CTCRI/QSF/RP/400

अनुसंधान की मुख्य विशेषताएं
RESEARCH HIGHLIGHTS
2020

भा कृअनु प - केन्द्रीय कंद फसल अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद्)
श्रीकार्यम तिरुवनन्तपुरम 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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Design & Printing
Colour Scan Digital Press, Technopark Campus, Thiruvananthapuram, Kerala

Cover Illustrations

Front

1. Beta carotene and anthocyanin rich sweet potato tubers
2. Greater yam plant in field
3. FLD on Chinese potato (var. Sree Dhara) in Tenkasi district, Tamil Nadu
4. Greater yam tuber (var. Sree Hima)
5. Prototype continuous steaming machine for sago wafers
6. New dairy unit (IOFS component) at ICAR-CTCRI
7. Inhibition of *Phytophthora colocasiae* by bacterial isolate of taro leaf
8. Yam cultivation in Thuria village, Koraput, Odisha
9. Cut tubers of biofortified cassava line 17S-325

Back

Promotion of tuber crops rainbow diet among school children of Anjaw, Arunachal Pradesh under ICAR-CTCRI NEH programme

Correct Citation

ICAR-CTCRI 2021, Research Highlights 2020, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, India, 45 pages.

CONTENTS

PREFACE

The ICAR-Central Tuber Crops Research Institute (ICAR-CTCRI), in its 57th year of service, is spearheading with great momentum and leaving its mark on the agricultural sector around the world with the introduction of 68 improved varieties in total, besides development of farmer-friendly production, protection and value addition technologies in tropical tuber crops. Tuber crops, an important group of climate-resilient crops can sustain food, nutritional, health and livelihood security as these crops are rich in dietary fibre, minerals, vitamins and many bioactive phytochemicals. In this background, I'm privileged to present the highlights of the research accomplishments, technological advancements and developmental activities of the Institute in the year 2020, documented as 'Research Highlights of ICAR-CTCRI'.

The field gene bank constituting 5,713 accessions is continued to be enriched and conserved. A high yielding greater yam hybrid, TGy12-1 was recommended for state release in Kerala with the name 'Sree Hima'. A yellow-fleshed cassava genotype, 17S-325 with high β-carotene and calcium content has been identified. Nutritional rich lines of taro with high contents of antioxidants, phenolics, starch and minerals were also identified. *In vitro* plant regeneration protocols were developed for purple (Bhu Krishna), orange (Bhu Sona) and white (Kishan) fleshed sweet potato varieties, cassava (Sree Jaya), taro (Muktakeshi) and greater yam (Orissa Elite).

The sustainable resource management technologies such as feasible cropping systems involving tuber crops, SSNM recommendations and customized fertilizer formulations, INM in greater yam and arrowroot, nutrient use efficient cassava genotypes and soil carbon sequestration packages for hill cassava production system were developed. Research on climate smart agricultural practices for cassava with reduced carbon emission, weed management and water scheduling for taro, diagnosis and correction of emerging soil-plant nutritional disorders, quality planting material production and physiological studies related to climate change were also conducted.

Development of biorational control measures to manage sweet potato weevil, identification of genes related to sweet potato weevil infestation, management of a new emerging pest called sweet potato leaf miner, isolation of a new strain of plant associated nematode *Panagrolaimus* sp. from the stems of cassava, designing of indigenous soilless growth pouches for maintaining axenic culture of root knot nematode in Chinese potato, isolation of pathogens associated with leaf rot and pseudostem rot in elephant foot yam, management of postharvest rot in elephant foot yam, anthracnose in greater yam and leaf blight in taro, preparation of small RNA sequence libraries using next-generation sequencing and editing of cassava mosaic virus genome for developing CMD resistance were some of the major research highlights.

The notable value addition technologies/products/machineries developed are particle boards from cassava stem-sugarcane bagasse, thermoplastic starch sheets from cassava starch-fibre composites, food grade cassava starch phosphate, rice analogue from cassava, anthocyanin and β-carotene rich nutri-jellies from sweet potato, ready-to-eat extruded puffed snacks, low cost cassava peeling machine and prototype continuous steaming machine for sago wafer production.

Self learning cassava model to add learning capability to eCrop, computational model for prediction of plant-pathogen interaction, interactive web application for the prediction of protein-protein interaction in plants, Biofortification Priority Index (BPI) and online marketing

platforms were also developed. Several field level demonstrations of tuber crops technologies and varieties as well as farm advisory visits were conducted in different parts of the country. Technologies of tropical tuber crops were disseminated through frontline extension activities under SCSP and NEH programmes. For the livelihood improvement of tribal farmers through tuber crops technologies, various activities were taken up under the Tribal Sub Plan.

The techno-incubation centre is extending hand holding support to young entrepreneurs. Three technologies on value addition were commercialized. The Institute is moving forward with the twin flagship programme of the Govt. of India, '*Mera Gaon Mera Gaurav*' and '*Swachh Bharat Mission*'. The quality research publications including those in high impact national and international journals have improved the scientific credibility.

For strengthening the R&D activities of the Institute, QRT, RAC and IMC meetings were convened. Besides, ICAR-CTCRI participated in 7 exhibitions and organized 45 trainings with the mission to reach the unreached. The Institute also observed National Science Day, Constitution Day, World Environment Day, International Yoga Day, Tuber Crops Day and World Soil Day.

Like other crops, cultivation and marketing of root and tuber crops were also adversely affected by the lockdown imposed due to Covid-19 pandemic. Even in the amidst of the adverse conditions, ICAR-CTCRI could manifest the potential of tuber crops as a food security crop through supply of tubers to 'Community Kitchens' run by different agencies in Thiruvananthapuram and Bhubaneswar. A massive and ambitious programme called '*Subhiksha Keralam*' was initiated by the Government of Kerala to boost farming of tuber crops among agricultural clubs and farming groups and ICAR-CTCRI supplied planting materials worth ₹2.7 lakhs under this programme.

I express my deep sense of gratitude to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR for his valuable guidance and support. I sincerely acknowledge the timely guidance and support provided by Dr. Anand Kumar Singh, DDG (Horticulture Science), Dr. T. Janakiram, former ADG (HS-I) and Dr. Vikramaditya Pandey, ADG (HS-1) (Acting).

The support extended by PPV&FRA, RKVY-Govt. of Kerala & Govt. of Odisha, KSCSTE, Kerala State Planning Board, Coconut Development Board, MANAGE, KVKs and other R&D Institutes and consortia research platforms of ICAR are duly acknowledged. The unstinted support from ICAR and the concerted efforts and hard work of the entire ICAR-CTCRI family enabled the Institute to make this year highly commendable despite the predicaments of Covid-19 pandemic situation. I also appreciate and congratulate the editorial team for bringing out this publication on time.

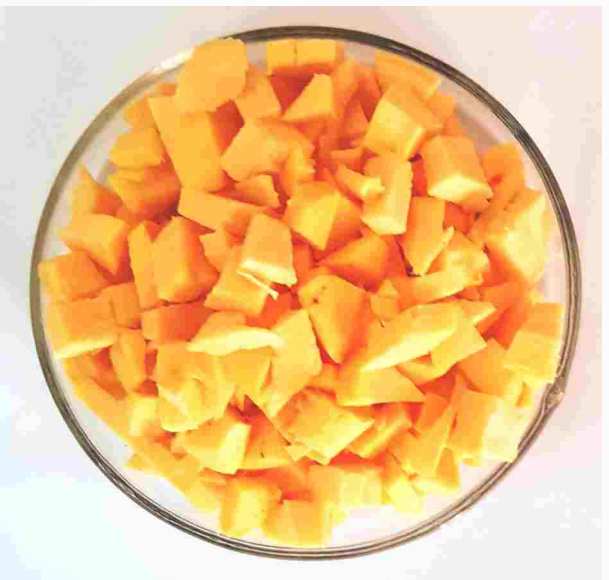
20-04-2021

V. Ravi
Director

RESEARCH HIGHLIGHTS

CROP IMPROVEMENT

- A total of 5,713 accessions, comprising of 1,217 cassava, 1,129 sweet potato, 1,121 yams, 701 edible aroids, 297 minor tuber crops and 1,248 collections from Regional Station were maintained and conserved in the field gene bank.
- Ninety three new collections of tuber crops viz., cassava (10), sweet potato (20), yams (20), edible aroids (33) and minor tuber crops (10) were added to the germplasm.
- In cassava, a clone, 17S-325 with high yield (57.7 t ha^{-1}) and good culinary quality was developed through the crossing of yellow fleshed genotype with cassava mosaic resistant varieties. It has higher carotene content (6.01mg 100 g^{-1}) than all the released varieties of cassava in India. The tubers also have high starch (27.6%), sugar (0.59%), protein (3.9%), potassium (0.46%), calcium (1840 ppm), Fe (80.60 ppm) and Zn (23 ppm) contents.



