

TAMIL NADU AGRICULTURAL UNIVERSITY

PROCEEDINGS

8th Scientists' Meet on Non-Crop Specific Projects (10th June 2020)

Lead Centre

Directorate of Natural Resources Management
Tamil Nadu Agricultural University
Coimbatore-641003

Directorate of Research

Tamil Nadu Agricultural University
Coimbatore 641 003

2020

8th Scientists' Meet on "Non-Crop Specific Projects"

The 8th Scientists' Meet on "Non-Crop Specific Projects" was conducted on 2.6.2020 in Anna Auditorium involving 70 scientists off-line and more than 280 scientists on-line covering all college campuses, research stations and KVKs.

Dr. N. Kumar, Vice Chancellor, TNAU, Coimbatore, offered initial remarks. He indicated that the Scientists' Meet dedicated for "Non-Crop Specific Projects" necessitated to cover new avenue research areas such as nanotechnology, geo-informatics, environmental sciences and climatology. The TNAU has made remarkable advancement in these areas that helped us to help the government by timely interventions such as nano-sanitizer against COVID-19, risk assessment using remote sensing, impact of industry effluents on agriculture, agro-advisory services using automatic weather stations installed across the state. These disciplines must collaborate with other scientists to develop cutting edge technologies.

Dr. K.S. Subramanian, Director of Research complimented the team for their excellent contribution and attracted several crores worth of projects from external funding agencies and made the departments self-reliant. He flagged off several issues to further translational research that include on-site detection gadgets for moisture, nitrogen and pesticide residues etc., smart delivery of nano-mediated agricultural inputs, commercialization of nano-products for available for preservation of fruits, referral nanotechnology center for the country, geo-informatics for the assessment of natural resources, strengthening weather advisory services and beekeeping to augment productivity of crops. **Dr. R. Santhi**, Director (DNRM) presented the action taken report on the recommendations of the 7th non-crop specific project meet. She also appreciated the scientists in DNRM bring bountiful of research projects to meet the challenges ahead in the university.

The **Prof. & Heads** of Dept. Nano Science & Technology, Remote Sensing & GIS, Environmental Sciences, Microbiology, Soil Science & Agrl. Chemistry, Agro-Climatology Research Center, Agronomy, Biochemistry and Apiary presented the salient outcome from the research projects for adoption, OFT and Information and action plan for 2020-2021. The Vice Chancellor offered concluding remarks and the Director of Research summarized the event.

Based on the discussion, the following recommendations and action plans were furnished pertaining to the Departments of Nano Science and Technology, Remote Sensing and GIS, Environmental Sciences, Soil Science and Agricultural Chemistry, Agricultural Microbiology, Agro-Climatology Research Center, Agronomy, Agricultural Entomology, Plant Pathology, Nematology, Biotechnology and Biochemistry under the following headings.

- A. Decisions made on Adoption / OFT/ Information
- B. Action plan 2020 – 21
- C. Research projects and remarks on the ongoing Research Projects
- D. Remarks of the Vice Chancellor
- E. Way forward of the Director of Research
- F. Participants

1. Department of Nano Science and Technology

A. Decisions made on Adoption / OFT / Information:

Adoption

i) Nano seed invigorant for improved germination, growth and yield

Seeds coated with nano seed invigorant (IAA nano emulsion) at 15 ml per kg of seeds along with other recommended package of practices recorded higher mean pod yield of 2186 kg ha⁻¹ in groundnut and mean grain yield of 902 kg ha⁻¹ in black gram. The yield increase in groundnut was 14.1 and 8.4 per cent over control (1916 kg ha⁻¹) and existing CaCl₂ soaking respectively. In blackgram, the yield increase was 19.6 and 10.1 per cent than control (754 kg ha⁻¹) and ZnSO₄ soaking (819 kg ha⁻¹) respectively. In both the crops income generated and BCR were also found to be higher as compared to control and existing recommended seed invigoration treatments.

ii) Chitosan nanoemulsion as an anti transparent for managing the impact of drought in crops

Foliar application of chitosan nanoemulsion @ 1000 ppm induced stomatal closure and reduced stomatal conductance in Maize and Pearl Millet. Field level studies demonstrated that foliar application of chitosan nanoemulsion @ 1000 ppm as an antitranspirant in maize after anthesis, recorded the yield advantage of 300 – 700 kg ha⁻¹ under moisture deficit conditions with additional returns of ₹ 2500 to 7800 ha⁻¹. Thus, the foliar application of chitosan nanoemulsion in crop is recommended as short-term drought management strategy.

OFT

OFT 1: Nano Capsule / Pellet Technology for pulses

Treatments

T1: Absolute Control

T2: Conventional fertilization (as per STCR)

T3: Fertilization through Nano capsule / pellet

(Note: for T₃, the doses as per STCR will be packed in the capsule/pellet)

Crop : Greengram Soil: Red

All the other package of practices will be followed as per CPG 2020.

Centers and Scientists:

Co-coordinating Centre Scientists: Department of Nano Science & Technology, TNAU, Coimbatore

Dr. K.S. Subramanian, Director of Research
Dr. S. Marimuthu, Assistant Professor (Agron.)
(Farmer's field at Coimbatore Dt.)

Sub Centers

: NPRC, Vamban

Dr. R. Parimala Devi, Asst.Prof. (AGM)
ARS, Bhavanisagar

Dr. N. Satheesh Kumar, Asst. Professor (Agron.)

OFT 2: Chitosan Nano formulation as an alternate to toxic sulphur for the safe preservation of coconut copra

Treatment

T1: Conventional method (Sulphur fumigation)

T2: Chitosan nano formulation spraying

Centre and Scientists:

Centre : Department of Nano Science & Technology, TNAU, Coimbatore
Dr. A. Lakshmanan, Professor & Head, DNST, TNAU, Coimbatore
Dr. R. Sharmila Rahale
Assistant Professor (SS &AC), DNST, Coimbatore

The technology will be validated in coordination with Copra units at Pollachi and Udumalpet and others stakeholders (Oil mills).

OFT 3. Biocatalytic Microbes Infused Nano-Hybrid System for the effective deodorization and decomposition of wastes

Treatment

T1: Control

T2: Biocatalytic microbes infused nano-hybrid system (MOF)

Centre and Scientists:

Centre : Department of Nano Science & Technology, TNAU, Coimbatore
Dr. A. Lakshmanan, Professor & Head, DNST, TNAU, Coimbatore
Dr. R. Sharmila Rahale, Assistant Professor (SS &AC), DNST, Coimbatore.
Dr.P.Kalaiselvi, Assistant Professor (ENS), Dept. of ENS, TNAU, Coimbatore.

Technology validation in coordination with stakeholders like civic bodies, corporation and NGO's involved in waste handling.

Information:**Carbon dots in water disinfection**

- Carbon dots were synthesized in filtration method with high reproducibility
- Carbon dots synthesized through hydrothermal carbonization method produced small sized dots less than 10 nm compared to microwave method.
- These carbon dots can be employed for disinfecting water after validation.

B. ACTION PLAN (2020-2021)		
Action plan 1 (New)	Insights and Bio safety of IFFCO Nano Fertilizers in agricultural production system	
Project Leader(s)	Dr. K. S. Subramanian, NABARD Chair Professor & Director of Research, TNAU, Coimbatore. Dr. R. Santhi, Director (DNRM), TNAU, Coimbatore Dr. A. Lakshmanan, Professor & Head, Department of NST, TNAU, Coimbatore. Dr. S. Maragatham, Associate Professor (SS&AC), TNAU, Coimbatore Dr. C. SharmilaRahale, AP (SS&AC), Dept. of NST, TNAU, Coimbatore Dr. S.K. Raj Kishore, AP (ENS), PG Deans Office, TNAU, Coimbatore	
Name Scientists & Centre	2020-21	Deliverables / Expected outcomes
Dr. K. S. Subramanian, NABARD Chair Professor & Director of Research, TNAU, Coimbatore. Dr. R. Santhi, Director (DNRM),TNAU,Coimbatore Dr. A. Lakshmanan, Professor & Head, Department of NST, TNAU, Coimbatore. Dr. S. Maragatham, Associate Professor (SS&AC),TNAU,Coimbatore Dr. C. SharmilaRahale, AP	<ul style="list-style-type: none"> • Characterization of nano fertilizers • Field study to evaluate the performance of nano fertilizers • Biosafety studies of nanofertilizers 	Nanofertilizers are assessed for their field efficacy and biosafety

(SS&AC), Dept. of ST, TNAU, Coimbatore Dr. S.K. Raj Kishore, AP (ENS), PG Deans Office, TNAU, Coimbatore		
Action plan 2 (New)	SERS based nano structure device for pesticide residue detection in Apple and Cauliflower	
Project Leader(s)	Dr. S. Thirumalairajan, DST-Ramalingasamy Fellow, Dept. of NST, TNAU, Coimbatore	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr. S. Thirumalairajan, DST-Ramalingasamy Fellow, Dept. of NST, TNAU, Coimbatore	Developing silver-metal oxide based nano sensor for the detection of Thiram in Apple and Cauliflower	A quick reliable nano sensors available for the detection of pesticide residue in Apple and Cauliflower
Action plan 3 (New)	Nano-Bio hybrid system using Halloysite Nanotube for methane oxidation and carbon sequestration in rice soils	
Project Leader(s)	Dr. A. Lakshmanan, Professor & Head, Department of NST, TNAU, Coimbatore. Dr. R. Abhinaya, NPDP, Department of NST, TNAU, Coimbatore.	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr. A. Lakshmanan Professor & Head, Department of NST, TNAU, Coimbatore. Dr. R. Abhinaya, NPDP,	Synthesis, characterization and assessing the impact of halloysite nano tube on methane oxidation.	Halloysite nano tubes based biohybrid available for GHG mitigation.

Department of NST, TNAU, Coimbatore.		
Action plan 4 (New)	Developing Nano Surface disinfectant for inanimate object	
Project Leader(s)	Dr. A. Lakshmanan, Professor & Head, Department of NST, TNAU, Coimbatore Ms. L. Sivashankari, SRF, Department of NST, TNAU, Coimbatore	
Name Scientists & Centre	2020-21	Deliverables / Expected outcomes
Dr. A. Lakshmanan, Professor & Head, Department of NST, TNAU, Coimbatore Ms. L. Sivashankari, Department of NST, TNAU, Coimbatore	Developing sustained release surface disinfectant using polymeric nano system.	A slow release nanotechnology-based surface disinfectant available for disinfection.
Action plan 5 (New)	Developing Self-disinfecting advanced medical Masks	
Project Leader(s)	Dr. K.S. Subramanian NABARD Chair Professor & Director of Research, TNAU, Coimbatore Dr. A. Lakshmanan, Professor & Head, Department of NST, TNAU, Coimbatore Dr.C.SharmilaRahale, AP (SS&AC), Dept. of NST, TNAU, Coimbatore Dr. JeyaSundara Sharmila, Assist. Prof. (Physics), DNST, TNAU, Coimbatore	
Name Scientists & Centre	2020-21	Deliverables / Expected outcomes
Dr. K.S. Subramanian NABARD Chair Professor & Director of Research, TNAU, Coimbatore Dr. A. Lakshmanan, Professor & Head, Department of NST,	Synthesis , Characterization and assessing the efficiency of nanofibresandwiched medical masks.	Medical masks with ability to self disinfectant the adsorbed microbes available for use.

<p>TNAU, Coimbatore</p> <p>Dr.C.Sharmila Rahale, AP (SS&AC), Dept. of NST,TNAU,Coimbatore</p> <p>Dr. JeyaSundara Sharmila, Assist. Prof. (Physics), DNST, TNAU, Coimbatore</p>		
<p>Action plan 6 (ongoing)</p>	<p>Design and fabrication of nano-agri inputs Chelated nanometals for enhancing mineral nutrition in soil, crop and human continuum</p>	
<p>Project Leader(s)</p>	<p>Dr.C.SharmilaRahale, AP (SS&AC), DNST , Dr.A.Lakshmanan, Prof.& Head, DNST, TNAU, Coimbatore</p>	
<p>Name Scientists and Centre</p>	<p>2020-21</p>	<p>Deliverables / Expected outcomes</p>
<p>Dr.C.SharmilaRahale, AP (SS&AC), DNST, TNAU, Coimbatore Dr.A.Lakshmanan, Prof.& Head, DNST TNAU, Coimbatore</p>	<p>Effective micronutrientmetal chelates will be available for farmers that would enhance the use efficiency of Zinc andIron.</p>	<ul style="list-style-type: none"> • Synthesis of metal nano particles and standardization of protocol. • Stabilizing the metal nano particles using natural chelating agents such as Rhamnolipd, humic and fulvic acids.

Action plan 7 (ongoing)	Design and fabrication of nano-agri inputs Nanofibre encapsulation of <i>Methylobacterium</i> for Groundnut seed invigouration to improve productivity under rainfed ecosystem	
Project Leader(s)	Dr. K. S. Subramanian , NABARD Chair Professor, DNST, TNAU, Coimbatore Dr. K. Raja ,Asst. Prof. (SST), DNST, TNAU, Coimbatore Dr. A. Lakshmanan, Professor & Head, DNST, TNAU, Coimbatore Dr. M. Senthilkumar, Assoc. Professor (AGM), AC & RI, Echankottai	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr. K. S. Subramanian , NABARD Chair Professor, DNST, TNAU, Coimbatore Dr. K. Raja, AP (SST), DNST, TNAU, Coimbatore Dr. A. Lakshmanan, Professor & Head, DNST, TNAU, Coimbatore Dr. M. Senthilkumar, Assoc. Professor (AGM), AC & RI, Echankottai	<ul style="list-style-type: none"> • Testing the bio-efficacy of microbial cells entrapped nanofibre seed invigouration for improved germination, seedling vigour and yield of groundnut • The product of the project would be evaluated under <i>in vivo</i> condition at different locations (Research stations) of University and farmers' fields for large scale adoption 	<ul style="list-style-type: none"> • Single solution product "encapsulation of seeds with nano-fibre carrying microbial cells" with an intention to tide over abiotic stresses. • These processes ensure germination, plant population, productivity and production of groundnut under rainfed conditions.

Action plan 8 (ongoing)	Design and fabrication of nano-agri inputs Developing advanced formulation for botanical insecticide (Azadirachtin) using nano-porous biogenic silica from sugarcane bagasse for high bio-efficacy. [New Project Proposal submitted to SERB-CRG & an initial Mini Project Proposal submitted for NABARD funds]	
Project Leader(s)	Dr. JeyaSundara Sharmila, Assist. Prof. (Physics), DNST, TNAU, Coimbatore Dr. A. Lakshmanan Professor & Head, Department of NST, TNAU, Coimbatore	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr. JeyaSundara Sharmila, Assist. Prof. (Physics), DNST, TNAU, Coimbatore Dr.A.Lakshmanan Professor & Head, Department of NST, TNAU, Coimbatore	<ul style="list-style-type: none"> • Efficacy studies of Azadirachtinloaded bio-silica formulation in laboratory (UV irradiation)and fieldcondition. • Scale-up technology 	<ul style="list-style-type: none"> • A new eco-friendly bio-formulation (Aza-Sil) would be available to control insect pests organically with UV-safe extendedbio-efficacy. • Interested agro-industries can commercialize the [Aza- Sil] technology so as to benefit large farmingcommunity.

Action plan 9 (ongoing)	Nano-Food Systems Nanoformulation of Annonaceous Acetogenins from <i>Annona muricata</i> for better delivery	
Project Leader(s)	Dr.S.Haripriya, Asst. Professor (Hort.), DNST, TNAU, Coimbatore	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr.S.Haripriya, Asst. Professor (Hort.), DNST, TNAU, Coimbatore	Nanoformulation and characterization of Annonaceous acetogenins. Assess the bioactivity and cytotoxicity of Nanoformulated acetogenins	Nanoformulated Acetogenins for Cancer patients.

