprole by enzymatic hydrolysis during fermentative growth on rice flour was found to remove approx. 35 to 67 % of residual pesticides within 30min of fermentation in the food matrix and 4h from the food surface.

14. **Strain improvement in *Chlorella* sp*. (KM504965) by radiation breeding and physiological modulations for biofuel production**

Gamma mutagenesis of oleaginous microalga *Chlorella* sp. KM504965 resulted in the development of three superior mutants namely Cl801 with higher biomass, growth rate and carbohydrate for bioethanol and bio-oil production, Cl805 with greater biomass and lipid for biodiesel production, and Cl803 with higher protein for single-cell protein production. The mutant Cl805 recorded a higher growth rate, biomass production (1.3-fold) and lipid accumulation (1.4-fold). Physiological modulation studies revealed Cl805 as the better biomass and lipid accumulator under mixotrophic mode (1% glucose) with wider adaptability to higher pH (8.5) and salt (3% NaCl). Furthermore, biodiesel derived from the mutant Cl805 met the fuel properties (CN: 67.48, IV: 42.22 mg $I_2$100 g^{-1}, KV:

4.87 mm^2 s^{-1}) of national and international biodiesel standards. A significant correlation was observed between the expression level of regulatory genes with higher biomass production, photosynthetic performance and lipid productivity of the mutants (Cl801 and Cl805) and the wild-type.

15. Surveillance and source tracking of Norovirus contamination in agricultural produces

An extensive investigation was performed in the vegetable production systems of Coimbatore. The samples from soil, manure, irrigation water, utensils, workers, plant, product, and market samples of tomato, brinjal, and lablab were assessed for the prevalence of foodborne pathogens. The results revealed that *Pseudomonas aeruginosa* and *E. coli* O157 are present in vegetable production systems and have no Norovirus, *Staphylococcus aureus*, or *Salmonella* spp. The manure and irrigation water are the primary sources of entry of these foodborne pathogens. This investigation suggests good agricultural practices such as proper decomposition of manures; avoiding animal grazing; use of bore well water instead of the pond; adequate irrigation and water drainage system; sanitation during harvest; and harvested product not touching the soil.

B. New action plan: Nil.

C. Remarks on the ongoing Action Plans/ URPs/ Core/ AICRPs/ Externally Funded Projects

S. No.	Title of the Project	Investigator	Funding Agency/ Period	Centre/ Location	Remarks
UNIVERSITY RESEARCH PROJECT					
1.	NRM/CBE/AGM/RIC/2021/001 Utilization of amylolytic characteristics of probiotic lactic acid bacteria in rice-based food formulations	Dr. K. Vijila Professor	URP; Aug. 2020 to June 2023	Dept. of AGM, TNAU, Coimbatore	• Completion report may be submitted • Publication may be done • Cultures must be submitted to the Microbial Culture collections facility of the Department of Agrl. Microbiology • Findings may be given for information
2.	NRM/MDU/AGM/2020/002 Development of thermo tolerant *Bacillus* isolates for plant growth promotion	Dr. R. Uma Sankareswari Asst. Professor	URP; Sep 2020 to August, 2023	NPRC, Vamban	• ROS studies may be undertaken Plate assay at 65 ºC may be done • Molecular identification of cultures may be done • Publication may be done • The project may be extended up to March 2024 • Findings may be given for information
3.	NRM/MDU/AGM/2020/004 Development of novel bacterial strains for Nitrogen fixation and PO$_4$ solubilization in sunflower	Dr. N. Ramalingam Professor	URP; Sept. 2020- August 2023	Dept. of AGM, AC&RI, Madurai	• Completion report may be submitted
4.	NRM/TRY/AGM/2020/001 Influence of AM fungal association on growth and root biomass production of Ashwagandha (*Withania somnifera* L.) in sodic soil	Dr. L. Srimathi Priya Asst. Professor	URP; Sept. 2020 – August 2023	HC&RI Periyakulam	• Findings may be given for information • Project may be extended up to March 2024 • Molecular identification of AMF and Phosphobacteria may be done • Root organ culturing of AMF may be initiated
5.	URP/2022-00039/NRM/AGM/ NON/ 001. Exploring antimicrobial secondary metaboliotes from agriculturally important microbes as next generation weedicide.	Dr. V. Gomathi Prof. (Agrl. Micro.)	URP; March, 2022 to Feb, 2024	CANT, NRM, TNAU, Coimbatore	• Findings may be given for information • Project may be continued

6.	URP 2021-00134 Computational approaches for analysis of phytochemicals of *Orthosiphon stamineus* against urolithiasis, anti-inflammatory activity and anticancer activity and development of data base	Dr. N. Bharathi Asst. Professor	URP; August 2021 to August 2023	Dept. of Plant Biotechnology, CPMB&B, TNAU, Coimbatore	• The results may be published in a high-impact factor journal
7.	CPMB/CBE/ PL.BIO/ Non-I 2022 I 001. Assessment of the antimicrobial and insecticidal activity of the nimbolide and its hybrid molecules	Dr. V.P. Santhanakrishnan Assoc. Professor	June 2022-May 2024	Dept. of Plant Biotechnology CPMB&B, TNAU, Coimbatore	• Project may be continued
Action Plan					
8.	Assessing the performance of Quantitative Color-based Probe in Farmers' fields for monitoring the soil biological health	Dr. D. Balachandar Professor	2022-2023	Dept. of AGM, TNAU, Coimbatore	• Given for Adoption
9.	Bio-capsule/Pellet formulation of NPK bio-inoculants and testing its bio-efficacy	Lead centre Dr. B. Jeberlin Prabina, Prof. (Agrl. Micro.) Dr. S. Suresh, Prof (SS&AC), ARS, Thirupathisaram **Sub centre** Dr. D. Balachandar Professor, Dept. of AGM, TNAU, Coimbatore Dr. K. Kumutha, Prof & Head Dept. of AGM, AC&RI., Madurai	2021-2024	Dept. of SS&AC, Killikulam	• Project may be continued • Field trials may be conducted to evaluate the effect of biopellets on tomato and brinjal • Hardening effect of biopellet on tissue-cultured banana may be studied
AICRIP					
10.	AICRP/NRM/CBE/AGM/001 All India Network Project on Soil Biodiversity and Biofertilizers	Dr. D. Balachandar Professor Dr. M. Gnanachitra Professor	ICAR-AICRIP	Dept. of AGM, TNAU, Coimbatore	• Project may be continued • Technology developed on Soil respiration indicator (SRI) gel probe for Soil health assessment is recommended for adoption
EXTERNALLY FUNDED PROJECTS					
11.	SERB/NRM/AGM/CBE/2021 /R026 Development of process for laccase production by *Hexagonia hirta* MSF2	Dr. U. Sivakumar Professor	SERB; 30.12.2020 – 29.11.2023	Dept. of AGM, TNAU, Coimbatore	• Project may be continued • Findings may be given for information

	using coconut industry wastes and recovery of biochemical (E28AFM)				
12.	ICAR/NRM/CBE/AGM/202/R002. Bioprocessing of Natural Fibres and Agro residues for Production of Oligo-saccharides and Starch	Dr. U. Sivakumar Professor	ICAR -CIRCOT: 2021-2024	Dept. of AGM, TNAU, Coimbatore	• Project may be continued • Findings may be given for information
13.	SERB/NRM/AGM/CBE/2021/R001: Nano-formulated plant probiotic *Bacillus altitudinis* FD48 and their metabolites for induced drought protection, plant defense and enhanced productivity in Rice.	Dr. U. Sivakumar Professor	SERB 2020-2023	Dept. of AGM, TNAU, Coimbatore	• Project may be continued • Findings may be given for information
14.	DBT/ACRI/KKM/AGM/2021/R001 Dissemination of Arbuscular Mycorrhizal fungi (AM fungi) production technology to enhance and empower the livelihood of farm women in the Aspirational district (Ramanathapuram) of Tamil Nadu(E28AGO)	Dr. M. Gomathy Asst. Professor	DBT 2021-2023	Dept. of SS&AC, Killikulam	• Root organ culture studies may be initiated • Patenting may be done for techniques developed to recover AMF spore
15.	TNSCST/ACRI/KKM/SAC/2020/R006 Synthesis and tailoring of novel degradable plastics using blue-green algal and tree oils for application in smart agriculture	Dr. B. Jeberlin Prabina Professor	TNSCST, Chennai	Dept. of SS&AC, Killikulam	• Patenting of process and product of oil-based polymer may be done • Publications may be done • Proposal may be submitted to BIRAC for funding
16.	TNSCST/HCRI/TRY/HOR/2021/R002: Investigation on the effect of AM fungi and PGPR against panama wilt in banana caused by *Fusarium oxysporum* f. sp. *cubense*	Dr. L. Srimathi Priya Asst. Professor	TNCST; April 2021 – March 2023	HC&RI(W), Trichy	• Molecular identification of AMF and PGPR may be done
17.	TNAU/CPMB/CBE/DPB/2019/R035 Cloning and characterization of novel biocidal protein genes from indigenous isolates of *Bacillus thuringiensis*	Dr. S. Mohankumar Professor Dr. E. Kokiladevi Professor & Head Dr. D. Sudhakar Professor Dr. V. Balasubramani Professor (Agrl. Ent.) Dr. N. Balakrishnan, Assoc. Prof. Dr. M. Jayakanthan	03-10-2019 to 02-10-2022	Dept. of Plant Biotechnology, CPMB&B, TNAU, Coimbatore	• May be extended until 31.3.2024

		Assistant Professor		
18.	GOI-DBT/CPMBB/DPB/2021 / R002 Exploration of Gut microbiome and quality bee products for sustainable bee keeping in India (Honey bee Gut microbiome India- through metagenomics – a network mode project)	Dr. S. Mohankumar Professor Co-PIs: Dr. M.R. Srinivasan, Prof. (Entomology), Dept of Entomology, CPPS Dr. N. Saranya, A.P (Bioinformatics), DPMB&B, CPMB&B	DBT; Dec. 2021 to Dec. 2023	Dept. of Plant Biotechnology, CPMB&B, TNAU, Coimbatore.	• May be continued for one more year
Students research work					
19.	Effect of root exudates on germination of AMF spore under *in vitro* condition	Name of the student: S. Kasthuri ID. No.: 2020511004 M.Sc. in Agrl. Micro., Name of the Chairperson: Dr. T. Kalaiselvi	TNAU	Dept. of AGM, Coimbatore	• Findings may be given for information
20.	Utilization of pesticide degrading *Lactobacillus plantarum* Pb3 to decontaminate the chemical pesticide pollutants on food matrices	Name of the student: M. Palanisamy ID. No.: 2018801103 Ph.D. in Agrl. Micro., Name of the Chairperson: Dr. K. Vijila, Prof.	TNAU	Dept. of AGM	• Findings may be given for information
21.	Strain Improvement In *Chlorella sp.* (KM504965) by radiation breeding and physiological modulations for biofuel production	Name of the student: D. Senthamilselvi ID. No.: 2017801105 Ph.D. in Agrl. Micro., Name of the Chairperson: Dr. T. Kalaiselvi	TNAU	Coimbatore	• Findings may be given for information
22.	Surveillance and source tracking of Norovirus contamination in agricultural produces (Jawaharlal Nehru Memorial Fellowship-2022)	Name of the student: Mohanapriya. R, ID. No.: 2020611002 Ph.D. in Agrl. Micro., Name of the Chairperson: Dr. D. Balachandar	TNAU	Dept. of AGM, Coimbatore	• Findings may be given for information

ENVIRONMENTAL STUDIES

A1. For Adoption: **In situ decomposition potential of TNAU Biomineralizer on crop residues**

➢ The crop residues incorporated using rotavator and TNAU Biomineralizer applied @2 $kg t^{-1}$ of residue along with application of urea for balancing C: N ratio performed better followed by treatment with Crop residues incorporated in soil using rotavator and applied with TNAU Biomineralizer @2 kg/ton of residue.

Specific Recommendation
* Adjust CN ratio of 30:1 with rotavator incorporation before 15 days of transplanting
* Adjust CN ratio with following formula

Nitrogen requirement (X) (kg) = ((Q x C) - 30 x (Q x N))/30
Urea requirement (kg) = X x 2.17
   Q = Quantity of the biomass (stubbles) (kg)
   C = Carbon content of the biomass (stubbles) (%)
   N = Nitrogen content of the biomass (stubbles) (%)

Recommendations

Method of harvesting	Addition of biomass (Rice stubbles kg ha^{-1})	Stubble height (cm)	No. of hills per sq. m	Urea recommendation when stubble incorporation with rotavator along with addition of TNAU Biomineralizer @ 2kg t^{-1}
Manual Harvesting	2500-3000	10 cm	25-30	25-30 kg
Machine Harvesting	4650-7280 kg ha^{-1}	36-43.5	20-25	60-75 kg

* **Calculated recommendation**

Average C = 46.8 % & Average N = 0.74%

Rice stubble addition (kg) (Q)	Optimum CN ratio for paddy straw - 30: 1		TNAU Biomineralizer requirement (kg)
	N requirement	Urea requirement	
1000	8.2	18	2
2000	16.4	36	4
3000	24.6	53	6
4000	32.8	71	8
5000	41.0	89	10
6000	49.2	107	12
7000	57.4	125	14
8000	65.6	142	16
9000	73.8	160	18
10000	82.0	178	20

A2. For OFT / Validation :
OFT 1: NRM/CBE/ENS/NON/2023/001: Effective Microbial (EM) formulation and assessing its potential in waste treatment

Treatment details
T1 - Control (Sewage water)
T2 - Sewage water + 3 % EM
Replication - 3

Treatment details
T1 - Control (Vegetable waste)
T2 - Vegetable waste + 3 % EM
Replication – 3

Locations	:	AC&RI, Kudimiyanmalai; HC&RI, PKM; AC&RI, Vazhavachanur; KVK, Sandhiyur; TNAU, Coimbatore
Co-ordinating center	:	KVK, Sandhiyur
Duration	:	July 2023 to April 2024
Scientists In-charge	:	Dr. P. Kalaiselvi, Assoc. Prof. (ENS), KVK, Sandhiyur Dr. A. Bharani, Prof. (ENS), Dept. of Env. Sciences, TNAU, Coimbatore Dr. E. Parameswari, Assoc. Prof. (ENS), NOFRC, TNAU, Coimbatore Dr. S. Paul Sebastian, Asst. Prof. (ENS), AC&RI, Kudimiyanmalai Dr. S. Shenbagavalli, Asst. Prof. (ENS), HC&RI, Periyakulam Dr. A. Krishnaveni, Assoc. Prof. (ENS), AC&RI, Vazhavachanur

A3. For Information:

Antibiotic residues in soils under intensive organic farming systems of Tamil Nadu
- The dynamics of manure driven antibiotics in tomato and paddy grown organically for more than three years were assessed for antibiotics *viz.,* Oxytetracycline (OTC), Enrofloxacin (ENRO), and Chlorotetracycline (CTC).
- The concentration of Oxytetracycline (OTC) ranged from BDL to 0.18 µg g^{-1}, Enrofloxacin (ENRO) ranged from BDL to 0.12 µg g^{-1} in tomato grown soils. In case of paddy field samples, the concentration of OTC, ENRO and CTC ranged from BDL to 0.12 µg g^{-1}, BDL to 0.08 µg g^{-1} and 0.10 to 0.12 µg g^{-1} respectively.