Biofortified cassava line 17S-325

Among the CMD resistant cassava varieties evaluated for dry matter content, 15S-156 had the highest dry matter (47.5%), followed by D-143 (44.2%). In the replicated yield trial of CMD resistant varieties for culinary purpose, 15S-59 yielded the highest (95.05 t ha^{-1}), followed by 15S-184 (90.11 t ha^{-1}) and 15S-433 (85.18 t ha^{-1}). The CMD resistant varieties were significantly high yielding as compared to the check variety, M-4 (37.04 t ha^{-1}).

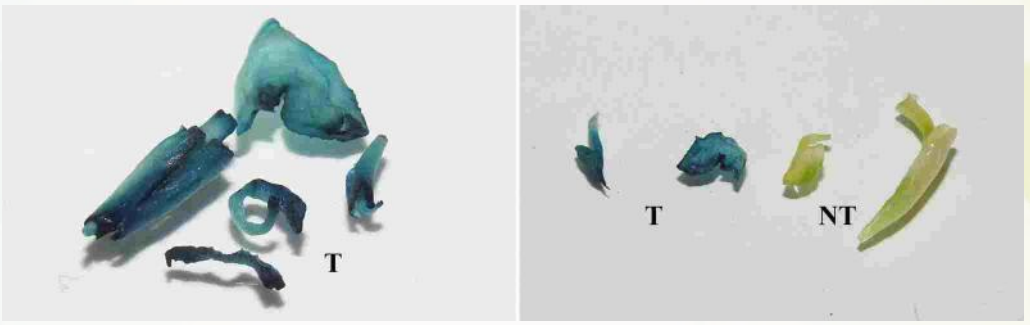
- Sweet potato genotypes, SB-5/61, Megh-2, BP-2, Dhenkanal Local-2 and RS-III-3 were identified as drought tolerance lines. These genotypes exhibited maximum shoot length, root length, number of leaves, number of roots and fresh plant weight at a concentration of 15 g l^{-1} of PEG in MS medium under *in vitro* conditions.
- Among 158 white yam accessions studied, the tuber yield ranged from 0.40 kg $plant^{-1}$ (DR-353) to 6.45 kg $plant^{-1}$ (DR-44). Seven accessions viz., DR-2, DR-43, DR-44, DR-46, DR-170, DR-313 and DR-128 were found to be high yielding (>5 kg $plant^{-1}$). The accession, DR-59 produced high yield coupled with compact tuber shape, while DR-80, DR-57 and DR-113 showed excellent cooking quality. The tuber yield per plant ranged

from 1.0 kg (CTDE-81) to 4.3 kg (CTDE-145) among the 220 accessions of lesser yam. Higher number of tubers/plant (>50) was recorded in accessions viz., CTDE-39, DE-49 and CTDE-53. High tuber yield (>4.0 kg plant^{-1}) was recorded in DE-62, DE-103 and DE-14.

- A high yielding (57.87 t ha^{-1}) greater yam hybrid, TGy12-1 was recommended for state release in Kerala with the name 'Sree Hima'. This variety has high dry matter (30.19%), starch (26.3%), crude protein (5.28%) and excellent culinary quality with high organoleptic score (7.97).
- In the advanced yield trial of greater yam hybrids, DaH-10-1-2 yielded the highest (55.95 t ha^{-1}) followed by DaH-66 (48.31 t ha^{-1}).
- Among the new bushy white yam genotypes evaluated, Drd-9495 produced the highest yield (36.41 t ha^{-1}) followed by Drd-835 (30.25 t ha^{-1}) as compared to the check variety, Sree Dhanya (25.55 t ha^{-1}). In the on-farm trials, the non-trailing white yam, SD-15 produced significantly higher yield (41.72 t ha^{-1}).

Sree Hima, a greater yam hybrid variety

- The *in vitro* pollen germination medium was optimized for greater yam to test the pollen viability of male parents. Maximum pollen germination (41.67%) of the variety Sree Karthika was recorded in modified Brewbaker and Kwack medium containing 100 mg l^{-1} boric acid, 300 mg l^{-1} calcium nitrate, 200 mg l^{-1} magnesium sulphate, 100 mg l^{-1} potassium nitrate and 15.0% sucrose.
- An efficient transformation protocol was optimized for taro (*Colocasia esculenta* L. Schott) variety Muktakeshi using Agrobacterium strain LBA4404 carrying β-glucoronidase (GUS) reporter gene on vector PBI 121. A total of 42.86% of transformed explants regenerated on regeneration medium supplemented with 4.0 mg l^{-1} BAP along with 1.0 mg l^{-1} NAA. The GUS histochemical assay was performed using stem and leaf cuttings of the transformed plants and 7.14% transformation frequency were observed.

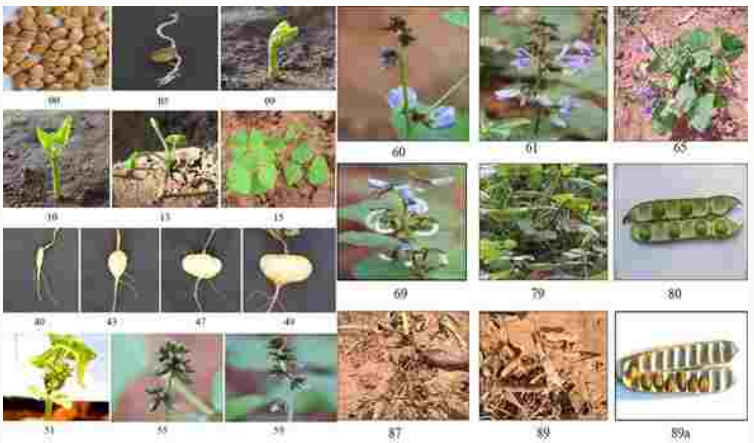


Histochemical GUS assay of the taro leaf and petioles of the transgenic line (T) and non-transformed control (NT)

- Nutritional rich line of taro such as TRC-369 for antioxidant, TRC-868 for sugar, Andaman for starch, Nycle for manganese, Tripura local-2 for phenolic, crude protein & potassium and NBPGR-37 for phosphorous, iron, copper and zinc content were identified.
- Three flowering lines were identified in elephant foot yam viz., Am-41, Am-141 and the hybrid , Sree Padma × Gajendra.
- In Chinese potato, out of 24 accessions, fifteen accessions recorded higher tuber yield (9.44 -18.70 t ha^{-1}) than the check variety, Sree Dhara (9.36 t ha^{-1}).
- Flower colour inheritance pattern was reported first time in yam bean. The number of tubers/plant was highest in TCR-136 (50) and the tuber size was highest in ASA-1 (7×7.1cm). The segregation of flower colour suggested monogenic dominant control of purple flower colour in yam bean.
- The DUS testing guidelines in greater yam and yam bean have been developed and published in the PPV&FRA website.

