The 3 A's of the Division of Crop Production…

Achievements, Aspirations & Action Plan

भाकृअनुप-केन्द्रीय कन्द फसल अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद)
श्रीकार्यम, तिरूवनन्तपुरम 695 017, केरल,भारत
ICAR-Central Tuber Crops Research Institute
(Indian Council of Agricultural Research)
SREEKARIYAM, THIRUVANANTHAPURAM 695 017, KERALA, INDIA

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Diamond Jubilee of ICAR-CTCRI

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July 2024

Correct Citation
ICAR-CTCRI. 2024. The 3A's of the Division of Crop Production…Achievements, Aspirations and Action Plan, ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala, India, 27 p.

From the Director

Dr. G. Byju

Roots and tubers like cassava, sweet potato, yams, elephant foot yam, taro and tannia are important staples in the developing world, and are decisive components in agri-food systems. These crops play a pivotal role in bridging future food demand gap. Most of these crops are grown by resource poor farmers under poly-culture in homesteads with very little care and management, which results in very low yields as compared to their potential yield. Higher yields and quality tubers can be realized by adopting timely and appropriate management practices.

The Division of Crop Production has developed protocols for quality planting material production, eco-region specific agro-techniques, productive and profitable cropping systems and integrated farming system, sustainable nutrient management including integrated plant nutrient management system, low input technologies, nutrient use efficient genotypes, fertilizer best management practices by site specific nutrient management, customized fertilizers and micronutrient formulations, organic production packages for tuber crops and cropping systems, precision nutrient and water management technologies, water saving techniques in elephant foot yam and taro, integrated weed management practices and climate resilient agricultural practices. A brief account of the crop production technologies, developed over 60 years, for efficient, competitive, profitable and sustainable farming is documented.

Greater focus on natural resource management for sustainable agri-food systems focussing on 3 Ps of sustainability viz., higher productivity, profitability (to farmers) and protection (offering services to agro-ecosystem) should be given during the next five years. This coffee table book covers notable achievements, aspirations and action plan of the Division of Crop Production, which will be useful to researchers and other stakeholders for sustaining tuber crop production and offering environmental security under changing climate scenario.

G. Byju
Director

01 July 2024

Our Mission

1. To develop protocols for the production of quality planting materials of tropical tuber crops and their popularization in major growing areas by a sound seed system.
2. To develop best agronomic practices, sustainable soil fertility management, resource conserving technologies and climate resilient agricultural practices for higher yield, income and soil health.

Our Team of 32

Scientists: 8

Sl.No.	Name	Cadre Discipline
1.	G. Suja	Agronomy
2.	K. Susan John	Soil Science
3.	S. Sunitha	Agronomy
4.	K. Sunilkumar	Vegetable Science
5.	V. Ramesh	Soil Science
6.	R. Muthuraj	Seed Science &Technology
7.	Saravanan Raju	Plant Physiology
8.	J. Suresh Kumar	Vegetable Science

Technical (3) & SSS (1)

Sl.No.	Name	Designation
1.	B. Satheesan	Technical Assistant
2.	D.T. Rejin	Senior Technician
3.	Rini Alocious	Technician
4.	S. Abhishek	Skilled Support Staff

Sl.No.	Category	Number
1.	Ph.D Scholar	5
2.	Young Professional	1
3.	Senior Research Fellow	1
4.	Field Assistant	1
5.	Contractual Staff	9
6.	Project Skilled Staff	1
7.	Apprentices	2

What have we delivered?

1. Quality planting materials through decentralized seed multipliers in established seed villages.
2. Agro-ecological region-specific cost effective agro-techniques to enhance yield and income.
3. Productive and profitable cropping systems and integrated farming system (IFS) models.
4. Organic production packages for tuber crops and cropping systems.
5. Sustainable nutrient management: Integrated plant nutrient management system (IPNMS), low input technologies (LIT), nutrient use efficient (NUE) genotypes.
6. Fertilizer best management practices (FBMP) by site specific nutrient management (SSNM), customized fertilizers and micronutrient formulations.
7. Precision nutrient and water management technologies.
8. Water saving techniques in elephant foot yam and taro.
9. Integrated weed management practices.
10. Climate resilient agricultural practices