Action plan 10 (ongoing)	Development of Biosensor: Development of Foliar Diagnostic Kit for on Site Detection of Nitrogen and Moisture Status in Crops	
Project Leader(s)	Dr. K.S. Subramanian , NABARD Chair Professor & Director of Research, TNAU, Coimbatore Dr. S. Marimuthu AP (Agron.), DNST, TNAU, Coimbatore Dr. Pon. Sathya Moorthy , AP (Physics), DNST, TNAU, Coimbatore Dr.K.M. Sellamuthu, Assoc. Pro. (SS & AC), HC &RI,Periyakulam	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr. K.S. Subramanian NABARD Chair Prof. DNST, TNAU, Coimbatore Dr. S. Marimuthu AP (Agron.), DNST, TNAU, Coimbatore Dr. Pon. Sathya Moorthy AP (Physics), DNST, TNAU, Coimbatore Dr.K.M. Sellamuthu, Assoc. Pro. (SS & AC), HC &RI, Periyakulam	Validation of these sensors with standard operational protocols for scaling up of the technology	Prototype for monitoring leaf moisture, nitrogen, phosphorus will be made available

Action plan 11 (ongoing)	Nano systems for pollution management and Eco system health Developing Metal Oxide Frameworks (MOFs) based heterogeneous Nano catalysts for the management of heavy metals and Green house gases	
Project Leader(s)	Dr. A. Lakshmanan Professor & Head, DNST, TNAU, Coimbatore Dr.K.S.Subramanian,NABARD Chair Professor & Director of Research, TNAU, Coimbatore. Dr.V.Geethalakshmi, Director, Crop Management, TNAU, Coimbatore.	
Name Scientists and Centre	2020-21	Deliverables / Expected outcomes
Dr. A. Lakshmanan Professor & Head, DNST, TNAU, Coimbatore Dr.K.S.Subramanian, NABARD Chair Professor & Director of Research, TNAU, Coimbatore Dr.V.Geethalakshmi, Director, Crop Management, TNAU, Coimbatore	<ul style="list-style-type: none"> • Assessing stability of the engineered nano systems • Confirming the efficacy on heavy metals reduction and methane adsorption • Assessing the bio safety of the MOF systems 	Metal Oxide Framework nano devices will be available for the eco friendly and cost effective management of heavy metal pollution besides trapping green house gases from various eco systems

Action plan 12 (ongoing)	Bio safety of nano particles Antimicrobial activity of metal-oxide nano particles on Plant Growth Promoting Rhizobacteria (PGPR)		
Project Leader(s)	Dr. Pon. Sathya Moorthy, Assistant Professor [Physics], DNST, TNAU, Coimbatore		
Name Scientists and Centre	2020-21	2021-22	Deliverables/Expected outcome
Dr. Pon. Sathya Moorthy, Assistant Professor [Physics], DNST, TNAU, Coimbatore	Characterization of synthesized nano particles using (i) PSA, (ii) PXRD, (iii) FTIR, (iv) SEM, (v) TEM, (iv) BET etc	Antimicrobial activity of metal oxide nanoparticles against (<i>Psuedomonas fluorescense</i> & <i>Bacillus subtilis</i>) using well diffusion method and broth dilution method	Minimum inhibitory concentration and minimum bactericidal concentration of individual nano particles can be determined. Above information may provide basic working concentration for any nano inputs formulations such nano pesticide, nano herbicide, nano fertilizer etc without perturbing the existing microbial ecology

C. Research Projects and remarks**Research Projects reviewed**

URPs	Core projects	EFP/ Private	Action Plan projects	Total
10	2	11	7	30

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

(i) UNIVERSITY RESEARCH PROJECTS				
S.No	Project No. & Title	Name of the Scientist(s)	Duration	Remarks
1	NRM/CBE/ NST/2013/004 Developing antimicrobial edible coating from plant sources	Dr. S. Haripriya Asst. Prof.(Hort.)	June 2013 to September 2018	Completion report submitted & approved.
2	NRM/CBE/ NST/2015/003 Computational design of nanomaterials and their interaction with natural product plant protective agents as inhibitors for Cauliflower mosaic virus (CaMV) transmission	Dr. D. Jeya Sundara Sharmila Asst. Prof.(Phy)	January 2015 to December 2018	Completion report submitted & approved.
3	NRM/CBE/ NST/2015/005 Developing a novel biocompatible coating to enhance the shelf life of fruit (Tomato)	Dr. Pon. Sathya Moorthy, Asst. Prof.(Physics)	September 2015 to August 2018	Completion report submitted & approved.
4	NRM/CBE/ NST/2015/001 Nano-encapsulation of hormones to promote seed germination and seedling vigour of blackgram and groundnut	Dr. K. Raja, Asst. Prof. (SST)	Aug 2015 to July 2018 (Extended till June 2019)	Completion report submitted & approved.

5	NRM/CBE/NST/14/002 Reactive oxygen species quenching in pollen grains using nano cerium to increase seed-set in sorghum under drought stress.	M.Djanaguiraman, Asst. Prof. (CRP)	Nov 2014 to Feb 2020	Completion report submitted & approved.
6	NRM/CBE/NST/2013/002 Chitosan Nano-formulation in Plant-Water Relations: Testing for an Antitranspirant (AT) Activity in Maize (<i>Zea mays</i> L.)	S. Marimuthu, Asst. Prof. (Agronomy)	September 2013 to August 2018	Project completion report should be submitted before 30 th June, 2020.
7	NRM/CBE/NST/2013/003 Synthesis and Characterization of Organic Wastes Based Superabsorbent Polymers (SAP) For Improving moisture Retention in the Soil	S. Marimuthu, Asst. Prof. (Agronomy)	September 2013 to August 2018	Project completion report should be submitted before 30 th June, 2020.
8	NRM/CBE/NST/2020/01 Chelated nanometals for enhancing mineral nutrition in plant soil and human continuum	Dr.C.Sharmila Rahale, Asst. Prof. (SS&AC)	June 2019 to May 2021	Recommended for continuation
9	NRM/CBE/NST/HOR/2019/001 Nanoformulation of annonaceous acetogenins from <i>Annona muricata</i>	Dr.S.Haripriya Asst. Prof. (Hort.)	October, 2019 to September, 2021	Recommended for continuation

10	NRM/CBE/NST/ PHY/2020/01 Developing advanced formulation for botanical insecticide (Azadirachtin) using nanoporous biogenic silica from sugarcane bagasse for high bioefficacy	Dr.D.Jaya Sundara Sharmila Asst. Prof. (Phy.)	September 2019 to August 2021	Recommended for continuation
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(ii) EXTERNALLY FUNDED PROJECTS

1	Development of Foliar Diagnostic kit for on-site detection of Nitrogen and moisture status in crops. DST Device Development Program, DST (Nano Mission)	Principal Investigator Dr.K.S.Subramanian Co-Principal Investigators: Dr. S. Marimuthu, Dr. Pon Sathya Moorthy, Dr.K.M. Sellamuthu, Dr. C. Sekar (Alagappa univ.), Dr.R.S.Viswanathan (Alagappa univ.)	2019 to 2020	Project to be closed.
2	Developing Chitosan Nanoformulation as an alternate to toxic sulphur for the safe preservation of coconut copra Coconut Development Board, Kochi	Principal Investigator: Dr. A. Lakshmanan Co-Principal Investigator: Dr. C. Sharmila Rahale	2019 to 2020	Findings may be proposed for OFT and the project to be continued
3	Transforming coconut waste into High value Carbon Dots (C-Dots) and Development of Nano-based Technology for Disinfection of water. Coconut Development Board, Kochi	Principal Investigator: Dr. S. K. Rajkishore Co-Principal Investigators: Dr. A. Lakshmanan Dr. C. Sharmila Rahale Dr. R. Sunitha	2019 to 2020	Findings may be given for information and the project to be continued

4	Flexible and Adhesive surface Enhanced Raman Spectroscopy Based Nanostructures Device for Efficient Detection of Multicomponent Pesticide Residues in Fruits and Vegetables Department of Biotechnology	Principal Investigator Dr.S.Thirumalai - rajan	2018 to 2023	Findings may be given for information and the project to be continued
5	Building Resilience to climate change and improving Food Security through climate smart solutions (BRIFS) DST - SPLICE - CCP	Principal Investigator Dr. A. Lakshmanan	2018-2021	Findings may be given for information and the project to be continued
6	Nano-based smart delivery of Agri-inputs to promote pulses productivity DST – SERB	Overall Coordinator & Lead Principal Investigator Dr.K.S.Subramanian Principal Investigators Dr. K. Raja, Dr. M. Kannan, Dr.M.Djanaguiraman Co-Principal Investigators: Dr. S. Haripriya, Dr. S. Marimuthu, Dr. Jeya Sundara Sharmila	2017 – 2020	Project to be closed and findings may be given for information. OFT may be proposed.
7	Nano Encapsulation of Plant Growth Promoting Rhizobacteria (<i>Pseudomonas fluorescens</i> and <i>Bacillus subtilis</i>) DST - SERB	Principal Investigator Dr. Pon. Sathya Moorthy	2018-2020	Findings may be given for information and project to be closed
8	Nano - Bio hybrid using Halloysite Nanotube Hydrogel and Microbial Consortium for Methane Oxidation and Carbon sequestration in Rice soils to promote Low carbon and sustainable agriculture. DST - SERB	Dr. R. Abhinayaa Mentor: Dr.A.Lakshmanan	2019-2021	Findings may be given for information and the project to be continued

9	Development of nano - fibre based nutrient delivery achieve balanced nutrition for groundnut NABARD, Mumbai	Principal Investigator Dr.K.S.Subramanian	2017 to 2020	The project to be continued
10	Nano-fiber encapsulation of Methyl bacterium for Groundnut Seed invigoration to improve productivity under rain fed ecosystem DST - SERB	Principal Investigator Dr. K. Raja	2020 to 2023	The project to be continued
11	Insights and Biosafety of IFFCO Nano fertilizer in Agricultural Production System- IFFCO - New Delhi	Overall Coordinator & Lead Principal Investigator Dr.K.S. Subramanian Principal Investigators Dr. R.Santhi, Dr. A. Lakshmanan Co-Principal Investigators: Dr. C. Sharmila Rahale, Dr. S.K.Rajkishore, Dr. S.Maragatham	2020 to 2021	The project to be continued

(iii) Core Projects				
1	Biocatalytic Microbes Infused Nano-Hybrid System for the Effective Deodorization and Decomposition of Vegetable Wastes from Markets and Mega Kitchens (Core Projects Phase III (CP128))	Dr. A.Lakshmanan Dr.R.Abhinayaa	2019-2020	Findings may be given for OFT and the project to be continued. The Project is to be completed on 30.9.2020
2	Preservation of Neera through selective separation of fermentative microorganisms using Nano filtration technology ERDF, TNAU	Principal Investigator Dr.A.Lakshmanan Co-Principal Investigator: Dr. C. Sharmila Rahale	2018-2021	Findings may be given for information and the project to be continued. The Project is to be completed on 30.9.2020

2.Department of Remote Sensing and GIS

A. Decisions made on Adoption / Information:

Adoption:

(i) TNAU Remote Sensing Technology for Crop area mapping

Methodology for mapping crops was developed and test verified from 2015-16 to 2019-20 for different crops viz., rice, maize, cotton, sugarcane, blackgram and greengram. Maps and statistics at district, block and village level were generated and validated with DES statistics and ground truth verification and accuracy assessment from more than 6,000 points. The anticipated outputs are (i) Spectral signature showing crop growth, condition and failure, if any (ii) Area map and statistics at district, block and village level (iii) Progress of Planting and Peak of the Season for scheduling harvest.

(ii) TNAU Remote Sensing Technology for Crop Insurances

TNAU Remote Sensing technology for crop insurances was piloted for paddy in PMFBY program of Tamil Nadu government during 2016-17 and approved for implementation seasonwise upto 2018-19. Based on the accuracy levels the state government has approved the usage of this technology in crop insurances for paddy, maize and cotton for the next three years upto 2022. The anticipated outputs are (i) Spectral signature showing crop growth, condition and failure, if any (ii) Area under failed sowing / prevented sowing (iii) Yield loss and total crop failure information for insurances (iv) Cadastral level maps for farm verification (v) NDVI, NDWI and flood maps for crop stress assessment and (vi) Smart sampling for optimizing crop cutting experiments.

(iii) Spatial Estimation of methane emission from rice fields

The study was conducted on pilot basis during 2015 in Tiruchirappalli district using IPCC factor. The technology was standardized integrating LST T factor and DNDC biogeochemical model and demonstrated in paddy field of Cauvery Delta Zone during 2017-18 and 2018-19. The outputs were validated using ground based observation in 30 monitoring sites across the Cauvery Delta Zone with an

accuracy of 86.3 to 91.4 per cent. The anticipated outputs are (i) Rate of Methane emission from paddy fields, (ii) Total Methane emission from paddy fields (iii) Day wise Methane emission during the cropping season.

A2. For Information:

- 1.** Generated digitized cadastral maps of 476 villages in Cuddalore and Perambalur districts
- 2.** Digital soil map of Coimbatore district
- 3.** Block level soil information system
- 4.** Mobile based Soil Information System
- 5.** Mobile application for Geotagging interventions on water resources
- 6.** Digitized maps of 2866 PWD tanks
- 7.** Water spread in tanks and reservoirs of Tamil Nadu during September 2019, November 2019 and January 2020.
- 8.** Cashewnut map of Ariyalur district.
- 9.** Maps and statistics for drought indices viz., NDVI, NDWI and MAI for Tamil Nadu during 2019-20 ensuring drought preparedness.

ACTION PLAN 2020-21			
Theme No. 1	Soil and Land Resource Mapping		
Theme Leader	Dr. R. Kumaraperumal, Asst. Prof. (SS&AC), Dept of RS &GIS		
Activity	Name of the scientist & centre	2020-21	Deliverables/ expected out come
Soil and Land Resource Mapping	Dr.R. Kumaraperumal, Asst. Prof. (SS&AC) Dr. K.P. Ragunath, Asst. Prof (SS&AC) Dr.K. Sivakumar, Asst. Prof. (SS&AC)	<ul style="list-style-type: none"> • Digitization and generation of cadastral Maps • To generate cadastral level soil nutrient mapping • Digital soil mapping for Coimbatore, Erode, Tiruppur and Salem districts • Developing mobile based soil information system adding soil constraints and crop suitability 	<ul style="list-style-type: none"> • Digitization and generation of cadastral Maps • To generate cadastral level soil nutrient mapping Digital soil maps • Mobile based Soil Information System

Theme No.2	Assessing impact of Drought, Flood, Climate Change and environmental monitoring using geospatial technologies		
Theme Leader	Dr. S. Pazhanivelan, Prof.& Head (RS&GIS)		
Activity	Name of the scientist and centre	2020-21	Deliverables/ expected out come
Assessing impact of climate change and Environmental monitoring	Dr. S. Pazhanivelan, Prof.& Head (RS&GIS) Dr. K.P. Ragunath, Asst.Prof (SS&AC) Dr.R.Kumaraperumal, Asst.Prof (SS&AC) Dr. S. P. Ramanathan, Prof.& Head (ACRC) Dr. P.C. Prabu, Asst.Prof. (ENS),ORS, Tindivanam	<ul style="list-style-type: none"> • Assessing rainfall departure, SPI, NDVI, NDWI and MAI at 8 to 15 days interval during NEM • Mapping flooded areas and assessing impact on yield loss in rice. • Assessing impact of other disasters in Agriculture. • Spatial estimation of methane emission using remote sensing and GHGs using FAO EXACT model. 	<ul style="list-style-type: none"> • Agricultural drought indices based on high resolution satellite products for ensuring drought preparedness at 8 to 15 days interval. • Spatial estimation and quantification of methane emission from rice ecosystem.

Theme No.3	Water resources monitoring and irrigation water management		
Theme Leader	Dr. K.P. Ragunath, Asst. Prof. (SS&AC)		
Activity	Name of the scientist and centre	2020-21	Deliverables/ expected out come
Assessing impact of climate change and Environmental monitoring	Dr. S. Pazhanivelan, Prof.&Head (RS&GIS) Dr. K.P. Ragunath, Asst. Prof. (SS&AC) Dr. R. Kumaraperumal, Asst. Prof. (SS&AC) Dr.K. Sivakumar, Asst. Prof. (SS&AC) Dr.Balajikannan, Asst. Prof (SWCE), AEC&RI, Coimbatore Dr. S. Panneerselvam, Director (WTC), WTC Dr. G. Thiyagraran, Asst. Prof. (SWCE), WTC Dr. T. Ramesh, Asst. Prof. (Agron.) ADAC&RI, Tiruchirapalli Dr. A. Nagarajan, Asst. Prof. (SWCE), AEC&RI, Kumulur Dr. S. Manikandan, Asst. Prof (SS&AC)AC&RI, Killikulam	<ul style="list-style-type: none"> • Developing methodology and tool for volume analysis in PWD tanks • 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 	<ul style="list-style-type: none"> • 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

Theme No. 4	Crop Area Mapping and Yield Estimation		
Theme Leader	Dr. S. Pazhanivelan, Prof.& Head (RS&GIS)		
Activity	Name of the scientist and centre	Activity	Name of the scientist and centre
Crop Area Mapping and Yield Estimation	Dr. S. Pazhanivelan, Prof.& Head (RS&GIS) Dr. K.P. Ragunath, Asst. Prof (SS&AC) Dr.R.Kumaraperumal, Asst.Prof (SS&AC) Dr. A.P. Sivamurugan, Asst.Prof. (Agron). Dr.M.Jayachandran, Prof. & Head, SRS, Cuddalore Dr.A. Raju, Assoc. Prof.(Agron.), TRRI, Aduthurai Dr.A.Kamaraj, Asst. Prof. (Agri. Engg), AC&RI, Echangkottai Dr. P. Kannan, Asst. Prof. (SS&AC), AC&RI, Madurai Dr. E. Subramanian, Asst. Prof (Agron.), AC&RI, Madurai	<ul style="list-style-type: none"> • Sustaining rice area and yield monitoring • Generating maps and area statistics in cotton, maize, pulses, groundnut, sugarcane at state level • Developing interface and integrating remote sensing products with DSSAT/Infocrop models to estimate yields of cotton, maize, pulses and groundnut spatially • Smart sampling of CCE's • Developing customized software for crop mapping integrating open source tools with python coding • Mapping Mango, Cashewnut and Banana. 	<ul style="list-style-type: none"> • 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 • Smart sampling plan for coordinating CCE's • Customized software for crop mapping • Maps of Mango, Cashewnut and Banana plantations and

Theme No. 5	Developing drone based spraying techniques for foliar application of nutrients, Organics and Plant Protection chemicals		
Theme Leader	Dr. S. Pazhanivelan, Prof.& Head (RS&GIS)		
Activity	Name of the scientist and centre	Activity	Name of the scientist & centre
<p>Developing drone based spraying techniques for foliar application of nutrients, Organics and Plant Protection chemicals</p>	<p>Dr. R. Santhi, Director, NRM, TNAU, Coimbatore, Team Leader Dr. S. Pazhanivelan, Professor and Head, Department of Remote Sensing and GIS, Team Co-ordinator and Reporting Dr. K.P. Ragunath, Assistant Professor (SS&AC), Department of Remote Sensing and GIS Dr. R. Kumaraperumal, Asst. Professor (SS&AC), Department of Remote Sensing & GIS Dr. K. Sivakumar, Assistant Professor (SS&AC), Department of Remote Sensing and GIS Dr. P. Kannan, Asst.Prof.(SS&AC),AC&RI, Madurai Dr. S. Thiruvaraman, Asst.Prof.(Agron.), Dept. of Cotton Dr. N. Sridharan, Assistant Professor (CRP), Dept. of Cotton Crop physiology Dr. P. Murali Arthanari, Assoc.Prof. (Agronomy), Dept. of Agronomy Dr. E. Subramanian, Asst. Prof.(Agron.), AC&RI, Madurai Dr. R. Anandham, Asst.Professor (Microbiology), Dept. of Agricultural Microbiology Dr.T.Srinivasan, Asst. Prof.(Ento), AC&RI, Coimbatore Dr. G. Srinivasan, Assoc.Prof.(Ento), AC&RI, Madurai Dr. I. Johnson, Assistant Professor (Plant Pathology), Dept. of Plant Pathology Dr. Balaji Kannan, Assoc.Prof. & Head (SWCE), AEC&RI, Coimbatore Dr.R.Kavitha, Professor, AMRC, AEC&RI, Coimbatore Dr. K. Shoba Thingalmanian, Asst. Prof.(Hort.), HC&RI, Coimbatore Dr. D. Vidhya, Asst. Prof.(Hort.), HC&RI, CBE</p>	<ul style="list-style-type: none"> • Drone Mission Planning, Image processing, crop health mapping using thermal and multispectral sensors, designing spraying protocols, experimentation and validation • Standardizing Nutrient spraying • Standardizing Growth regulators, boosters, herbicide and organics Sprays • Standardizing PPFM Spray • Standardizing Plant Protection spray • Standardizing spray dynamics • Standardizing drone spraying techniques in Vegetables and Plantations 	<ul style="list-style-type: none"> • Standardized and validated drone spraying technology capsule for foliar application of nutrients, Organics and Plant Protection chemicals