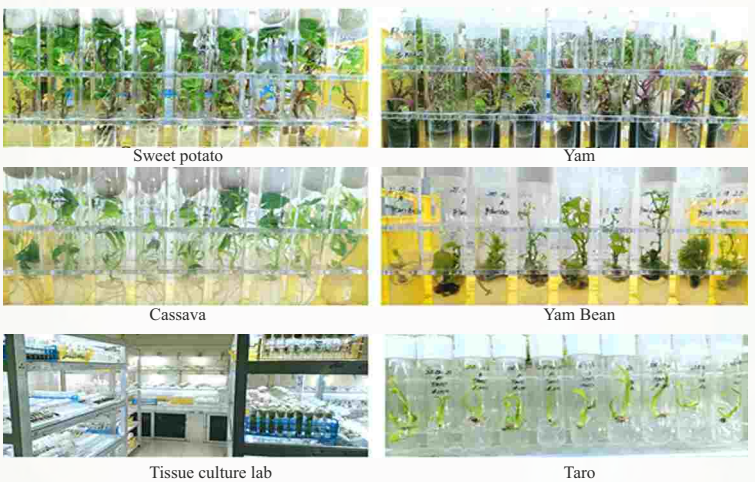
Distinctive characteristics of Tikabali Yam-1

- Yam bean phenological growth stages through extended BBCH (Biologische Bundesantalt, Bundessortenamnt and ChemischeIndustrie) scale was reported for the first time.



Phenological growth stages of yam bean according to the extended BBCH scale

- *In vitro* plant regeneration protocol was developed for anthocyanin rich purple flesh sweet potato var. Bhu Krishna, β-carotene rich orange flesh sweet potato var. Bhu Sona and white flesh sweet potato var. Kisan.
- *In vitro* plant regeneration protocol was developed for taro var. Muktakeshi, yam var. Orissa Elite and cassava var. Sree Jaya.

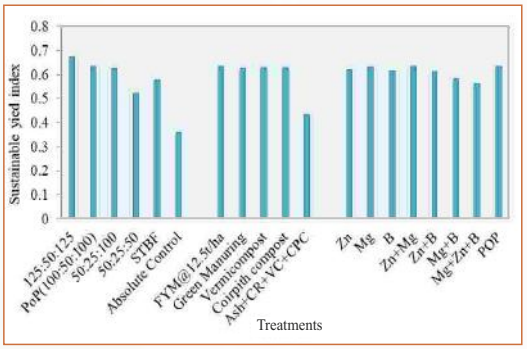


In vitro conservation of tuber crops at Regional Station, Bhubaneswar

- Genome-wide HMM based-analysis led to the identification of 82 *MeMADS* family genes in cassava. Presence of tissue-specific, biotic, abiotic, light-responsive, circadian and cell cycle-responsive *cis*-regulatory elements in their promoter region revealed their potential role in plant growth and development and stress tolerance in cassava.

CROP PRODUCTION

- Application of only 25% of the recommended dose of PoP (NPK @ 25:6.25:25 kg ha^{-1}) in the four cassava nutrient efficient genotypes viz., CI-905, CI-906, 7 III E3-5 and Sree Pavithra produced sustainable tuber yield of 31.12, 20.12, 28.52 and 28.41 t ha^{-1} respectively, for the third consecutive season (2019-20).

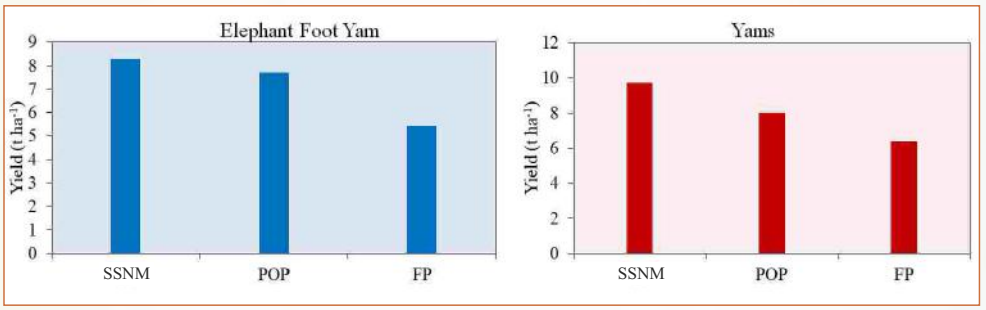


Sustainable yield index under different treatments in cassava

- The sustainable yield index (SYI) of NPK @ 125:50:125 kg ha^{-1} (0.676) was established over absolute control (0.359) after 15 years of continuous experimentation in cassava. The SYI of different organic manures ranged from 0.626-0.636, whereas that of combinations of organic manures alone, without chemical fertilizers, was found to be 0.432.
- Among the ten cassava varieties evaluated under irrigated and water deficit stress (WDS) conditions (early stress period for 90 days), Sree Reksha was found to be the most drought-tolerant cassava variety based on various morpho-physiological parameters.
- Among the twelve different cassava varieties evaluated for their response to organic farming, Sree Reksha (CR-24-4) produced significantly higher yield (36.97 t ha^{-1}) followed by Sree Vijaya (26.94 t ha^{-1}).
- In the integrated organic farming system model (IOFS), a net return of ₹54,862 was achieved from cassava based cropping system (with animal components for 4 months started during April 2020) from an area of 75 cents.

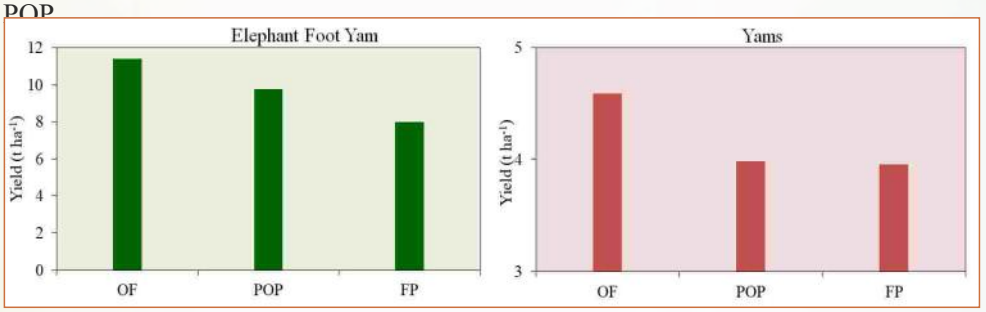
IOFS components

- Among the various carbon inputs studied for its quality in hill cassava production systems, farm yard manure applied @ 12.5 t ha^{-1} along with RDF (NPK @ 50:65:125 kg ha^{-1}) had a significant influence on labile carbon content and tuber yield (28.7 t ha^{-1}) over the control (21.6 t ha^{-1}).
- On-farm validation studies of SSNM based customized fertilizers conducted in elephant foot yam and greater yam in Kollam district has shown that SSNM resulted in higher yield, followed by package of practices (POP) and farmers' practice (FP). In elephant foot yam, SSNM resulted in higher yield over FP by 52.21% and POP by 7.25%. In yams, SSNM performed better than FP by yielding 52.26% higher and POP by 21.47%.



Productivity of tuber crops under SSNM *vs* POP *vs* FP

- Effect of different treatments on the yield of elephant foot yam and greater yam under Organic farming (OF) *vs* POP *vs* FP at Kollam showed that in elephant foot yam, OF resulted in higher yield, followed by POP and FP. In yams, OF resulted in higher yield, followed by POP and FP, which were almost the same, i.e., about 15% higher over FP and POP.



Productivity of tuber crops under OF *vs* POP *vs* FP

- Results on validation of SSNM based customized fertilizers developed for cassava and elephant foot yam based on OFTs conducted in Kerala showed an average yield increase of 5.85 t ha^{-1} in SSNM treatment compared to farmer fertilizer practice (18.10% yield increase). The B:C ratio calculated for SSNM and PR for cassava, EFY, greater yam, white yam and taro also has revealed higher values for SSNM technology.
- Customized fertilizer practices were demonstrated and popularized in Kollam, Idukki and Alappuzha districts of Kerala and application of N, P_2O_5, K_2O, Mg, Zn, B @

7:12:24:2.5:1.25:0.4 (@ 625 kg ha^{-1}) was found best for EFY in coconut cropping system, where there was an increase in tuber yield in elephant foot yam up to 15-20% over POP and in cassava, to an extent of 15-30%.