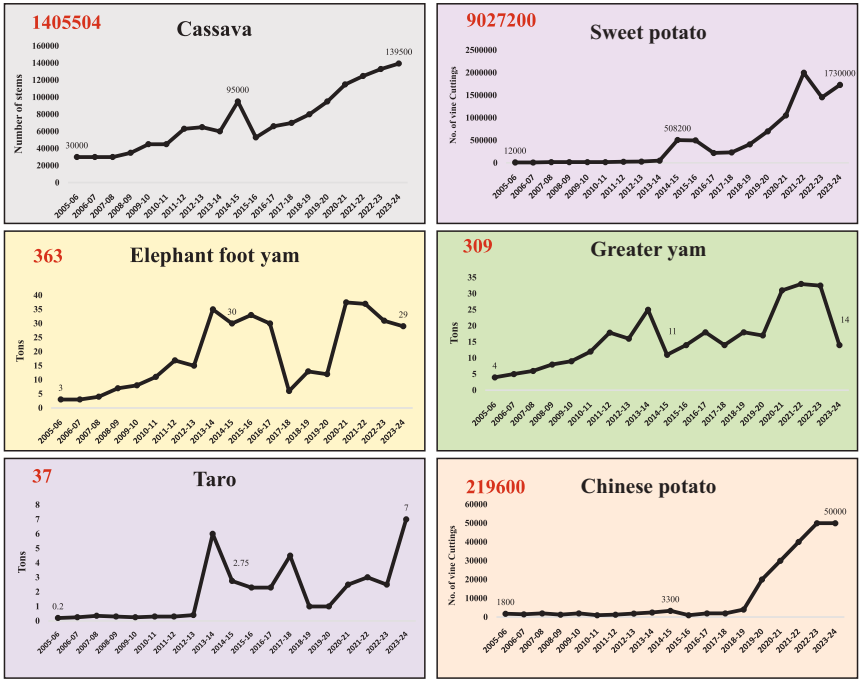
1. Sustainable seed systems to deliver quality seed to farmers`

- Technologies for rapid quality planting material production
- Registered seed growers
  - Decentralized Seed Multiplier farmers (128 nos., 146 acres)
  - Commercial seed growers
- Seed villages (117 nos., 332 acres)
- States: Kerala, Tamil Nadu, Odisha, Andhra Pradesh

Decentralized seed multipliers of cassava, elephant foot yam and Chinese potato from Kerala and Tamil Nadu

Seed production system in tuber crops

- Selection of quality planting material
- ↓
- Tissue culture initiation
- ↓
- Meristem, micropropagation, minisetts
- ↓
- Mass multiplication of healthy planting materials in the field
- ↓
- Agriculture Department, Horticulture Department, KVKs, NGOs, SHGs
- ↓
- Seed villages - Selected farmer cluster
- ↓
- Healthy planting materials distribution



Quality planting material production during 2005-06 to 2023-24

2. Eco-region specific agro-techniques

- Scientific cultivation practices from planting till harvest for different agro-eco-zones.
- Good agricultural practices.
- Agro-techniques, soil fertility management, soil and water conservation methods for hill cassava production systems.
- Technological support for establishment of farms.
- Farm advisory services and field diagnostic visits.

Package of Practices for tuber crops

3. Regenerative & low C landscapes

i. Resilient agro-ecology based cropping and farming systems

- Coconut based cropping systems
- Banana based cropping systems
- Rice based cropping systems
- Tuber crops-based cropping systems
- Integrated organic farming system (IOFS) model

Model	Yield (t/ha)	B:C ratio
Rice-short duration Cassava + Blackgram	26.67 26% ↑	2.93
Elephant foot yam + Soybean / Blackgram	41.62/38.58 8.57% ↑	3.20/2.92
Taro + Greengram / Blackgram	11.22/10.38 5.68% ↑	2.78/2.52
Dwarf white yam + Greengram	26.78 1% ↑	3.52


Coconut + cassava


Coconut + elephant foot yam


Coconut + greater yam


Coconut + dwarf white yam


Coconut + arrowroot


Coconut + tannia

Coconut based cropping systems

Banana based cropping systems



Cropping systems involving short-duration cassava & pulse crops in rice based systems