Potential of biostimulants on soil health and crop growth in polluted soils
- The study on the effect of biostimulants such as sea weed extract, humic acid and fish meal extract revealed that the soil application of 0.2%humic acid to green gram grown in the tannery effluent contaminated soil (pH – 8.9 & EC -3.1dSm^{-1}) recorded maximum germination (100%), plant height (17.3cm) and number of leaves (7.3%).
- Soil application of 0.2% seaweed extract to tomato grown in the tannery effluent contaminated soil recorded maximum germination (93%).

Floating Wetlands for Eco-Restoration of lakes

- Assessment of Water Quality Index (WQI) of Periyakulam and Selvachinthamani lakes of Coimbatore district recorded 36.1 ± 10.5 and 29.6 ± 5.1respectively during2022 - 2023which falls under "Bad" category in terms of quality.
- The removal efficiency of standardised Vetiver Floating Wetlands (1x1 ft) with 4 vetiver clumps in 50 litres of lake water was in the order of Nitrates (78%), Phosphates (52%), Sulphates (37%), Total Solids (35%), Chlorides (33%), BOD (29%) and COD (27%).

Evaluation of flowering annuals and vegetables suitable for sodic soil

- The flowering annuals grown in soil with an ESP of 24 recorded the total phenol content in the order of Globe Amaranthus (176 mg GAE/g) > Cockscomb (172 mg GAE/g) > Marigold (168 mg GAE/g) > Cluster beans (92 mg GAE/g) > Amaranthus (64 mg GAE/g).
- The maximum yield in Globe Amaranthus (68.4 g pot-1) > Cockscomb (67.5 g pot-1) > Marigold (65.7 g pot-1) > Cluster beans (36.0 g pot-1) was observed in soil with an ESP of 24; whereas, the maximum yield in Amaranthus (32.4 g pot-1) was observed in soil with an ESP of 16.

Bioremediation of arsenic contaminated soil

- In accordance with bioconcentration factors and Translocation Factor, and *T. erecta* is considered as better accumulator and can be used in remediating As because of its rapid growth, biomass and adaptability to various environment.
- Application of biocompost @ 5 t ha^{-1} amendment with AM fungi @ 50 kg ha^{-1} and *Azotobacter*@ 2 kg ha^{-1}decreases the bioavailability of As and therefore it has the potential to remediate as contaminated soil.

Impact of treated paper and pulp industry effluent on soil and crops

- Monitoring studies revealed that the soil and ground water samples collected from treated paper board industrial effluent irrigated areas of Pallipalayam (SPB), Thekkmpatty (ITC), Karur (TNPL-Unit I) and Trichy (TNPL Unit II) indicated that the soil and ground water quality were not deteriorated in these areas due to treated effluent irrigation. All the parameters were observed to be within the permissible limits prescribed by TPCB, and hence the ground water can be used for irrigation.
- A slight buildup of salts in soil was observed in the low-lying areas of TEWLIS due to irrigation of ground water with high Electrical conductivity.
- Studies with *Sesuvium portulacastrum*, a halophyte grown in effluent irrigated soils at 10 cm X 10 cm spacing recorded a biomass yield of 10.28 t ha^{-1}with a salt uptake of 436 kg ha^{-1}. In the remediated soil, soil application of Microbial Consortium @ 4 kg ha^{-1} along with @ 0.1 % foliar spray and Poultry manure @ 5 t ha^{-1} recorded 38.8% higher yield in grafted brinjal (Dhruva) than control.
- In ITC, Thekkampatty, the treated paperboard mill effluent through drip irrigation along with ETP sludge vermicompost @ 5t ha^{-1} increased the yield of Ragi , var. ATL (2970 Kg ha^{-1}) to the tune of 13.64 over flood irrigation with well water and vermicompost @ 5 t ha^{-1}.

Rhizo filtration potential of vetiver in wastewater treatment

- Vetiver plants thrived well in the raw dairy effluent and Installation of Vetiver Floating Wetlands in the Dairy effluent collected from the Aavin, Coimbatore recorded a significant reduction in the total solids (38%), BOD (58%) and COD (66%) after 60 days.

Impact of treated sewage irrigation on soil and fodder quality

- Due to continuous irrigation of treated sewage for four years, over well water irrigation, an increase in organic carbon by 14.29 per cent, available NPK by 11.93, 30.99, and 41.14 per cent respectively and 10.68 per cent microbial biomass carbon were recorded besides higher microbial population and enzyme activities.
- The treated sewage from TNAU STP unit I has high algal growth which could be avoided by increasing the aeration time during treatment.

Synthesis of nanomaterials for environmental application

- Carbonization of groundnut shell (10kg) at an elevated temperature of 450°C produced 30% pre-carbonized charcoal.
- Volatile content in raw peanut shell (65%) was decreased to 8.2% in obtained biochar produced at 450°C. This reduction resulted in the well-pronounced porosity and stability of carbon in the biochars that helps in the preparation of Nano sheet at 800° C.
- The groundnut shell carbon nano sheet activated with solid and solute KOH showed multilayer thin plates comprising of multi-layer ultra fine nano sheets, carbon fragment structure dispersion overlapping with each other.
- The nanosheets thus produced are separated individually is cleaner and smoother compared to KOH (Solid).

Air pollution tolerance of various tree species for urban forestry and improved air quality

- Air Pollution Tolerance Index (APTI) of 38 tree species were assessed and classified into highly tolerant, tolerant, moderately tolerant, sensitive and highly sensitive based on the APTI class. In this classification, 1 falls under highly tolerant, 4 under tolerant, 18 under moderately tolerant, 15 under sensitive and none under highly sensitive class.
  Highly tolerant species: Sacred fig (*Ficus religiosa*) - APTI 30.55
  Tolerant species: False Ashoka Tree (*Polyalthia longifolia*) - APTI 25.80; Manila tamarind (*Pithecellobium dulce*) - APTI 19.17; Rain tree (*Samanea saman*) - APTI 18.36; Portia Tree (*Thespesia populnea*) - APTI 17.15
  Moderately tolerant species Neem (*Azadirachta indica*), Pungam (*Pongamia pinnata*), Tamarind (*Tamarindus indica*), Indian Almond (*Terminalia catappa*), Banyan (*Ficus benghalensis*), Teak (*Tectona grandis*), Aayamaram (*Holoptelea integrifolia*), Aachamaram (*Hardwickia binata*), Vagai (*Albisia lebbeck*), Blackboard tree (*Alstonias cholaris*), Bidi leaf tree (*Bauhinia racemosa*), Kassod Tree (*Cassia siamea*), Cluster fig (*Ficus racemosa,* Eucalyptus (*Eucalyptus globus*),

Wax apple *(Syzygium samarangense),* Stone apple *(Aegle marmelos),* Jack fruit (*Artocarpus heterophyllus*), Java plum (*Syzygium cumini*)

Oxygen release potential of selected tree species and urban parks of Coimbatore city

- Coimbatore city is having a total population of 20.99 lakhs as on year 2021with an estimated O_2 requirement 662312.16 ton yr^{-1}.
- In Bharathi Park, out of 34 tree species studied*, Albizia lebbeck* (1142.10 kg tree^{-1} year^{-1}), *Tabebuia heterophylla* (1119.54 kg tree^{-1} year^{-1}) and *Peltophorum pterocarpum* (858.70 kg tree^{-1} year^{-1}) showed highest net oxygen release.
- In Gandhi park, out of 31 tree species studied, *Albizia lebbeck* (2869.57 kg tree^{-1}year^{-1}) *Parkia biglandulosa* (1976.34 kg tree^{-1} year^{-1}) and *Casuarina equisetifolia* (1509.89 kg tree^{-1} year^{-1}) showed highest net oxygen release.
- VOC Park, out of 30 tree species studied, *Delonix regia* (1341.06 kg tree^{-1} year^{-1}), *Albizial ebbeck* (1321.84 kg tree^{-1} year^{-1}) and *Pterospermum acerifolium* (1262.96 kg tree^{-1} year^{-1}) showed highest net oxygen release.

Aerosol Radiative Forcing over India (ARFI) at high altitudes

- The overall mean black carbon concentration during 2023 was about 0.63 ± 0.028 µg m^{-3} which was less than the concentration recorded during 2022 (1.31 ± 0.028 µg/m^3). The black carbon concentration over the past years confirms the ubiquity of Aerosol particles and their seasonal heterogeneity.
- The overall mean Aerosol optical depth value was 0.317 during the year 2022, which decreased to 0.217 during the reporting period.

Sustainable management of tea waste to transform the tea industry into carbon neutral and zero waste industry

- Standardized the operational protocol for transforming different tea wastes into carbon dots (pyrolysis under 250 ˚C for 4 hours). Two sequential synthesis method (pyrolysis followed by ultrasonication at 70% amplitude for 15 minutes) was found to be the best method for synthesizing Carbon Dots from all the three different tea wastes (tea garden waste, tea processing waste and spent tea waste).
- Bio-surfactant (Saponins) was extracted from unutilized tea leaves and its potential as surfactant for foliar application have to be studied.

Developing human excreta-based bio- product and evaluating its effect on the quality of soil and crop produce

- The bio product of humanure, biochar and human urine at 1:1:1 ratio recorded higher nutrients (N-3.97%, P-2.12%, K- 4.15%) after 30 days of incubation and found to be pathogen free. The nutrient content was observed to increase on 30th day with 13% N, 23% P and 20% K.

Assessment of Microplastics in Agricultural Soils

- The FTIR results highlighted that all the soils predominantly contain MP fibres followed by fragments with MPs mean abundance as follows: treated sewage

irrigated farm (1650 ± 0 items/kg) > well water irrigated and inorganic fertilizers applied paddy field (1500 ± 1.41 items/kg) > Integrated Farming System field (1250 ± 4.24 items/kg) > Inorganic fertilizers applied field (1025 ± 9.19 items/kg) > organic manures amended field (1000 ± 1.41 items/kg) > plastic mulched soil (800 ± 11.31 items/kg).

(i) Crops
- Exposure to Polyethylene Microplastics (PE - MPs, 60um) exhibited a short-term effect on the germination of both blackgram (CO6) and tomato (PKM1). The study revealed that exposure to PE - MPs exhibited a short-term effect on both blackgram [90.0% (1.00% PE-MPs) - 96.6% (control) at 72 hr of exposure] and tomato [92.0% (1.00% PE-MPs) – 96.0% (control) at 9 days of exposure].
- In both blackgram and tomato, PE − MPs exposure significantly reduced the physiological traits; while enzymatic and non − enzymatic antioxidants like MDA, SOD, proline, ascorbic acid, catalase in both blackgram and tomato increased at a significant level.
- Exposure to PE − MPs exhibited no significant difference in the yield attributes of blackgram; whereas in tomato a decline in yield attributes and fruit quality were observed. Addition of PE − MPs were observed to alter the soil properties by reducing the bulk density, enzymes involved in P cycling and bacterial diversity.

(ii) Ecotoxicity studies using earthworms
- Toxicity studies conducted with Earthworm (*Eisenia fetida*) for 60 days revealed a dose - dependent detrimental effect by increased mortality (46.80% at 1% PE - MPs) and decreased weight (4.25g at 1% PE - MPs).
- The co-exposure impact of microplastics and hexavalent chromium were observed to be maximum in the treatments of 0.1 % PE concentration with hexavalent chromium (5 ppm and 10 ppm) on 90th day with 100% mortality rate.
- The mortality rate was observed to be similar on earthworms in the treatments without co-exposure of both PE and Cr (VI). The mortality percentage was virulent in treatment containing 0.1% PE + 10 ppm Cr (VI) on day 7 (50±6.81 %) > 0.05% PE + 10 ppm Cr (VI) on day 42 (91.67±3.93 %) >0.1% PE + 10 ppm Cr (VI) on day 42 > 0.1% PE + 10 ppm Cr (VI), 0.05% + 5 ppm Cr (VI) (100±0.0 %). Therefore, indicated that impact increased during co-exposure.

B. New Action Plan: 04

1. Interactive effect of elevated levels of tropospheric ozone and carbon dioxide on rice cultivars and developing nutrient based mitigation strategies for sustainable agriculture

Rationale:
Interactive effect of carbon dioxide (CO_2) and tropospheric ozone (O_3) on rice is still unexplored

Objectives:
1. Assessing the interactive effect of elevated levels of CO_2 and tropospheric ozone (O_3) on rice cultivars

2. Evaluating the influence of elevated CO_2 and O_3 on root morphology and soil characteristics
3. Development of nutrient-based mitigation measures to alleviate the interactive effect

Treatments:

Rice Cultivar: CO 47, CO 51 and ADT 43; CO_2 and O_3 concentration: CO_2 – 550 µmol min^{-1}, O_3 – 100 ppb
Exposure stages and period: From transplanting to harvest stage, 7 hours per day (10.00 AM – 5.00 PM)
Analysis stages: Vegetative, active tillering, panicle initiation, harvest

Nutrient management strategies:
T_1 - Recommended dose of N fertilizer
T_2 - 1.25 times the Recommended dose of N fertilizer
T_3 - foliar application of 1 % NCU
T_4 - foliar application of 1 % nanourea
T_5– foliar spray of Pink Pigmented Facultative Methylotrophs (PPFM) at 1 %
T_6 –Azolla as a dual crop at 250 kg ha^{-1} from 3 – 5 DAT (days after transplanting)
Replication: Four
Design: FRBD

Parameters to be recorded:
1. Physiological, Biochemical, Growth and Yield attributes
2. Soil physicochemical characteristics
3. Root System Architecture

Duration: Two year (2023-2025)
Location: Dept. of ENS, DNRM, TNAU, Coimbatore
Scientists In- charge:
Dr. P. Dhevagi, Professor (ENS)
Dr. K. Boomiraj, Associate Professor (ENS)

2. Evaluation of *in situ* decomposition potential of Maize stalks by using TNAU Biomineralizer

Rationale:
1. Resilient recycling of crop residues
2. Improvement and sustenance of soil fertility and soil health

Objective:
- To assess the in situ degradative ability of the TNAU Biomineralizer on Maize stalks