- Polysulphate was found to be a good soil ameliorant for cassava in the acid laterite and sandy loam soils of Kerala. Bulking of tubers, better cooking quality, improvement in starch content and lowering of bitterness were observed due to polysulphate application along with improvement in the soil status of nutrients, especially K, Ca, Mg and S.

Tuber yield in cassava under polysulphate application

- Cormel yield of elephant foot yam (28.67 t ha^{-1}) and grain and haulm yields of black gram as an intercrop (6.35 and 17.22 q ha^{-1}, respectively) along with sustainable soil quality benefits was obtained with a combined application of NPK @ 40, 15 and 40 kg ha^{-1} and incorporation of FYM @ 10 t ha^{-1}.
- Bulk density was found to be the critical soil parameter that influences the most important hydro physical variables such as saturated hydraulic conductivity and soil sorptivity, based on the soil infiltration and Guelph permeameter field estimation studies. Conventional tillage with weed control ground cover sheet was suitable for achieving soil health and optimum yield benefits in cassava under ultisols.
- Adoption of plant density @74,000 plants ha^{-1} (45 × 30 cm) and paddy straw mulching in taro helped to lower the weed dry weight to an extent of 152.4 g m^{-2} and 118 g m^{-2} and to achieve higher tuber yield of 14.38 and 16.58 t ha^{-1}, respectively. Hand weeding at 30, 60 and 90 DAP recorded significantly lower weed dry weight (24.5 g m^{-2}) and higher yield (20.81 t ha^{-1}).
- Sole taro produced significantly greater cormel equivalent yield (17.62 t ha^{-1}) followed by taro + maize (5:1) (16.75 t ha^{-1}). Sole maize and pigeon pea systems resulted in lower cormel equivalent yield (4.86 and 6.71 kg ha^{-1}, respectively). The treatment taro + maize (5:1) resulted in greater B:C ratio of 2.47 followed by taro + maize (5:2) and taro sole cropping with 2.41 each.
- Fertigation of N-P_2O_5-K_2O @ 140-90-140 kg ha^{-1} in 60 splits at 3 days intervals in greater yam+maize intercropping system resulted in a higher gross return (₹6,10,000) and net return (₹3,97,200) as well as B: C ratio (2.87).
- Plastic ground cover mulching with drip irrigation at 50% CPE was found to be the superior water saving treatment in taro with a cormel yield of 29.4 t ha^{-1} and a total yield of 38.32 t ha^{-1} followed by biomulching (28.9 and 36.5 t ha^{-1}, respectively).
- The suitability of the AquaCrop in estimating the crop's yield irrespective of the

agro-climatic conditions was established with percentage error values ranging from -2.33 to 3.92% and 0.3 to 5% in the case of cassava and sweet potato, respectively.

- In elephant foot yam, treatment of corms with carbon disulphide @ 80 ml 100 kg^{-1} was found to produce higher uniform sprouting (84.92 and 99.96% at 15 and 40 days after planting (DAP), respectively) and higher corm yield (36.84 t ha^{-1}).
- The effect of biological treatments and minisett sizes in yams has influenced the sprouting percentage appreciably and it was maximum (84.14%) under fungicide pre-treatment (control) and increased with increase in sett size from 56.91% in 10 g sett to 81.62% in 50 g sett.
- The quality planting materials of improved varieties of cassava viz., Sree Reksha and Sree Jaya were distributed to five farmers in Shenkottai Taluk, Tenkasi district, Tamil Nadu for seed production under seed village programme and 8,000 sweet potato vine cuttings were supplied for the seed village at Karode, Thiruvananthapuram. The Chinese potato crop (var. Sree Dhara) was distributed to 15 farmers in Tirunelveli and Tenkasi districts, Tamil Nadu under seed village programme.

Distribution of sweet potato vines for the seed village at Karode, Thiruvananthapuram

Quality planting material production of Chinese potato at Kuthapanchan, Tenkasi

- Under RKVY, multiplication of planting materials at ICAR-CTCRI has been taken up with about 3.1 acres of elephant foot yam and 5.5 acres of cassava (Sree Reksha, Sree Pavithra, Sree Vijaya, Sree Jaya and Vellayani Hraswa) for supply and demonstration to ST farmer beneficiaries in Kerala.

Distribution of planting materials to farmers under RKVY programme

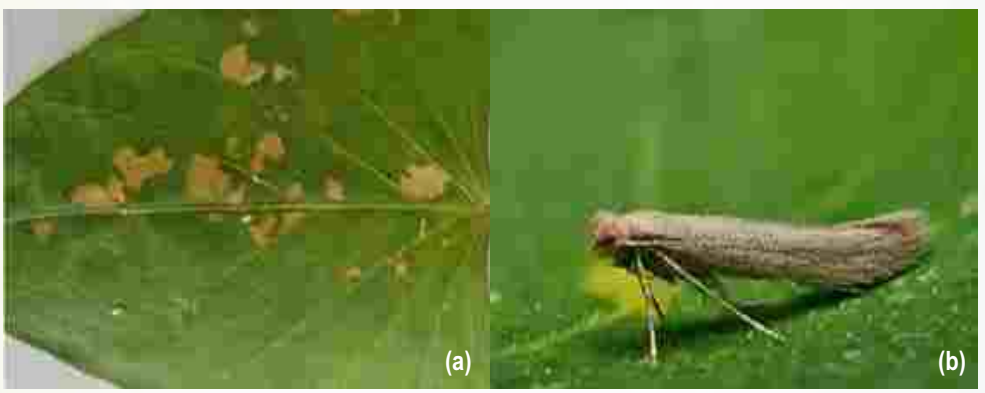
- Under RKVY in Odisha, field level demonstrations on tuber crops were conducted in 78.35 ha (sweet potato in 18.85 ha, cassava in 11.5 ha, yam in 12.2 ha, yam bean in 15.85 ha, elephant foot yam in 9.5 ha and colocasia in 10.35 ha) and 892 farmers were covered under the FLDs. Scaled up demonstrations on purple flesh sweet potato (var. Bhu Krishna) in 2.0 ha, orange flesh sweet potato (var. Bhu Sona) in 0.5 ha, white flesh sweet potato (Var. Kishan) in 0.5 ha, yam bean in 2.0 ha, greater yam+maize intercropping system in 1.0 ha were laid out in farmers' fields in Nabarangpur district.

Yam cultivation in Thuria village, Koraput district, Odisha

Purple flesh sweet potato field in Telatandi, Nabarangpur

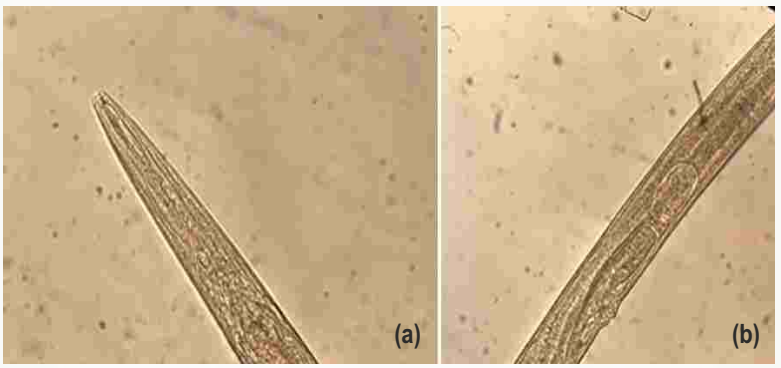
CROP PROTECTION

- A new emerging pest of sweet potato was identified in Thiruvananthapuram as sweet potato leaf miner, *Bedellia somnulentella* (Lepidoptera: Bedelliidae). It caused around 30% leaf damage. Various insecticides evaluated against this pest revealed that application of Spinosad 45% SC (0.3 ml l^{-1}) at fortnightly intervals was the most effective.
- Six synthetic insecticides were evaluated against sweet potato weevil (SPW). Of which, Imidacloprid showed the highest toxicity to SPW, and a positive correlation (r = 0.8) was found between the mortality and concentration of insecticides. This was followed by Chlorpyriphos. Malathion and Dimethoate caused least mortality to SPW.
- An experiment was designed to establish whether synthetic insecticides have any adverse effect on beneficial soil microbes. Quinalphos at recommended dose caused more than 90% inhibition of the growth of *Trichoderma*. Imidacloprid was comparatively safer for soil application.
- A distinct genetic variant of whitefly was identified from sweet potato fields of Thiruvananthapuram. It was compared with all available 44 whitefly genetic variants of Bayesian phylogenetic tree inferred from mtCOI data using the GTR+G model.