C. Research projects and remarks

Research projects

URP / Core projects	Interdisciplinary projects	Externally funded projects	Total
04	04	05	13

Remarks on the University Research projects/AICRP/Externally funded projects

S. No.	Project Number and Title	Project Leader	Period	Remarks
University Research projects				
1	NRM/CBE/RSG/SAC/2020/001 Digital Soil Mapping using machine learning algorithms and expert system approach	Dr.R.Kumaraperumal, Asst Prof (SS&AC)	October 2019 – March 2022	<ul style="list-style-type: none"> • Project is to be continued • Extending Digital soil of mapping to Tiruppur, Erode and Salem districts.
2	NRM/CBE/RSG/SAC/2020/002 Developing an Automated tool for extraction of crop condition from temporal Synthetic Aperture Radar (SAR) data	Dr. K.P.Ragunath, Asst. Professor (SS&AC)	Febru-ary 2020 - March 2021	<ul style="list-style-type: none"> • The project is to be continued.
3	NRM/CBE/RSG/2019/001 Cadastral level soil Nutrient mapping in Madathukkulam block in Tiruppur District	Dr. K. Sivakumar, Asst Prof (SS&AC)	Decem-ber 2019 to March 2021	<ul style="list-style-type: none"> • The project is to be continued

4	<p>NRM/CBE/SAC/RSG/2018/CP13 5 Coconut area mapping and change detection in Coimbatore and Tiruppur districts of Tamil Nadu using Remote Sensing techniques</p>	<p>Dr. K. Sivakumar, Asst Prof (SS&AC) Dr.R.Jagadeeswaran Assoc. Prof. (SS&AC)</p>	<p>February 2019 to December 2019</p>	<ul style="list-style-type: none"> • The project is to be completed as per the technical programme and completion report has to be submitted on time.
Externally funded projects				
5	<p>NADP/NRM/CBE/RSG/2017/001 Remote sensing based information for crop coverage, yield estimation and drought monitoring</p>	<p>PI: Dr. S.Pazhanivelan Professor and Head (RS&GIS) Co-PIs: Dr. K.P.Ragunath, Asst. Professor (SS&AC) Dr.R.Kumaraperumal, Asst Prof (SS&AC) Dr. K. Sivakumar Asst Prof (SS&AC)</p>	<p>Sep 2017 to March 2020</p>	<ul style="list-style-type: none"> • The project may be completed and completion report has to be submitted on time. • Remote Sensing Technology for Crop Area Mapping may be given for Adoption • TNAU Remote Sensing Technology for Crop Insurances may be given for Adoption
6	<p>TNIAMP–Phase I Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP) Phase I</p>	<p>PI: Dr. S.Pazhanivelan Professor and Head (RS&GIS) Co-PIs: Dr. K.P. Ragunath, Asst.Prof.(SS&AC), RS&GIS Dr.R.Kumaraperumal, Asst.Prof.(SS&AC), RS&GIS Dr. G. Thiyagarajan, Asst.Prof.(SWCE), WTC</p>	<p>Sep 2017 to March 2023</p>	<ul style="list-style-type: none"> • The project may be continued • Methodology and tool may be developed for volume analysis in PWD tanks • Water Bodies Information System may be hosted as web portal for PWD tanks • Spatial Estimation of Methane Emission from Rice Fields may be given for Adoption.

7	<p>NRSC/NRM/CBE/RSG/2018/R005 Developing a methodology and interface for spatial maize crop production estimation using Crop simulation model</p>	<p>PI: Dr. S.Pazhanivelan Professor and Head (RS&GIS) Co-PIs: Dr. K.P. Ragunath, Asst.Prof.(SS&AC), RS&GIS Dr.R.Kumaraperumal, Asst.Prof.(SS&AC), RS&GIS</p>	November 2018 to October 2020	• To be continued
8	<p>SAC/NRM/CBE/RS G/2019/R006 SUFALAM- Space technology for Groundnut area and Yield estimation for Insurances</p>	<p>PI: Dr. S.Pazhanivelan Professor and Head (RS&GIS)</p>	April 2019 to October 2021	• To be continued
9	<p>DST/NRM/CBE/RS G/2019/R007 Developing DST Network Project on Agriculture GIS – Advances in SAR applications and Digital Initiatives in Agriculture</p>	<p>PI: Dr. S.Pazhanivelan Professor and Head (RS&GIS)</p>	2019 to 2020	• To be continued

3. Department of Environmental Sciences

A. Adoption / OFT / Information:

Adoption

(i) Development of Elite Microbial Consortium for Degradation of Ligno cellulosic Wastes

For improving the efficiency of existing microbial consortium to degrade the ligno cellulosic wastes, bacterial and fungal cultures were isolated, characterized and included in the "TNAU biomineralizer " which is given for technology commercialization. It is recommended @ 2kg per tonne of biodegradable waste for composting and the clientele are farmers, entrepreneurs, municipalities, panchayats and State Departments.

(ii) Biosorbents for Sequestration of Heavy metals

The optimum conditions for maximum chromium (Cr) adsorption by water hyacinth biochar were found to be biosorbent size: 0.2 mm, dosage: 2.5% and contact time of 12 hours for Cr (III) and 36 hours for Cr (VI). The efficiency of the desorbing agents to recover Cr were in the order of 0.1M HCl > 0.5M HCl > 0.1M H₂SO₄ > 0.5M H₂SO₄. Hence Water hyacinth biochar @ 2.5% for chromium removal from tannery effluent and 0.1M HCl for higher desorption of Cr from Cr adsorbed biochar for recycling in tanneries for chrome tanning process is recommended.

(iii) Odour Management in Sewage through Biofloating Technique

Biofloating technique with *Terminalia arjuna*, *Millingtonia hortensis*, *Hibiscus tiliaceus* and *Melia dubia* and two microbial consortium viz., *Acidithiobacillus ferrooxidans*, *Acidithiobacillus thiooxidans* @0.5%v/v ($\times 10^4$ CFU ml⁻¹) along with two reed plants like *Brachiaria mutica* and *Phragmites sp* were found to reduce odour in sewage under open lagoon system. This can be adopted by civic bodies and private consultants adopting sewage treatment through open lagoon system / oxidation ponds.

(iv) Phytoremediation for Salt Affected Soils

A plant, *Sesuvium portulacastrum* with a spacing of 10 cm x 20 cm which produced a biomass of 15 t ha⁻¹ in 90 days with a total salt removal upto 1.7 tons and reduced the soil ESP from 32 to 27.7 and EC from 6.12 to 4.95 dS m⁻¹ can be recommended for phytoremediation of salt affected soil, which can be adopted by farmers / industries.

(v) Recycling of Coir Industry Wastewater through Phytoremediation

Low cost constructed wetland system with vetiver grass achieved a reduction of BOD 44.47 %, COD 47.23%, TDS 57.07% and polyphenols 40 % in the coir industry wastewater. Therefore, coir industry wastewater treated through constructed wetland system can be utilized by coir Industries along with farm yard manure @ 12.5 t ha⁻¹ and recommended fertilizer dose (1.3 kg of Urea, 2 kg of SSP, 3.5 kg of MOP and 1 kg of TNAU micronutrient mixture per palm) for coconut.

OFT

OFT (i): Sustainable Management of Textile and Tannery Effluent Contaminated Soil and Water using Castor Priming with AM fungi

Treatments

- i. Recommended dose of fertilizer (90:45:45 NPK kg ha⁻¹).
- ii. RD of N and K and 50% of recommended P + AM fungi @ 50 kg ha⁻¹ vermicompost @ 5t ha⁻¹
- iii. RD of N and K and 50% of recommended P + AM fungi @ 50 kg ha⁻¹ + composted poultry manure @ 5t ha⁻¹

Parameters to be recorded

Growth parameters : Biometrics, yield attributes and seed yield

Soil parameters : pH, EC, OC, nutrients, heavy metals and biological properties

Duration : One year (2020-2021)

Locations:

Textile effluent contaminated site : Tiruppur and Erode Districts

Tannery effluent contaminated site : Vellore and Erode Districts

Scientists in- charge: Dr.P.Kalaiselvi, Assistant Professor (ENS),
Dr.S.Anandha Raja, Assoc.Professor (Ag.Extension) &
Programme Coordinator, KVK, Tiruppur and
Dr.P.Veeramani, Asst.Professor (Agr.),
KVK, Virinjipuram.

Information

1. Sewage Treatment and Energy Production

Sewage inoculated with Sulphate Reducing Bacteria (SRB) @ 10 ml L⁻¹ reduced the population of coli form in sewage to the tune of 58 per cent. Anaerobic microbial consortium containing *Clostridium sp*, *Bacteroides sp*, *Methanobacterium sp* and *Methanosarcina sp* showed the highest reduction of volatile solids (64 %), coupled with higher biogas and methane content (59 %) from sewage.

2. Wastewater Treatment using Coconut shell based Activated Carbon

Activated carbon prepared from coconut shell improved for its efficiency through chemical activation. The yield of activated carbon with zinc chloride, calcium carbonate, sulphuric acid, hydrogen peroxide and phosphoric acid activated samples were found to be 51.4 %, 47.2 %, 49.6 %, 47.5% and 39.8% respectively.

Filtration system with zinc chloride impregnated activated carbon with nitrogen flow along with coir geotextile, nano cellulose fibrils resins and vermiculite for effective pollutant removal in wastewater was designed. Upscaling and process modification like design parameters, flow rate, flow pattern to suite specific site have been optimized.

3. Impact of Paper mill Effluents on Soil, Groundwater and Crops

Studies on assessing the long-term impact of paper and pulp mill effluent and paper and board effluent on soil, groundwater and crops were taken up with four industries viz., TNPL unit-I at Karur, TNPL unit-II at Trichy, ITC at Thekkampatty and SPB at Erode. Periodical monitoring of treated waste water showed that the quality of wastewater was found to be within the limits as prescribed by TNPCB (pH of 6.8 -7.2, EC of <2 dS m⁻¹, 1BOD of <100 mg/l, COD of <250 mg/l). Due to continuous application of paper board mill effluent soil salinity is observed (TNPL area), for which a phytoremediation technique is recommended.

4. Aerosol Characteristics Over High Altitude In Southern India

Diurnal variations of aerosol black carbon (BC) revealed an evening peak (during 17:00 to 22:00 h) during Feb to May, which decrease gradually towards morning and become lowest during the early morning hours (05:00 h). Annual averaged Aerosol Radiative Forcing values (SBDART model) were -11.47 Wm⁻²,

36.23 Wm⁻² and 22.34 Wm⁻² at the top of the atmosphere and earth's surface and within the atmosphere, respectively.

5. Impact of Troposphere Ozone on Crops, Tamil Nadu

Fifteen short duration rice cultivars obtained from various rice research stations of TNAU were screened for elevated tropospheric ozone tolerance (100 ppb) in open top chamber (OTC). Based on the Principle Component Analysis (16 traits), the chosen 15 rice cultivars were grouped into four categories: sensitive, moderately sensitive, moderately tolerant and tolerant. Rice TPS5, Anna(R)4 and PMK(R)3 exhibited more tolerance to eO₃.

Eight black gram varieties (CO 6, VBN 1, VBN 2, VBN 3, VBN 5, VBN 6, VBN 7, VBN 8) screened for elevated tropospheric ozone tolerance (50 ppb) in open top chamber (OTC) showed that VBN3 was found to be sensitive and VBN 8, VBN 5 were found to be tolerant

6. Carbon Sequestration by Oil Palm

The fronds and empty fruit bunches of oil palm recorded phytolith contents of about 59 and 5.7 mg g⁻¹ respectively. Among the age groups (4, 8 and 15 years), the eight year old oil palm recorded the highest soil carbon (17.11 Mg C ha⁻¹) at 0-20 cm depth of frond pile zone which was 69% higher than the four year old oil palm plantations.

7. Activated Hydrochar from Paper Board Mill (PBM) Sludge for Pollutant Removal

The hydrothermal temperature of 200°C and residence time of 10 h were optimized process parameters for hydrochar production from PBM-ETP sludge. The higher heating value of PBM-ETPS derived hydrochar was 18.39 MJ kg⁻¹ with an energy densification quotient of 1.07 and energy yield of 75.03% and it was holding the BET surface area of 3.74 m² g⁻¹, particle size of 104.7 nm with the zeta potential of -17.1 mV and it showed the cation exchange capacity of 12 cmol [p+] kg⁻¹ with the point of zero charge as 7.6.

The post activated PBM-ETP sludge derived hydrochar achieved a higher removal percentage of 66.48 % at pH 8 with initial diclofenac concentration of 10 mg L⁻¹ after 15 h. The highest removal of 72 % was obtained at pH 5 with initial orthophosphate concentration of 100 mg L⁻¹ after 24 h by Post activated PBM-ETP sludge derived hydrochar with predicted response of 59.70 % at pH 8.

B. Action Plan for 2020 – 2021 (to be continued from 2019-2020)

S. No	Action Plan	Duration	Scientist in Charge	Remarks
1	Low Cost Constructed Wetland System for the Treatment of Polluted Noyyal River Water at Downstream of Tirupur City for the sustainable reuse in Agriculture	Two years	Dr. S. Paul Sebastian, Dr. M. Maheswari, Dr. K. Sivasubramanian and Dr. K. Boomiraj	To be continued
2	Monitoring and Utilization of Municipal Treated Sewage water for Agriculture at Udumalpet and Thanjavur areas	Two Years (2019 to 2021)	Dr. P. Thangavel, Professor (ENS) Dr. M. Selvamurugan, Asst. Professor (ENS), AC&RI, Thanjavur	To be continued

Action Plan Proposed for 2020-2021 (new)

Action plan 1	Assessing the <i>in situ</i> decomposition potential of TNAU Biomineralizer on crop residues	
Project Leader(s)	1. Dr.P.Kalaiselvi, AP (ENS) 2. Dr. V.Davamani, AP (ENS) Dept.of ENS, TNAU, Coimbatore	
	3.Dr.M.Selvamurugan, AP (ENS),AC&RI, Eachankottai	
Activities	2020-2021	Deliverables / Expected outcomes
Two years	To study the decomposition potential of TNAU biomineralizer for <i>in-situ</i> composting of crop residues	Technology developed will be useful for the farmers to recycle the crop residues of paddy and maize residues.

Action plan 2	Standardization of extractants for estimation of Chromium (VI) in plant parts		
Project leader (s)	1. Dr.P.Thangavel, Professor (ENS) ; 2. 2. Dr. G.Balasubramanian, Professor (ENS) Dept. of ENS, TNAU, Coimbatore		
Activities	2020-2021	2021-2022	Deliverables / Expected outcome
Two year	Collection of major plant species in hot spots of Cr contamination (tannery industry) for speciation of Cr	Evaluating suitable extractants such as hot and cold water, potassium hydroxide, sodium hydroxide	The method standardized will be useful to quantify the hexavalent Cr in various plant parts and the extent of transformation of hexavalent Cr into non toxic trivalent form.

Action plan 3	Screening of Air Pollution Tolerant Indigenous Tree Species for Urban Greening and Avenue Planting		
Project Leader(s)	1. Dr. M. Prasanthrajan, Associate Professor (ENS) 2. Dr. S. Radhakrishnan, Associate Professor (Forestry) FC&RI, Mettupalayam 3. Dr.M.P.Sugumaran , Associate Professor (ENS) Dept. of ENS, TNAU, Coimbatore		
Activities	2020-21	2021-22	Deliverables / Expected outcomes
Two Years	To evaluate the air pollution tolerant index (APTII) of indigenous tree species	To screen air pollutant tolerant indigenous tree species for urban greening and avenue planting	Tolerant tree species can be recommended for urban greening and avenue planting which will provide not only aesthetic value but also for air pollutant mitigation.