Treatments:
T_1 - Maize stalks (Natural degradation)
T_2 – 100 % Maize stalks incorporated in soil using rotavator and applied with TNAU biomineralizer
T_3 - 100 % Maize stalks incorporated in soil using rotavator and applied with TNAU biomineralizer + Urea for balancing C:N ratio
T_4 - 100 % Maize stalks incorporated in soil using rotavator and applied with TNAU biomineralizer + Cowdung for balancing C:N ratio
T_5 - 75 % Maize stalks incorporated in soil using rotavator and applied with TNAU biomineralizer
T_6 - 75 % Maize stalks incorporated in soil using rotavator and applied with TNAU biomineralizer + Urea for balancing C:N ratio

T$_7$ - 75 % Maize stalks incorporated in soil using rotavator and applied with TNAU biomineralizer + Cowdung for balancing C:N ratio

Replication: Four   Design: RBD Plot size: Minimum of 1 cent for each treatment
Duration: Two years (2023-2025) including validation
 Location: Dept. of ENS, DNRM, TNAU, Coimbatore
                MRS, Vagarai; KVK, Salem

Scientists In- charge:
1. Dr. V. Davamani, Associate Professor (ENS), DNRM, TNAU, Coimbatore
2. Dr. P. Kalaiselvi, Associate Professor (ENS), KVK, Salem
3. Dr. T. Selvakumar, Associate Professor (AGR) & Head, MRS, Vagarai
4. Dr. S. Paul Sebastian, Associate Professor (ENS), AC & RI, Kudumiyanmalai
5. Dr. M. Maheswari, Professor and Head, Dept. of Env. Sciences, TNAU, Coimbatore

3. Standardizing rapid propagation method for *S. portulacastrum* to maximize its large-scale adoption for restoration of salt affected soils

Rationale:
- Faster propagation could remediate a large area in short duration
- Could improve growth vigor of *S. portulacastrum*

Objective:
- To evaluate various propagation methods of the *S. portulacastrum*
- Propagated through vegetative methods
- Mother bed – 10 m^2 – 4 weeks
- 4500 cuttings
- Root trainer – 100 Nos. 2 weeks
- 4200 saplings
- Produces Seeds after 100 days of planting
- 1 gram of seeds = 1300 -1500 seeds
- Germination percentage *= 4%*

Duration: One year (2023-2024)

Location: Dept. of ENS, DNRM, TNAU, Coimbatore
Scientists In- charge:
1. Dr. K. Sivasubramanian, Professor (ENS), Dept. of ENS, TNAU, Coimbatore
2. Dr. V. Manonmani, Professor and Head (SST), Dept. of SST, TNAU, Coimbatore

4. Assessing the Green House Gas (GHG) emission from Integrated Farming System using IPCC model

Rationale:
GHG emissions from integrated farming systems using the IPCC model is crucial for understanding the impact of agriculture on the environment and developing effective strategies to reduce emissions.

Objectives:
Assessing the green house gas emission from different components of IFS using IPCC model
Identification of mitigation measures for reducing GHG emission from different components of IFS
Duration: One year (2023-2024)
Location: Dept. of ENS, DNRM, TNAU, Coimbatore

Scientists In- charge:
  1. Dr. P. C. Prabu, Associate Professor (Env. Sci.), Dept. of Agronomy
  2. Dr. K. Boomiraj, Associate Professor (Env. Sci.), ACRC

C. Project wise remarks

S. No.	Project Number and Title	Name and Designationof the Project leader	Duration	Remarks
Environmental Sciences				
1.	NRM/CBE/ENS/NON/2021/001 Studies on antibiotics residue in soils and crops under intensive organic farming systems of Tamil Nadu	Dr. V. Davamani, Assoc. Professor (Env. Sci.) DNRM, CBE Dr. S. Paul Sebastian, Assoc. Prof. (Env. Sci.), AC&RI, Pudukkottai Dr. A. Christopher Lourduraj, Prof. (Env. Sci.) O/o DR, CBE	Aug. 2021 to July, 2023	• Project may be closed and closing proposal may be submitted.
2.	NRM/MDU/ENV/NON/2022/001 Assessing the potential of biostimulants on soil health and crop growth in polluted soils	Dr. R. Jayashree, Assoc. Professor, (Env. Sci.) Dept. of Env. Sci., TNAU, Cbe	April, 2022 to May, 2024	• May be given for information
3.	Study on release of toxicants by *Ipomoea carnea* in Kodikulam water tank in Madurai and Singanallur tank in Coimbatore	Dr. R. Jayashree, Assoc. Prof. (Env. Sciences) Dr. A. Bharani, Professor (Env. Sciences), Dept. of Env. Sci. TNAU, CBE	December 2022 to November 2023	• May be continued • Findings may be given for information to the. • Alkaloid presence in the roots may be studied.
4.	ITC/NRM/CBE/ENS/2014/R003 Studies on the impact of ITC-Kovai Paper Board Mill treated effluent along with sludge on soil health and crop productivity	Dr. M. Maheswari, Prof. and Head (Env. Sci.) Dr. R. Jayashree, Assoc. Professor (Env. Sci.), Dept. of Env. Sci.	July, 2020 to June, 2023	• May be continued as per the technical programme. • Polluted sites may be mapped. • Continuation proposal may be submitted for next phase
5.	*In situ* decomposition potential of TNAU Biomineralizer on crop residues	Dr. P. Kalaiselvi, Assoc. Prof. (Env. Sci.), KVK, Sandhiyur Dr. V. Davamani, Assoc. Prof. (Env. Sci.), DNRM, Coimbatore Dr. M. Selvamurugan, Asst. Prof. (Env. Sci.), KVK, Needamangalam	2020 to 2023	• Closing report may be submitted
6.	NRM/PKM/ENS/NON/2021/001 Development of Effective Microbial (EM) formulation and assessing its potential in waste treatment	Dr. P. Kalaiselvi, Assoc. Professor (Env. Sci.), KVK, Sandhiyur Dr. E. Parameswari, Assoc. Prof (Env. Sci.), NOFRC, TNAU Dr. M. Maheswari, Prof. and Head (Env. Sci.), Dr. A. Bharani, Professor (Env. Sci.) Dept. of Env. Sci., TNAU, Cbe	Nov. 2021 to October, 2023	• EM may be tested in on-farm trials at 3 places; Coimbatore, Vazhavachanur and Kudumiyanmalai • May be given for information • Compare with the commercial EM formulations available in the market.
7.	NRM/CBE/ENS/NON/2022/001	Dr. A. Bharani, Professor (Env.	April, 2023	• The treatments should be

S. No.	Project Number and Title	Name and Designationof the Project leader	Duration	Remarks
	Enhancement of phytoextraction potential through chelators and subsequent recovery of chromium using Bamboo (*Bambusa balcooa*)	Sci.), Dept. of Env. Sci., TNAU, Coimbatore	to March, 2024	compare with organic amendments • Two or three field studies may be conducted before giving for recommendation
8.	SPBL/NRM/CBE/ENS/2014/R005 Ecofriendly utilization of Seshasayee paper mill effluent and solid wastes of Unit I, Pallipalayam, Erode, Namakkal district and Unit II, Elanthaikulam, Thirunelveli district and monitoring its impact on soil and groundwater	Dr. M. Maheswari, Prof. & Head (Env. Sci.), Dr. A. Bharani, Professor (Env. Sci.), Dept. of Env. Sci. Dr. V. Davamani, Assoc. Prof. (Env. Sci.), DNRM, TNAU	April, 2023 to March, 2024 (Continuing scheme)	• The project may be continued as per technical programme
9.	NRM/TNSLURB/CBE/ENS/2022/R001 Eco-Restoration of Coimbatore lakes with Floating Wetlands	Dr K Sara Parwin Banu, Professor (Env. Sci.), TCRS, Yethapur	April, 2022 to September, 2023	• Reduction in eutrophication rate of lakes may be studied. • The scientific part of root chemistry /rhizosphere biology may be studied. • Pollutant removal from roots may be explored. • Essential oil quantity and quality may be checked.
10.	NRM/CBE/ ENS/2019/002 Rhizo filtration of micro pollutants using vetiver	Dr. K. Sara Parwin Banu, Professor (Env. Sci.), TCRS, Yethapur	Oct- 2019 - Oct- 2022	• Completion report may be submitted.
11.	TNPL/NRM/TRY/SAC/2019/R001 Environmental quality assessment in the use of Paper Board Industry (TNPL Unit II) waste water for agro-forestry system	Dr. M. Baskar, Prof. & Head (SS&AC) Dr. P. Uma Maheswari, Asst. Prof. (AGM) Dr. V. Dhanuskodi, Asst. Prof. (SS&AC) Dr. S. Radhika, Assoc. Prof. (AGR), ADAC&RI, Trichy. Dr. C. Prabakaran, Asst. Professor (Env. Sci.), HC&RI(W), Trichy	April, 2019 to March, 2023	• The project may be continued as per the technical programme.
12.	NRM/TVM/ENS/2021/001 Synthesis of carbon nano sheet from groundnut shell as potential agent for sewage wastewater treatment	Dr. P.C. Prabu, Assoc. Professor (Env. Sci.), Dept. of Agronomy, TNAU, Coimbatore Dr. K. Raja, Assoc. Prof. (SST),	October, 2020 to Sept. 2023	• The project may be continued as per the technical programme. • May be given for information.

S. No.	Project Number and Title	Name and Designationof the Project leader	Duration	Remarks
				• The project may be closed after lab studies. • Industry may be identified for scaling up the technology.
13.	NRM/CBE/ENS/2020/002 Recycling of sewage sludge for synthesis of functional nanomaterials and its environmental applications	Dr. E. Parameswari, Assoc. Professor (Env. Sci.), NOFRC, TNAU, Coimbatore	March, 2020 to Feb. 2023	• Completion report may be submitted.
14.	NRM/CBE/ENS/NON/2023/001 Assessing the fate and remediation of mixed contaminants in soil	Dr. E. Parameswari, Assoc. Prof. (Env. Sciences) NOFRC, TNAU, Coimbatore Dr. P. Kalaiselvi, Assoc. Prof. (Env. Sciences), KVK, Sandhiyur Dr. A. Bharani, Prof. (Env. Sciences)	January, 2023 to December 2024	• May be continued as per the technical programme.
15.	TNPL/NRM/CBE/ENS/2021/R008 Evaluation of long-term effect of using treated TNPL Unit I (Karur) effluent water for irrigation and remediation of effluent irrigated soil habitat	Dr. M. Maheswari, Professor & Head Dr. K. Sivasubramanian, Professor (Env. Sci.), Dept. of Env. Sci. Dr. M. Prasanthrajan, CANT, TNAU	April 2021 to March, 2024	• May be continued as per the technical programme.
16.	ISRO/NRM/KKM/ENS/2014/D002 Establishment and Maintenance of Environmental Observatory at Wood House, HRS, Ooty for Atmospheric Trace gases Chemistry Transport Modelling (ATCTM)	Dr. M. Maheswari, Prof. & Head (Env. Sci.) Dr. P. Dhevagi, Professor (ENS) Dr. S. P. Thamaraiselvi, Assoc. Prof. & Head (HRS, Ooty)	April, 2008 to March, 2024	• May be continued as per the technical programme.
17.	NRM/CBE/ENS/2020/004 Assessment of Microplastics in Agricultural Soils	Dr. P. Dhevagi, Professor (Env. Sci.), Dept. of Env. Sci., TNAU, Coimbatore	April, 2020 to Sept- 2023	• Completion report may be submitted
18.	NRM/MTP/ENS/ 2020/002 Assessing the air pollution tolerance of various tree species for urban forestry and improved air quality	Dr. M. Prasanthrajan, Professor and Head, CANT	October, 2020 to Sept. 2023	• The tree species identified in the previous year and this year may be combined and a comprehensive list of trees and package may be given for urban planning.
19.	NRM/KDM/ENS/SNF/2020/001 Info Crop model for sunflower to sustain the production under changing climate	Dr. K. Boomiraj, Assoc. Professor (Env. Sci.) ACRC, TNAU, Coimbatore	Sept.2021 to August, 2023	• The model may be developed before October 2023, and calibration and validation may

S. No.	Project Number and Title	Name and Designationof the Project leader	Duration	Remarks
		Dr. T. Selvakumar, Assoc. Professor and Head, MRS, Vagarai		• be completed. • Extension proposal may be submitted.
20.	ISRO/NRM/CBE/ ENS/2012/D001 Establishment and maintenance of Aerosol Observatory at HRS, Ooty for assessing the Aerosol Radiative forcing over India (ARFI)"	Dr. M. Maheswari, Prof. & Head (Env. Sci.) Dr. P. Jothimani Professor (Env. Sci.), Dept. of Env. Sci. Dr. K. Boomiraj, Assoc. Professor (Env. Sci.), ACRC, TNAU, Cbe Dr. S. P. Thamaraiselvi, Assoc. Prof. & Head (HRS, Ooty)	April, 2022 to March, 2024	• The efforts may be taken for identifying the sources of Black carbon aerosols
21.	NRM/PKM/ENS/2020/001 Strategy to increase the organic carbon content and micronutrient status of soils of AC&RI, Madurai	Dr. J. Kannan, Professor (Env. Sci.), AC & RI, Madurai	October 2020 to Sept. 2023	• Phosphorous content in the soil may be checked.
22.	NRM/TRY/SSAC/RIC/2021/001 Studies on hydrochar derived from sewage sludge and water hyacinth and its application in Rice cultivation	Dr. S. Paul Sebastian, Assoc. Prof. (Env. Sci.), AC&RI, Pudukkottai	November, 2020 to October, 2022	• The dosage of hydrochar may be optimized. • Completion report may be submitted.
23.	NRM/DBT/CBE/ENS/REE/2022/R002 Sustainable Management of tea waste to transform tea industry to carbon neutral and zero waste industry	Dr. S. K. Raj Kishore, Asst. Prof. (Env. Sci.), ARS, Bhavanisagar Dr. M. Maheswari, Prof. & Head (Env. Sci.)	March, 2022 to February, 2025	• May be given for information • May be continued as technical programme • Objectives may be completed.
24.	NRM/TRY/ENS/FLO2020/001 Evaluation of flowering annuals and vegetables suitable for sodic soil	Dr. C. Prabakaran, Asst. Professor (Env. Sci.), HC&RI(W), Trichy	June, 2020 to March, 2023	• CEC and other values may be checked. • The project may be extended up to Dec.2023
25.	SFI/NRM/CBE/ENS/2022/R003 Developing human excreta based bioproduct and evaluating its effect on the quality of soil and crop produce	Dr. M. Maheswari, Prof. and Head (Env. Sci.) Dr. P. Jothimani, Professor (Env. Sci.), Dept. of Env. Sci., Dr. G. Sridevi, Asst. Professor (SS&AC), Dept. of SS&AC, TNAU	July 2022 to June 2024	• The project may be continued as per technical programme.
26.	NRM/CBE/ENS/NON/2022/001 Assessment of fluoride transportation in food chain continuum	Dr. P. Jothimani, Professor (ENS) Dept. of Env. Sci. Dr. E. Parameswari, Assoc. Prof. (Env. Sciences) NOFRC, TNAU	December 2022 to Nov. 2024	• The project may be continued as per technical programme.
27.	NRM/CBE/ENS/2019/001 Ecological impact of	Dr. M. P. Sugumaran, Professor	August, 2020	• The project may be continued

S. No.	Project Number and Title	Name and Designationof the Project leader	Duration	Remarks
	Miyawaki plantations in TNAU Campus	(Env. Sci.), SRS, Cuddalore	to July, 2024	as per technical programme.
28.	NRM/KVK/NEM/NON/2023/001: Fertility mapping of the farm soils of KVK, Needamangalam using GIS	Dr. M. Selvamurugan, Asst. Prof. (ENS), KVK, Needamangalam	Dec. 2022 to Nov. 2023	• Micronutrients and soil physical properties may also be tested and included for map preparation. • The map may be displayed in the KVK.
29.	NRM/CBE/ENS/2020/001 Impact of treated sewage irrigation on soil and fodder quality	Dr. M. Maheswari, Prof. & Head (Env. Sci.), Dr. Rani, Assoc. Prof. (Agronomy)	January, 2020 to December 2023	• The project may be continued as per technical programme.
30.	DST-POWER/NRM/ENS/CBE/2022/ R004 Rhizobiology of reed plants and its role in water quality improvement for effective recycling	Dr. M. Maheswari, Professor & Head Dr. P. Dhevagi, Prof. (Env. Sci.), Dept. of Env. Sci. Dr. K. Suganya, Assoc. Prof. (Env. Sci.), FC&RI, Mettuapalyam	August 2022 to August 2025	• The project may be continued as per technical programme.
31.	Estimating the Aerosol Radiative Forcing efficiency over Nilgiris Biosphere	Dr. R.M. Jayabalakrishnan, Assoc. Prof. (Env. Sciences), KVK, Ooty Dr. P. Raja, Assoc. Prof. (AGM), HRS, Ooty Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC), Dept. of RS&GIS	December 2022 to November 2024	• The action plan project may be continued as per technical programme.