(a) Leaf miner damage in sweet potato leaf and (b) Adult of leaf miner *(Bedellia somnulentella)*

- A study was conducted to identify host plant resistance genes against sweet potato weevil infestation. The validation of protease inhibitor, cysteine inhibitor and Kunitz trypsin inhibitor gene expression in tubers of *Ipomoea mauritiana* and the roots of *I. palmata, I. triloba* and *I. obscura* were studied. For all the plants, both control and weevil infested tubers and roots were used for RNA isolation with replicates and cDNA was synthesized for Reverse Transcriptase-PCR (RT-PCR). The cDNA from all the samples were amplified with gene-specific primers.
- A new strain of plant-associated panagrolaimid nematode, *Panagrolaimus* sp. was isolated and identified from cassava stems (var. Sree Vijaya) from ICAR-CTCRI. This is the first report of its kind from cassava.



Plant associated *Panagrolaimus* sp. (a) Anterior region showing Panagrolaimoid oesophagus and (b) Adult female with mature eggs

- *In vitro* soilless culture of root-knot nematode on Chinese potato was developed using indigenous growth pouches. Thirty days after inoculation, galls containing adults and egg masses were noticed on the root surface.
- A survey was undertaken in nematode affected Chinese potato fields of Ravanasamudhram, Kadayam, Tenkasi, Tamil Nadu. The tubers were malformed and found infested with root-knot nematodes. The population density of *Meloidogyne incognita* was 1.5 nematodes per gram of soil.
- Field evaluation of a combination of fungicides to reduce taro leaf blight incidence showed that all the treatments significantly reduced the disease incidence. The reduction of percent disease index (PDI) over control ranged from 29.35% (Cymoxanil + Mancozeb (I) to 48.05% (Potassium phosphonate).

Symptom produced by isolates of *Colletotrichum* sp. and *Fusarium* sp. on EFY on challenge inoculation

- Fifteen distinct microorganisms were isolated from infected leaves/pseudostem of elephant foot yam (EFY) from ICAR-CTCRI and farmers' fields (Kottarakkara, Kerala). of which, *Colletotrichum* sp. and *Fusarium* sp. was the most predominant and Koch's postulates were successfully proved with these two pathogens.
- Ammonium bicarbonate at 0.5% and 1% concentration inhibited 100% of mycelial growth of eight pathogens associated with postharvest rot in yams.
- Treating the EFY corms with biocontrol agent, biopesticide and fungicide before storage

Mycelial growth inhibition of postharvest rot pathogens by ammonium bicarbonate

could bring down both postharvest rot and mealybug incidence in corms to less than 10%. The least postharvest rot incidence (1.8%) was with the treatment, Mancozeb + Carbendazim 0.2%. While, *Trichoderma* enriched cow dung slurry kept PHR and mealybug incidences below 8%.

- The potential endophytes, *Bacillus amyloliquefaciens* isolated from the roots of *Phyllanthus niruri* and *Bacillus licheniformis* from Aloe vera leaf, were evaluated against *Colletotrichum gloeosporioides* causing anthracnose in greater yam using cowpea as test plants. Seed treatment along with spraying *Bacillus licheniformis* showed higher leaf length and plant height of 13.9±0.1 cm and 28.43±0.5 cm, respectively, followed by seed treatment of *Bacillus licheniformis,* which are 13.7±0.3 cm and 26.9±.52 cm more than those of control.
- Soil and tuber treatment with *Trichoderma asperellum* along with seven sprays of Carbendazim (0.05%) showed the lowest anthracnose intensity (55%) in greater yam in the field as compared to control (97.5%). It was followed by spraying the combination of Carbendazim (0.025%) and *Nanma* (0.7%) seven times (75%) and spraying of 0.025% Carbendazim (82%), and growing of Sree Keerthi (83 %), a resistant variety around the susceptible plants.
- Recently, cassava root rot was observed as an emerging problem in Kollam and Thiruvananthapuram districts of Kerala. The infection occurred throughout the crop period. The incidence was 50 to 80% in Kollam district and 10% in Thiruvananthapuram. *Fusarium* sp. and *Pythium* sp. were associated with this disease.
- *In vitro* screening of fungicides and biocontrol agent against *Fusarium* sp. showed that Carbendazim was effective up to 5 ppm and *Trichoderma asperellum* showed the pathogen's highest inhibition (80%).
- Eight novel microRNAs were predicted from 123A library, four from 123B and 123C library using miRDeep2 under Small RNA sequencing of cassava mosaic disease (CMD) tolerant cassava variety, CMR-123 through NGS approach.
- MicroRNA families miR160, miR319, miR390, miR395, miR403, miR482, miR535 have predicted targets in immune receptors like leucine-rich repeats (LRR) and nucleotide-binding site (NBS) and miR403, miR2950, miR3627 regulate resistance (R)

genes, and pathogenesis-related (PR) proteins and defensins.

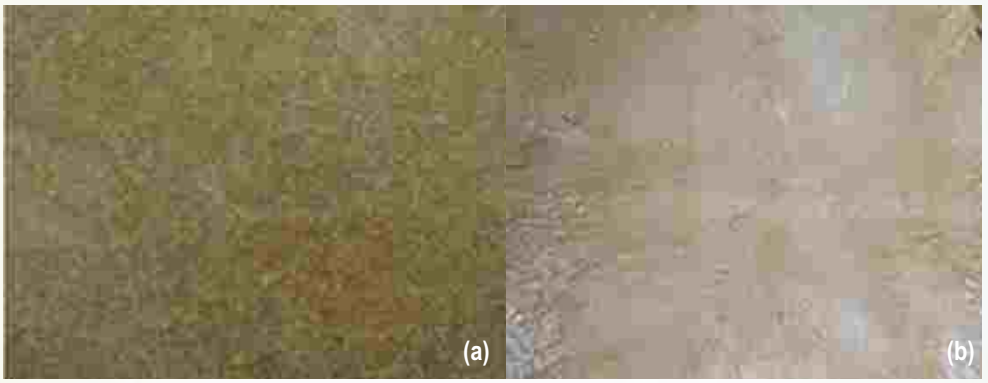
- Differential expression analysis showed that 67 miRNAs were upregulated (Log2 ≥ 0.5) and 28 miRNAs were down-regulated (Log2 ≤ 0.5) during *Cassava mosaic virus* infection.
- Targets for editing of *Sri Lankan cassava mosaic virus* (SLCMV) genome (AC1& BV1 gene) using CRISPR/ Cas9 and guide RNAs were designed based on various online tools.
- Fifteen cassava breeding lines (15S-103, 15S-409, 8S-501-2, 9S-132, 17S-143, 17S-135, 17S-241, CI-889, 17S-209, 9S-75, 15S-436, 17S-48, 17S-39, CR-54A3 and 15S-278) were evaluated for cassava mosaic disease resistance through chip bud grafting. All these lines showed a high level of resistance, further confirmed through ELISA, PCR and qPCR.
- Field trials on the impact of *Dasheen mosaic virus* infection in different cultivars of elephant foot yam showed a significant effect of the virus on biometric and morphological characters in infected plants compared to healthy ones.
- A diagnostic kit (DsMV ELISA KIT) against *Dasheen mosaic virus* was developed from the DsMV polyclonal antibody obtained after immunization in two New Zealand white rabbits against *Dasheen mosaic virus* protein (DsMV-IgG) and validated with more than 250 elephant foot yam leaf samples from different locations.