Action plan 4	Assessment of Microplastics in Agricultural soils		
Project Leader(s)	1. Dr. P. Dhevagi, Associate Professor (ENS) 2. Dr. S. Paul Sebastian, Assistant Professor (ENS)		
Activities	2020-21	2021-22	Deliverables / Expected outcomes
Two Years	Assessment of MPs in soil Characterization, Identification of MPs in soil	Microplastics impact on soil properties and organisms.	Outcome of the result will be helpful to develop alternate methods to prevent the entry of microplastics in agricultural soils.
Action plan 5	Assessing the Impact of Troposphere Ozone on the Growth and Yield of Bush Beans Under Nilgiris Biosphere		
Project Leader(s)	1. Dr.R.M.Jayabalakrishnan, AP (ENS), Dept. of ENS, TNAU, Coimbatore 2. Dr.S. Karthikeyan, AP (Hort), HRS, Ooty		
Activities	2020-21	2021-22	Deliverables / Expected outcomes
Two Years	To study the impact of ambient and controlled ozone (40 ppb) on growth and physiological attributes of bush beans	To study the impact of ambient and controlled ozone (40 ppb) on yield attributes of bush beans varieties	Effect of tropospheric ozone on the growth of crops can be assessed in Nilgiris biosphere region

Action plan 6	Impact of COVID 19 on River Water Quality	
Project Leader(s)	Main Centre: 1. Dr.K.Suganya AP(ENS), Dept. of ENS, TNAU, Coimbatore	
	2. Dr.P.T. Ramesh, Assoc.Professor (ENS), AC&RI, Killikulam	
Activities	2020-21	Deliverables / Expected outcomes
One year	To assess the chemical and biological changes in river quality of major rivers of Tamil Nadu during COVID 19	Understand the impact of human intervention on rivers. To identify solutions for cleaning up of rivers

C. Research Projects and Remarks

Research Projects

Projects Reviewed

Theme Wise Research Projects

S.No	Theme Area	Number of Projects			Projects recommended to be closed
		URP	EFP	Total	
1	Bioremediation of Polluted Environments	5	1	6	5
2	Wastewater Treatment and Recycling	4	5	9	2
3	Air pollution Monitoring and Mitigation	2	3	5	-
4	Integrated Solid Waste Management	6	-	6	2
5	Agro-ecology and Ecosystem Services	1	-	1	-
	Total	18	9	27	9

Remarks on the ongoing Research Projects

Theme Area -1 Bioremediation of Polluted Environment

S. No	Project Number	Title of the Project	Scientist in Charge	Period/Remarks
1.	DST/HCRI/PKM/ENS/2016/R004	Assessment on the utility of water hyacinth (<i>Eichhornia crassipes</i>) biomass as potential bio-sorbent for sequestration of heavy metals from tannery effluent and desorption of chromium from bio-sorbent for effective reuse (DST-SERB)	Dr. E. Parameswari, Asst.Prof(ENS) Dr. S. Avudainayagam Prof (ENS) Dr. V. Davamani Asst.Prof(ENS)	August 2016- November 2019. The project may be closed and the outcome may be given for adoption in NCSM 2020.

2.	NRM/ALR/ENS/ CNT/2016/001	Evaluating the impact of Organic amendments on Coconut growth, nut yield and soil nutrients in Coir Industry wastewater affected areas (URP)	Dr.R.M.Jayabalakrishnan Asst.Prof(ENS)	July 2016- June 2020 The project may be closed and the findings may be proposed for adoption in NCSM 2020.
3.	NRM/CBE/ENS/ 2017/001	Assessing the bioavailability, bioaccumulation and bioremediation of mercury in the contaminated soils and plants at Kodaikanal (URP)	Dr. S. Avudainayagam, Prof (ENS) Dr. V. Davamani Asst.Prof(ENS)	January 2017- December 2020 The findings may be given for information and closing report may be submitted.
4.	NRM/CBE/ENS/ REM/2017/002	Sustainable management of textile and tannery effluent contaminated soil and water using castor priming with AM fungi (URP)	Dr. P. Kalaiselvi Asst.Prof. (ENS) Dr. M. K. Kalarani, Prof. (CRP)	April 2017- March2020 The findings may be taken for OFT and the project may be closed.
5.	NRM/CBE/ENS/ 2018/002	Fate and transport of pesticide residues in soil and water of predominant vegetable growing village of Ottanchathiram (URP)	Dr.R.Jayasree Asst.Prof(ENS)	Feb 2018 – May 2022 The proposed objectives of the research work should be completed as per the objectives in a focused

				way and the completion report to be submitted.
6.	NRM/CBE/ENS / 2018/003	Evaluation of natural adsorbents for removal of mercury from wastewater (URP)	Dr. K. Suganya Asst. Prof (ENS)	June 2020 to May 2022 The research work is to be initiated on time and the findings are to be furnished for NCSM 2021.

Theme Area 2 Wastewater Treatment and Recycling

S. No	Project Number	Title of the Project	Scientist in Charge	Period/ Remarks
1.	ITC/NRM/CBE/ENS/ 2014/R003	Effective utilization of treated effluent water and sludge generated from ITC factory (ITC- Private)	Prof. & Head, Dept. of ENS Dr.G.Balasubra - manian Prof(ENS)	April 2017- March 2020 To be continued as per technical programme.
2.	TNPL/NRM/CBE/ENS/2015/R008	Evaluation of long term effect of using treated TNPL Unit I (Karur) effluent water for irrigation and remediation of effluent irrigated soil habitat (TNPL-Private)	Prof. & Head, Dept. of ENS Dr. P. Thangavel Professor (ENS)	April 2018 - March 2021 To be continued. The effect of <i>Salicornia</i> on salt removal may be evaluated and reported.
3.	TNPL/NRM/TRY/ SAC/2015/ R002	Environmental quality assessment in the use of Paper Board Industry (TNPL Unit II) waste water for	Dr.P.Balasubra - maniam, Professor and Head (SS&AC),ADAC&RI, Trichy.	November 2019 to March 2022 To be continued and in addition to monitoring of quality of effluent and well

		agro-forestry system (TNPL-Private)		water, the remaining objectives may be carried out at the earliest.
4.	NRM/MTP/ENS/2016/001	Development of biofloating technology for the odour management in sewage water (URP)	Dr. M. Prasanthrajan Assoc. Prof(ENS)	December 2016 - November 2019. The findings may be given for adoption and the Project to be closed.
5.	DST/NRM/ALR/ENS/2017/R005	Preparation and development of adsorbent carbon and nano cellulose fibrils from <i>Cocos nucifera</i> and its potential application in wastewater treatment system (SERC-DST)	Dr. R.M.Jayabala krishnan, Asst. Prof (ENS)	May 2017 - April 2021. Findings may be given for NCSM 2020 and to be continued as per the technical programme.
6.	SPBL/NRM/CBE/ENS/2018/R005	Ecofriendly utilization of Seshasayee paper mill effluent and solid wastes and monitoring its impact on soil and groundwater (SPBL-Private)	Prof. & Head, Dept. of ENS Dr. V. Davamani Asst.Prof(ENS)	April 2019-March 2020 . Soil profile study may be undertaken and the project may be continued as per technical programme
7.	NRM/CBE/ENS/2018 /004	Sustainable Biogas Production from Sewage through Bioaugmentation (URP)	Dr. M. Maheswari, Prof & Head (ENS)	September, 2018 to August, 2020. To be continued for evaluating SRBs on coliform bacterial reduction in sewage.

8.	NRM/CBE/ENS/ /2019/002	Rhizofiltration of micropollutants Using Vetiver (URP)	K Sara ParwinBanu, Professor (ENS)	October 2019 to October 2021 The work on removal of micro pollutants from sewage with vetiver may be carried out and the findings may be presented in NCSM 2021. The project is to be continued.
9.	NRM/CBE/ENS/ 2020/ 001	Impact of treated sewage irrigation on soil and fodder quality (URP)	Dr.M.Maheswari Prof& Head (ENS) Dr.S.D.Sivakumar, Assoc. Prof (Agro)	January 2020 to December 2022 To be continued and the findings may be furnished for information in NCSM 2021.

Theme Area -3 Air Pollution Monitoring and Mitigation

S. No	Project Number	Title of the Project	Scientist in Charge	Period/ Remarks
1	ISRO/NRM/KKM/ ENS/2012/D001	GOI-ISRO-GBP-ARFI project on "Assessing the Aerosol Radiative Forcing over India" (ARFI) (ISRO – ARFI)	Professor &Head, Dept of ENS Dr. R.M.Jayabala krishnan Asst. Prof. (ENS) Dr. K. Boomiraj, Asst. Prof. (ENS) Professor &Head, HRS, TNAU, Ooty	April 2018 - March 2021. The database on black carbon at high altitudes may be given for information in NCSM 2020. The project is to be continued.
2	ISRO/NRM/KKM/ENS /2014/D002	Establishment and Maintenance of Environmental Observatory at Wood House, HRS, Ooty for Atmospheric Trace gases	Professor &Head, Dept. of ENS Dr.P.Dhevagi, Assoc. Professor (ENS), Professor and Head, HRS, Ooty.	April 2018 - March 2020. To be continued and the findings may be given for information in NCSM 2020.

		Chemistry Transport Modeling (ATCTM) (ISRO- ATCTM)		
3	DST/NRM/CBE/ENS/ 2018/R011	Assessment on the potential of oil palm (<i>Elaeis guineensis</i>) plantations for carbon sequestration in different regions of Tamil Nadu (DST-SERB)	Dr.V.Davamani Asst. Prof(ENS) Dr.E.Parameswari Asst. Prof(ENS) Dr.M.Velmurugan Asst. Prof(Hort)	April 2018 to March 2021. The project may be continued.
4	NRM/CBE/ENS/ BGR/2019/001	Impact of Tropospheric Ozone on Blackgram (URP)	Dr.P.Dhevagi, Assoc.Prof (ENS)	October 2019 - September 2021. The project may be continued.
5	NRM/CBE/ENS/ VEG/2019/001	Influence of "N" inhibitors on nitrous oxide emission under intensive tomato cultivation system (URP)	Dr. V. Davamani, Asst. Prof (ENS) Dr.M.Velmurugan Asst. Prof(Horti.),	September 2019 - August 2020. The project may be continued.

Theme Area – 4 Integrated Solid Waste Management

S. No	Project Number	Title of the Project	Scientist in Charge	Period/ Remarks
1	NRM/KKM/ENS/ 2017/001	Development and standardization of enriched fish waste compost and its evaluation on soil and crop.	Dr.S.Shenbagavalli Asst. Prof(ENS)	June 2017 to May 2020 May be given for information and the project is to be closed.
2	NRM/CBE/ENS/2019/003	Development of elite microbial consortium for degradation of	Dr. P. Kalaiselvi, Asst. Prof(ENS), Dr.M.Prashanth - rajan Assoc . Prof(ENS)	November 2019 to October2021. To be

		lignocellulosic wastes.		continued with experiments on testing its effectiveness on various substrates as per the proposed objectives.
3	NRM/TPS/ENS/2017/RIC/2018/001	Studies on effect of composted market waste and graded levels of fertilizer on carbon storage and yield of aerobic rice.	Dr. C. Prabakaran, Asst. Prof. (ENS)	January 2017 to December 2019. The project is to be closed.
4	NRM/MTP/ENS/SER/2018/001	Standardization of the dose of additives and inocula for combined seriwaste composting.	Dr.P. Jothimani Asst.Prof.(ENS)	July 2018 to June 2021. Findings may be given for information in NCSM 2020. To be continued for completing evaluation of the seriwaste compost on mulberry.
5	NRM//VVR/2019/01.	Study on assessing the effectiveness of native microorganism for quick decomposition of farm and industrial wastes.	Dr.A.Krishnaveni Asst. Prof. (ENS)	June 2019 to May 2021. The effectiveness of the isolates may be evaluated with the existing consortia and the findings may be given for information during NCSM 2021.

6	NRM/ENS/CBE/2020/002	Recycling of sewage sludge for synthesis of functional nano materials and its environmental applications.	Dr. S.Paul Sebastian Asst. Prof (ENS)	March 2020 to February 2022. Project is to be continued.
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Theme Area - 5 Agro-ecology and Ecosystem Services

S. No	Project Number	Title of the Project	Scientist in Charge	Period/ Remarks
1	NRM/CBE/ENS/2019/001	Screening trees for bio-silencing of Noise (URP)	Dr.M.P.Sugumaran Asso. Prof (ENS)	June 2019 to May 2021. Assessment of noise pollution in industrial area may also be done and the findings of the project may be given for information NCSM 2020.

4. Department of Soil Science and Agricultural Chemistry

A. Decisions made on Adoption / OFT / Information:

A1. Adoption: Nil

A2. OFT

OFT 1 (New): Response of crops to applied amendments under fluoride stress condition

Treatments

T₁-Control (RDF alone) T₂- RDF + FYM @ 12.5 t ha⁻¹

T₃-RDF + Gypsum @ 2 t ha⁻¹

*RDF: As per STCR

Crop: Maize (CO 6) ; Irrigated

Observations to be recorded:

- ❖ Growth and yield parameters (Grain & Stover)
- ❖ Fluoride content in the soil and plant samples
- ❖ Soil pH, EC and organic carbon content

Co-ordinating Centre:

Dept. of SS&AC&WTC, TNAU, Coimbatore

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

Centres involved:

WTC, TNAU, Coimbatore :

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

RRS, Paiyur :

Dr.M.Vijayakumar, Assistant Professor (SS&AC)

MRS, Vagarai :

Dr. M. Mohamed Amanullah, Professor (Agronomy)

OFT 2 (Ongoing): Field scale validation of sensor for automated drip irrigation.

Centres: HC&RI, Periyakulam & AC&RI, Killikulam

Work Progress:

The OFT was initiated with Chilli var PKM1 in Horticultural College and Research Institute, Periyakulam and with chilli local variety in AC&RI, Killikulam. An area of 4 cent was utilized and gravity-based irrigation and sensor system was installed. The work is in progress and will be continued during 2020 – 2021.

A3. Information:

1. The overall calcium deficiency in Tamil Nadu was only 7.0%; however, the soils of few districts viz., Kanyakumari (57.7%), Thoothukudi (54.9%) and Pudukkottai (46.3%) were having more than 40 % Ca deficiency. As regards Mg, the average deficiency was 10.8% ranging from 0.11 to 64.5% deficiency; the soils of Kanyakumari (66.6%), Pudukkottai (64.5%) and Thoothukudi (42.4%) districts were having very high Mg deficiency. Groundwater samples of Ramanthapuram district is characterized under good quality (10%), marginally saline (10%), saline (4%), marginally alkaline (1%), alkaline (10%), high SAR saline (46%), and high alkaline (19%) water.
2. Potential salinity exceeded the critical limit of 10 me L⁻¹ in about 48% of the groundwater samples in Periyanaickenpalayam block. About 17 % of the groundwater samples were grouped under saline.
3. About 25% of the groundwater samples in Kundadam block and 32% of the samples in Reddiyarchatram block is affected with fluoride (>1.5 mg L⁻¹).
4. Capacitive deionization with zinc and iron electrodes was successful in reducing the electrical conductivity of irrigation water by 1 unit at < 4 V. Because at > 4 V, the water is unstable and electrodes also get ionized resulting in an increase in electrical conductivity of water.
5. Nitrogen, phosphorus, potassium, copper and zinc content of seriwaste compost were significantly higher in sericompost through EM (N - 2.78 %, P - 1.3%, K -1.7% Cu - 61.3 mg kg⁻¹ and Zn - 95.2 mg kg⁻¹) followed by sericompost through earthworm (N - 2.41 %; P -0.8 %, K - 1.1% , Cu - 55.8 mg kg⁻¹ and Zn -90.3 mg kg⁻¹). Iron and manganese content was higher in sericompost through earthworms (1298 and 479.3 mg kg⁻¹) followed by EM (1190.2 and 463.1 mg kg⁻¹).

B. Action Plan 2020 – 2021:			
Action plan 1 (New)	Fertility mapping of the farm soils of HRS, Ooty using GIS		
Name of the Scientists and Centre	2020-2021	2021 - 2022	Deliverables/Expected outcome
Dr. N. Chandra Sekaran Professor (SS&AC), TNAU, Coimbatore Dr. K. Sivakumar, Asst. Professor (SS&AC), Department of RS & GIS, TNAU, Coimbatore.	<p>➤ Collection and Mapping of geo-referenced surface soil samples</p> <p>The location of soil sampling sites of farms will be marked on base map on 1:5,000/10,000 scales and digitized using Arc-info GIS.</p> <p>➤ Surface soil samples analysis</p> <p>The surface soil samples will be analyzed for various soil properties (physical, physic-chemical and chemical) by adopting standard procedures.</p> <p>➤ Classification of soil, identification of constraints, land evaluation and soil site classification, LCC and FCC</p> <p>➤ Preparation of thematic maps by GIS techniques.</p>	<p>➤ Geo-referenced soil profiles cutting, description and collection of horizon wise bulk and core soil samples from the Wood House Farm and Nanjanad farm.</p>	<p>The two research farms of Horticultural Research station, Udthagamandalam with varied soil types viz., Wood House Farm and Nanjanad farm are selected for developing the strong soil resource database for proper appraisal of their productivity, potential and their rational use.</p>

Action plan2 (ongoing)	Soil resource inventory and Fertility mapping of soils of AC&RI, Vazhavachanur using GIS		
Name of the Scientists and Centre	2019-2020	2020 - 2021	Deliverables/Expected outcome
Dr.V.Arunkumar Assistant Professor (SS & AC) AC&RI, Vazhavachanur	<p>Work done:</p> <ul style="list-style-type: none"> • Six soil profiles were dug in C,D, G,J, O and P blocks and examined for their morphological characteristics. • GPS aided surface samples (40 Nos) were collected covering A,B,C,D blocks of AC&RI, Vazhavachanur and analysed for available nutrient status. 	<p>GPS aided surface (15 cm) and sub surface (30 cm) soil samples will be collected in G, I, J, O, P, M and N blocks of AC&RI, Vazhavachanur by adopting standard soil sampling procedures.</p> <p>Soil samples will be analysed for their physical and chemical properties.</p> <p>The base map of AC&RI, Vazhavachanur will be generated and thematic maps will be prepared on various soil attributes.</p>	<p>Soil resource information of AC&RI, Vazhavachanur will be developed.</p> <p>Database on soil Physical and chemical properties will be developed.</p> <p>GIS based soil fertility maps will be developed.</p>
Remarks of the Technical Director	Project to be continued and proposal may be submitted for obtaining project number.		

Action plan3 <i>(ongoing)</i>	Mapping Groundwater Quality in Pollachi taluk		
Name of the Scientists and Centre	2019-2020	2020 – 2021	Deliverables/Expected outcome
<p>Dr.C.Sudhalakshmi, Asst. Professor (SS&AC), Coconut Research Station, Aliyarnagar</p> <p>Dr.R.Kumaraperumal, Asst. Professor (SS&AC), Department of RS & GIS, TNAU, Coimbatore.</p>	<p>Work done: GIS aided ground water samples (open wells and bore wells) representing the post monsoon period (Sep. – Dec. 2019) were collected from 45 farmers' holdings in Anaimalai block of Pollachi taluk and analysed for quality parameters.</p>	<p>Collection of groundwater samples during pre monsoon and post monsoon seasons in Anaimalai, Pollachi (N) and Pollachi (S) blocks. Analysis of quality parameters.</p>	<p>Ground Water Quality Index maps of three blocks of Pollachi taluk.</p>
Remarks of the Technical Director	Pre-monsoon water samples may be collected during the appropriate time and proposal may be submitted for obtaining project number.		