AGRICULTURAL NANOTECHNOLOGY

A1. For Adoption: Nil.
A2. For OFT: Nil.

A3. For Information: 04

1. Continuous monitoring of the mode of entry of IFFCO nano urea was compared with conventional urea on hourly basis using SEM high resolution imaging. The data revealed that the nano urea entered into the leaves through stomata and leaf pores within 2 hours of spray while conventional urea takes about 48-72 hours indicating the rapid absorption of nano urea and minimal loss of N.

2. The key enzymes involved in N assimilation such as NR, NiR, GS and GOGAT were measured on hourly basis and the data indicated that both the forms of urea (nano urea and conventional urea) have similar assimilation pattern.

3. The dynamic range of chlorpyrifos was found to be 10^{-2} to 10^{-9} M with a detection limit of 2 ng/cm^2 for grapes and 5 ng/cm^2 (S/N=3) for tomatoes, through a correlation coefficient of 0.9983 and 0.9966, respectively.

4. Nanoporous biogenic silica nanoparticle synthesis process using *sugarcane* bagasse has been standardized and the release studies confirmed the sustained release up to 96 hrs.

B. Action plan: 02

Action Plan: 1	
Theme No. 1	**Agricultural Nanotechnology**
Scheme Title	**Nanoformulation of plant bioatcives from Ashwagandha (*Withania somnifera*) and Kalmegh (*Andrographis paniculate* Nees) for enhanced Immunoboosting activity**

S. No.	Activity	Scientist	2023-24	Deliverables
1.	Extraction of Plant bioactives of *Withania somnifera* and *Andrographis paniculata* using green solvent extraction technique and quantification of major marker compounds Development and characterization of novel nano formulation with enhanced bioavailability with sustained release mechanism Assessing the immune boosting activity, in vitro release pattern and biosafety studies through in vitro cell line studies	Dr. S. Haripriya, Assoc. Prof. (Hort.), HC&RI, TNAU, Coimbatore	Assessing the immune boosting activity, *in vitro* release pattern and biosafety studies through in vitro cell line studies	Nanoformulation of plant bioatcives will be developed for enhanced Immunoboosting activity

Action Plan 2.	
Theme No. 2	Environmental nanotechnology
Scheme Title	**Flexible and Adhesive Surface Enhanced Raman Spectroscopy Based Nanostructures Device for efficient Detection of Multicomponent Pesticide Residues in Fruits and Vegetables**

S. No.	Activity	Scientist	2023-24	Deliverables
1.	To prepare controlled size and different shape of metal (Ag, Au and metal-semiconductor hybrid nanostructure using facile wet chemical and modified physical method. To perform a complete study on the morphological, structural, surface area for invention prepare sample. Fabricate and determineSERS Substrate To analysis and perform of SERS sensing substrate for pesticide residues in fruits and vegetables To investigate and analyze prepare SERS substrate for the selectivity, sensitivity, stability, molecular information, LOD, and reproducibility.	Dr. S. Thirumalairajan DBT-Ramalingaswami Re-entry Faculty Fellow, CANT, TNAU, Coimbatore	Comparative study, deep analysis, and selection of good SERS-active substrates of pesticide residue detection for different shape and size of metal and metal-semiconductor hybrid nanostructures will be obtained. To analyze and perform of SERS sensing tape for demonstration by direct extracting pesticide residues in fruits. To validate the performance of prepared SERS substrate for detection of various neonicotinoid pesticide in	Detection of pesticide on various fruits and vegetable surfaces: The dynamic range of chlorpyrifos will be achieved for the detection limit of 2 ng/cm^2 for grapes and 5 ng/cm^2 (S/N=3) for tomatoes through a correlation coefficient of 0.9983 and 0.9966, respectively The corresponding limit of detection in acetamiprid on the surface of okra, cabbage, and cucumber will be achieved 3 ng/cm^2, 7ng/cm^2, and 10 ng/cm^2 through a correlation

			different fruits and vegetables.	coefficient of 0.9896 and 0.9867.
New Action Plan (2023-2025)				
1.	Compatibility study of Nano urea and Zinc sulphate in Rice	Dr. C. Sharmila Rahale Dr. M. Prasanthrajan	To assess the option of using Zn in conjunction with nano urea in order to reduce N loss and minimizing environmental pollution.	Compatibility of Nano urea and Zinc sulphate Reduction of N loss
2.	Effect of Nano urea on quality of Rice (grains)	Dr. C. Sharmila Rahale Dr. M. Prasanthrajan Dr. N. Sritharan Assoc. Prof. (Crop Physiology), Dept. of Rice, TNAU	To study the effect of Nano urea on quality of Rice	Effect of Nano urea on quality of Rice
3.	Development of Nano Bio Formulation for enhancing the Shelf life of Fruits	Dr. M. Prasanthrajan Dr. C. Sharmila Rahale Dr. S.K. Rajkishore Dr. Jeya Sundara Sharmila	To develop new nano bio formulations (Yeast) for enhancing the shelf life of mango, banana and tomato	A new nano bio formulation (Yeast) for enhancing the shelf life of mango, banana will be developed

C. Project wise remarks

Remarks on the ongoing University Research projects/ Externally Funded Projects/ Core Projects

S. No.	Project No. and Title	Scientistsin-charge	Duration	Remarks
Externally funded projects				
1.	Insights and Biosafety of IFFCO Nano fertilizer in Agricultural Production System (Phase 1, II and III)	**Overall Coordinator & Lead Principal Investigator** Dr. K. S. Subramanian **Principal Investigators** Dr. R. Santhi Dr. A. Lakshmanan Dr. S. Pazhanivelan **Co-Principal Investigators** Dr. C. Sharmila Rahale Dr. S.K. Rajkishore Dr. S. Maragatham	February 2020 to March 2023 IFFCO - New Delhi	Completion report may be submitted
2.	Eco-friendly management of Citrus Greening Disease through phloem specific Delivery of IMPDH inhibitors encapsulated in Nano system**.**	**Principal Investigators** Dr. Jeya Sundara Sharmila Dr. A. Lakshmanan	October, 2021 to September, 2023 GOI – BIRAC	Completion report may be submitted
3.	Developing cost effective and biodegradable mulching sheet, grow bags from bagasse fibres and value addition of grow medium through hydrogel	**Principal Investigator** Dr. C. Sharmila Rahale Dr. A. Lakshmanan	July 2020 to June 2022	Completion report may be submitted

	and nano nutrients		EID Parry (I) Ltd.,	
4.	Flexible and Adhesive surface Enhanced Raman Spectroscopy Based Nanostructures Device for Efficient Detection of Multicomponent Pesticide Residues in Fruits and Vegetables	**Principal Investigator** Dr. S. Thirumalairajan	December 2018 to December 2023 DBT, New Delhi	The projectmay be continued
5.	Insights into molasses-based Potash and value addition of bio methanated slurry and spent wash through nanotechnological interventions	**Principal Investigator** Dr. C. Sharmila Rahale Dr. M. Prasanthrajan	August 2021 to July 2024 EID Parry (I) Ltd	The projectmay be continued
6.	Nano-fiber encapsulation of Methyl bacterium for Groundnut Seed invigoration to improve productivity under rain fed ecosystem	**Principal Investigator** Dr. K. Raja	February 2020 to July 2023 DST – SERB, New Delhi	Completion report may be submitted
7.	NanoBeeLure – A novel nano-based honeybee lure dispense mechanism to increase pollination in vegetable crops	**Principal Investigator** Dr. M. Praghadeesh **Project Mentor** Dr. K.S. Subramanian	October 2020 to September 2023 DST- Young Scientist	The projectmay be continued. Necessary steps may be taken to get the remaining grants.
8	Establishing Rural Bio Resource Centre for the production of Nano Bio Polymer (bioplastic) from agrocellulosic wastes and dry land succulent plants.	**Principal Investigator** Dr. C. Sharmila Rahale Dr. A. Lakshmanan	January 2021 to December 2022 DBT, New Delhi.	Completion report may be submitted
9.	Smart nano bio pesticides for the stimuli based sustained release of active ingredients for the safe management of Coffee White Stem borer	**Principal Investigator** Dr. M. Kannan Dr. A. Lakshmanan	April 2021 to September 2022 Coffee Board	Completion report may be submitted
10.	Evaluation of Coromandel International Ltd., Nano DAP (Liquid) on Rice and Maize	**Principal Investigator** Dr. C. Sharmila Rahale Dr. M. Prasanthrajan	December 2022 to November 2023 Coromandel International Ltd.,	The projectmay be continued

D. University Research Projects

1.	Dr, V. Gomathi Professor (Agrl. Micro.)	NRM/CBE/AGM/NON/001 Exploring Antimicrobial secondary metabolites from agriculturally important microbes as next-generation weedicide	March 2022 to February 2024	The project maybe continued

2.	B. Anita, Professor (Nematology)	NRM/ CBE/ CAN/NON/2022/ 001 Development of Marigold (Tagetes spp.) plant extract-based chitosan nano formulation for the management of root knot nematode *Meloidogyne incognita* in Tomato	July 2022 to March 2025	The project t may be continued
3.	Dr. S. Haripriya, Assoc. Professor (Hort.)	NRM/CBE/NST/HOR/2019/01 Nanoformulation of Annonaceous Acetogenins from *Annona muricata* for better delivery	October 2021 to September 2022	Recommended for closure. Completion Report may be submitted
4.		NRM/CBE/NST/NON/001 Nanoformulation of plant bioactives from Ashwagandha (*Whitania somnifera*) and Kalmegh (*Andrographis paniculata*) for enhanced immune boosting activity	January 2022 to December 2024	The project maybe continued
5.	Dr. C. Sharmila Rahale, Asst. Professor (SS&AC)	NRM/CBE/NST/PUL/2022/001 Design and Fabrication of nano P fertilizer utilizing Rock phosphate and P solubilising bacteria and its effect on green gram	September 2022 to June 2024	The projectmay be continued
6.	Dr. D. Jaya Sundara Sharmila, Asst. Professor (Physics)	NRM/CBE/NST/PHY/2020/01 Developing advanced formulation for botanical insecticide (Azadirachtin) using nanoporous biogenic silica from sugarcane bagasse for high bioefficacy.	January 2020 to December 2023	The project may be continued
7.	Dr. Pon. Sathya Moorthy, Asst. Professor (Physics) Dr. K. Raja, Asst. Prof. (SST)	NRM/CBE/NST/ 2021/001 Synthesis and characterization of CuO & Fe_2O_3 quantum dots to improve seed quality in important agriculturalcrops.	Sept. 2020 to August 2022	Completion Report may be submitted

CENTRE FOR WATER AND GEOSPATIAL STUDIES

1. Technologies for adoption/OFT
1. Adoption
1. Vertical Roughing Filter for Groundwater recharge through Bore Wells

Centre for Water and Geospatial Studies has developed a vertical roughing filtering system for groundwater recharge through borewells. In this filter, 120 cm diameter concrete rings are installed by digging a pit of 1.50 m depth and 2.1 m diameter. Around the rings, crushed stones of size 4 mm to 10 mm is placed for a width of 45 cm. Crushed stones of size 20 mm to 40 mm are placed around the filter over the ground. Inside the concrete rings polyurethane foam of thickness of 2.5 cm and of density 450 kg/m^3 is placed with an aluminium framework. The perimeter of the foam is 80 cm. For a 30 cm height of water around the foam, the filtration rate was evaluated to be 2 l/s. When clogging occurs to a level of 50 %, at least a filtration rate of 3 l/s can be expected for a depth of 90 cm of water inside the rings. A filtration efficiency of 70 % was observed with this set up when only one layer of polyurethane foam was used. The filtration efficiency can be increased by providing more number of polyurethane foam layers around the casing pipe

2. Siphon Filter for Bore well Recharge

Centre for Water and Geospatial Studies has developed a Siphon filter for bore well recharge**.** In this design, the filter is placed over the ground. The filter sucks the water from a lower elevation and filters the water inside the filter and pass it to the bore well. This filter does not need any electric power for operation. Prime the filter to initiate the filtering process. The priming process is filling the filter as well as the inlet and outlet pipes of the filter with water for which around 10 to 20 litres of water is needed. This water can easily be collected from the rain and stored in a tank placed at a higher elevation.