Elephant foot yam + pulse crops

Taro + pulse crops

Dwarf white yam + pulse crops

Dwarf white yam after pulse crop harvest

Rice-cassava + cluster bean

Greater yam + maize

Sustainable cropping systems models

Cassava + amaranthus

Vegetable cowpea

Banana + cucumber

Hedge rows of pineapple, agathi & moringa

General view of IOFS

Dairy unit

Hybrid napier fodder grass

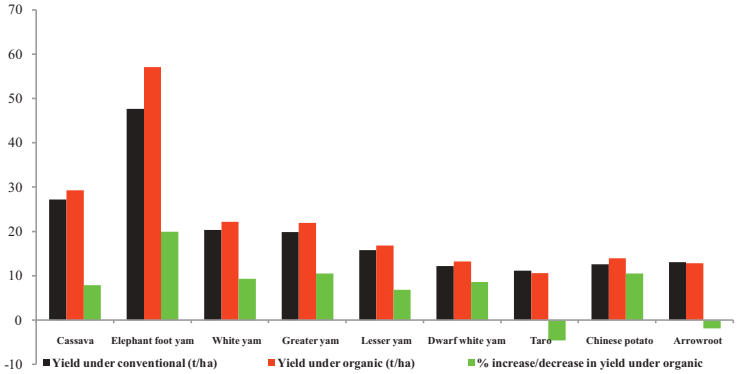
Vermicompost unit

Field view of IOFS

ii. Organic and natural farming

- Organic production packages for cassava, elephant foot yam, yams, taro, tannia, Chinese potato and arrowroot; 10-20% higher yield, 20-40% higher profit.
- Organic package for cropping systems involving tuber crops: cassava-groundnut, cassava-vegetable cowpea, elephant foot yam + cucumber/amaranthus.
- Cassava var. Sree Reksha identified as the most suitable for organic farming.
- Geo-tagged characterisation of 232 organic growers.
- Technology for natural farming of cassava + vegetable cowpea-green gram system.

Glimpses of experiments on organic farming



Yield: Conventional vs organic farming

Protocol for organic farming

iii. Conservation agriculture (CA)

Conservation agriculture (CA) practices for banana-elephant foot yam intercropping system

- CA Productive: with 13% higher yield over PoP.
- CA Energy efficient: Highest energy use efficiency and energy productivity (+55% over PoP) and lower energy input (-36.17%) over conventional.
- CA Sustainable: Soil building nature and better soil health maintenance. Significantly improved soil pH (+0.65 unit), available K, Ca, Mg, Mn and Zn status.
- CA Profitable: +32% profit and -9% production costs with higher net income and B:C ratio.

CA practices for banana-elephant foot yam intercropping system

4. Sustainable soil fertility management

- Blanket nutrient recommendations.
- Integrated plant nutrient system.
- Low input management.
- Customized plant nutrient formulations for tuber crops under intercropping in coconut.
- Nutrient use efficient genotypes in cassava: The first K efficient cassava variety, Sree Pavithra; Two N use efficient genotypes: CR 43-8, W-19; NPK efficient genotypes: 7 III E3-5, CI-905, CI-906.
- Alternatives to traditional manures: Green manuring *in situ* with cowpea as the best alternate organic manure resource for cassava followed by residue of the crop.
- Nutrient management for CMD management: Identified nutrients viz., P, K, Ca, Si, Zn in the management of CMD expression.
- Integrated soil and plant B management strategy to correct the suspected B deficiency disorders in tubers.

Sree Pavithra

CI-905

7 III E3-5

CI-906

Wealth from waste

- Nutrient rich organic manure 'Thippi compost' from cassava starch factory solid waste.
- Biochar from tuber crop wastes.

Nutrient use efficient microbes identified

- N fixers (*Bacillus cereus).*
- P solubilizer (*Bacillus megaterium).*
- K solubilizer *(Bacillus subtilis)* to reduce chemical fertilizer use in elephant foot yam.

Biochar

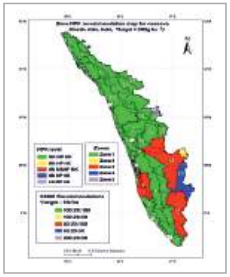
Thippi compost

5. Fertilizer best management practices (FBMP) by site specific nutrient management (SSNM) and customized fertilizers

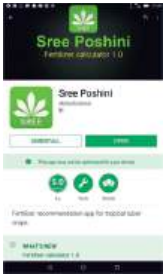
- Fertilizer best management practices (FBMP) based on SSNM for 7 tuber crops for different agro eco-zones using 4R nutrient stewardship.
- Technology for preparation of customized plant nutrient formulations and micronutrient formulations.
- Zone-specific secondary and micronutrient inclusive customized fertilizers for 6 crops.
- Six designer foliar liquid micronutrient formulations commercialized.
- Ten Decision Support Systems (DSS).