C. Research projects and remarks**Research projects**

Department / Station	URP	Core Project	AICRP/ ICAR	Ext. Funded	Student Thesis		Total
					M.Sc.	Ph.D.	
AC&RI, TNAU, Coimbatore	-	1	2	-	3*	1	7
AC&RI, Madurai	-	-	-	2	-	-	2
ADAC&RI, Trichy	-	-	1	-	1	-	2
AC & RI, Vazhavachanur	-	-	-	-	-	-	1
HC & RI, Periyakulam	1	-	-	-	-	-	2
FC&RI, Mettupalayam	1	-	-	-	-	-	1
CRS, Aliyar Nagar	1	-	-	-	-	-	2
ORS, Tindivanam	1	-	-	-	-	-	1
Total	4	1	3	2	4	1	18

*Interdisciplinary

Remarks on the Research projects

S. No	ProjectNo. & Title	Name and designation of the project leaders	Duration	Remarks
University Research Projects				
1.	NRM/ALR/SAC/2016/001 Desalinization of irrigation water for sustainable agriculture	Dr.C.Sudhalakshmi Asst. Prof. (SS &AC) CRS, Aliyarnagar	July 2016 - Dec. 2019	To be closed and completion report may be submitted.
2.	NRM/MTP/SAC/2019/001 Status and dynamics of soil nutrients with organic manures in mulberry growing soil	Dr.R.Rajeswari Assistant Professor (SS&AC) Department of Sericulture FC&RI, Mettupalayam.	March 2019 - February 2022	Findings may be given for information and to be continued.
3.	NRM/PKM/SAC/2019/001 Developing Spatial Variability maps of soil physico-chemical properties and available nutrient status and assessment of irrigation water quality of Central and eastern Farms of HC & RI, Periyakulam	Dr.K.M.Sellamuthu Assoc. Professor (SS&AC) Dept. of Natural Resour Management HC&RI, Periyakulam Dr.R.Kumaraperumal, Asst. Professor (SS&AC) Dept. of RS&GIS, TNAU, Coimbatore	June 2019 - May 2021	To be continued
4.	NRM/TVM/ENS/2020/001 Fertility mapping of the farm soils of Oilseeds Research Station of Tindivanam using GIS	Dr. P.C. Prabu Assistant Professor (ENS) Oilseeds Research Station, Tindivanam Dr.R.Kumaraperumal Assistant Professor (SS&AC) Dept of RS &GIS TNAU, Coimbatore	January, 2020 - April 2022	To be continued
Externally funded				
1.	NASF/ACRI/MDU/DSE/2020/R007 Development of electrochemical sensor tool for soil health analysis	Dr. P. Kannan Assistant Professor (SS&AC) Dept. of Soils and Environment AC&RI, Madurai	February 2020 - January 2023	Geocoordinated soil samples may be collected for testing with sensors and to be continued as per programme.

2.	DST/NRM/MDU/AGC/2018/R001 Development of Dry Formulation from Botanicals for Insect Pest Management	Dr.K.Senthil Assistant Professor (Agricultural Chemicals) Dept. of Soils and Environment AC&RI, Madurai	November 2017 - October 2020	To be continued and findings may be proposed for on farm testing of the developed product involving the Agrl. Entomologist.
AICRP Projects				
1.	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	Dr.T.Chitdeshwari Professor (SS&AC) Dr.D.Jegadeeswari Assoc. Professor (SS&AC) Dept. of SS&AC TNAU, Coimbatore	2018-2020	To be continued.
2.	ICAR/WTC/CBE/AGR/2016/R 009 Agri Consortia research platform on water - Groundwater contamination due to geogenic factors and industrial effluents and its impact on food chain.	Dr. M. Elayarajan Associate Professor (SS & AC) Dr. A. Raviraj Professor (SWCE) WTC, TNAU, Coimbatore.	April 2019 - March 2020	To be continued. Findings may be proposed for OFT.
3.	AICRP/NRM/TRY/005 Survey and characterization of ground water of Coastal districts of Tamil Nadu for Irrigation	Dr.P.Balasubramaniam, Professor and Head, Dept. of SS&AC ADAC&RI, Trichy	April 2018 - March 2020	Findings may be given for information and to be continued.
Core Project				
1.	NRM/CBE/SAC/WQI/2018/CP132 Hydrochemical assessment of water quality for irrigation in Periyanaickenpalayam block, Coimbatore district, Tamil Nadu.	Dr.D.Jayanthi Associate Professor (SS&AC) Dept. of SS&AC, Cbe Dr. R.Jagadeeswaran Associate Professor (SS&AC) AC&RI, Kudumianmalai.	Feb 2019 -March 2020	Thematic maps may be prepared and the project is to be completed on 30.9.2020.

5. Department of Agricultural Microbiology

A. Decisions made on Adoption / OFT / Information:

A1&A2 - For Adoption and OFT : Nil

A3 - For information:

1. Recombinant xylose reductase (XR) was cloned and over produced in *E. coli* up to 5mg/100 ml with specific activity of 270 U/mg. Besides, BC Projelly and spray powdered products were also produced.
2. BC nanofibre was fabricated and immobilized with *Lactobacillus acidophilus* 016. Spray dried probiotic BC powder improved viability of the encapsulated cells.
3. Maximum lipid content of 48.59 % produced by yeast was used as feedstock for biodiesel production. Besides, COD, BOD and cyanide content were reduced to 83.52%, 92.11%, and 78.93%, respectively. Lipid yield under shake culture condition was 1.21g/L and under Air Lift Bioreactor, the lipid yield is 2.68g/L .
4. Thermophilic bacteria viz., *Brevibacillus borstelensis* & *Bacillus subtilis* with pH (3-9) & temperature tolerance (50°C) was isolated from Himachal Pradesh (Manikkaran) and has higher the ability to produce cellulase, protease, lipase, esterase, amylase & laccase.
5. Among the 11 phyllosphere yeasts, *Rhodotorula* showed maximum inhibition against *H. oryzae*(50.80 %), *P. oryzae*(46.69 %) and *S. oryzae*(40.26 %). Further, *Rhodotorula*+ *Dirkemia* + *Pseudozyma* +75% RDF increased the grain yield of rice (ASD 16) by 12% under pot culture conditions.

B. Action Plan (ongoing)			
Action plan 1:	Development of microbial formulation for effective management of root knot nematode		
Project leader (s):	Dr. V.Gomathi, Professor and Head Dr. A. Ramalakshmi, Asst. Prof. (Agrl. Micro) Dr. P. Vetrivelkai, Asst. Prof. (Nematology)		
Dept of Agricultural Microbiology, TNAU, Coimbatore	2020-2021	2021-2022	Expected deliverables
	Evaluation of best performing strains along with existing bio-formulation in tomato through seed priming / soil drenching under pot conditions	Testing the microbial consortia against root knot nematode in tomato crop under field conditions	A newer microbial formulation will be developed for effective management of root knot nematode in tomato

C. Research projects and remarks**Research projects****Projects Reviewed**

S. No	Particulars	TNAU, Coimbatore	AC and RI, Killikulam	AC and RI, Vazhavachanur	Total
1	Action plan 2019-2021	1	-	-	1
2	University research projects	-	-	2	2
3	Core research projects	1	-	-	1
4	External funded scheme	3	3		6
Total					10

Ongoing URPs/Core/AICRPs / Externally Funded Projects

S. No.	Project No. and Title	Project leader(s) / Co-Project Leader(s)	Duration	Remarks
UNIVERSITY RESEARCH PROJECTS				
1	NRM/CBE/AGM/2018/CP016 Enzymatic Production of xylitol from corncob biomass: a cost economic approach for biorefineries	U.Sivakumar, Professor (AGM), TNAU, Coimbatore	2019-2021	Findings may be given for information and to be continued for completing xylitol yield optimization
2	NRM/VVR/AGM/2019/001 Isolation and identification of micronutrient solubilising elite microorganism from soil ecosystem	Dr. E. Jamuna Asst. Prof. (Agrl. Microbiology) Agricultural College and Research Institute, Vazhavachanur	2019-2022	Characterization of initial soil sample for available micronutrients is to be completed at the earliest. Soil scientist is to be included as co project leader. Project to be continued

EXTERNALLY FUNDED PROJECTS				
3	CIRCOT/NRM/CBE/AGM/2016/R020 ICAR – CIRCOT, Mumbai under CR-Natural Fibres entitled "ICAR – Consort. Res. Platform on Natural Fibres: Production and characterization of bacterial cellulose from natural fibre biomass" (C31 WL)	U.Sivakumar Professor (AGM), TNAU, Coimbatore	2016-2020	<ul style="list-style-type: none"> • Project to be completed and completion report may be submitted • Up scaling of technology through commercialization may be taken with Director (ABD)
4	BT/PR18134/BIC/101/795/2016 dated 10.07.2017 Novel Biocatalysts for Biomass Valorization: Functional analysis and Engineering of Glycosyl Hydrolases and Laccases from thermal springs and <i>Haloferaxvolcanii</i>	U.Sivakumar (Mentor) Dr.R.Priyadharshini (Women Scientist &PI)	2017-2020	Findings may be given for information and project to be continued
5	No.BT/PR8280/PBD/26/382/2013 Biodiesel production: Sago processing industrial wastewater as feedstock's for the microbial production of oil and derived co-products	U.Sivakumar, Professor (AGM) K. Kumutha, Professor (AGM) D. Ramesh, Associate professor	2013-2019	Up scaling of technology through commercialization may be taken with Director (ABD)

6	DBT/AGM/KKM/SAC /2018/T002 "Raising the livelihood of women farmers in selected villages of Thoothukudi district through development of <i>Azolla</i> bio-village"	B.JeberlinPrabina Associate Prof. (AGM) Dept. of SS & AC AC & RI, Killikulam M.Hemalatha Associate Prof. (Agronomy) S. Merina Premkumari Asst. Prof. (Biotechnology)	2018-2021	Works may be carried out as per the programme and to be completed in time
7	DST/NRM/KKM/AG M/2018/R002 Development of electro spun fibrenano-matrix to encapsulate beneficial microbes for smart delivery and sustainable productivity	Dr.K.G.Sabarinathan Asst.Prof. (Agrl.Micro), AC & RI, Killikulam Dr.K.S.Subramaniyan Director of Research Dr.R.Kannan, Professor and Head Dr.M.Gomathy, Asst Prof. (Agrl. Micro.)	09.08.2018 to 08.08.2021	The project to be continued
8	DBT/AGM/KKM/SAC/2018/RO11 The Spatio temporal documentation of the phyllosphere microorganisms in different agricultural ecosystems through foldscope	Dr.M.Gomathy Asst. Prof. (Agrl. Micro), AC & RI, Killikulam Dr.K.S.Subramaniyan Director of Research Dr.K.G.Sabarinathan Asst.Prof. (Agrl.Micro.),	2018-2019	The completion report may be submitted and findings may be given for information

6. Agro Climate Research Centre

Agricultural Meteorology

A. Decisions made on Adoption / OFT / Information:

A1. For Adoption

Theme 1: Weather forecasting and Agro advisory

- Studies on TNAU-AAS web cum Mobile application in blackgram under three different eco systems viz., irrigated (ACRC, Coimbatore), rice fallow (TRRI, Aduthurai) and rainfed (ARS, Kovilpatti) revealed the major advantages of the TNAU-AAS App. Each farmer was receiving 10 to 12 advisories, specific to their crop and stage while the mKisan portal issued only one advisory for the entire cropping period. The partial budget analysis indicated that about Rs. 2800, Rs. 2300 and Rs. 1900/- were gained by the irrigated, rice fallow and rainfed black gram farmers who had registered with TNAU – AAS web cum Mobile App. In view of the benefits realized by the farmers, the “TNAU – AAS web cum Mobile App” may be considered for adoption.

Theme 2: Basic and applied meteorological studies

- Studies on the yield gap assessment of cotton had categorized the districts of Tamil Nadu in to different crop efficient zones. About 15 districts viz., Vellore, Tiruvannamalai, Salem, Namakkal, Dharmapuri, Sivaganga, Tirunelveli, Theni, Dindigul, Tiruvarur, Karur, Perambalur, Ariyalur, Pudukkottai and Tiruppur were categorized as Most Efficient Cropping Zones (MECZ) and 3 districts viz., Thoothukudi, Virudhunagar and Madurai as Yield Efficient Cropping Zones (YECZ) for cotton. Similarly, 9 districts viz., Kancheepuram, Tiruvallur, Cuddalore, Villupuram, The Nilgiris, Kanyakumari, Erode, Nagapattinam and Thanjavur were categorized under Spread Efficient Cropping Zone (SECZ) because of low RSI. Tiruchirapalli and Ramanathapuram districts have less RYI and RSI indicating non Efficient Cropping Zones (NECZ) for cotton crop.
- In another study undertaken in Sugarcane, it was revealed that only four districts viz., Cuddalore, Erode, Namakkal, Viluppuram were classified as Most Efficient Cropping Zone (MCEZ) and Tiruvarur, Thanjavur, Pudukkottai,

Kancheepuram, Coimbatore were coming under Yield Efficient Cropping Zone (YECZ) for Sugarcane. The other districts viz., Karur, Krishnagiri, Madurai, Nagappattinam, Salem, Sivaganaga, Theni, Tiruppur, Thoothukodi, Tiruchirappalli, Tirunelveli, Vellore, and Virudhunagar though possessed more area but recorded low productivity and were grouped under "Spread Efficient Cropping Zone (SECZ)". Ariyalur, Perambalur, Thiruvallur and Tiruvannamalai districts having both less area and productivity were classified under Non Efficient Cropping Zone (NECZ) for sugarcane.

A2. For Information

Theme 1: Weather forecast and Agro advisory

- In GOI - GKMS scheme, analysis of IMD's district level rainfall forecast indicated that, inclusion of Western Ghats in Coimbatore gives more unrealistic alarms to other plains of Coimbatore district. The correctness of rainfall forecast was <50% in all districts during past three years, though it was slightly improved during 2019-20. Separate forecast from IMD for Coimbatore plains and Valparai is needed and the same has been informed to IMD. On the other hand, the verification and error structure analysis of IMD's rainfall forecast indicated higher usability of forecast at Tirunelveli (48-59%), Thoothukudi (70-78%), Virudhunagar (68-78%) and Pechiparai (70%). The forecast of other parameters viz., minimum temperature, maximum temperature, relative humidity and cloud cover, were perfectly (>80%) matched with actual. The wind speed forecast had lesser usability during 2019-20.
- In Tamil Nadu, about 12.34 lakh farmers had registered for SMS advisory in mKisan portal. Awareness creation on Agro Advisory Services and farmers' registration for receiving SMS advisory through TNAU AAS is being taken up continuously.
- Weather based agro advisories issued by GKMS-AMFU scheme has increased the maize yield from 4000 kg/ha (non AAS) to 6250 kg/ha (AAS farmers). The income of Agro Advisory Service adopted farmers had increased to the tune of Rs. 5000/- per ha of Cotton, Rs. 5000/- ha in rice (Kovilpatti- AMFU). Farmers

opined that the agro advisory from ARS, Kovilpatti had minimized the cost of cultivation up to 15-20 percent.

- URP on medium range weather forecast accuracy improvement inferred that in Weather Research Forecast(WRF)Model, the forecast usability of Kessler microphysics option was varying from 84 to 91 per cent for Summer, 60 to 78 per cent for South West Monsoon, 60 to 80 per cent for North East Monsoon and 98 to 100 for Winter seasons. The forecast usability was decreasing with increasing lead time. In particular, the forecast skill is decreased from correct to usable and usable to unusable with increasing lead time.
- URP on seasonal weather forecast accuracy improvement inferred that incorporation of Indian Ocean Dipole (IOD) index in the Australian Rainman Software model, in addition to El Nino Southern Oscillation (ENSO) index and SST had improved the accuracy of NEM seasonal forecast output and well matched with the observed values except six districts in Tamil Nadu.
- In continuation of previous years' astrometeorological study on rainfall and wind speed events, a study undertaken with 3358 eye points of Bay of Bengal's cyclone over 27 years (1990 – 2016) indicated that, the planets viz., Mercury, Venus, Moon, Saturn, Uranus and Neptune had higher number of cyclone influencing capability under the azimuth range of 61 – 120 degree and 240 – 300 degree. Among the planets, the active state of Mercury and Venus, the negative state of Sun had higher influence on the Cyclone events than other planets. Saturn with Uranus and Neptune had high influence on high intensity cyclones such as Very Severe Cyclone to Super Cyclone system.

Theme 2: Basic and applied meteorology

- According to Moisture Adequacy Index (MAI) analysis done in GOI – GKMS scheme, it was found that there was mild to moderate drought in all the districts of Tamil Nadu during SWM 2019, which was nullified during NEM 2019 after the receipt of good rainfall.
- From the research studies on microclimate modification in rice, it was revealed that closer plant spacing had enhanced surface soil, leaf and water temperatures in early hours, soil temperature at 30 cm depth and relative humidity (all time of

observations) than wider spacing levels. Surface soil temperature, water and leaf temperatures during late hours (10.00, 14.00 and 18.00 hrs), soil temperature (15 cm depth), canopy temperature and all leaf gas exchange parameters (photosynthetic rate, transpiration rate, stomatal conductance and chlorophyll index) were observed higher in wider spacing levels.

- A doctoral research on the effect of climate variability on the productivity of chillies revealed that under irrigated condition, delayed planting by 2nd week of Nov. for TNAU chilli hybrid CO1 was found to have beneficial effect during projected climate change. Early planting by 3rd week of October has positive effect on its yield. Enhanced N dose up to 125 per cent had assisted all the cultivars, both under irrigated and rainfed conditions.
- In a research on artificial rain process, it was observed that the foliar spray of *P. fluorescens* on tomato leaves was found to exhibit higher ice nucleation and retain higher RWC and stomatal conductance while lower leaf temperature while PPFM was found to improve the drought tolerance of the plants by maintaining physiological activity under severe drought conditions. *P. fluorescens* possesses ice nucleation activities that facilitate retention of leaf moisture and lower temperature which may of practical significance to develop microbe mediated artificial rain. It was also observed that the use of PPFM spray assisted in drought tolerance of the plants by the stomatal regulation but it didn't have the ice nucleation activity.