2. On Farm Trial: Nil
2.   Research Projects and remarks
2.1   Research Projects

Crop	Centre	URP	Action plan	Core project	AICRP	EFP	Total
Rice	AC&RI, Madurai	-	-	-	2	**-**	**2**
Maize	CWGS-Coimbatore & AC&RI, Madurai	-	-	-	2	**7**	**2**
Banana	ARS, Bhavanisagar	-	-	-	1	**-**	**1**
Brinjal and Chilli	AC&RI, Madurai	-	-	-	1	**-**	**1**
Others	CWGS-Coimbatore	-	-	-	2	**-**	**2**
	ARS, Bhavanisagar	-	-	-	1	**-**	**1**
Total					**9**	**7**	**9**

2.2 Remarks on the ongoing university research projects/AICRP/Externally funded projects

S. No.	Project No. and Title	Project leaders	Duration	Remarks
1.	Standardization of automated irrigation to increase water productivity in major irrigated crops	**CWGS- Coimbatore** Dr. V. Ravikumar, Professor (SWCE) Dr. M. Raju, Professor (Agronomy) Dr. S. Selvakumar, Assoc. Prof. (SWCE) Dr. A.P. Sivamurugan, Assoc. Prof. (Agron.) Dr. K.P. Ragunath, Assoc. Prof. (SS&AC) **ARS, Bhavanisagar** Dr. N. Sakthivel, Professor and Head Dr. V. Vakeeshwaran, Assoc. Prof. (SST) **AC&RI, Madurai** Dr. Veeraputhiran, Assoc. Prof. (Agronomy) Dr. Bhakiyathusaliha, Prof. (SS&AC)	June,2022–May,2024	Project may be continued
2.	Assessing methane emission by using satellite measurements and micro-meteorological observation	Dr. M. Raju, Professor (Agronomy) Dr. A.P. Sivamurugan, Assoc. Prof. (Agron.) Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)	June,2022–May,2024	Project may be continued
3.	Application of SWAT model for estimation of surface water resources and temporal water demand for sustainable water management in a selected watershed of Bhavani river basin	Dr. K. Arunadevi, Agrl. Engineer – Project Leader	2022 to 2024	Project may be continued
4.	Estimation of crop coefficient of Banana under drip irrigation in western zone of Tamil Nadu	Dr. K. Arunadevi, Agrl. Engineer – Project Leader	October 2020 to January 2022 (First crop) January 2022 to May 2023 (First ratoon crop)	Project may be continued
5.	IPNS based Coordinated Fertigation Experiment in Chilli	Dr. B. BhakiyathuSaliha, Professor (SS&AC) Dr. Veeraputhiran, Assoc. Prof. (Agron.)	2021-2023	Completion report is to be submitted
6.	Deficit Irrigation for rice follow crop with higher productivity and profitability for Periyar Vaigai Command area	Project Leader Dr. T. Sampathkumar, Asst. Prof. (Agron.) Co- Project Leader Dr. R. Indirani, Assoc. Prof. (SS&AC)	2021-2023	Completion report is to be submitted
7.	Precising irrigation scheduling through Leaf Water potential in drip	Project Leader Dr. T. Sampathkumar, Asst. Prof. (Agron.)	2021-2023	Completion report is to be submitted

S. No.	Project No. and Title	Project leaders	Duration	Remarks
	irrigated Maize	Co- Project Leader Dr. R. Indirani, Assoc. Prof. (SS&AC)		
8.	Automatic drip irrigation scheduling for Maize	Dr. V. Ravikumar, Professor (SWC)	2022-2024	Project may be continued
9.	Estimation of crop coefficient for Cotton under drip irrigation	Dr. S. Selvakumar, Assoc Prof. (SWC) Dr. V. Ravikumar, Professor (SWC)	2022 - 2024	Project may be continued
10.	ICAR/AICRP/WTC/CBE/IWM/001 Design of Sediment Filtration for Groundwater Recharge through wells	V. Ravikumar, Professor & Head Department of SWCE	2021-2024	Project may be continued
11.	ICAR/AICRP/WTC/CBE/IWM/001Iden tification of potential Groundwater Recharge zones in various river basins of Tamil Nadu	V. Ravikumar, Professor & Head Department of SWCE	2020-2023	Completion report is to be submitted
12.	Assessment of Water Resources in the Parambikulam Aliyar river basin - Water Budgeting for Tamil Nadu	Dr. S. Selvakumar, Assoc. Prof. (SWCE)	2022-2024	Project may be continued
13.	NICRA/NRM/CBE/ RSG/2021/Assessing Crop Loss During Extreme Weather Events Integrating Satellite and Drone Imageries with Crop Growth Models	Dr. S. Pazhanivelan, Director, CWGS, TNAU Co-PI: Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)	2021-2024	Project may be continued
14.	NRM/IGB/RSGIS/2022/R001 Innovative Climate Risk Insurance	PI: Dr. S. Pazhanivelan, TNAU, Coimbatore Dr. R. Kumaraperumal, Asst. Prof., (SS&AC), RS&GIS Dr. R. Jagadeeswaran, Assoc. Prof. (SS&AC), RS&GIS Dr. D. Muthumanickam, Prof. (SS&AC), RS&GIS Dr. A.P. Sivamurugan, Asst. Prof. (Agron.), CWGS Dr. D. Suresh Kumar, Prof. & Head, Agri. Economics ARS, Bhavanisagar Dr. K.P. Ragunath, Asst. Prof. (SS&AC) Dr. V. Vakeswaran, Asst. Prof. (SST) ITC, Chennai Dr. A.D. Ashok, Prof. (Horti)	December 2021-June 2023	Project may be continued

S. No.	Project No. and Title	Project leaders	Duration	Remarks
		KVK, Thiruvarur Dr. V. Radhakrishnan, Prog. Coordinator KVK, Cuddalore Dr. N. Sriram, Prog. Coordinator Dr. R. Baskaran, Asst. Prof. (Agron.)		
15.	Pilot Studies on Gp Level Crop Yield Estimation using Advanced Technologies for Non-Cereal Crops	PI: Dr. S. Pazhanivelan, TNAU, Coimbatore Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC), RS&GIS Dr. M. Raju, Professor (Agronomy) Dr. D. Muthumanickam, Prof. (SS&AC), RS&GIS Dr. A.P. Sivamurugan, Assoc. Prof. (Agron.), CWGS Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)	2022-2023	Project may be continued

3. Action Plan proposed for 2022-2024

Action Plan 1:
Standardization of automated irrigation to increase water productivity in major irrigated crops

Rationale
- Conventional method of irrigation results in heavy water loss due to seepage and deep percolation in the irrigation channel.
- In order to minimise water loss and enhancing water productivity, automatic irrigation planning process in the farm plan is needed.
- Automatic irrigation is the use of a device to operate irrigation structures so as to the change of flow of water from bays can occur in the absence of the irrigator
- Precise quantities of water matching crop water requirement will further optimise the utilisation of water resources and increase the productivity

Objectives
- To estimate water requirement precisely by integrating evaporative demand and soil moisture condition.
- To design effective irrigation schedule for major irrigated crops
- To validate and propose effective sensors and water controllers for different farm situations.
- To develop Standard Operating Procedures for automated micro irrigation for major irrigated crops

Duration: 2 Years (2022-2024)

Centre and Scientists involved

CWGS, Coimbatore Dr. V. Ravikumar, Professor (SWCE)
Dr. M. Raju, Professor (Agronomy)
Dr. S. Selvakumar, Associate Professor (SWCE)
Dr. A.P. Sivamurugan, Associate Professor (Agronomy)
Dr. K.P. Ragunath, Associate Professor (SS&AC)

ARS, Bhavanisagar
Dr. N. Sakthivel, Professor and Head
Dr. V. Vakeeshwaran, Associate Professor (SST)

AC&RI, Madurai
Dr. Veeraputhiran, Associate Professor (Agronomy)
Dr. Bhakiyathu saliha, Professor (SS&AC)

Action Plan 2:
  Working out the water productivity in different sub basins and developing policy document on crop planning, crop intensification and alternate livelihood

Rationale
- Water productivity varies from region to region and from field to field, depending on many factors viz., crop patterns, climate patterns etc.
- The loss of water and improper utilization of available water in the sub basins tanks are to be rectified
- Proper sharing of water for crop intensification and diversification has to be achieved to optimise water use.
- Water productivity in the sub basin level or tank level needs to be analysed through a holistic modelling framework by deploying spatial analytical tools.

Objectives
- To estimate water productivity at sub basin level for create historic data base on cropping intensity and identifying potential areas for crop intensification and diversification to increase water productivity and profitability.
- To develop frame work for advising suitable integrated farming system models for alternate livelihood under normal and water stress conditions

Duration: 2 Years (2022-2024)

Centre and Scientists involved

CWGS, Coimbatore Dr. V. Ravikumar, Professor (SWCE)
Dr. M. Raju, Professor (Agronomy)
Dr. S. Selvakumar, Associate Professor (SWCE)
Dr. A.P. Sivamurugan, Associate Professor (Agronomy)
Dr. K.P. Ragunath, Associate Professor (SS&AC)

Action Plan 3:
Assessing methane emission by using satellite measurements and micro- meteorological observation
Rationale
- Methane emission from rice ecosystem accounts 1.5 percent of total global greenhouse gas emissions
- Flooding a rice field cuts off the oxygen supply from the atmosphere to the soil, results in anaerobic fermentation of soil organic matter.
- Spatial estimation of methane emission through integration of remote sensing and field measurements helps in developing climate resilient agricultural systems.
- Proposed an ICT tool utilizing GIS platform: designed, developed and deployed to acquire data through remote sensing satellites *viz.*, sentinel IA, sentinel 5P, GOSAT satellite sensors and other global open-source data sets.
- At field level, Eddy covariance flux towers will be installed in two locations to quantify methane emission and its contribution to atmospheric flux.

Objectives
- To create inventory on GHG including CH4 for TNIAMP sub basins integrating remote sensing, DNDC and FAO EXACT model
- To assess the impact of TNIAMP crop management practices in reducing

methane emission using remote sensing technique.
- To estimate of methane at field and spatial scale using portable gas analyzer and Eddy Flux tower
- To demonstrate agronomic practices for reducing GHG emission in the sub basins.

Duration: 2 Years (2022-2024)

Centre and Scientists involved CWGS, Coimbatore

Dr. M. Raju, Professor (Agronomy)
Dr. A.P. Sivamurugan, Associate Professor (Agronomy)
Dr. K.P. Ragunath, Associate Professor (SS&AC)

REMOTE SENSING AND GIS

1. Technologies for adoption/OFT
1. Adoption
1. Comprehensive drone spraying protocals in Black gram

Comprehensive drone spraying protocols in Blackgram

Spray Dynamics		
Type of Drone	Battery – operated drone	Fuel operated hybrid drone
Spray Fluid	10L/ac	30L/ac
Nozzle	Anti-drift Flat fan nozzle	Atomizer nozzle

	Agro Inputs used	Battery – operated drone	Fuel operated hybrid drone
Spray I	Pre emergence Herbicide Pendimethalin 30 EC (Stomp) @1000 ml/ac – 3 DAS	100 ml/L	33.3 ml/L
Spray II	Insecticide Imidacloprid (Confidor) @ 60ml/ac – 20 DAS	6 ml/ L	2 ml/ L
Spray III	Crop Booster TNAU Pulse wonder @ 2 kg/ac – 40 DAS	200 g/L	66.7 g/ L
Spray IV	Insecticide Chlorantranilliprole (Corogen) @ 60 ml/ac – 50 DAS	6 ml/ L	2 ml/ L

Flat jet nozzle   Atomizer nozzle

2. Comprehensive drone spraying protocals in green gram

Comprehensive drone spraying protocols in Greengram

Spray Dynamics		
Type of Drone	Battery – operated drone	Fuel operated hybrid drone
Spray Fluid	10L/ac	30L/ac
Nozzle	Anti-drift Flat fan	Atomizer nozzle

	Agro Inputs used	Anti-drift Flat fan nozzle	Fuel operated hybrid drone
Spray I	Pre emergence Herbicide Pendimethalin 30 EC (Stomp) @1000 ml/ac – 3 DAS	10g/L	3.3 ml/L
Spray II	Insecticide Imidacloprid (Confidor) @ 60ml/ac – 20 DAS	6 ml/ L	2 ml/ L
Spray III	Crop Booster TNAU Pulse wonder @ 2 kg/ac – 40 DAS	200 g/L	66.7 g/ L
Spray IV	Insecticide Chlorantranilliprole (Corogen) @ 60 ml/ac – 50 DAS	6 ml/ L	2 ml/ L

Flat jet nozzle   Atomizer nozzle

On Farm Trial: Nil

For Information

1. Rice area map, Seasonality and yield maps across 11,911 major rice-growing villages of Tamil Nadu during samba (2022-23) by integrating Sentinel 1A SAR satellite data and ORYZA crop growth model through an interface RiceYES V.3.0.
2. Digital soil class (Taxonomy), organic carbon and pH maps were generated for entire Tamil Nadu Machine learning-based Remote Sensing technologies
3. Maps and statistics for Drought Indices *viz.,* NDVI, NDWI and MAI for Tamil Nadu during 2022-23, ensuring drought preparedness
4. Flood affected areas of coastal districts were mapped using Sentinel 1A SAR data, and damages were assessed in November 2022.
5. Completed Drone mapping of 220 PWD tanks for deriving a Digital Terrain Model of the tank for Water spread and volume analysis in the South Velar Subbasin.
6. Standard operating procedures for drone spraying were developed for Rice, Maize, Cotton, and Groundnut and released during Scientific Workers Conference 2022.
7. Agricultural drought vulnerability and Rainfed area maps of Tamil Nadu were generated under ICRI project
8. Drone spraying demonstrations and awareness creation to farmers were conducted of 1550 acres covering major districts of Tamil Nadu under the ICAR-ATARI and GIZ-ICRI projects.