DsMV ELISA kit developed at ICAR-CTCRI

- A highly efficient and cost-effective diagnostic technique using RPA (Recombinase Polymerase Amplification) was developed for the detection of SLCMV from field samples.
- Sweet potato feathery mottle virus coat protein (SPFMV) polyclonal antibody (SPFMV-IgG) obtained after immunization into two New Zealand white rabbits with SPFMV coat protein (SPFMV-CP) was used for development of DAC ELISA diagnostic kit against SPFMV. The developed IgG reacted very efficiently with SPFMV positive samples and gave positive results upto 1:6000 dilutions.

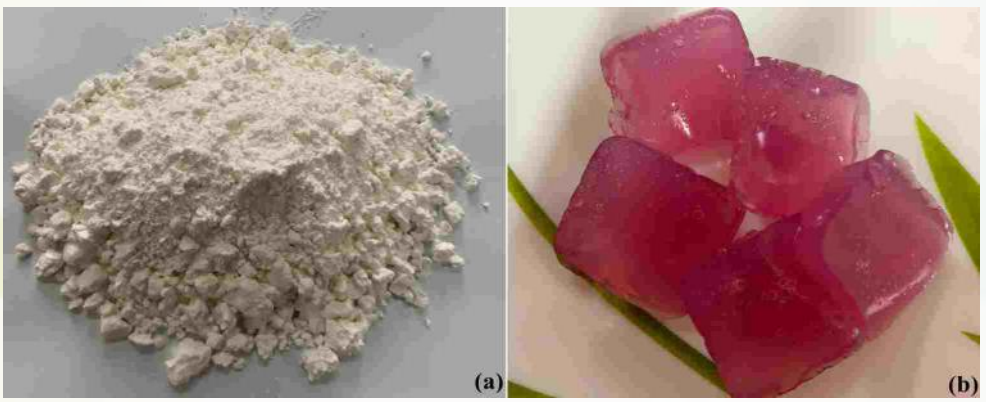
CROP UTILIZATION

- The optimum process parameters standardized for the production of high quality cassava flour (HQCF) by static pressing method were: pressure-60 bar, pressing time-30 s and loading weight-571g of cassava mash. The starch loss in the mash due to pressing was extremely low (0.44 to 1.70%).
- Process conditions were optimized for the development of particle boards from cassava stem-sugarcane bagasse using cashew nut shell liquid as binder.
- Cassava starch, in the native and different chemically modified forms were tested as an ingredient in cement mortar to optimize the properties.
- Thermoplastic starch sheets were prepared from cassava starch-cassava stem fibrous flour as well as from cassava starch-sorbitol composites and the process parameters were optimized.



Thermoplastic starch sheets prepared from (a) Cassava starch-cassava stem fibrous flour and (b) Cassava starch-sorbitol composites

- Synthetic conditions were standardized for food grade and low temperature gelling cassava starch monophosphates with (Phosphorous <0.4% as per FDA regulations) using orthophosphate salts and the physicochemical properties were determined. The modified starch was successfully tested as gelling agent in a model gel candy.



(a) Cassava starch phosphate and (b) Gel candies prepared from starch phosphate

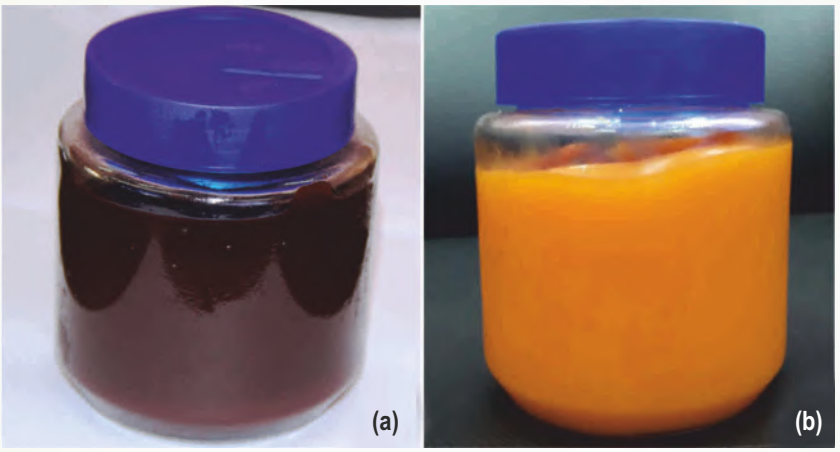
- The extraction process was standardized for Chinese potato starch to minimize the interference of phenolic compounds and maximize the starch yield. The physicochemical, pasting and *in vitro* enzymatic digestibility were determined. The starch possessed unique paste stability and very high viscosity and water binding capacity.
- *In silico* QSAR analysis for the structure-antioxidant activity relationship of sweet potato and purple yam anthocyanins revealed that acylated anthocyanins exhibited higher antioxidant potential than non-acylated anthocyanins. The purple yam anthocyanins acylated with sinapic acid and sweet potato anthocyanins acylated with caffeic and ferulic acids exhibited excellent antioxidant potential than others.
- A prototype continuous steaming machine for production of sago wafers/sago papad was developed and tested for its performance. The capacity of the steaming tank is 290 litres and the overall length of the machine is 2.83 m.

Prototype continuous steaming machine for sago wafer production

- A prototype continuous low cost cassava peeling machine for small scale processing was designed, fabricated and evaluated for its performance.
- Rice analogue was developed from the composite flour containing cassava (60-70%), maida (20-30%) and beetroot powder (5-10%). Cassava, maida and beet root powder in concentrations of 68.16%, 22.13% and 9.71%, respectively were found to be optimum for producing the rice analogue.

Rice analogues from cassava flour

- Anthocyanin rich nutri-jelly was developed from the extract of purple fleshed sweet potato variety, Bhu Krishna and β-carotene rich nutri-jelly from the extract of orange fleshed sweet potato variety, Bhu Sona. The moisture content, total soluble solids (TSS), titratable acidity and anthocyanin content of the nutri-jelly were 28.4%, 67.51° Brix, 0.50%, 54.11 mg 100 g^{-1}, respectively and the overall acceptability as determined by sensory evaluation was 8.72. The carotene rich nutri-jelly contained 27.29% moisture, 67.53°Brix TSS, 0.53% titratable acidity and 7.20 mg 100 g^{-1} β-carotene content. Both the nutri-jellies have good storage stability at ambient and refrigerated temperatures up to 90 days of storage period.



(a) Anthocyanin rich and (b) β-carotene rich nutri-jellies prepared from sweet potato

- Ready-to-eat extruded puffed snacks were prepared from sweet potato (30%), cassava (30%), maize (25%) and finger millet flours (15%).
- A process was standardized for preparing nutri-sauce from orange fleshed sweet potato variety, Bhu Sona.