Theme 3: Climate change and crop weather model

- Rice, maize and groundnut yield forecast study under GOI sponsored FASAL scheme at ACRC, Coimbatore confirmed that the Crop Simulation Model (CSM) performed better (-7 to 8% deviation) than the Statistical model (-10 to 24 deviation). Among the yield forecast generated between F2 (flowering stage) and F3 (pre harvest stage), the F2 stage gave more accurate estimation of rice, maize and groundnut yield than F3 stage. Hence, the CSM models could be used for yield estimation for the policy level planning.
- GOI sponsored FASAL scheme experiment at TRRI, Aduthurai recorded higher yield in June 2nd week sowing with 100 per cent RDF for ADT 53 during *kharif*

season. Similarly, October 2nd week sown ADT 46 rice with 125 per cent RDF recorded higher yield during *rabi season*.

- Though the increased drought frequency is alarming outcome of climate change impact as revealed through a doctoral research under DST sponsored BRIFS scheme, it was also found as a positive influence that in future, under RCP 4.5 and RCP 8.5 scenarios, rainfall was expected to increase in the mid and end century due to increased hydrological activity, which would reduce the drought severity in most parts of Tamil Nadu. Observed drought frequency is higher in southwest monsoon season compared to northeast monsoon season over Tamil Nadu.
- A doctoral research on the impact of climate change on groundnut and sugarcane productivity indicated that the maximum and minimum temperatures over southern India were projected to increase irrespective of the models and scenarios studied. The magnitude of increase in minimum temperature was higher than that of maximum temperature over Tamil Nadu. Compared to northeast monsoon season, the maximum and minimum temperatures were projected to be higher during southwest monsoon season under both the scenarios. A noticeable increase in rainfall during NEM and decrease in rainfall during SWM are projected for near, mid and end century in both RCP 4.5 and RCP 8.5. Under rainfed condition, the groundnut yield was found to be deviating negatively under RCP 4.5 and RCP 8.5 scenarios in mid and end period of the 21st century while the yield was positively deviating in nearest time period (2011-2040).
- Under DST – BRIFS scheme, the study on the impact of climate change revealed that irrespective of the models, scenarios and time slices, the maximum and minimum temperatures are projected to increase with seasonal variations. The projected increase in maximum and minimum temperature for Coimbatore is 0.2 to 4.1°C and 0.3 to 5.3 °C and for Thanjavur is 0.3 to 4.6°C and 0.2 to 5.2 °C respectively. Rainfall is projected to vary between a decrease of -15 to an increase of +73.1 per cent for Coimbatore and a decrease of -15.3 to an increase of +80.7 per cent for Thanjavur.

- The DSSAT crop simulation model results for Thanjavur and Tiruvannamalai districts for rice and groundnut revealed no definite trend in the yield of the crops. As the level of CO₂ enrichment got increased the yield of the crops also increased compared to normal level of CO₂(330 ppm). The future yield of maize under both rainfed and irrigated conditions was expected to be impacted by the projected climate. Yield had both positive and negative deviations ranging from -21.9 to +26.7 per cent for rainfed and -42.0 to +33 per cent for irrigated maize. In case of rice, the consistent decrease was projected (-3.4 to -39.2 per cent) with the advancement of time.
- A Master's research under DST – BRIFS scheme on the impact of elevated temperature (+2°C) and moisture stress (-40%) on organic manure decomposition revealed that both the stresses had slowed down the decomposition process and nutrient release from FYM and maize crop residue. The elevated temperature stress could be nullified by providing excess moisture and adding of decomposing microbes. Necessary soil moisture conservation strategies have to be designed for drought with elevated temperature, where the decomposition of organic matter would be hindered. The maize stover applied soil had higher available K than FYM applied soil even under elevated temperature. In K deficient soil or shortage of K fertilizer, maize stover residue might be an option to sustain the K supply to the crop production.
- The results of another Master's research on elevated temperature and moisture stress on weeds revealed that the Horse purslane and Parthenium exposed to elevated temperature of +4°C, produced more growth and induced early germination and flowering, whereas, if these weeds were subjected to moisture stress, it led to negative impact on growth and induced the early flowering and also increased the seed production potential of the weeds. The efficacy of post emergence herbicides on these weeds was increased with elevated temperature and excess moisture condition.
- The sugarcane yield would be higher in TN due to high variability in rainfall - compared to other states in Southern India. The cane yield declined by 1.0 to 1.19% - near century and 1.9 to 3.5% - mid-century with RCP 4.5 scenario under dynamical downscaling of CCSM-4 model. Sucrose yield -13.2 t/ha and the variation in sucrose is very minimum among the study region for the baseline period. In future, sugar yield is expected to decline due to increase in temperature, which has negative impact on sugar accumulation. Early planting

(Dec) - favoured the cane productivity compared to late planting ((Apr-Jun). The predicted increase in cane yield varied from 8 to 10% for statistically downscaled climate and 14 to 33% for dynamically downscaled climate under Dec planting.

B. Action Plan (ongoing)			
Theme 2: Basic and applied meteorology			
1.	DCM/CBE/AMT/RIC/2019/001 (Old Sl.No.5 in Theme 2) Climate Smart Organic Farming in Rice	Dr. SP. Ramanathan, P&H, ACRC Dr. E. Somasundaram, P&H, SOA Dr. K. Ganesan, Asst. Prof, SOA Dr. S. Kokilavani, Asst. Prof, ACRC Dr. C. Uma Maheswari, Assoc. Prof, TRRI, Aduthurai Dr. M. Raju, Assoc. Prof, TRRI Dr. E. Subramanian, Asst. Prof, AC&RI, Madurai. Dr. P. Kannan, Asst. Prof, AC&RI, Madurai Dr. V. Muralidharan, Prof., RRS, Tirur Dr. S.R. Shreerangaswami, Asst. Prof, RRS, Ambasamudram. Dr. K.G. Sabarinathan, Asst. Prof, AC & RI, KKM	2019 – 2021 To be continued Report presented in Rice Crop Scientists' Meet
2.	DCM/CBE/AMT/2020/001 (Old Sl.No.6 in Theme 2) Impact of Micro-Climate modification on the performance of crossbred animals.	Dr. N. Maragatham, Prof. (Agronomy), ACRC Dr. Thirunavukkarasu Asst. Prof. (VAS), Dept. of Agronomy	2019 – 2021 To be discontinued

Theme 3: Climate change and crop weather model			
1	DCM/CBE/AMT/MLT/2019/001 (Old SI.No.5 in Theme 3) Studies on the climate variability of millets through crop simulation model	Dr. N. K. Sathyamoorthy Assoc. Prof. (Agronomy), ACRC,	2019 – 2021 To be continued
6.	Action Plan (Old SI.No.6 in Theme 3) Effect of climate variability on cereals (Rice & Maize) through crop simulation model	Dr. N. K. Sathyamoorthy Assoc. Prof. (Agronomy), ACRC.	2019 – 2020 To be concluded

New Action Plans – 2020-2022			
S.No	Project Title	Project Teams	
Theme 1 – Weather forecasting and agro advisory services			
1.	Developing Forewarning model for major pest and disease Pest and disease are the major biological threat to crop production. Weather is the major factor for the epidemic and outbreak of pest and disease incidence. Recent past, due to changing climate and shift in cropping pattern, minor pest and disease become major and causes severe damages. Based on the weather – pest – host interaction studies, pest and disease outbreak could be predicted in advance and necessary preparedness may be ensured. In this context, development of forewarning model for recently emerged Fall Army Worm in maize and Yellow Mosaic Virus in pulses have been proposed as action plan.	1. Agro Climate Research Centre, DCM, TNAU 2. Dept. of Agril. Entomology 3. Dept. of Plant Pathology, CPPS, 4. Dept. of Physical Sciences, TNAU, Coimbatore	

2.	<p>Improving agro advisory services</p> <p>ACRChas developed theAutomated Agro Advisory Services (AAS) software for dissemination of weather based agro advisory for 108 crops under 54 weather scenarios and 6 crop stages which reach directly to the farmers’ through mobile. It is planned to add perennial crops, livestock and additional weather scenarios in the existing app. The soil characteristics will also be added as an additional module for improving the holistic agro advisory to the farmers.</p>	<p>Dr. SP. Ramanathan Professor and Head & Dr. Ga. Dheebakaran Asst. Prof (Agronomy) Agro Climate Research Centre, TNAU</p>
Theme 2 – Climate change and crop weather modelling		
5	<p>Quantifying the Oxygen and CO₂ flux from the Bamboo plantation in TNAU</p> <p>An ‘Oxygen park’ with ‘Beema’ bamboo has been established at TNAU. It is stated that one mature Beema bamboo after four years sequesters more than 400 kgs of CO₂ annually from the surrounding areas and acts as the best carbon sink for CO₂ emission. The real impact of the Oxygen park could be ascertained by continuous monitoring the biomass production, microclimate and GHC emission.</p>	<p>Agro Climate Research Centre, DCM & Dept of ENS, NRM, TNAU.</p>

C. Research projects and remarks

Research projects

Projects reviewed

Theme-wise Research Projects

Theme	URP	Externally funded Projects				Students' Research	Total
		AICRP	GOI	GoTN	Private		
1. Weather forecasting and Agro Advisory	4	-	5	-	-	2	11
2. Basic and applied meteorology	2	-	-	-	-	3	5
3. Climate change & Crop models	2	-	3	-	-	7	12
4. Remote sensing & GIS		-	-	-	-	1	1
Total	8	-	8	-	-	13	29

Crop-wise Research Projects

Type of project	URP	AICRP	GOI	GoTN	PVT	Students' Research	Total
Rice	1		2*			1	4
Millets	2		1*			1	4
Pulses	1						1
Oil seeds	-		1*			1	2
Sugarcane	-					1	1
Cotton	-					1	1
Horticulture	-					2	2
Non crop**	4		6	0	0	6	16
Total	8		10*	0	0	13	31

* Multi crop projects; ** Weather forecasting and agro advisory services

A. University Research Projects

S.No	Project Title	Project Leader(s)	Period & Status
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 Asst. Prof (Agronomy), ACRC Dr. SP. Ramanathan, Prof. and Head, Dr. S. Kokilavani Asst. Prof (Agrl. Met.), ACRC	2019 – 2021 To be continued
2.	DCM/CBE/AMT/2019/002 Developing TNAU's village level medium range forecast with higher accuracy.	Dr. Ga. Dheebakaran Asst. Prof (Agronomy), ACRC Dr. K.P. Rangunath Asst. Prof. (SAC), RS & GIS	2019 – 2021 To be continued
3	DCM/CBE/AMT/RIC/2020/002 Enhancing the predictability of location specific seasonal rainfall for Tamil Nadu.	Dr. S. Kokilavani Asst. Prof (Agrl. Met.), ACRC Dr. V. Geethalakshmi, Director, Crop Management	2019 – 2021 To be continued

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. Sathiya Bama Assoc. Prof. (SS&AC) Dr. M. Raju, Assoc. Prof.(Agronomy) TRRI, Aduthurai	Apr. 2014 to Mar. 2021 To be continued
2.	IMD/DCM/CBE/ACR/2014/R006 GOI – IMD – Agmet – GraminKrishiMausamSewa (GKMS) - Weather based agro advisory services for farm decision making for western zone of TN.	Dr. SP. Ramanathan Prof. and Head Dr. Ga. Dheebakaran Asst. Prof. (Agronomy) ACRC, TNAU, Cbe -3	Apr. 2014 to Mar. 2021 To be continued
3.	IMD/DCM/KPT/AGR/1995/R001 GOI – IMD - Agromet – GraminKrishiMausamSewa (GKMS) – Rural Agro meteorological Advisory Service for Southern zone	Dr. E. Murugan Prof. and Head Dr. B. Arthirani Asst. Prof. (Agrl. Met) ARS, Kovilpatti	Apr. 2014 to Mar. 2021 To be continued
4.	GOI/DCM/OTY/ACRC/2016/R003 Agrometeorology Field Unit (AMFU) for Agrometeorological Advisory Services (GKMS – GraminKrishiMausamSewa) under IMD, GOI at HRS, Ooty	Dr. D. Keisar Lourdusamy, Assoc. Prof. and Head Dr.P.Balasubramanian Teaching Asst. (Agron) HRS, Ooty.	Mar. 2014 to Mar. 2021 To be continued
5.	GOI/DCM/PPI/ACRC/2016/R001 Agro meteorology Field Unit (AMFU) for Agro meteorological Advisory Services (GKMS – GraminKrishiMausamSewa) under IMD, GOI at HRS, Pechiparai.	Dr. A. Jaya Jasmine Prof. and Head Dr. P. Rajarathinam Asst. Prof. (Agronomy)	Mar. 2014 to Mar. 2021 To be continued

II	Theme 2: Climate change & crop modeling		
6.	IMD/DCM/ADT/AGR/2011/R001 Forecasting Agricultural output using Space, Agrometeorology and Land based observations (FASAL) to Agro Advisory Services for Cauvery Delta Zone – a linked project of AMFU for AAS (GKMS) under IMD at TRRI, Aduthurai.	Dr. M. Raju, Assoc. Prof.(Agronomy) Dr. K. Sathiyabama, Assoc. Prof. (SS&AC) TRRI, Aduthurai	Jan. 2011 Mar. 2021 To be continued
7.	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 Director, DCM Dr. Ga. Dheebakaran Asst. Prof. (Agronomy), ACRC, TNAU, Coimbatore	Jan. 2011 Mar. 2021 To be continued
8.	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 Director, DCM Dr. Ga. Dheebakaran Asst. Prof. (Agronomy), Dr. S. Kokilavani, Asst. Prof. (Agr. Met), ACRC, TNAU	Nov. 2018 - Mar. 2021 To be continued

7. Department of Agronomy

AICRP-IFS & AICRP- WEED MANAGEMENT

A. Decisions made on Adoption / OFT / Information:

Decisions made on Adoption / OFT : Nil

For Information

- In an experiment on **Sustainable Resource Management for Climate Smart IFS** conducted at **TNAU, Coimbatore**, Integrated Farming System model involving components *viz.*, Crop + Horticulture + Dairy + Goat + Poultry + Kitchen garden + Boundary planting + Vermicompost + Value addition in an area of 1.0 ha recorded an overall gross return of Rs. 9,05,451/- and net return of Rs. 3,63,122/- with a B:C ratio of 1.59. Cropping system contributed 36.96 % to the total net returns followed by goat (18.02%), dairy (15.51 %) and the rest by other components. Employment generation from the IFS model was 551 man days. By residue recycling the total quantity of nutrient addition achieved was 201 kg N, 87 kg P and 131 kg K/ha.
- In an experiment on **Sustainable Resource Management for Climate Smart IFS** conducted at **SWMRI, Thanjavur**, Integrated Farming system model involving components *viz.*, Crop + Horticulture + Dairy + Fishery + Poultry + Vermicompost in an area of 0.8 ha recorded a total net return was Rs.1,78,529/year. The maximum net return of Rs.63,640/ year was obtained from the cropping system followed by dairy unit (Rs.39,494/year) and fishery unit (Rs.27,302/year) from 0.8 ha. A major share of 35.6% was contributed by cropping system to the net income followed by dairy unit (22.1%) and fishery unit (15.3%). Employment generation from the IFS model was 402.5 man days. 30.7 % of inputs generated from the IFS model was recycled within the system

B. Action Plan**Action plan 1: Agricultural and horticultural crops based integrated organic farming system model for small and marginal farmers of Tamil Nadu**

Activity	Name of the scientist and centre	2020-2021	Deliverables/ expected outcome
To identify the best integrated organic farming system model for Tamil Nadu Treatments T1: Control T2: Field Crops (Green manure-Rice-Blackgram)+ fish + Japanese quail T3: Vegetable crops (Tomato-Green manure-Pumpkin) + fish + duck T4: Leaf Banana + fish + Desi chicken Kitchen garden: Amaranthus, Coriander, Fenugreek, Mint, Gourds, Radish, Palak Border Planting: Papaya, Moringa	Department of Agronomy, TNAU, Coimbatore Dr.K.R.Latha Professor (Agronomy) & Chief Agronomist, (AICRP – IFS), TNAU, Coimbatore Dr. N. Thavaprakash, Assoc. Prof. (Agronomy), CFU, Department of Agronomy , TNAU, Coimbatore Dr.S.P.Sangeetha, Assistant Professor (Agronomy), TNAU, Coimbatore Dr.T.Saraswathi Professor (Horticulture) TNAU, Coimbatore	<ul style="list-style-type: none">• Confirmative trial• Data processing• Report preparation	The suitable integrated organic farming system model will be identified for small and marginal farmers of Tamil Nadu

Action Plan 2. Validation of GHG emission in IFS model for Crop Component from real time field data				
Activity	Name of the scientist and centre	2020-2021	2021-2022	Deliverables/ expected outcome
<p>To study the GHG emission from crop component in IFS model</p> <p>Treatments</p> <p>A. Cropping Systems</p> <p>1. Cowpea (G) - Ragi - G.Manure</p> <p>2. Maize - Sunflower - G.Manure</p> <p>3. Proso millet - Chillies - G.Manure</p> <p>4. Pearl millet - Cotton - G.Manure</p> <p>5. Perennial fodder grass and <i>Desmanthus</i></p> <p>B. Sample Collection</p> <p>Seasons- (kharif, rabi and summer)</p>	<p>Centre : Dept. of Agronomy</p> <p>Scientists Involved</p> <p>Dr.K.R.Latha Prof. (Agron.), TNAU, Coimbatore</p> <p>Dr.A.Renukadevi Asst. Prof. (SS&AC), TNAU, Coimbatore</p> <p>Dr.S. Kokilavani Asst. Prof. Agri. Meteorology, TNAU, Coimbatore</p> <p>Dr.S.P.Sangeetha Asst. Prof.(Agron) TNAU, Coimbatore</p>	<ul style="list-style-type: none"> • Sowing of crops at different seasons • Collection of gases and estimation in Gas Chromatography 	<ul style="list-style-type: none"> • Sowing of crops at different seasons • Collection of gases and estimation in Gas Chromatography 	Quantification of green house gases from different cropping systems in IFS model