Research Projects and remarks
I. UNIVERSITY RESEARCH PROJECTS

S. No.	Project Number	Title	Period	Project scientist	Remarks
1.	NRM/CBE/RSG/SAC/2020/001	Digital Soil Mapping using machine learning algorithms and expert system approach	October 2019 – September 2022	Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)	Project report has to be submitted
2.	NRM/CBE/RS&GIS/NON/001	Quantification of Soil Nutrients using Hyperspectral Remote Sensing Techniques	November 2021 to October 2023	Dr. R. Jagadeeswaran, Prof. (SS&AC) D. Muthumanickam, Prof. and Head Dr. Bakiyathu Saliha, Prof. (SS&AC), AC&RI, MDU	Project to be continued
3.	NRM/CBE/RSG/HOR/2021/001	Standardizing Drone Spraying of Nutrients and Plant Protection Chemicals in Agricultural and Horticultural Crops	December 2020 to March 2023	Team Co-ordinator & Principal Investigator: Dr. S. Pazhanivelan, Director (CWGS) Dr. R. Kumaraperumal, Assoc. Prof. (SSAC) Lead Project Leaders: Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)	Project report has to be submitted
4.	NRM/CBE/RSG/SAC/2022/New	Inter-comparison of satellite derived soil moisture products and their validation using ground-based observations	June 2022 to May 2024	Dr. D. Muthumanickam Professor and Head (RSGIS) Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)	Project to be continued

II. EXTERNALLY FUNDED PROJECTS

S. No.	Project Number	Title	Period	Project Scientists	Remarks
1.	TNIAMP (F36NT)	Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP) Phase I	Sep 2017 to March 2023	Dr. S. Pazhanivelan, Director (CWGS) Dr. K.P. Ragunath, Assoc. Prof. (SS&AC) Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC), RS&GIS	Project completed and report to be submitted
2.	NRSC/NRM/CBE/RSG/2021/R001	Remote Sensing based ET and Soil Moisture Assessment	April 2021-March 2024	Dr. S. Pazhanivelan, Director (CWGS) Co-PI: Dr. K.P. Ragunath, Assoc. Prof. (SS&AC) Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)	Project to be continued

S. No.	Project Number	Title	Period	Project Scientists	Remarks
3.	NRM/IGB/RSGIS/2022/R001	Innovative Climate Risk Insurance	December 2021 – June 2023	Dr. S. Pazhanivelan, Director (CWGS) Dr. D. Muthumanickam, Prof & Head, RS&GIS Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)	Project to be continued
4.	NRM-FWL/NRM/CBE/RSGIS/2021/T002	Standardizing Drone spraying protocols for various inputs in selected field crops.	January 2022 – June 2022	Dr. S. Pazhanivelan, Director (CWGS) Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC), RS&GIS	Project completed and report submitted to Fowler Westrup
5.	ATARI/NRM/RSGIS/CBE/2022/R001	Agricultural Drone Project- Large-scale Demonstrations of Drone Spraying Technology for various inputs in selected field crops	April 2022- March 23	Dr. S. Pazhanivelan, Director (CWGS) Dr. P.P. Murugan, Director, (EE) Dr. D. Muthumanickam, Prof and Head, RS&GIS Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC) Dr. K.P. Ragunath, Assoc.Prof. (SS&AC), Dr. M. Raju, Prof (Agronomy), CWGS Dr. A.P. Sivamugurgan, Assoc. Prof. (Agron) Dr. P. Jai Sridhar, Asst. Prof. (AEX), DEE, TNAU	Project completed and report submitted
6.	NRSC/NRM/RS&GIS/CBE/2023/T001	Spatial yield Estimation using Crop Models - Completed	April 2022- March 23	Dr. S. Pazhanivelan, Director (CWGS) Dr. D. Muthumanickam, Prof and Head, RS&GIS Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC) Dr. K.P. Ragunath, Assoc. Prof. (SS&AC), CWGS	Project completed and report submitted

B. Action Plans Proposed for 2023-24

S. No.	Action Plans Proposed
1	**Deep learning based Digital Soil Mapping and quantification of soil nutrients** **Activities:** • Digital soil mapping of Tamil Nadu using deep learning tools • Quantification of soil nutrients using hyperspectral remote sensing • Digitization and generation of cadastral Maps and soil nutrient mapping • Land degradation mapping for Tamil Nadu Duration: Three Years (2021 – 2024) Linkages established: SLUB, NBSS&LUP and DOA **Centres with Scientist** Department of RS&GIS: Dr. D. Muthumanickam, Prof. & Head (RS&GIS), Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC) Dr. R. Jagadeeswaran, Professor (SS&AC) AC&RI, Madurai Dr. B. Saliha, Professor (SS&AC) **Expected outcome** • Cadastral level soil nutrient map • Block level soil available nutrient status • Digital Soil Maps • Spectral library on soil nutrients • Land Degradation maps of Tamil Nadu
2	**Crop Area Mapping and Yield Estimation** **Activities:** • Sustaining rice area and yield monitoring • Developing Automated crop information system for generating maps and area statistics in cotton, maize, pulses, groundnut, sugarcane at state level • Mapping horticultural crops and plantations using object-based classification Duration: Three Years (2021 – 2024) Linkages established: MNCFC, NRSC, SAC, IRRI, and Sarmap Centres with Scientist CWGS: Dr. S. Pazhanivelan, Director (CWGS) Dr. K.P. Ragunath, Assoc. Prof. (SS&AC) Dr. D. Muthumanickam, Prof. & Head (RS&GIS) Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC) Dr. R. Jagadeeswaran, Professor (SS&AC) **Expected outcome** • Real time area statistics and maps on crop area, yield and losses at District, Block and village level for rice, cotton, maize, pulses, groundnut, sugarcane and millets • Automated crop information system • Maps and statistics on tomato, onion and turmeric
3	**Crop loss assessment, climate change and environmental monitoring using geospatial technologies** **Activities:** Developing methodology for crop loss assessment due to flood, cyclone, drought and hail storm Spatial estimation of ET and Soil moisture and its impact on crop growth Spatial estimation of methane emission using remote sensing and GHGs as influenced by land use and agronomic practices

	Mapping of Industrial Polluted areas and Mining sites in Tamil Nadu
	Mapping of peri urban areas of Tamil Nadu
	Duration: Three Years (2021 – 2024)
	Linkages established: MNCFC, NRSC, SAC, IRRI and Sarmap
	Centres with Scientist
	Department of RS&GIS:
	Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)
	Dr. D. Muthumanickam, Prof. & Head (RS&GIS)
	Dr. R. Jagadeeswaran, Professor. (SS&AC)
	CWGS
	Dr. S. Pazhanivelan, Director (CWGS)
	Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)
	ORS, Tindivanam:
	Dr. S. Thiruvarasan, Assoc. Professor (Agron)
	ACRI, Madurai
	Dr. B. Saliha, Professor (SS&AC)
	Expected outcome
	   • Methodology for crop loss assessment during disasters
	   • Maps and statistics on ET and soil moisture
	   • Spatial estimation and quantification of methane emission from rice ecosystem.
	   • Pollution map of Tamil Nadu

4	**Water resources monitoring and irrigation water management**
	Activities:
	• Developing methodology and tool for volume analysis in PWD tanks using drones
	• Water Bodies Information System hosted at web portal for PWD tanks
	• Assessing the impact on crop yield and intensity of cropping
	• Mobile and Web application for monitoring interventions and assessing impact
	Duration: Three Years (2018 – 2023)
	Linkages established: MNCFC, NRSC, SAC, IRRI, and Sarmap Centres with Scientist
	Department of RS&GIS:
	Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)
	CWGS
	Dr. S. Pazhanivelan, Director (CWGS)
	Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)
	Expected outcome
	   • Crop area maps for Sub Basins and crop cover change
	   • Information on water storage in major tanks
	   • Water resource mapping – water spread & duration of water availability in tanks & its impact on crop yield and intensity of cropping

5	**Developing drone based comprehensive spraying protocol for major crops**
	Activities:
	   • Developing comprehensive drone spraying protocol for various inputs
	   • Standardize spray dynamics by selecting right drone model and nozzles
	   • Validation of drone spraying with conventional spraying through field experiments
	Duration: Three Years (2022 – 2024)
	Centres with Scientist
	Department of RS&GIS:
	Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC)
	Dr. D. Muthumanickam, Prof. & Head (RS&GIS),
	Dr. R. Jagadeeswaran, Professor (SS&AC)
	CWGS
	Dr. S. Pazhanivelan, Director (CWGS)
	Dr. K.P. Ragunath, Assoc. Prof. (SS&AC)

	Dr. A.P. Sivamurugan, Assoc. Prof. (Agronomy) Crop Physiology: Dr. Babu Rajendra Prasad, Asst. Prof. (CRP) Pathology: Dr. Senthilvel, Assoc. Prof. (Pathology) Dr. T. Srinivasan, Assoc. Prof. (Entomology) **Expected outcome** Comprehensive standardized spraying protocol for Sugarcane and vegetable crops
6	**Setting up of Drone production unit, Service centres and Establishing Remote Pilot Testing Organization.** **Activities:** - Establishment of Kissan Drone Production unit and Service centre - Training persons for drone operation and with technicalities to handle various operations. - Imparting Entrepreneurship skills in Agricultural Drone Operation. Duration: Three Years (2022 – 2024) Centres with Scientist CWGS: Dr. S. Pazhanivelan, Director (CWGS) Dr. K.P. Ragunath, Assoc. Prof. (SS&AC) Department of RS&GIS: Dr. D. Muthumanickam, Prof. & Head (RS&GIS), Dr. R. Kumaraperumal, Assoc. Prof. (SS&AC) Dr. R. Jagadeeswaran, Assoc. Prof. (SS&AC) **Expected outcome** - Persons trained will become empowered on the usage of Drones in Agriculture - Enhanced Employment opportunities as drone pilots for using Kisan drones and trainees with entrepreneurial

AICRP-IFS

A1. For Adoption

a. Integrated Farming System for marginal farmers of Cauvery New Delta Zone (Sustainable Resource Management for Climate Smart IFS)

Centre: AICRP-IFS Sub centre, ARS, Thanjavur

In an experiment conducted at ARS, Thanjavur on Integrated Farming System model for wet land involving components *viz.,* Crop + Horticulture + Dairy + Fishery + Poultry + Vermicompost in an area of 0.8 ha. This IFS model produced rice grain equivalent yield of 28.3 tonnes/year with Net return of Rs.2,19,007/year and BCR (1.82). Among the components, Crop contributes 33 % of income followed by dairy with 29%. Employment generation created was 403-man days/year. Resource Recycling to the tune of 29.1 % of inputs to the worth of Rs. 85,811/- and additional nutrients added 256 kg N, 29 kg P and 226 kg K.

b. Identification of cropping systems module for different farming systems (Western zone of Tamil Nadu)

Centre: AICRP-IFS Main centre, Department of Agronomy, DCM, TNAU, Coimbatore

Best identified cropping systems for adoption in garden land farming systems.

Income enhancement:
- Maize - chillies - radish system recorded higher Maize Equivalent Yield of 27.0 t/ha with higher net return (Rs.3,87,881/-) and B:C ratio (3.29).

Family nutrition:
- By adoption of proso millet - cowpea - sunflower cropping system, 2032 kg millets, 1020 kg pulses and 1299 kg Oilseeds were obtained. From this food grain, 2317 kg carbohydrate, 780 kg protein and 780 kg fat were produced to satisfy the nutrition of average family size of 5 nos.

Livestock nutrition:
- Perennial fodder system BN hybrid grass + *Desmanthus* produced grass fodder and 26.4 tonnes leguminous fodder to meet out the fodder requirement of 2 milch cow with calf.

Soil fertility:
- Among the different cropping systems were tested, Soil fertility was improved in Maize- Bengal gram- Cowpea (G) system with higher soil organic carbon (5.49 g/kg) and available N (249 kg/ha), available P (20.1 kg/ha) and available K (668 kg/ha).

c. Integrated farming system module for improving profitability and livelihood of small and marginal farmers of Salem and Erode District

Centre: AICRP-IFS OFR centre: TCRS, Yethapur and ARS, Bhavanisagar
- On Farm Research experiments on IFS mode conducted at 36 farmers' fields of Salem District and identified two predominant IFS modules viz., 1. Crop + dairy + goat / sheep + poultry in 8 farmers holding and 2. Crop + dairy in 4 farmers holdings. After interventions implemented in the existing IFS, Crop +

dairy (3 nos.) + goat (10 nos.) + poultry (20 nos.) integrated farming system recorded higher net income of Rs 3,53,979/- over bench mark net income (Rs.70,365/-).

- On Farm Research experiments on IFS mode conducted at 36 farmers' fields of Bhavani and Perundurai blocks of Erode District. Interventions related with IFS *viz.*, INM and IPM in tapioca, sugarcane, rice and groundnut, year-round green fodder supply through Cumbu Napier hybrid CO 5, supplementation of mineral mixture and salt lick, supply of new varieties of vegetables for kitchen garden were implemented. After implementation of all IFS interventions, improvement of income was maximum in Crop + Dairy (3 nos.) + Goat (7 nos.) + Poultry (13 nos.) and recorded 95 % increased mean net income (Rs. 1,67,779/-) over benchmark year in small and marginal farmers of Erode District.

A2. OFT- Nil
A3. For Information

a. Identification of cropping system module for different farming system modules
Centre: AICRP-IFS Sub centre, ARS, Thanjavur
Income enhancement:
- Among the ten cropping sequences, the higher RGEY of 24483 kg/ha/year was recorded with Maize- Rice (*Seeraga samba*) - Bhendi + blackgram (5:1). The maximum net return of Rs. 3,56,658 /ha/year was obtained with Maize – Rice (*Seeraga samba*) Bhendi + blackgram (5:1). With respect to system productivity of 67.08 kg/ha/day was registered with Maize- Rice (*Seeraga samba*) - Bhendi + blackgram (5:1) sequence.

Family nutrition:
- With regards to family nutrition, blackgram – rice – groundnut recorded highest food grain production of 778 kg blackgram, 5621 kg rice and 2846 kg of groundnut which was fulfils the food grain demand of 5-7 family members.

Livestock nutrition:
- The higher livestock nutrition (in terms of green fodder and dry fodder production) was achieved in fodder sorghum – rice – fodder cowpea which was met the fodder needs of 3 cow + 4 calf milch animals with the production of dry fodder 7061 kg/ha of paddy straw and green fodder yield of 72838 kg/ha (fodder sorghum 50419 kg/ha & fodder cowpea 22419 kg/ha).

Soil fertility:
- *Daincha* (Incorporation) – Rice + *Daincha* (5:1) – Blackgram system enhanced the soil fertility status

b. On-Farm crop response to plant nutrients in rice-gingelly cropping systems
Centre: AICRP-IFS OFR centre, ARS, Bhavanisagar
- In the experiments conducted at 24 farmers' fields of Bhavani and Perundurai blocks of Erode District, balanced application of N, P, K (150: 50: 50 kg NPK/ha)

along with $ZnSO_4$ (25 kg/ha) in rice-gingelly cropping system produced higher system rice equivalent yield (9779 kg ha^{-1}) with higher net return of Rs. 1,23,038 ha^{-1}.

c. On-Farm crop response to plant nutrients in cropping systems
Centre: AICRP-IFS OFR centre, TCRS, Yethapur
- Application of recommended dose of fertilizers N: P: K: $ZnSO_4$ under maize-maize cropping system produced higher system yield (12353 kg ha^{-1}) with higher net return of Rs. 1,72,359 ha^{-1}. Application of recommended dose of NPK (25:50:75 kg/ha) along with 10 kg borax/ha to groundnut in *kharif* season and 60:30:30 kg of NPK/ha and 12.5 kg of $ZnSO_4$ /ha to finger millet in *rabi* season recorded higher groundnut equivalent yield of 4735 kg/ha

B. Action plan for 2023-24

S. No.	Action plan proposed

1.	Title: Carbon sequestration and soil carbon pools in integrated farming system under garden land ecosystem
	Objectives:
	• To investigate the real effect of IFS under garden land condition on SOC fraction and C sequestration
	• To identify the best management practices to improve the soil organic carbon status under IFS
	Treatments:
	T_1: Farmers practice
	T_2: IFS for garden land ecosystem
	Duration: One year 2023-24
	Centre with Scientist: Dr. K. Sivasubramanian, Professor (ENS),
	        Dr. P. M. Shanmugam, Professor (Agronomy),
	        Dr. S. P. Sangeetha, Assistant Professor (Agronomy),
	        AICRP-IFS Main Centre, Dept. of Agronomy, TNAU, Coimbatore
	Expected Outcome:
	• Estimation of total carbon sequestration potential of Integrated farming system
	• Estimating carbon credit equivalence under irrigated upland IFS.