Micronol for tuber crops

Nutrient decision support system



Zone wise NPK recommendations



Mobile App for SSNM

SSNM validation experiments

6. Precision nutrient and water management

- Drip irrigation schedules for cassava, elephant foot yam, taro, greater yam and sweet potato.
- Fertigation schedule for cassava, elephant foot yam, greater yam and taro.
- Water saving techniques for elephant foot yam and taro.
- Water requirement and water productivity worked out.

Crop	Water requirement (WR) mm/day	Total WR mm	Water productiity kg/m^3
Cassava	2.7-3.0	550-600	8-9
Elephant foot yam	4.3-4.5	700-800	4-5
Taro	3.0-3.3	600-650	3-4
Sweet potato	2.6-3.0	240-270	9-10


Cassava


Elephant foot yam


Sweet potato


Taro

7. Weed management

- Weed management in elephant foot yam, IWM in taro.
- Weed control ground cover in cassava and taro.

8. Climate resilient technologies

- Climate modeling studies: Calibrated and validated 5 Models, viz., ECOCROP, WOFOST, MaxEnt, CROPWAT and Aquacrop.
- Climate resilient agricultural practices for cassava and yams: 14% higher yield, reduction in global warming potential.
- Foliar application of 1% KNO_3 or 1% solubor is effective against drought stress.
- Against heat stress, benzyl adenine 1000 ppm imparted tolerance.

9. Environmental soil science

- Synthesis of near neutral zeolite (NNZ) for agricultural applications for enhancing soil C quality and conservation under climate change.
- Important parameters of interest in zeolites (as soil amendments) such as pH, exchangeable Na and CEC estimated.
- The efficiency of NNZ in decomposition resistance of carbon in soils added with commonly available organic materials (as estimated from carbon dioxide emission rates) studied under controlled conditions.
- Addition of zeolites decreased the very labile C, increased the recalcitrant C and cumulative quantity of carbon dioxide released in soil-organic manure mixture.

10. Physiology of tropical tuber crops

- Crop physiology in response to climate change.
- Cassava genotypes viz., *Noorumuttan*, Sree Pavithra and Sree Sahya are superior under drought stress.
- Sweet potato varieties, Kalinga, Bhu Swami, Sree Kanaka, Sree Varun, and Sree Vardhini performed better under drought stress.

New Initiatives

- Techniques for uniform and higher sprouting (99%) in elephant foot yam under field condition with fumigation treatment with carbon disulphide 80 ml @ 100 kg (38% higher yield and 27% higher income over untreated).
- Developed protocol for production of protray plants of greater yam using 20 g minisetts and potting mixture consisting of soil + FYM + cocopeat in 1:1:1 ratio.
- Standardized greater yam propagation through two-node vine cuttings.
- Standardized potting mixture i.e., soil + vermicompost + perlite in 1:1:1 ratio for poly bag cultivation of sweet potato for urban farming.
- Standardized the nutrient stock preparation and its dilutions for proper growth and tuber yield of sweet potato for clean seed production (quality vines, tuber) under soil less condition.

Greater yam propagation through vine cuttings

Protray nursery of greater yam

Fumigation treatment with carbon disulphide

Protray plants of greater yam

Greater yam propagation through vine cuttings

Hydroponic sweet potato and greater yam

Facilities and Infrastructure

Laboratories

- Agronomy lab
- Soil Science lab
- Soil Physics lab
- Atomic Absorption Spectrophotometer (AAS) lab
- Climate Modelling lab
- Plant Physiology lab


Agronomy lab


Soil Science lab


Soil Physics lab


AAS lab


Climate Modelling lab


Plant Physiology lab

Equipments

- pH meter
- Conductivity meter
- Spectrophotometer
- Flame photometer
- Graphite furnace AAS
- N analyzer
- SPAD 502 chlorophyll meter
- Portable photosynthetic system
- Soil CO_2 flux system
- Portable leaf area meter
- Pressure plate apparatus
- International pipette apparatus
- Bouyoucos hydrometer
- Guelph permeameter
- Infiltrometer