C. Research projects and remarks

Research projects

List of Research Projects during 2020 - 2021

	Centre	URP	AICRP	EFP	TNAU Core project (Phase II)	Total
Agronomy						
AICRP-IFS	Department of Agronomy, Coimbatore	-	3	-	1	4
	SWMRI, Thanjavur	-	1	-		1
	ARS, Bhavanisagar	-	3	-		3
	TCRS, Yethapur	-	3	-		3
AICRP-Weed Management	Department of Agronomy, Coimbatore	-	1	-	1	2

Ongoing URPs / AICRPs / Externally Funded Projects/Core Projects

AICRP-IFS, Dept. of Agronomy		
Sl. No.	Project No. and Title	Remarks
1.	AICRP/DCM - CBE – AGR/001 Sustainable resource management for climate smart IFS (June 2017- May 2022) Dr.K.R.Latha Professor (Agronomy) & Chief Agronomist (AICRP – IFS), TNAU, Coimbatore	<ul style="list-style-type: none"> The project may be continued
2.	AICRP/DCM - CBE – AGR/001 Expt. 1 a. - Identification of cropping system module for different farming system modules (June 2017- May 2022) Dr.S.P.Sangeetha, Assistant Professor (Agronomy), TNAU, Coimbatore	<ul style="list-style-type: none"> The project may be continued
3.	AICRP/DCM - CBE – AGR/001 Carbon crediting and GHG emission in IFS model (June 2017- May 2022) Dr.A.Renukadevi, Assistant Professor (SS & AC), TNAU, Coimbatore	<ul style="list-style-type: none"> The project may be continued

4.	<p>AICRP/DCM - CBE – AGR/001 Integrated farming system for marginal farmers of Cauvery New Delta Zone (August 2016 – August 2019) Dr. S. Porpavai, Professor (Agronomy) and Head, SWMRI, Thanjavur</p>	<ul style="list-style-type: none"> • The project may be continued
5.	<p>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 (April 2017 to March 2020) Dr.N.Satheeskumar, Assistant Professor (Agronomy), ARS, Bhavanisagar</p>	<ul style="list-style-type: none"> • The project may be continued
6.	<p>AICRP/DCM - CBE – AGR/001 OFR Experiment II- Diversification of Existing Farming Systems under Marginal household conditions (April 2017 to March 2020) Dr.N.Satheeskumar, Assistant Professor (Agronomy), ARS, Bhavanisagar</p>	<ul style="list-style-type: none"> • The project may be continued
7.	<p>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 (April 2017 to March 2020) Dr.N.Satheeskumar, Assistant Professor (Agronomy), ARS, Bhavanisagar</p>	<ul style="list-style-type: none"> • The project may be continued
8.	<p>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 (April 2017 to March 2022) Dr. D. Ravisankar, OFR Agronomist and Teaching Assistant, TCRS, Yethapur</p>	<ul style="list-style-type: none"> • The project may be continued
9.	<p>AICRP/DCM - CBE – AGR/001 OFR 2: Diversification of existing farming systems under marginal household conditions. (April 2017 to March 2020) Dr. D. Ravisankar, OFR Agronomist and Teaching Assistant , TCRS, Yethapur</p>	<ul style="list-style-type: none"> • The project may be continued
10.	<p>AICRP/DCM - CBE – AGR/001 OFR 3: On-farm evaluation of farming system modules for improving profitability and livelihood of small and marginal farmers (April 2017 to March 2020) Dr. D. Ravisankar, OFR Agronomist and Teaching Assistant , TCRS, Yethapur</p>	<ul style="list-style-type: none"> • The project may be continued

11.	No.DR/P2/ICAR/AICRP on WM/ASO/2019/ of the DR, TNAU, Cbe /Dt.9.4.2019 ICAR- AICRP on Weed Management Persistence and dissipation pattern of Oxyfluorfen in soil Dr. C. Bharathi, Assistant Professor (SS&AC), Department of Agronomy, TNAU, Coimbatore.	<ul style="list-style-type: none"> The project may be closed
(TNAU Core project – Phase II)		
1.	DCM/CBE/AGR/IFS/2018/CP060 GOTAG/GEN/2018/R001 Integration of Rice + duck farming system in irrigated transplanted rice under organic farming June 2018 to Sep.2021 Dr. N. Thavaprakash, Assoc. Prof. (Agronomy), CFU, Department of Agronomy , TNAU, Coimbatore.	<ul style="list-style-type: none"> The project to be continued and completed on 30.9.2020
2.	DCMCBE/AGR/WEE/2018/CP056 'In vitro establishment and improving the absorption and translocation of foliar applied herbicide in Cyperus rotundus' Dec 2018 - Sep 2020 Dr.C.R.Chinnamuthu, Professor and Head, Department of Agronomy, TNAU, Coimbatore.	<ul style="list-style-type: none"> The project to be continued and completed on 30.9.2020.
3.	DCMCBE/AGR/WEE/2018/CP058 Eco friendly Sustainable Parthenium Management Dr. P. Murali Arthanari, Associate Professor (Agronomy), Department of Agronomy, TNAU, Coimbatore.	<ul style="list-style-type: none"> The project may be closed. Completion report may be submitted.

8. Department of Agricultural Entomology

A. Decisions made on Adoption / OFT / Information:

A1. OFT

OFT : 1.Pollination of moringa with *Apis cerana indica* for improved crop productivity

Treatments proposed:

T1: 4 bee colonies / acre

T2: 2 bee colonies /acre

T3: Control (open pollination - no bee colonies)

T4: Pollinator exclusion (sleeve cages for 10 inflorescences per tree)

For individual treatment minimum one km isolation distance should maintained

Design: RBD, Replication: Five (one tree per replication)

Observations to be recorded:

1. No. of fruits/ tree
2. Fruit length (cm)
3. Fruit girth (cm)
4. Individual fruit weight
5. Total fruit weight
6. Bee visitation rate/5 inflorescence/tree/3 min.
7. Colony growth parameters namely brood area and honey store (cm²)
8. Diversity of pollinators in moringa

Participating Centres:

- | | | | |
|------|----------------------|---|---|
| i. | AC&RI, Coimbatore | : | Dr.P.A.Saravanan, Asst. Prof (Entomology) |
| ii. | AC & RI, Madurai | : | Dr. K. Suresh, Asst. Prof. (Entomology) |
| iii. | HC & RI, Periyakulam | : | Dr.S. Irulandi, Asst. Prof. (Entomology) |
| iv. | AC&RI, Killikulam | : | Dr. M.R. Srinivasan, Prof and Head,
Entomology, Killikulam |

B. For Information

Pesticide dissipation and residue studies

- Dissipation of chlorantraniliprole residues with half-life period of 2.21, 1.62 and 1.26 days respectively in okra, chilli and tomato and safe waiting period of one day was suggested for consumption.
- Tamarind + lemon juice (2%) was the best decontaminant solution for removing chlorantraniliprole residue in okra, chilli and tomato fruits.
- Acetamiprid and imidacloprid residues recorded in both pollen (1 no./9) & honey (2 nos./11) and hence to be avoided in crops being managed with bee colonies during full bloom

Stingless bee biology and colony management

- The total developmental period of stingless bee queen of *Tetragonula iridipennis* is 59 ± 3 days
- Among the different enemies of stingless bees, the pollen mite (62.6%) and phorid flies (49.32%) causes significant damage to stingless bee colonies

B. Action plan (2020-2021) Agricultural Entomology			
Action Plan No. 1	Diversity, multiplication and utilization of stingless bees		
Theme Leader	Dr. P.A. Saravanan, Asst. Professor (Agrl. Entomology), AC&RI, Coimbatore		
Activity	Name of the scientist(s) and centre	Observations to be recorded	Deliverables/ expected outcome
Standardization of queen rearing in stingless bees Promotion of <i>Tetragonula laeviceps</i>	Dr. P.A.Saravanan, Entomology, TNAU, Coimbatore	<ul style="list-style-type: none"> • Number of queen cells, gynes produced in divided stingless bee colonies • Duration for new colony development • Colony growth parameters of <i>T. laeviceps</i> 	Colony multiplication method for stingless bees
Action Plan No. 2	Potential of stingless bees in mango pollination		
Theme Leader	Dr.P.A.Saravanan, Asst. Professor (Entomology), TNAU, Coimbatore		
Activity	Name of the scientist(s) and centre	Observations to be recorded	Deliverables/ expected outcome
<ul style="list-style-type: none"> • Pollination efficiency of stingless bees in mango ecosystem to be evaluated • Number of colonies per acre to be standardized Duration: 2020-2021 and 2021-2022	TNAU, Coimbatore Dr.P.A.Saravanan KVK, Pappalapatti Dr.P.Shanmugam HC&RI, Periyakulam Dr. Irulandi AC&RI, Killikulam Dr. G. Preetha	<ul style="list-style-type: none"> • Peak foraging activity • No. of fruits/panicle • Fruit length (cm) • Fruit girth (cm) • Individual fruit weight • Bee visitation rate/5 inflorescence/tree/3 min. • Fruit yield /tree 	Protocol for enhancing the mango yield through managed bee pollination with stingless bees

C. Research projects and remarks							
Crop	Centre		URP	Core	AICRP	Ext. funded project/students project	Total
Non crops	Coimbatore	Entomology	4	-	1	1	6
		Pathology	2	1	1	5	9
		Nematology	-	-	-	2	2
	Madurai	Entomology	1	-	-	-	1
	Trichy	Entomology	-	1	-	-	1
	Killikulam	Entomology	-	1			1
		Pathology	1	-	-	1	2
	Kudumiyamalai	Pathology	1	-	-	-	1
		Total	9	3	2	9	23

Remarks on the ongoing University Research Projects

1. AGRICULTURAL ENTOMOLOGY

S. No.	Project Number and Title	Name & Designation of the Project leader	Duration	Remarks
University Research Projects				
1	CPPS/CBE/ENT/NCR/2018/001 Evaluation of stingless bees as potential pollinators of polyhouse greenhouse vegetables	Dr. P.A.Saravanan, Assistant Professor (Entomology)	April 2018- March 2021	The project may be continued. It may be extended for one more year
2	CPPS/CBE/RES/2018/001 Multiresidue analysis of diamide group insecticides in vegetable ecosystem and their risk assessment	Dr. M.Paramasivam Assistant Professor (SS & AC)	January 2018 to December 2021	The project may be continued.
3.	CPPS/CBE/ENT/RES/2018/001 Multiresidue method for the determination of neonicotinoid pesticide residues in pollen, honey and bees using LC/MS/MS	Dr.A.Suganthi Assistant Professor (Entomology)	July 2018- June 2020	The project may be continued.

4.	CPPS/CBE/ENT/2019/001 Diversity of <i>Callosobruchus</i> pic in Coimbatore district and its management	Dr.R.Arul Prakash Assistant Professor (Agrl. Entomology)	April 2019 -March 2022	The project may be continued.
5.	CPPS/MDU/ENT/EVA/2017/00 Evaluation of different bait material to attract termites and formulation of termite poison cake.	Dr. K. Premalatha Assistant Professor (Agrl. Entomology)	Aug 2017 to July 2020	The project work has to be intensified
Core projects				
6.	CPPS/TRY/ENT/RES/2018/CP02 Early detection of insecticide residues on crop samples at market/household level using the instant residue indicator drop (i-RID) in comparison with analytical procedures	Dr.P.Yasodha Assistant Professor (Agrl. Entomology)	Sep. 2018 to Sep.2020	The project is to be continued and completed on 30.9.2020.
7.	CPMB/CBE/PBT/2018/CP076 Exploring effective Bt crystal toxic proteins from indigenous Bt isolates for the management of the invasive pest, fall army worm (<i>Spodopterafrugiperda</i>)	Dr. N. Balakrishnan Associate Professor (Agrl. Entomology)	November 2018 to Sep. 2020	The project is to be continued and completed on 30.9.2020. This will be included under Millets crop meet
AICRP projects				
8.	AICRP/PPS/CBE/AEN/006 All All India Coordinated Research Project on Honey bees and Pollinators	Dr. P.A.Saravanan, Assistant Professor (Entomology)	2020 - 2021	The project may be continued as per the technical programme.
Externally funded projects				
9.	ICAR/CPPS/CBE/AEN/2017/R011 Evaluating the impact of neonicotinoids on pollinators in cotton	Dr. P.A.Saravanan, Assistant Professor (Entomology)	2020 - 2021	The project may be continued.

9. Department of Plant Pathology

A. Decisions made on Adoption / OFT / Information:

A1. Adoption

1. Recyclable PP containers as an alternative to Polypropylene bags for oyster mushroom cultivation

Treatment	Average yield (g/300g substrate)	Bioefficiency (%)	C:B
T1: PP container	367.0	126.34	1:3.1
T2: PP bags	374.9	128.86	1:3.2
CD (P=0.05)	9.5		

Polypropylene containers can be used as an alternative to Polypropylene bags for cultivation of oyster mushroom. Oyster mushroom cultivation in Polypropylene container recorded yield on par with Polypropylene bags with bioefficiency of 126.35 and 128.9% respectively with C:B of 3.1.

Mushroom species: All Oyster mushroom varieties

C. FOR INFORMATION

- i. Strain Vv-4 of paddy straw mushroom *Volvariella volvacea* found suitable for outdoor cultivation.
- ii. Antimicrobial compound benzothiazole identified from cap portion of *Ganoderma lucidum* recorded mycelial distortion and inhibited spore germination of *C. gloeosporioides*
- iii. Antiviral compound squalene identified from solvent fractions of *Ganoderma lucidum* inhibited symptom development of GBMV in Tomato and number of lesions in local lesion host cowpea.
- iv. Antimicrobial compounds, alpha copaene and 2-undecanone from *Coprinus cinereus* effective against *Fusarium oxysporum* f.sp. *lycopercisi*
- v. Coconut wood log saw dust supported significant production of fruiting bodies of *G. lucidum* with BE of 45%
- vi. MDU-19-03 strain of milky mushroom and woody 1 oyster mushroom found suitable for tropical regions with higher bio efficiency

D.MULTILOCATION TRIAL (MLT)

1. Evaluation of milky mushroom CBE-TNAU-1523 at growers cropping house

Treatments proposed:

T1: Test culture - *Calocybe indica* CBE-TNAU-1523

T2: Commercial variety *Calocybe indica* (var.APK2)

Design: RBD; Replication: 13 (Beds/ replication: 2)

Observations to be recorded:

Days for spawn run (DFSR) ; Days for pinhead formation (DFPF) ; days for first harvest (DFFH); yield (g/bed of 500g substrate); average weight (g) of single sporophore (data taken at 10 cm height of fruiting body; average weight to be taken for 10 fruiting bodies), Bioefficiency (BE %); Any pest and diseases, C:B ratio, Organoleptic evaluation.

Coordinating centre: Dept. of Plant Pathology, TNAU, Coimbatore

Scientist: Dr.G.Thiribhuvanamala,Assoc.Prof.(Pl.Path.)

To be conducted in farmers cropping houses covering tropical regions of Tamil Nadu (Tirupur, Erode, Virudhunagar, Tindivanam Tiruvannamalai, Trichy, Tirunelveli, Madurai)

Participating Centre:

i.	Coimbatore (AICRP centre)	:	Dr.G Thiribhuvanamala, Assoc.Prof.(Pl.Path.)
ii	AC&RI, Madurai	:	Dr.M.Theradimani, Prof.(Pl.Path)
iii	AC&RI, Killikulam	:	Dr.V. Ramamoorthy, Asst. Prof.(Pl.Path)
iv.	RRS, Aruppukottai	:	Dr.P. Mareeswari, Asst. Prof.(Pl.Path)
v.	AC&RI, Trichy	:	Dr.S. Sangeetha, Asst. Prof.(Pl.Path)
vi.	KVK, Tindivanam	:	Dr.M. Satya, Asst. Prof.(Pl.Path)
vii	AC&RI, Vazhavachanur	:	Dr.M.Devanathan, Prof.(Pl.Path)

B. ACTION PLAN			
Action plan 1. Identification of promising mushroom species and developing mass production techniques (continued)			
Theme Leader : Dr.G.Thiribhuvanamala Assoc.Prof.(Pl.Path.)			
Action Plan	Name of scientist and centre	Activities	Outcome
Collection and selection of potential mushroom strains/ species suitable for commercial utilisation	Dr.G.Thiribhuvanamala Assoc.Prof.(Pl.Path.) TNAU, Coimbatore	<ul style="list-style-type: none"> Collection , Identification and maintenance of different mushroom fungal collections. 	<ul style="list-style-type: none"> Strengthening of wild mushroom collections with taxonomy for further utilisation.
	Dr.G.Thiribhuvanamala Assoc.Prof.(Pl.Path.) TNAU, Coimbatore	<ul style="list-style-type: none"> Standardising techniques for production of specialty/medicinal mushrooms by utilising agrowastes 	<ul style="list-style-type: none"> Production technology of specialty/ medicinal mushrooms
	Dr.M.Theradimani Prof.(Pl.Path.),AC&RI, Madurai	<ul style="list-style-type: none"> Identification of promising milky mushroom strains/species 	<ul style="list-style-type: none"> New species / strains identified will be of mushrooms identified developed for commercial utilisation.
	Dr.M.Revathy, Assoc.Prof.(Pl.Path.) AC&RI, Kudumiyamalai	<ul style="list-style-type: none"> Identification of edible oyster and milky mushroom strains/species 	
	Dr.V.Ramomoorthy,,Asst.Prof.(Pl.Path.),AC&RI, Killilulam	<ul style="list-style-type: none"> Identification of promising oyster mushroom strains/species 	

Action Plan 2. Developing innovative methods for mushroom cultivation (continued)			
Theme Leader : Dr.G.Thiribhuvanamala Assoc.Prof.(PI.Path.)			
Action Plan	Name of scientist and centre	Activities	Outcome
Testing various cost effective methods for commercial cultivation of paddy straw mushrooms	Dr.G.Thiribhuvanamala Assoc.Prof.(PI.Path.),TNAU, Coimbatore	<ul style="list-style-type: none"> Outdoor cultivation of paddy straw mushroom (<i>Volvariella</i> spp) will be standardized 	<ul style="list-style-type: none"> Technology for paddy straw mushroom for cultivation in coastal areas

C. Project wise remarks

S. No.	Project No. and Title & Period	Name and Designation of Project Leader Period	Remarks
AICRP PROJECT			
1	D32 AN -All India Coordinated Project on Mushroom Improvement (2020-21)	Dr.G.Thiribhuvanamala Assoc.Prof. (Plant Pathology)	The project may be continued as per the technical programme of AICRP
CORE RESEARCH GRANT			
2	CPPS/CBE/PAT/MUS/2018/CP118 Innovative methods of oyster mushroom cultivation for home growing (2018-19)	Dr. P.Latha, Asst.Professor (Plant Pathology)	Completion report is to be submitted
UNIVERSITY RESEARCH PROJECT			
3	CPPS/CBE/PAT/MUS/2019/001 Standardization of techniques for commercial cultivation of paddy straw mushroom (2019-2021)	Dr.G.Thiribhuvanamala Assoc.Prof. (Plant Pathology)	The project may be continued.
4	CPPS/CBE/PAT/MUS/2019/002. Yield enhancement in milky mushroom through casing soil supplementation with substrates (2019-2022)	Dr.K.Angappan Professor (Plant Pathology)	The project may be shelved. A new project may be proposed.
5	CPPS/KDM/PAT/MUS/2019/001. Collection and identification of edible mushroom species from natural habitat of Gaja cyclone affected areas of Pudukkottai district and assessing their edibility (2019 - 2022)	Dr.N.Revathy Associate Professor (Plant Pathology)	More cultures may be collected and the taxonomical identification may be concentrated. The project may be continued.