C. Research Projects and Remarks
List of Research Projects during 2022 – 2023

S. No.	Centre	URP	AICRP	EFP	Total	Project recommended for closure
1.	AICRP-IFS Main centre, Department of Agronomy, TNAU, Coimbatore	1	-	-	1	-
		-	3	-	3	-
2.	AICRP-IFS Sub centre, ARS, Thanjavur	-	2	-	2	-
3.	AICRP-IFS OFR centre, MRS, Vagarai	-	3	-	3	The OFR centre was shifted from ARS, Bhavanisagar to MRS, Vagarai during April 2022 and continued with new technical programme from

						June 2022-2027	
4.	AICRP-IFS OFR centre, TCRS, Yethapur	-	1	-	1	OFR experiment I, II and III were completed at TCRS, Yethapur and new project on "Pilot study on Model value chain development for integrated farming system" has been initiated from May 2022 after approval obtained from ICAR- IIFSR, Modipuram, Meerut.

Remarks on the Ongoing URPs /AICRPs / Externally Funded Projects

S. No.	Project Number and Title	Scientist in-charge	Duration	Remarks
I	**URP**			
1.	DCM/CBEAGR/NON/2022/001: Prediction and validation of carbon footprint in components of IFS model	Dr. P.C. Prabu Assoc. Prof. (ENS) Dr. P.M. Shanmugam Professor (Agron.) Dr. S.P. Sangeetha Asst. Prof. (Agron.)	April 2022 - May 2024	The Project may be continued as per the objectives
II	**AICRP-IFS**			
1.	**AICRP/DCM/CBE/AGR/IFS/2020/001** Sustainable resource management for climate smart IFS	Dr. P.M. Shanmugam Professor (Agron.) Dr. S.P. Sangeetha Asst. Prof. (Agron.) Dr. P.C. Prabu Assoc. Prof. (ENS)	June 2017 -May 2023	• All the evaluated IFS models may be popularized • The project may be continued
2.	**AICRP/DCM/CBE/AGR/IFS/2020/002** Expt. 1 a. - Identification of cropping system module for different farming system modules	Dr. S.P. Sangeetha Asst. Prof. (Agron.) Dr. P.M. Shanmugam Professor (Agron.) Dr. P.C. Prabu Assoc. Prof. (ENS)	June 2017- May 2023	• The project may be continued • Given for adoption
3.	**AICRP/DCM - CBE – AGR/001** Carbon crediting and GHG emission in IFS model	Dr. P.C. Prabu Associate Prof. (ENS) Dr. P.M. Shanmugam Professor (Agron.) Dr. S.P. Sangeetha Asst. Prof. (Agron.)	June 2017- May 2023	• The project may be continued
4.	**AICRP/DCM - CBE - AGR/001** Sustainable Resource Management for Climate Smart IFS (June 2017- May 2022)	Dr. T. Parthipan, Asst. Prof. (Agron.)	June 2017- May 2023	• The project may be continued • Given for adoption
5.	Identification of cropping system module for different farming system modules (Profitable Cropping System for Cauvery New Delta Zone)	Dr. T. Parthipan, Asst. Prof. (Agron.)	June 2019- May 2024	• The project may be continued • Given for information
6.	**AICRP/DCM - CBE – AGR/001** OFR Experiment I- On-Farm crop response to plant nutrients in pre-dominant cropping systems and their impact on crop-livestock-human continuum	Dr. N. Satheeskumar, Asst. Prof. (Agron.)	April 2017 to March 2022	• Given for information

7.	**AICRP/DCM - CBE – AGR/001** OFR Experiment II- Diversification of Existing Farming Systems under Marginal household conditions	Dr. N. Satheeskumar, Asst. Prof. (Agron.)	April 2017 to March 2022	• Given for adoption
8.	**AICRP/DCM - CBE - AGR/001** OFR Experiment III- On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers	Dr. N. Satheeskumar, Asst. Prof. (Agron.)	April 2017 to March 2022	
9.	**AICRP/DCM - CBE - AGR/001** OFR 1: On Farm crop response to plant nutrients in pre-dominant cropping systems and their impact on crop - livestock - human continuum	Dr. S.K. Natarajan, Assoc. Prof. (Agron.)	April 2017 to March 2022	• Given for information
10.	**AICRP/DCM - CBE – AGR/001** OFR 2: Diversification of existing farming systems under marginal household conditions	Dr. S.K. Natarajan, Assoc. Prof. (Agron.)	April 2017 to March 2022	• Given for adoption
11.	**AICRP/DCM - CBE – AGR/001** OFR 3: On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers	Dr. S.K. Natarajan, Assoc. Prof. (Agron.)	April 2017 to March 2022	

AGRICULTURAL METEOROLOGY

A1. For Adoption - Nil

A2. OFT - Nil

A3. For information

Theme 1: Weather forecast and Agro advisory

- The adoption of weather-based agro advisories by farmers had increased over the past five years in various agroclimatic zones of Tamil Nadu, and the main drivers are yield advantage and the prevention of total loss through the use of Agro Advisory Bulletins (AAB). The WhatsApp, mobile Apps and video format are more preferred by the farmers for AAB communication than the text message. The AMFU &DAMU centers of GKMS scheme had recorded an additional income ranging from Rs. 2000-14000 per ha by the AAB adopters as compared to non-adopters.

- Astro meteorological forecast research under University Research Project (URP) inferred that the planets at 61-120and 241-330 degree azimuth had a markable influence on the solar radiation and temperature events on earth. Neptune followed by Saturn, Jupiter, Uranus and the Sun at 271-300 degree azimuth had influenced the lower radiation. In contrast, the 61-90 degree azimuth of the Sun, Mercury, Venus, the Moon, Mars, Jupiter and Uranus had influence on the higher solar radiation event ($>60MJ/m^2$). In the context of activeness, the frequency of "Vagram" activeness state of the Sun was increased with increase in solar radiation and temperature. The "Active" state of Mercury decreased with increase in solar radiation.

Theme 2: Basic and applied meteorology

- URP on the effect of Lunar Cycle on the yield and quality of rice indicated that the 3rd quarter sown crop had more tillers DMP and yield parameters in both conventional and traditional varieties, followed by full moon sown crop. The new moon sown varieties had blossomed earlier than in others stages of lunar cycle. Planning of sowing window based on lunar cycle may be a no cost technologies for higher grain yield.

- IMD sponsored FASAL scheme at TRRI, Aduthurai found that the ADT 53 sown on 1st June with 125% N recorded higher grain yield (4748 kg/ha) than other varieties. Similarly rice variety ADT 54 with 125 % RDN sown on 2nd week of October recorded higher grain yield of 4714 kg/ha than other varieties. FASAL scheme at ACRC, TNAU, Coimbatore recorded lesser deviation between forecasted and actual yield in rice, maize and groundnut by using DSSAT ((<10%) and Bayesian statistical model (<15%) for both *kharif* and *rabi* 2022. Between the stages, yield prediction during pre-harvest (F3) was better than flowering (F2) stage.

- Ph.D. thesis research on the modification of microclimate in maize with intercropping under additive series and drip irrigation favoured higher productivity during both summer and *kharif*.

- Ph.D. thesis research in drip irrigated tomato and cucumber under polyhouse with different coloured poly mulches revealed that black mulch with drip irrigation at 100% PE enhanced the growth and yield of cucumber whereas white mulch with drip irrigation at 100% PE boosted the growth and yield of tomato. The water productivity was higher with 50%PE with black and white coloured mulch for Cucumber and Tomato, respectively. All mulched plot had hasten flowering 2 – 4 days early. Soil temperature and irrigation had inverse relation in mulched plot and the afternoon Soil temperature was 1-2°C higher in poly mulch plots. The bacterial population was high in black + 100%PE, whereas fungal & actinomyces were high in white + 100%PE.

- PG thesis research on microclimate modification for higher yield in pearl millet indicated that paired row intercropping coupled with mulching under 0.75 IW/CPE moisture regime resulted higher grain yield due to lower temperature values (leaf, canopy and soil), increase in soil moisture and maximum light interception delivered high leaf area index and dry matter production encouraged the crop growth and development.

- PG thesis research to optimize weather requirements to maximize yield potential of maize intercropped with paddy straw mushroom recorded higher yield when mushroom beds placed under maize with closer row spacing (45 x 25 cm) and paired row (30/60 x25 cm) with mulch than wider spacing (75 x 25cm)

- Ph.D. thesis research under DST BRIFS scheme on cropping system under Periyar Vagai Command area suggested that a change in the cropping pattern to black gram- rice- maize + cowpea /green gram during normal rainfall years, sugarcane + sun hemp or banana + elephant foot yam during excess rainfall years and black gram/ cowpea- rice during deficit rainfall years will fetch additional returns to the farmers

- Ph.D. thesis under DST BRIFS scheme on cropping system under Thamairabarani command area indicated that the best rice-based cropping system under excess rainfall situation is rice – rice followed by rice-maize and rice-pearl millet. During deficit rainfall years, pulse crops perform better than other crops. In normal rainfall years, the performance of rice-based cropping system follows the order of rice-maize, rice-pearl millet, rice-sorghum and rice-pulses.

Theme 3: Climate change and crop weather model

- An URP on climate variability on millets indicated that advancing sowing time by 15 days during rabi season i.e sowing during Sep. 15th had higher grain and fodder yield during near and mid-century. Whereasdelayed sowing during kharif season did not show any yield advantage in the near future.

- DST sponsored Australia India Strategic Research Fund (AISRF) project showed that the area under mango cultivation, production cost, and irrigation practice had positive impacts on improving the mango yield. In tackling the impact of drought, irrigating at least once increases mango yield by 9.64%.

- Neem seed yield prediction model developed with LASSO & SMLR technique revealed that the neem seed yield had a negative relationship with minimum

temperature, relative humidity and rainfall, whereas no significant interaction with maximum temperature and wind speed.

- Crop weather modelling studies to project cocoa yield with the APEX model results indicated a positive correlation of increase in rainfall with cocoa biomass and bean yield. In contrast, both maximum and minimum temperatures were negatively correlated with biomass and yield of cocoa. The study found that most potential districts for expansion of cocoa cultivation in Tamil Nadu are Coimbatore, Theni, Tirunelveli, Thiruvarur, Kanyakumari, Vellore and Dindigul. Potential districts for expansion are Dharmapuri and Erode. Moderately suitable districts are Nagapattinam, Sivagangai, Tuticorin and Karur and rest of the districts are found to be not suitable for cocoa cultivation.
- Ph.D. thesis research revealed that the High Night Temperature (HNT) and elevated CO_2 had a negative impact on green gram production and seed quality.

Theme 4: Weather based pest and disease forewarning model

- Findings of a Ph.D. thesis research work indicated that the incidence and development of rice leaf blast are mainly influenced by minimum temperature, grass minimum temperature, morning dew point temperature, afternoon dew point temperature, afternoon relative humidity and rainfall like drizzling for more than two days with lower temperature leads to an outbreak of leaf blast. Among all these weather parameters, minimum temperature had significant relationship with disease incidence. These parameters will fit well into the disease forewarning model for blast disease in rice.

ACTION PLAN for 2023 – 2025

S. No.	Project Title	Project Teams
Theme 2 – Basic and Applied Agrometeorology		
1.	**Revisiting the crop water coefficient of major crops** (URP / Network project at Coimbatore & Kovilpatti) Crop water coefficient is important parameter, required for field level irrigation scheduling, water budgeting and distribution of large storages. Available crop water coefficient was calculated long before during 1970s. Due to global warming and climate change, there must be change in this value, may result in erroneous scheduling and water budgeting. Hence, it is need of the hour to revisit the crop water coefficient of important irrigated crops of Tamil Nadu. The functioning lysimeter at ARS, Kovilpatti will be used for the proposed study	Dr. N.K. Sathyamoorthy ACRC, TNAU Dr. B. Arthirani ARS, Kovilpatti
2.	**Study the wind drift from drone spray during different wind speed and drone height.** Application of pesticides and nutrient spray using drone is one of the important transformations in agriculture. Precision farming, labour scarcity, low costand quicker coverage are the important factors that makes the drone's intervention as inevitable for agriculture. There are lot of studies are carried in many centers to optimize the spray fluidconcentration, droplet size, drone speed and drone height. Wind Speed has profound influence on these parameters and the wind drift causes lots issues to crops in the nearby field, animals and humans. Hence, it is proposed to quantify the wind drift at different height of drone spray in different wind speed at varying distance from the source.	Dr. Ga. Dheebakaran Assoc. Prof. (Agronomy) ACRC, TNAU Dr. KP. Ragunath Assoc. Prof. (SS&AC) CWGS

B. Research Projects and Remarks
THEME WISE RESEARCH PROJECTS

Theme	URP	Externally funded Projects				Students' Research	Total
		AICRP	GOI	GoTN	Private		
1. Weather forecasting and Agro Advisory	1	-	14	-	-	2	**17**
2. Basic and applied meteorology	2	2	-		-	8	**12**
3. Climate change & Crop models	1	-	5	-	1	6	**13**
4. Pest & Disease Forewarning						1	**1**
Total	**4**	**2**	**19**		**1**	**17**	**43**

CROP WISE RESEARCH PROJECTS

Crop	URP	AICRP	GOI	GoTN	Private	Students' Research	Total
Rice	1					3	**4**
Millets	1		1			2	**4**
Pulses		1				2	**3**
Oil seeds							**0**
Vegetables						3	**3**
Non crop	3		18		1	7	**29**
Total	**5**	**1**	**19***		**1**	**17**	**43**

* Multi crop projects added in rice

A. UNIVERSITY RESEARCH PROJECTS

S. No	Project Title	Project Leader(s)	Period & Remarks
I	**Theme 1: Weather forecasting and Agro Advisory**		
1.	**DCM/CBE/AMT/2019 /001** Developing hybrid weather forecast by integrating the numerical and astrometeorological forecast	Dr. Ga. Dheebakaran Assoc. Prof (Agronomy), ACRC, TNAU, CBE Dr. SP. Ramanathan, Prof. and Head, ACRC	Jun. 2019 – May 2022 Project completed. Completion report to be submitted.
II	**Theme 2: Basic and applied meteorology**		
2.	**DCM/CBE/AGR/RIC/ 2021/002** Influence of Lunar phases at flowering stage on the productivity and quality of rice varieties	Dr. N. Maragatham, Director (DSW) Dr. Ga. Dheebakaran, Assoc. Prof. (Agronomy) ACRC, TNAU, CBE	Nov. 2021 - Oct. 2023 Project to be concluded. Completion report to be submitted.
3.	**AECRI/CBE/COM/ 2021/002** Developing Artificial Neural Network model to calculate Potential Evapo-	Mrs. Hema Bharathi Asst. Prof. (CSC) Dr. Balaji Kannan	Mar. 2021 - Feb. 2023 In progress Report submitted in

		Prof. & Head, PS&IT Dr. Ga. Dheebakaran, Assoc. Prof. (Agronomy) ACRC, TNAU, CBE	11th Agrl. Engineering Meet.
III	**Theme 3: Climate change and crop weather model**		
4.	**DCM/CBE/AMT/MLT/ 2019/001** Studies on the climate variability of millets through crop simulation model	Dr. N. K. Sathyamoorthy Prof. (Agronomy), ACRC, TNAU, CBE	Jun. 2021 - May. 2022 Project completed. Completion report to be submitted.