Climate Modelling lab

Geospatial Data Collection

- Total station
- Hand-held GPS: Garmin GPS 12
- PDA GPS: Magellan eXplorist Pro 10

Geoinformatics Softwares

- IDRISI Selva
- Cartalinx
- Arcpad 7.1
- Surfer 11

FOSS for Geoinformatics

- Quantum GIS
- Grass GIS
- gvSIG
- ILWIS
- Mapwindow
- SWAT
- DivaGIS
- NEST

Modelling Softwares

- DSSAT 4.5
- QUEFTS
- ECOCROP
- MAXENT
- WOFOST
- CROPWAT
- AQUACROP

Facilities

- Dairy unit
- IOFS model
- Automatic weather station (AWS)
- Crop museum
- Glass house
- Poly houses
- Green houses
- Planting material storage sheds
- Climate controlled plant growth facility

Automatic weather station

Poly house

ICAR-CTCRI Dairy unit: Established under the aegis of AINPOF, the dairy unit houses 13 animals (9 cows & 4 calves). It is a component of Integrated Organic Farming System Model for undertaking experiments on organic farming and natural farming. It also envisages healthy animal life and clean milk production. Total production of 25340 litres of milk and 140 tons of cowdung has been obtained since its establishment in May 2020.

IOFS Model (AINPOF project) (worth ₹ 15.35 lakhs): Involving tuber crops and animal components in 75 cents (since October 2020) with drip irrigation facilities viz., cropping systems involving horticulture crops and food crops, banana + elephant foot yam (13%), cassava + vegetable cowpea/amaranthus (7% area), taro + maize (13%), vegetables (bhindi, amaranthus, cucumber, cluster beans)-pulses (green gram, black gram, soybean) (20%), vegetables-oilseeds (groundnut) (7%), pineapple, moringa, agathi (as hedge crops) (13%), hybrid napier grass (for fodder) (7%), dairy unit (9 cows & 4 calves) (13%), lemon grass and vermi compost units (5 nos.).

Climate controlled plant growth facility: The facility was constructed as part of the RKVY-RAFTAAR project for research on clean seed production. The facility consists of two chambers, a 1000 sq. ft chamber with complete controlled environment, where specific nutrient, moisture, light, temperature and humidity requirements are provided and another 1000 sq ft mist chamber cum-net house, provided with micro sprinkler and fogging system meant for achieving better sprouting of minisetts and vine cuttings in vegetatively propagated crops as well as improving germination of seed propagated crops.



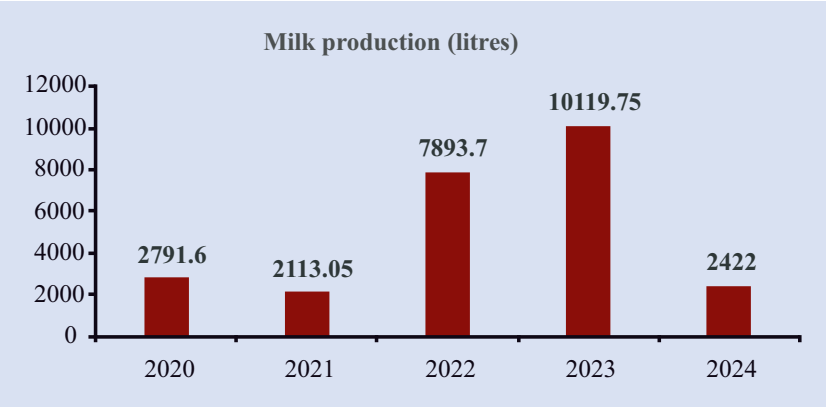
Dr. Himanshu Pathak, Hon'ble Secretary, DARE and DG, ICAR, inaugurating the climate controlled plant growth facility on 22 July 2023 during inauguration of Diamond Jubilee Celebrations of ICAR-CTCRI

Technologies Licensed

1. Technology on foliar micronutrient formulations (Micronol) for cassava, sweet potato, elephant foot yam, greater yam and Chinese potato were commercialized to M/s Linga Chemicals, Madurai, Tamil Nadu.
2. ICAR-CTCRI signed MoA with M/s Entryway Shipping and Logistics Pvt Ltd., MIV CFS Admin Building, Vallarpadam, Cochin, Kerala to transfer the technology of wax coating of cassava tubers to extend shelf life.