6	New. Development of short duration, temperature tolerant and high yielding elite <i>Pleurotus</i> mushroom (2019 - 2022)	Dr. V. Ramamoorthy Assistant Professor (Plant Pathology)	The live fresh fruiting bodies of woody 1 may be shown to Director (CPPS). The project may be continued .
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10. Department of NEMATOLOGY

A. Decisions made on Adoption / OFT / Information:

OFT 1.Validation of alginate beads of *Pasteuria penetrans* for the management of root-knot nematode infestation in tomato

Treatments Proposed

T1 – Application of *P. penetrans* bead @1 / plant twice at the time of planting and 30 DAP
T2 – Seed treatment with *B. subtilis* @ 10g/kg of seed and soil application with 2.5kg/ha
T3 – Untreated control

Replications: 7;Design: RBD ;Plot size: 4 x 2 m²

Observations to be recorded:

- Soil (250g soil) and root (5g root) nematode population.
- Root-knot index
- Number of eggmasses / g of root
- Number of *P. penetrans* infested females / g of root
- Yield / plot (kg/plot) and (t/ha)

Coordinating Centre: Dept. of Nematology, TNAU, Coimbatore
Dr. N. Swarnakumari, Asst. Prof. (Nem)

Participating Centres:

AC &RI, Coimbatore - Dr. G. Jothi, Assoc. Prof (Nem) – Coimbatore
AC & RI, Coimbatore - Dr. P. Kalaiarasan, Asst. Prof. (Nem) - Dharmapuri
AC & RI, Vazhavachanur- Dr. P. Senthikumar, Asst. Prof. (Nem)
ADAC & RI, Trichy - Dr. S. Jayakumar, Asst. Prof. (Nem)

Project wise remarks			
Externally Funded Project			
Project Number and Title	Name and Designation of the Project leader	Duration	Remarks
CPPS/NEM/EMR/2016 Development of novel biodegradable beads of nematode antagonistic bacterium, <i>Pasteuria penetrans</i> as bionematicide	Dr.N.Swarnakumari Asst. Professor (Nematology)	2020-21	Findings of the project may be test varied by conducting OFT.

11. Department of Biotechnology**A. Action Plan****Action plan (2020-2021)**

Activity	Name of the scientist and centre	Action Plan for 2020 - 2021	Deliverables and expected outcome
F37AJO - Cloning and characterization of novel biocidal protein genes from indigenous isolates of <i>Bacillus thuringiensis</i>	Dr. S. Mohankumar, Director, CPMB&B	DNA isolation and characterization Assessment of Biocidal activity of the isolates Protein profiling of the isolates	Novel biocidal proteins.
CPMB/CBE/PBT/2018/CP076 Exploring effective <i>Bt</i> crystal toxic proteins from indigenous <i>Bt</i> isolates for the management of the invasive pest, Fall armyworm (<i>Spodoptera frugiperda</i>)	Dr. N. Balakrishnan, Associate Professor Dept. of Agricultural Entomology, AC&RI, Killikulam.	Protein profiling of the isolates will be carried out using SDS- PAGE analysis.	Toxic proteins from indigenous isolates effective against Fall army worm.

B. Research Projects and remarks

Centre	Externally funded project	URP	Core	Students Project	Total
AC&RI, CBE	1				1
AC&RI, KKM			1		1
Total					2

S. No.	Project No. and Title	Project Leaders	Duration	Remarks
1.	F37AJO - Cloning and characterization of novel biocidal protein genes from indigenous isolates of <i>Bacillus thuringiensis</i>	Dr. S. Mohankumar, Director, CPMB&B	03-10-2019 to 02-10-2022	The project may be continued.
2.	CPMB/CBE/PBT/2018/CP076 Exploring effective <i>Bt</i> crystal toxic proteins from indigenous <i>Bt</i> isolates for the management of the invasive pest, Fall armyworm (<i>Spodoptera frugiperda</i>)	Dr. N. Balakrishnan, Associate Professor Dept. of Agricultural Entomology, AC&RI, Killikulam.	26.11.2018 to 25.11.2020	The project may be continued.

12. Department of Biochemistry

A. Action Plan

Action plan (2020-2021)

Theme 1: Biochemistry of stress response in plants			
Activity	Name of the scientist and centre	Action Plan for 2020 - 2021	Deliverables and expected outcome
CPMB/MDU/BIT /BGR/2019/001 Exploration of trehalose pathway for enhancing drought tolerance in black gram	Dr. M. L. Mini Assistant Professor (Biochemistry) AC & RI, Madurai	<ul style="list-style-type: none">• Study on the impact of trehalase inhibitor, PPFM and KCl• Analysis of carbohydrates (Trehalose, Sucrose, Starch, Glucose, Fructose)• Assay of enzymes (Trehalase, Invertase, Sucrose synthase, Amylase)• Analysis of Osmolytes Study on membrane stability	Understanding drought tolerant mechanism related to trehalose metabolism that can be used for developing strategies to enhance drought tolerance
CPMB/KKM/BIC /BGR/001 Elucidating the changes in polyamine metabolism during water stress in black gram	Dr.A.Kavitha Pushpam Assistant Professor (Biochemistry) AC & RI, Killikulam	The impact of exogenous application of polyamines during drought stress and changes in the polyamine metabolites- spermidine, spermine and putrescine will be evaluated.	Understanding changes in polyamine metabolism during drought to develop strategies for stress-tolerance

Theme 2: Nutritional Biochemistry

<p>CPMB/KDM/BIC/ RIC/2019/001</p> <p>Nutritional analysis of selected traditional and TNAU released rice varieties to identify low Glycemic Index lines</p>	<p>Dr.P. Radha</p> <p>Assistant Professor (Biochemistry)</p>	<ul style="list-style-type: none"> • Evaluation of the nutritional composition in traditional and TNAU released rice varieties. • Assessing the factors influencing Glycemic index in these rice lines. 	<p>Nutritious and low glycemic index rice lines can be identified</p>
<p>CPMB/VVNR/BIC/ RIC/2019/001</p> <p>Studies on profiling of nutritional and anti nutritional factors in selected minor millets</p>	<p>Dr. S. Geethanjali</p> <p>Assistant Professor (Biochemistry)</p> <p>AC & RI, Vazhavachanur</p>	<p>Analysis of nutrient profile, mineral profile and anti-nutritional factors of selected minor millets varieties</p>	<p>Complete nutrient and anti nutrient profile of minor millets</p>

Theme 3: Bioprospecting

<p>CPMB/CBE/BIC/ 2018/CP078</p> <p>Antioxidant and <i>in vitro</i> anti diabetic activity of <i>Basella alba</i></p>	<p>Dr. P. Meenakshi</p> <p>Assistant Professor Department of Biochemistry, CPMB&B, TNAU, Cbe.</p>	<ul style="list-style-type: none"> • Separation of compounds from ethanol extract of <i>Basella alba</i> by column chromatography and characterization of the isolated compounds by spectroscopic techniques. • The effect of <i>Basella alba</i> extract on cell lines studies 	<p>Antidiabetic principles from <i>Basella alba</i> can be identified</p>
<p>CPMB/ECK/BIC/ FRU/2019/001</p> <p>Exploration of bioactivity of flavonoids from Citrus species</p>	<p>Dr.M.Chitra,</p> <p>Department of Crop management, AC & RI, Eachangkottai, Thanjavur.</p>	<ul style="list-style-type: none"> • Identification of flavonoids in the leaves of <i>Citrus medica L.</i> and <i>Citrus medica L var.limetta syn</i> 	<p>Identification of bioactive products from <i>Citrus medica L.</i></p>
<p>CPMB/TRY/BIC/ FRU/2019/001</p> <p>Bioprospecting of guava (<i>Psidium guajava L.</i>) leaves for therapeutic principles</p>	<p>Dr.K.Gurusamy</p> <p>Assistant Professor (Biochemistry)</p> <p>Horticultural College and Research Institute for Women Tiruchirappalli-27</p>	<ul style="list-style-type: none"> • Isolation of bioactive compounds and its characterization by spectroscopic and NMR techniques. • Biological activities such as anti diabetic and anti tumor activities of <i>Psidium guajava</i> Linn. leaf extract will be carried out. 	<p>Therapeutic properties and principles of <i>Psidium guajava L</i> leaves</p>

B. Research Projects and remarks

Centre	URP	Core	Students Project	Total
AC&RI, CBE		1		1
HC &RI , (W), TRY	1			1
AC&RI, MDU	1			1
AC&RI, KKM	1			1
AC&RI, KDM	1			1
AC&RI, ECK	1			1
AC&RI, VVNR	1			1
Total				7

S. No	Project No and Title	Project Leaders	Duration	Remarks
1.	CPMB/MDU/BIT /BGR/2019/001 Exploration of trehalose pathway for enhancing drought tolerance in black gram	Dr. M. L. Mini Assistant Professor (Biochemistry) AC & RI, Madurai	August 2019 to July 2021	The project may be continued
2.	CPMB/KKM/BIC /BGR/001 Elucidating the changes in polyamine metabolism during water stress in black gram	Dr.A.Kavitha Pushpam Assistant Professor (Biochemistry) AC & RI, Killikulam	Aug 2019-July 2021	The project may be continued
3.	CPMB/TRY/BIC/ FRU/2019/001 Bioprospecting of guava (<i>Psidium guajava L.</i>) leaves for therapeutic principles	Dr. K. Gurusamy, Assistant Professor (Biochemistry)	July 2019 to June 2021	The project may be continued. The antidiabetic activity of guava leaves and fruits

				may be explored
4.	CPMB/KDM/BIC/ RIC/2019/001 Nutritional analysis of selected traditional and TNAU released rice varieties to identify low Glycemic Index lines	Dr. P. Radha Assistant Professor (Biochemistry)	September 2019 to August 2021	The project may be continued. Biochemical parameters are to be assessed in the therapeutic rice varieties
5.	CPMB/CBE/BIC/2018/CP078 Antioxidant and in vitro antidiabetic activity of <i>Basella alba</i>	Dr. P. Meenakshi Assistant Professor (Biochemistry)	November 2018 - September 2020	The project is to be completed on 30.9.2020
6.	CPMB/VVNR/BIC/ RIC/2019/001 Studies on profiling of nutritional and anti nutritional factors in selected minor millets	Dr. S. Geethanjali Assistant Professor (Biochemistry) AC & RI, Vazhavachanur – 606 753	June, 2019 to May, 2021	The project may be continued. The bitterness level of barnyard millet to be checked.
7.	CPMB/ECK/BIC/ FRU/2019/001 Exploration of bioactivity of flavonoids from Citrus species	Dr.M.Chitra, Department of Crop management, AC & RI, Eachangkottai, Thanjavur.	September 2019 to August 2021	The project may be continued. The scientific nomenclature of citron species has to be specified more appropriately

Remarks of the Vice - Chancellor

Directorate of NRM

- Phyto molecules from *Eucalyptus globulus*, *Eucalyptus grandis* and *Alnus sp* may be explored for allelopathic principles for developing nano-bio herbicide.
- Research on the development of nano surfactant (wetting agent) may be initiated to improve the efficiency of functional molecules in formulations while spraying especially in Drones.
- Possibility of collaboration with institutions/laboratories in Coimbatore may be explored for assessing biosafety of nanomaterials.
- The effect of chitosan nano emulsion and PPFM can be compared for effective drought management.
- Remote sensing-based crop monitoring shall be extended for horticulture crops and high-density mango plantations.
- GIS tools to be utilized in assessing varietal spread and incidence of invasive pests.
- Wasteland map and statistics generated using remote sensing has to be compared with the government statistics of Agricultural Economics Department.
- Mapping of hill station farms has to be taken up for effective resource utilization.
- Priority should be given for standardizing drone spraying technique.
- Demonstration on coffee pulp waste composting technology may be arranged at Lower Palani Hills in coordination with HRS, Thadiyankudisai.
- Heavy metals in forage irrigated with TNAU STP water may be analyzed on milk.
- Fate of removed metals from water hyacinth biochar collected from Erode area, heavy metals in rice samples of Vellore area may be studied
- Use of banana peel biochar as bio-absorbent of heavy metals may be explored
- Priorities may be given to assess the status of major rivers of Tamil Nadu before and after COVID 19.
- Chemistry of Fluoride with gypsum/ground water contamination and its effect on human chain may be observed
- Rhizoremediation of pollutants may be attempted with vetiver and mycoremediation with VAM.
- Fertility status of farm soils may be assessed in a phased manner and the current fertility status may be compared with previous years data.
- Nematode related works may be carried out with the help of Nematologists.

- Works on phyllosphere yeast are to be evaluated under field conditions. The inhibition of pathogens by yeast inoculants are to be validated with a help of plant pathologists.

Directorate of Crop Management

- Data of more than 100 years old Research Stations like Kovilpatti be analyzed for policy level
- Spatial analysis by Remote Sensing Department and ground truth studies in ACRC may be compared for better results.
- In IFS, sheep may also be included, since less labourers are required for management

Directorate of CPPS

Agricultural Entomology

- Stingless bee colonies should be multiplied and promoted for pollination and sale to farmers
- Number of Indian bee colonies present in TNAU main campus should be strengthened.
- Indian bee hives made from different wood materials with help of Dean, Forestry College and Research Institute should be evaluated for colony performance.
- Data observation in the pollination studies and number of bee colonies maintained in Madurai campus should be properly monitored and reported to the Director (CPPS)
- Pollination studies in Moringa should be continued.
- Colonies be increased at CRS, Aliyarnagar

Plant Pathology

- Research findings of Mushroom may be reported under CSM on Horticulture in Vegetables from the next Meet
- Precautionary measures and safe disposal to be practiced while handling *Ganoderma lucidum* (All centres)
- Focus to be given on medicinal mushrooms (AC&RI, TNAU, Coimbatore)
- Antiviral compound Squalene may be explored for combating Covid 19 in consultation with Dr.M.Raveendran (TNAU, Coimbatore)
- Confirm the suitable possibilities for outdoor technology of paddy straw mushroom (AC&RI, TNAU, Coimbatore)

- New URP may be proposed from Madurai Centre (AC&RI, Madurai)
- A record may be maintained separately for new collections and uniform naming of new cultures may be practiced in all centres (All Centres)

For Directorate of CPMB

- The projects in Biochemistry can be presented in the respective crop meet.
- More externally funded projects are to be proposed in identified areas by all the scientist of the Department of Biochemistry.

Way forward of the Director of Research

- More patents required especially from Nanotechnology.
- Risk assessment and insurance study of Remote Sensing and GIS may have multidisciplinary
- Environmental Science has to broaden their study area
- Digital Soil Mapping may be done for Research Stations
- More collaborations required between Agricultural Microbiology and the departments of CPPS
- ACRC has to make 385 units functional and explore a possibility to link private weather providers
- In Agronomy, i) bio-herbicide synthesis, allelopathy and specificity of action required and ii) IFS models should be evolved for doubling farmers income
- Honey bees in relation pollination and productivity of crops may be established
- In Mushroom, diversity on medicinal mushroom and others are also to be considered

DIRECTOR OF RESEARCH

PARTICIPANTS**Offline Participations**

S.No	Name & Address of the scientist	e-mail id	Phone Number
1.	Dr. N. Kumar, Vice-Chancellor, TNAU, Coimbatore	vc@tnau.ac.in	0422-6611251
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3.	Dr. K. Prabakar, Director (CPPS), TNAU, Coimbatore	directorcpps@tnau.ac.in	0422-6611237
4.	Dr. S.Geetha, Director (CPBG), TNAU, Coimbatore	directorcpbg@tnau.ac.in	0422 6611215
5.	Dr.V.Geethalakshmi Director DCM, TNAU, Coimbatore	directorscms@tnau.ac.in	0422-6611316
6.	Dr. R. Santhi Director NRM, TNAU, Coimbatore	nrm@tnau.ac.in	0422-6611390
7.	Dr. S. Mohankumar Director, CPMB&B, TNAU, Coimbatore	directorcpmb@tnau.ac.in	9442224572
8.	Dr. S. Sundaeswaran Director, Seed Centre, TNAU, Coimbatore	seedunit@tnau.ac.in	0422-6611232
9.	Dr.SP.Ramanathan Prof. & Head, ACRC, TNAU, Coimbatore		9442284759
10.	Dr.P.Malarvizhi Professor & Head Dept. of SS& AC, TNAU, Coimbatore	ssac@tnau.ac.in	9486911038
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