B. EXTERNALLY FUNDED PROJECTS

S No	Project Title	Project Leader(s)	Period & Status
I	**Theme 1: Weather forecasting and agro advisory services**		
1.	**NCMRWF/DCM/ADT/AGR/2013/ R003** GOI – IMD – Agromet – Gramin Krishi Mausam Sewa (GKMS) - Experimental Agro-Met Advisory Services (AAS), Aduthurai.	Dr K. Manikandan Assoc. Prof. (SS&AC) Dr. S. Elamathi Assoc. Prof. (Agronomy) TRRI, Aduthurai	Apr. 2014 - Mar. 2024 To be continued. Repetition of same message may be avoided.
2.	**IMD/DCM/CBE/ACR/2014/R006** GOI – IMD – Agmet – GraminKrishiMausamSewa (GKMS) at Agro Meteorological Field Units (AMFU), Coimbatore	Dr. SP. Ramanathan, Prof. and Head, ACRC Dr. Ga. Dheebakaran Asst. Prof. (Agronomy) ACRC, TNAU, CBE	Apr. 2014 - Mar. 2024 To be continued. Reconstruct and share the Agromet bulletin format to all the AMFU centers for uniformity.
3.	**IMD/DCM/KPT/AGR/1995/R004** Agrometeorology Field Unit (AMFU) for Agrometeorological Advisory Services (GKMS) under IMD, GOI at ARS, Kovilpatti.	Dr. B. Arthirani Asst. Prof. (Agrl. Met) Dr. K. Baskar Professor and Head ARS, Kovilpatti	Apr. 2014 - Mar. 2024 To be continued. Timely uploading of messages in Agromet portal should be strictly followed.
4.	**GOI/DCM/OTY/ACRC/2016/R003** Agrometeorology Field Unit (AMFU) for Agrometeorological Advisory Services under IMD, GOI at HRS, Ooty	L Rajendran Assoc. Prof. (Pl. Pathology) Dr. Thamaraiselvi Assoc. Prof. & Head HRS, Ooty	Mar. 2014 - Mar. 2023 To be continued. Number of advisories should be increased.
5.	**GOI/DCM/PPI/ACRC/2016/R001** Agro meteorology Field Unit (AMFU) for Agro meteorological Advisory Services (GKMS – Gramin Krishi Mausam Sewa) under IMD, at HRS, Pechiparai.	Dr. A. Jaya Jasmine Prof. and Head Dr D. Rajakumar Assoc. Prof. (Agronomy) HRS, Pechiparai	Mar. 2014 - Mar. 2023 To be continued. Number of advisories should be increased.
6.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Virudhachalam, Cuddalore.	Dr. K. Natarajan Prog. Coordinator Ms. C. Arulmathi SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
7.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Papparapatti,	Dr. M.A. Vennila, Prog. coordinator Mr. P. Arunkumar. SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.

			Dharmapuri.		

8.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Pudukkottai District	Dr. A. Yuvaraja Prog. Coordinator Mr. B. Balamurali SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
9.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Ramanathapuram District	Dr. S. VallalKannan Prog. Coordinator Dr. M. Vengateswari SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
10.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Sandhiyur, Salem District	Dr. R. Jegathambal Prog. Coordinator Dr. C. Pradipa SMS (Agromet.)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
11.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – Sirugamani, Tiruchirappalli	Dr. P. Murali Arthanari, Prog. Coordinator Dr. V. Guhan SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
12.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Tiruvallur, Thirur District	Dr. S. Banumathy, Prog. Coordinator Dr. S. Arul Prasad SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
13.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – Virinjipuram, Vellore Dt.	Dr. A. Thirumurugan Prog. Coordinator Ms. K. Rathika, SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
14.	Setting up District Agro Met Units (DAMUs) at KVKs for Weather Based Agro Advisory Services under ICAR-IMD Collaboration – KVK, Aruppukottai, Virudhunagar.	Dr. ChelviRamessh Prog. Coordinator Dr. N.S. Sudarmanian SMS (Agromet)	2019 – 2024 To be continued Increase registration of farmers in mKisan.
III	**Theme 3: Climate change & crop modeling**		
15.	**IMD/DCM/ADT/AGR/2011/ R001** Forecasting Agricultural output using Space, Agrometerology and Land based observations (FASAL) to Agro Advisory Services for Cauvery Delta Zone TRRI, Aduthurai.	Dr K. Manikandan Assoc. Prof. (SS&AC) Dr. S. Elamathi Assoc. Prof. (Agronomy) TRRI, Aduthurai	Jan. 2011 Mar. 2025 To be continued
16.	**IMD/DCM/CBE/ACR/2010/ R001** Yield forecasting for rice, maize and Groundnut in Western zone of Tamil Nadu using space, Agrometeorology and land-based observation (FASAL)	Dr. V. Geethalakshmi Vice Chancellor, TNAU Dr. Ga. Dheebakaran Assoc. Prof. (Agrn), ACRC, TNAU	Jan. 2011 Mar. 2025 To be continued.
17.	**DST/DCM/CBE/AGR/2018/ R003** DST - CCP- SPLICE (BRIFS) - Building Resilience to Climate Change and Improving Food Security through Climate Smart Solutions (E28ADP)	Dr. V. Geethalakshmi Vice Chancellor, TNAU Dr. Ga. Dheebakaran Assoc. Prof. (Agron.), Dr. S. Kokilavani, Asst. Prof. (Agrl. Met) ACRC, TNAU	Nov. 2018 -Sep. 2022 Project completed. Completion report may be submitted.

18.	**DST/DCM/CBE/FARM/2021/R001 AISRF:** Enhancing Climate Change Adaptation Processes for Farmers and Agribusiness	Dr. V. Geethalakshmi, Vice Chancellor, TNAU Dr. M. Raveendran Director of Research Dr. A. Senthil, Prof. & Head, CRP	Apr 2021 to Mar. 2024 To be continued.
19.	**CIL/DCM/CBE/DCM/2019/R008** Neem (*Azadirachta indica*) seed yield prediction exploring weather and physiological interaction (F37AIV)	Dr. V. Geethalakshmi Vice Chancellor, TNAU Dr. A. Senthil, Prof. & Head, CRP Dr. M. Rajavel, Assoc. Professor, PRO	July 2019 – Jun. 2024 To be continued.
20.	**PVT/DCM/ACRC/COCOA/ 2022/R001** Crop weather modeling studies to project cocoa yield under changing climatic conditions.	Dr V. Geethalakshmi Vice-Chancellor	Oct. 2021 – Mar. 2023 Project completed. Completion report may be submitted.
IV	**AICRP Projects**		
21.	**AICRP/DCM/ KPT/AGR/003** Effect of weather on powdery mildew disease of Blackgram	Dr. S. Kokilavani, Asst. Prof. (Agrl. Met.), ARS, Kovilpatti.	2022 - 2023 To be continued
22.	**AICRP/ DCM/ KPT/ AGR/003. All India Coordinated Research Project on Agrometeorology** Effect of micro environments on phenology, thermal requirements and grain yield of prominent rabi maize hybrids under rainfed condition.	Dr. S. Kokilavani, Asst. Prof. (Agrl. Met.), ARS, Kovilpatti.	2022 - 2023 To be continued

CENTRE FOR PLANT PROTECTION STUDIES

A1. For Adoption

I. Technology for Adoption

1. Queen production in stingless bee, *Tetragonula iridipennis*

Emergency queen cell production method is faster (60 days) and achieves more number of queen production (3 queens) with good colony growth in *Tetragonula iridipennis*.

2. Drumstick as forage for Italian honey bee and its utilization in Pollination

Increase of 40.71 % and 34.77 % pod yield of moringa by keeping three and two Italian bee colonies/acre respectively

3. Managed stingless bee pollination for enhancing mango productivity

Keeping eight stingless bee hives per acre increased the mango yield by 19.77 per cent with benefit / cost ratio of 1: 3.3.

4. Ergonomic technique for collection of *Corcyra* moths in mass rearing

In stack rearing method, fifteen rice moth trays without gada cloth cover were placed one over the other in a specially designed tripod stand with 4" gap between the rearing medium and lower surface of the upper tray and covered with a mosquito net. In the new stack method, labour saving was 54.44% when compared to conventional method. Total numbers of moth emerged in stack rearing method was 22.27% more than the moths emerged in conventional method. Quantity of eggs obtained in conventional method and stack rearing method was 46.23 and 77.55cc, respectively

A2. On-farm trial -Nil

A3. For information
1. Agricultural Entomology

TNAU Ac 22 type hive was found to be superior irrespective of the wood type compared to the other two types of hives *viz.*, BIS and Marthandam

2. Plant Pathology

Candidatus Phytoplasma associated with groundnut (0.63% in Vriddhachalam), tomato (0.21% in Coimbatore) and neem (Coimbatore) were documented during *kharif* 2022.

B. Action Plan
AP 1. Establishment of Bee hotels with Non *Apis* group of pollinators
Theme Leader: Dr. V. R. Saminathan, Prof. (Ento.), TNAU, Coimbatore

Action: Designing and evaluating different nesting and roosting materials for harboring various non *Apis* bee pollinators

Observations to be recorded:
Success rate of establishment and diversity indices

Participating Centres:

TNAU, Coimbatore	Dr. V. R. Saminathan, Prof. (Ento.)
KVK, Madurai	Dr. K. Suresh, Assoc. Prof. (Ento.)
HC & RI, Periyakulam	Dr. S. Suganya Kanna, Assoc. Prof. (Ento.)
HC & RI(W), Trichy	Dr. S. Sheeba Joyce Roseleen, Asst. Prof. (Ento.)

C. Remarks on the URPs/ Externally funded projects
1. Agricultural Entomology

S. No.	Project number and title	Period	Investigators	Remarks
1.	**CPPS/KKM/ENT/VEG/2020/001** Evaluating drumstick *Moringa oleifera* Lam as forage for Italian honey bee *Apis mellifera* L. and its utilization in pollination	June 2020 to May 2022	Dr. M.R. Srinivasan Professor (Ento.) TNAU, Coimbatore	Project may be concluded and completion report may be submitted
2.	**AICRP/CPPS/CBE/ENT/RIC/2020/001** Developing ergonomic methods for mass culturing of rice moth, *Corcyra cephalonica* Stainton	July 2020 - June 2023	Dr. S. Jeyarajan Nelson Professor and Head	Project may be concluded and completion report may be submitted. Patent application may be submitted for stacking system
3.	**CPPS/CBE/ENT/2019/001** Diversity of *Calloso bruchus* sp. in Coimbatore district and its management	Apr. 2019 to Sep. 2022	Dr. R. Arulprakash Assoc. Prof. (Ento.) CRS, Aliyarnagar	Project may be concluded and completion report may be submitted
4.	**CPPS/CBE/ENT/2021/006** Establishment of a repository for key insect pests	Dec. 2020 to Dec.2022	Dr. V. Baskaran AP (Ento.), TNAU, Coimbatore	Project may be concluded and completion report may be submitted
	AICRP			
5.	All India Coordinated Research Project (AICRP) on Honey bees and Pollinators	2022-2023	Dr. V.R. Saminathan, Prof. (Ento.), TNAU, Cbe	Project may be continued

2. Plant Pathology

S. No.	Project Number and Title	Period	Investigators	Remarks
1.	**CPPS/CBE/PAT/NON/2022/001** Unravelling the molecular phylogeny of phytoplasmas associated with important crop plants in Tamil Nadu	July 2022 to June 2025	Dr. G. Senthilraja Assistant Professor (Plant Pathology)	Project may be continued

D. REMARKS

a. General

- Action plans may be formulated involving multi-disciplinary scientists to address the issues of farmers and other stake holders (**Action**: All Scientists).
- Scientists may be encouraged to publish their research findings in the peer reviewed journals having NAAS rating more than 7 (**Action**: All Scientists).
- Efforts may be made to obtain more externally sponsored schemes (**Action**: All Scientists).
-

b. NRM

- Efforts may be taken to document the efficiency of PPFM spraying on mitigation of drought. Identification of diverse isolates of PPFM may be intensified.
- Microbe-based-organic packages need to be developed for hilly horticultural crops particularly for tea.
- Host factors determining microbiome, especially in land races are to be analyzed.
- Efforts may be taken to isolate and register effective stress-alleviating molecules from the microbial strain(s).
- Registration of drought-mitigating microbe, *Bacillus altitudinus* FD48 may be prioritized and research on developing stage specific inoculants for other crops may be strengthened.
- Field studies may be undertaken to analyse the effects of Phyllospheric yeast and its effect on rice growth and yield
- Biocontrol agents against *Fusarium* wilt in banana available with Dr. S. Nakeeran, Dean, AC&RI, Kudumiyanmalai may be taken for registration
- Efforts may be made to scale-up environmental friendly technologies
- Basic research on water and soil quality monitoring may be intensified
- Research on micro plastics may be intensified
- Research on identification of potential PGPRs for reclamation of saline soil may be intensified
- Technologies for converting waste to wealth may be popularized.
- Technologies/products developed from CANT may be documented and efforts may be taken to upscale commercial production of viable products. Promotion of Nanoproducts through hands on training to KVK scientists may be carried out.
- Microbial/Hexanal based shelf-life enhancer for fruits and vegetables may be taken for commercialisation
- Salient findings on minimizing air pollution may be popularized.

c. CWGS

- Mapping of polluted soil/inland saline soil in Tamil Nadu may be done in coordination with NRM Scientists and suitable remediation measures may be advocated.

- A comprehensive model for automated irrigation may be developed for major crops
- Drone spraying of herbicides, crop boosters and pesticides may be evaluated in major crops

d. DCM
i. AICRP-IFS

- All the identified IFS models may be popularized among the stake holders
- Impact assessment of garden land and wetland integrated farming system in Western Zone and Cauvery Delta New Zone of Tamil Nadu respectively may be studied and documented

ii. ACRC

- Commercialization of Weather forecasting and Agromet advisory service may be explored.
- Improvement in accuracy and frequency of seasonal rainfall forecast may be done.
- Economic advantage of Agro Advisory Services may be recorded by all the GKMS AMFU & DAMU centers and published.

e. CPPS

- Capacity building on beekeeping may be strengthened through trainings.

List of Participants

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