Technological Products

- Customized fertilizers
- *Panchagavya*
- *Jeevamrit*
- Vermi compost (Sree Amrutham)
- Vermi wash
- Protray raised seedlings of IOFS crops: Vegetables, tuber crops, pulses, oilseeds, millets
- Cow milk



Impact Assessment

Technology	Present value of gross benefits (Crore ₹)
Cassava (1971 to 2018)	
Land preparation	899
Sett making	257
Planting method	1387
Spacing	386
Quantity and application of organic manures	604
Quantity and application of N fertilizers	109
Quantity and application of P_2O_5 fertilizers	121
Quantity and application of K_2O fertilizers	201
Retaining two shoots per plant	214
Irrigation	106
Storage of planting material	166
Total	**4450**
Sweet potato (1968 to 2018)	
Land preparation	866
Ridge height	330
Time/season of planting	331
Selection of vines	345
Spacing	13
Quantity and application of organic manures	170
Quantity and application of N fertilizers	520
Quantity and application of P_2O_5 fertilizers	281
Quantity and application of K_2O fertilizers	117
Intercultural operations (Weeding and turning of vines)	633
Irrigation	45
Total	**3651**

Other technologies (2010 to 2018)	
Soil test based INM involving secondary and micronutrients in cassava	1.63
SSNM of cassava	29.8
Sree Pavithra: K efficient variety in cassava	0.21
Soil texture and nutrient test-based adoption of improved cassava variety in rainfed hills of eastern ghats	0.25
Organic production technology for cassava	0.7
Low input management strategy for cassava	2.72
Organic production technology for elephant foot yam	22.53
SSNM of elephant foot yam	11.43
Organic production technology for yams	0.13
Organic production technology for taro	35.48
Organic production technology for Chinese potato	0.27
Total	**105.15**
Grand Total	**8206.15**

ICAR Certified technologies presented during 60th Foundation Day Ceremony of ICAR-CTCRI

1. Multi-micronutrient formulation for Chinese potato.
2. Package of practices for organic production of cassava.
3. Wax coating for fresh cassava tubers: Improving preservation and shelf-life.
4. Power operated size based Chinese Potato grader.
5. e-Crop based smart farming .

Technologies in state package of practices

1. Agro-techniques of all tuber crops.
2. Minisett technique for quality planting material production in cassava.
3. Minisett technique for quality planting material production in elephant foot yam.
4. Rapid seed yam production by minisett technique in white yam.
5. Soil test based secondary and micronutrient recommendation for cassava.
6. Secondary and micronutrient management for sweet potato.
7. Management of tuber cracking due to B deficiency in sweet potato.

8. INM strategy for tannia.
9. Customized fertilizer (CF) formulations for elephant foot yam, greater yam and cassava under intercropping in coconut.
10. Organic farming package for cassava.
11. Organic farming package for elephant foot yam.
12. Organic farming package for yams.
13. Organic farming package for taro.
14. Production technology for arrowroot.

Publications

Total publications: 1138 (last 30 years)

Number of research papers: 279			
Sl. No.	**NAAS Score**	**Nos.**	**Per cent**
1.	>6	80	29
2.	<6	199	71
	Total	**279**	

Other publications: 859		
Sl. No.	**Name of publication**	**Nos.**
1.	Symposia	245
2.	Books	14
3.	Book chapters	52
4.	Technical bulletins	58
5.	Technical folders	101
6.	Technical leaflets	49
7.	Popular articles	340
	Total	**859**

Peer Recognition

Students Guidance

Post-Doc: 2
Ph. D.: 18
M.Sc.: 76
Integrated M.Sc.: 11
Total: 107

External Examiner

Ph.D.: 153
M.Sc.: 218
Total: 371

Peer Reviewer

NAAS >6: 61
Others: 42
Total: 103

Awards & Fellows

Awards: 38
Fellow: 11
Total: 49

What are our expectations?