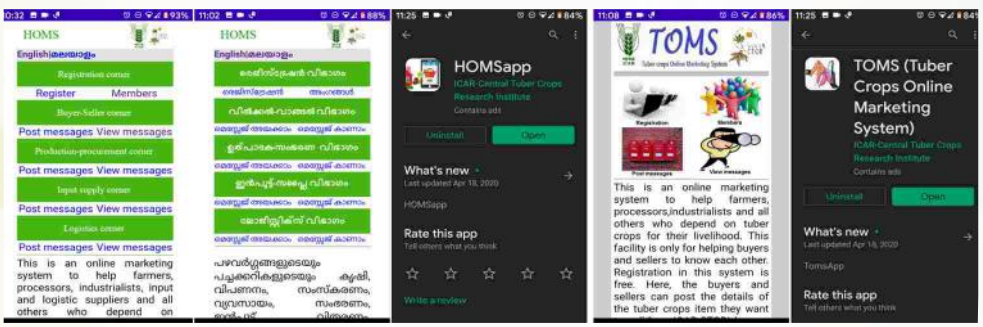
EXTENSION AND SOCIAL SCIENCES

- FLDs on Fertilizer Best Management Practices (FBMP) in greater yam (Local cultivar: Bombay yam) intercropped with coconut and turmeric conducted in East Godavari district of Andhra Pradesh revealed that the average yield of greater yam in FBMP treatment was 14.25 t ha^{-1}, which was 10.81% more than the yield obtained from farmers' practices (12.86 t ha^{-1}). Similar trend was observed in the gross income (10.81%) and net income (40.13%) in comparison to farmers' practices. Farmers opined that FBMP treatment resulted in robust vegetative growth, absence of nutrient deficiencies, higher yield, good shape and size of tuber and increase in the weight of tuber.
- FLDs on improved varieties of sweet potato viz., Sree Arun, Sree Varun, Sree Kanaka and Bhu Krishna conducted in Thiruvananthapuram district of Kerala showed that the sweet potato variety Sree Arun produced the maximum yield (22.30 t ha^{-1}) followed by Sree Varun (21.70 t ha^{-1}), Sree Kanaka (17.80 t ha^{-1}) and Bhu Krishna (15.40 t ha^{-1}) under irrigated lowland conditions. Average yield of improved varieties of sweet potato was 19.30 t ha^{-1} which was (9.66%) greater than the yield of local varieties (17.60 t ha^{-1}). Gross income realized from improved and local varieties of sweet potato were ₹2.89 and ₹2.64 lakhs ha^{-1} respectively.
- FLDs on improved varieties of elephant foot yam viz., Gajendra and Sree Padma conducted in Tenkasi district of Tamil Nadu revealed that the variety Gajendra produced the maximum yield (39.6 t ha^{-1}) followed by Sree Padma (37.5 t ha^{-1}). Net income realized from improved and local varieties of elephant foot yam were, ₹2.58 lakhs ha^{-1} and ₹1.99 lakhs ha^{-1}, respectively. The benefit: cost ratio of the improved varieties was 1.81 whereas, it was 1.58 for local varieties.

Demonstration plots on FBMP in greater yam

Demonstration plots of improved varieties of elephant foot yam

- The per capita consumption data of sweet potato in different states of India revealed that Arunachal Pradesh had highest annual per capita consumption of sweet potato (6.31 kg) followed by Mizoram (2.26 kg) and Meghalaya (1.25 kg). A Biofortification Priority Index (BPI) was developed by modifying the methodology adopted by Harvest Plus for identifying the states which require field interventions to promote biofortified varieties of sweet potato. Results indicated that Meghalaya (36.62%), Odisha (27.86%), Mizoram (25.58%), Assam (19.25%) and Arunachal Pradesh (13.75%) are prioritized states for promoting biofortified varieties of sweet potato.
- Promotional programme of biofortified varieties of sweet potato viz., Bhu Sona and Bhu Krishna was implemented through 10 FLDs in 10 Anganwadis in Tenkasi district of Tamil Nadu.
- Mapping of women empowerment in cassava cultivation was conducted during 2020 among 65 women and 35 men in Thiruvananthapuram and Pathanamthitta districts of Kerala. Majority of the women respondents (61.53%) and men respondents (68.57%) had medium level of participation in cassava cultivation. The overall participation score was more for men (2.43) than women (2.16) in cassava cultivation which was significant at 1% level. Empowerment index of women in cassava was estimated to be 0.78 and for men 0.86. The mean empowerment index of men was more than women in all indicators except group membership. This may be due to the membership of women in the self help groups at the villages.
- Developed methods and tools in R software to predict the farm harvest price and wholesale market price of cassava and sweet potato using exponential smoothing technique (EST), autoregressive integrated moving average (ARIMA) and artificial neural network model (ANN).
- Growth rate analysis of tuber crops in India revealed that the area under cassava (-1.38%) and sweet potato (0.70%) as a whole is showing a declining trend for the period 2001-02 to 2017-18 due to changes in the agro climatic conditions and socio economic constraints.
- eCrop based smart farming technology was developed and demonstrated in sweet potato field by setting up a smart fertigation facility. Mobile apps viz., Horticultural Crops Online Marketing System (HOMS) and Tuber Crops Online Marketing System (TOMS) were developed for directly linking the producers, consumers, input suppliers and logistics service providers of all vegetable crops including tuber crops.



View of HOMS and TOMS

- A computational approach was developed for the prediction of protein-protein interaction of plant host with *Phytophthora*, using the protein sequence information on plant and pathogen. An interactive web application for prediction of interacting proteins using RShiny was developed, which can select the protein features and the methods for prediction of plant host *Phytophthora* interaction.
- A survey of impact of COVID-19 lockdown conducted among nine startups revealed that 16% startups have their cash flows dampened, followed by problems in getting raw materials and other inputs (13.95%) and additional expenses spent for non-working hours of the employees (11.62%). Among the startups surveyed, 56% startups are severely impacted and fully closed followed by 33% partially closed and 11% had manageable impact. Social entrepreneurship meet was organized by ICAR-CTCRI ABI, in collaboration with North Eastern Hill University Incubation Centre (NEHU, Tura, Meghalaya), ICAR-National Institute for Biotic Stress Management (Raipur, Chhattisgarh) and ICAR-ABI, ICAR Research Complex for NEHR (Umiam, Meghalaya).
- Rainbow diet campaign comprising mixed methods approach involving campaigns, public rallies, frontline demonstrations, school gardens and entrepreneurship development programmes, was organized in four northeastern states viz., Arunachal Pradesh, Mizoram, Meghalaya and Tripura under the NEH programme. Two public rallies, 30 frontline demonstrations involving antioxidant rich sweet potato varieties, four entrepreneurship programmes, four campaigns involving 820 farmers and 260 school and college students were conducted. Three ethnic food festivals were conducted in Arunachal Pradesh, Mizoram and Tripura. During these festivals, 30 farmers displayed 123 food products developed from tuber crops. Fifty recipes from tuber crops from Tripura were also documented.

Raw and boiled form | Processed form

Tuber crops rainbow diet

- Under TSP, 47 tribal households were adopted from six villages of Chakapada (Block), Kandhamal (District) for demonstrating tuber crops based farming system (0.4 ha model). Planting materials of sweet potato (2,25,000 vine cuttings), greater yam tubers (3,000 kg), elephant foot yam (3,000 kg), taro (500 kg), cassava (3,000 stems), yam bean

seeds (25 kg), maize seeds (20 kg), red gram (10 kg), vegetable seed kits (125 nos.) and back yard poultry birds (Vanaraja, 1,000 nos.) were distributed to the tribal farmers.

Tuber crops cultivation in tribal farmers' fields

- A total of 64 demonstrations on improved varieties/technologies of tuber crops were conducted in Thiruvananthapuram, Kollam, Alappuzha, Pathanamthitta and Ernakulam districts of Kerala and Tenkasi and Tirunelveli districts of Tamil Nadu for enhancing the productivity and profitability of tuber crops farming under SCSP programme. Critical inputs viz., planting materials, customized fertilizers, microfood, farm implements and tools were distributed to the SC farmers. Training programmes, field days, farm advisory visits and exhibitions were also conducted in these districts of Kerala and Tamil Nadu for the benefit of 514 SC farmers.

Demonstrations on site specific nutrient management in cassava under SCSP programme

Supply of critical inputs and planting materials

FLD on improved variety of elephant foot yam

FLD on improved variety of Chinese potato

- The super absorbent polymer technology was transferred to one Maharashtra based company and technology for tuber crops based fried snack products was transferred to two entrepreneurs in Kerala. A total of ₹22.56 lakhs was generated through technology commercialization, sale of technological products, student fee and other professional service functions.

ALL INDIA CO-ORDINATED RESEARCH PROJECT ON TUBER CROPS

All India Coordinated Research Project on Tuber Crops (AICRP TC) is the largest national network of tropical tuber and root crops covering eighteen states and one union territory consisting of north-eastern, eastern, western and southern parts of India. Presently, the AICRP TC has 21 centres, located in 12 State Agricultural Universities, 3 ICAR Institutes and two Central Agricultural Universities.