1. Sound seed system with road map to ensure adequate quality seed availability, expansion of area under tuber crops and exploring/spreading to non-traditional areas.
2. Tuber crops are no more poor man's crop, but versatile crops with changing roles from subsistence to commercial from rural to urban cities. Thus, urban farming, peri-urban farming, container farming, soil-less cultivation etc. would be prospective under climate change.
3. Agro-ecology based sustainable agri-food systems (involving tuber crops) and coexistence of various enterprises for climate resilience.
4. Rationalization of chemical inputs by integration, reduction, reuse and recycling of resources.
5. Nature based farming, organic regenerative agriculture and nature positive solutions in a systems perspective with emphasis on safe diet for a green planet.
6. Per drop more crop (PDMC).
7. Smarter protocols for climate ready agriculture involving tuber crops.
8. Farmer-friendly agro-advisories to emerging management issues.

How will we rise to the expectations?

Strengthening the seed system

1. Road map for strengthening seed chain – requirement and plan of action.
2. Involvement of KVKs in seed chain.
3. Decentralized Seed Multipliers.
4. Commercial seed producers.
5. Establishment of seed villages.
6. Standardization/refinement of rapid multiplication protocol for yams and aroids microsett/minisett.
7. Hydroponics, aeroponics and tissue culture techniques for QPM .

Soil-less production and controlled environment agriculture

1. Standardization of protocols for growbag/container growing/protected cultivation/soilless cultivation of tuberous vegetables with special emphasis on bio-fortified varieties for addressing malnutrition.
2. Standardization of nutrient and water requirements, and growth conditions for better resource efficiency, particularly micro-climate.

Agro-ecology based sustainable agri-food systems

1. Development of more productive-profitable-resource efficient cropping systems model and IFS models for climate resilience and sustainable livelihoods.
2. High density planting for tuber crop-based cropping/farming systems.
3. Bankable IFS models and projects.

Rationalization of chemical fertilizers/inputs

1. Standardisation of nano urea and nano DAP for tuber crops.
2. Up-scaling SSNM and INM technologies for sustainable agri-food systems involving tuber crops based on long-term studies and farmer participatory evaluation.
3. Evolving NUE varieties in tuber crops with immense use under climate change.
4. Smart farming of tuber crops using WUE and NUE varieties, IoT and AI devices, models, sensors, UAVs.
5. Drones for nutrient management.
6. Development of integrated weed management with emphasis on non-chemical, cultural and biological practices.

Nature based farming

1. Development of technologies for organic farming and natural farming in tuber crop-based cropping systems.
2. Unravelling the science behind natural farming for recommending to farmers/policy makers.
3. Product development for nature-based farming – nature positive solutions.
4. Establishment of model organic farms and natural farms.
5. Cost-benefit analysis, assessment of soil health, global warming potential, trade off and sustainability.

Per drop more crop

1. Standardization of drip irrigation schedule and fertigation schedule for higher water productivity and water use efficiency.
2. Development of water saving techniques.

Climate smart agriculture

1. Development of climate resilient agricultural practices in tuber crops .
2. Establishment of climate resilient villages.
3. Studies on soil carbon quality and soil conservation under climate change.
4. Development of mineral nutrition package to manage drought stress.
5. Identification of heat stress alleviating chemicals.
6. Physiological screening and identification of abiotic stress resistant genotypes/breeding lines.

Agro-advisories to emerging management issues

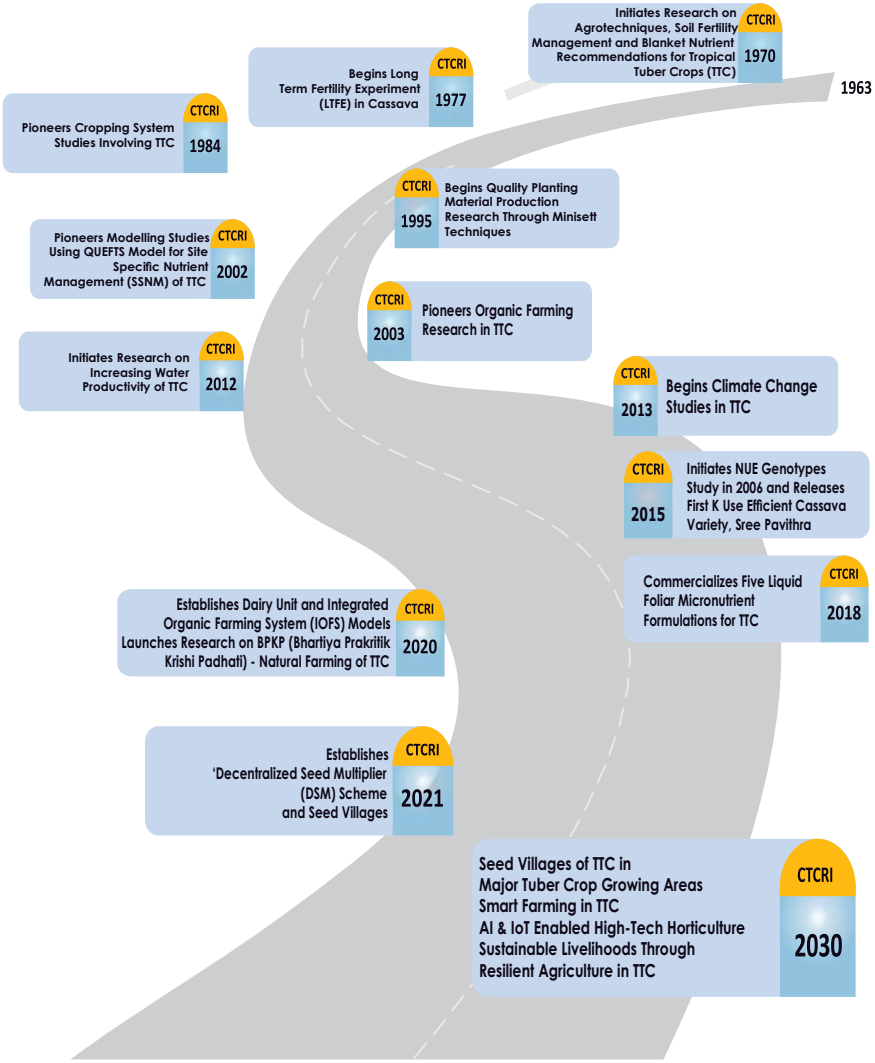
1. Diagnosis and correction of emerging soil-plant nutritional disorders in tropical tuber crops by controlled condition and field studies.

Road map for strengthening seed chain for next five years (2024-2029)

Sl. No.	Year	Crop	District	State	No. of seed villages	Area to be covered (acres)
1	2024-25	Cassava, Sweet potato, Elephant foot yam, Yams, Taro, Chinese potato and Yam bean	Thiruvananthapuram, Pathanamthitta, Salem, Namakkal, Pudukottai, Kallakuruchi, Dharmapuri, Gajapati, Kandhamal, Rayagada, Koraput, Jajpur and East Godavari	Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Meghalaya, and Tripura	51	140
2	2025-26	Cassava, Sweet potato, Elephant foot yam, Yams, Taro, Chinese potato and Yam bean	Thiruvananthapuram, Pathanamthitta, Kollam, Salem, Namakkal, Pudukottai, Kallakuruchi, Dharmapuri, Cuddalore, Gajapati, Kandhamal, Rayagada, Koraput, Jajpur and East Godavari	Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Meghalaya, and Tripura	58	175
3	2026-27	Cassava, Sweet potato, Elephant foot yam, Yams, Taro, Chinese potato, and Yam bean	Thiruvananthapuram, Pathanamthitta, Kollam, Salem, Namakkal, Pudukottai, Kallakuruchi, Dharmapuri, Cuddalore, Gajapati, Kandhamal, Rayagada, Koraput, Jajpur and East Godavari	Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Meghalaya, and Tripura	59	180

4	2027-28	Cassava, Sweet potato, Elephant foot yam, Yams, Taro, Chinese potato, and Yam bean	Thiruvananthapuram, Pathanamthitta, Kollam, Salem, Namakkal, Pudukottai, Kallakuruchi, Dharmapuri, Cuddalore, Gajapati, Kandhamal, Rayagada, Koraput, Jajpur and East Godavari	Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Meghalaya, and Tripura	60	185
5	2028-29	Cassava, Sweet potato, Elephant foot yam, Yams, Taro, Chinese potato and Yam bean	Thiruvananthapuram, Pathanamthitta, Salem, Namakkal, Pudukottai, Kallakuruchi, Gajapati, Kandhamal, Rayagada, Koraput, Jajpur and East Godavari	Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Meghalaya, and Tripura	61	190
				Total	**289**	**870**

Roadmap: Milestones and Vision 2030



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