Achievements of AICRP on Tuber Crops during 2020

The 20th Annual group meeting of All India Coordinated Research Project on Tuber Crops was held online at ICAR-Central Tuber Crops Research Institute during 10-12 June 2020. Dr. Anand Kumar Singh, DDG (Hort. Sci.), Dr. T. Janakiram, ADG (Hort. Sci.), Dr. P. Rethinam, Chairman, QRT and Scientists from 21 AICRP TC and ICAR-CTCRI Headquarters and Regional Station, Bhubaneswar participated in the meeting. The DDG (Hort. Sci.) inaugurated the meeting and released the publication on 'Standard Operating Procedure (SOP) for AICRP on Tuber Crops' and a mobile app 'Data Collector' for real time data collection of AICRP TC projects. Two yam bean varieties were recommended for release during the meeting.

Technologies recommended for adoption

- Based on the varietal evaluation trials conducted across various centres, two yam bean varieties were recommended for release, one for the state of West Bengal (TYb14-8 (DPH-69), entry from Dholi centre) and the another for the state of Bihar (TYb14-9 (DPH-6), entry from Dholi centre).
- Successful tuber crops based integrated farming system models, comprising of improved varieties of vegetables, tuber crops, cereals, pulses, fruit crops, piggery, fish culture, livestock and poultry, were recommended for more units in North-Eastern states and tribal areas.
- Organic farming technology in elephant foot yam, comprising of raising green manure cowpea, use of organically produced planting materials, seed treatment with cow dung, neem cake and *Trichoderma,* application of *Trichoderma* incorporated farmyard manure, neem cake and ash, was recommended for the states of Maharashtra, Jharkhand, Bihar, Gujarat, Andhra Pradesh and West Bengal.
- Organic farming technology in greater yam, comprising of raising green manure cowpea, application of farmyard manure, neem cake, ash and bio-fertilizers, was recommended for the states of Tamil Nadu, Rajasthan, Manipur, Andhra Pradesh and West Bengal.
- Organic farming technology in taro, comprising of raising green manure cowpea, application of farmyard manure, neem cake, ash and bio-fertilizers, was recommended for the states of Tamil Nadu, Jharkhand, Manipur, Assam, Telangana and West Bengal.

- Use of weed control ground cover was found effective for weed management in elephant foot yam and it was recommended for the states of Tamil Nadu, Bihar, West Bengal, Andhra Pradesh and Andaman and Nicobar Islands. Post emergence application of herbicide, Glyphosate at 30, 60 and 90 DAP was found effective in the states of Himachal Pradesh, Gujarat, Chhattisgarh, Jharkhand and Tripura and was recommended for adoption.

Glimpses of 20th Annual Group Meeting of AICRP TC, ICAR-CTCRI

GENERAL

TRAININGS AND OTHER PROGRAMMES

Education

ICAR-CTCRI is the approved Research Centre of University of Kerala and Kannur University, Kerala; Manonmaniam Sundaranar University, Tamil Nadu; Utkal University and Orissa University of Agriculture and Technology, Odisha; Jawaharlal Nehru Krishi Viswavidyalaya, Jabalpur, Madhya Pradesh and Dr. YSR Horticultural University, J. R. Gudem, Andhra Pradesh for undertaking Ph.D. programmes on tuber crops. During the period, the Institute has offered exposure trainings to students and imparted technical guidance to Ph.D. programmes and project work of M.Sc. students. Besides, the scientists of ICAR-CTCRI have handled courses at College of Agriculture, Vellayani for the students of M.Sc. Course on Integrated Biotechnology.

Particulars of the programme	Number of students/scholars
B.Sc./B.Tech project work	44
M.Sc. project work	44
M.Sc. Integrated Biotechnology	6
Ph.D.	9

Award of Ph.D.

- Mr. Prakash P. was awarded Ph.D. in Agricultural Economics from ICAR-Indian Agricultural Research Institute, New Delhi for the thesis titled 'Institutional Finance for Horticulture Development in India: A Case of Protected Cultivation in Maharashtra State' under the guidance of Dr. Pramod Kumar.
- Mr. Prakash Krishnan, B.S. was awarded Ph. D. in Biotechnology from the University of Kerala, Thiruvananthapuram for the thesis titled 'Replicase (AC1) gene mediated resistance in cassava (*Manihot esculenta* Crantz) against *Indian cassava mosaic virus*' under the guidance of Dr. T. Makeshkumar.
- Ms. Remya K. was awarded Ph.D. in Environmental Science from the University of Kerala for the thesis titled 'Conservation agriculture: a tool for sustainable ecological intensification of elephant foot yam in banana based system under climate change' under the guidance of Dr. G. Suja.
- Ms. Anju, P. S. was awarded Ph.D. in Environmental Science from the University of Kerala for the thesis titled 'Development of customized fertilizer formulations for the cultivation of elephant foot yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson) in Kerala for better farm income and improved tuber and soil quality' under the guidance of

Dr. Susan John, K.

- Ms. Sujina M.G. was awarded Ph.D. in Biotechnology from the University of Kerala, Thiruvananthapuram for the thesis entitled 'Management of taro leaf blight using endophytes from medicinal plants' under the guidance of Dr. M. L. Jeeva.

Training Programmes

A total of 657 farmers, 368 students and 69 officials from different parts of the country had undergone training at ICAR-CTCRI and various places by ICAR-CTCRI staff. They were taught on the recent technologies of tuber crops for enhancing productivity and profitability in farming.

On campus training programmes

Particulars of training	Date	Number of beneficiaries and category	Sponsoring Institute/ State
Training on improved technologies of tuber crops	23 January 2020	110 farmers from Tirunelveli district of Tamil Nadu	ATMA, Tirunelveli, Tamil Nadu
Training on improved technologies of tuber crops	28 January 2020	47 farmers from Kozhikode district of Kerala	Prathiksha farmers club, Kozhikode
Training on scientific cultivation of tuber crops	29 January 2020	25 farmers from Theni district of Tamil Nadu	ATMA, Theni, Tamil Nadu
Training on scientific cultivation of tuber crops	30 January 2020	18 farmers from Thiruvarur district of Tamil Nadu	ATMA, Thiruvarur, Tamil Nadu
Training on improved technologies of tuber crops	05 February 2020	25 farmers from Udupi district of Karnataka	ATMA, Udupi, Karnataka
Agriculture Skill Council of India development training programme on Quality Seed Grower	07 February 2020 to 02 March 2020	20 Scheduled Caste farmers	Agricultural Skill Council of India (ASCI), Govt. of India
Training on improved technologies of tuber crops	19 February 2020	16 farmers from Bhubaneswar district of Odisha	Department of Agriculture, Govt. of Odisha
Training on improved technologies of tuber crops for enhancing farm income	19 February 2020	65 farmers from Kerala	Farmers clubs from different districts of Kerala
Training on scientific cultivation of tuber crops	29 February 2020	29 farmers from Kollam district of Kerala	Farmers Club, Kollam, Kerala
Online training on scale construction using structural equation modeling	30 April to 02 May 2020	64 officers/students from ICAR Institutes/SAUs	ICAR-CTCRI, Thiruvananthapuram

Particulars of training	Date	Number of beneficiaries and category	Sponsoring Institute/ State
Online RHWE training programme on Improved technologies of tropical tuber crops	15 September to 31 December 2020	Eight B.Sc. Horticulture students of Dr. YSRHU, College of Horticulture, Andhra Pradesh	Dr. YSRHU, College of Horticulture, Andhra Pradesh
Training programme on Improved technologies of tropical tuber crops	23-26 November 2020	Eight B.Sc. Horticulture students of KAU, College of Agriculture, Padannakkad, Kasaragod	Kerala Agricultural University, College of Agriculture, Padannakkad
Tuber Crops Rainbow Diet Campaign School Connect programme – Orientation Training for Anganwadi workers	24 November 2020	50 Anganwadi workers from Tirunelveli district, Tamil Nadu	ICAR-CTCRI, Thiruvananthapuram
Online Entrepreneurship Development Programme for Students of Agriculture and Allied Sciences	03-05 December 2020	192 students of agriculture and allied sciences from 12 states	Kerala Agricultural University, College of Agriculture, Vellayani, Thiruvananthapuram

Farmers from Thiruvarur, Tamil Nadu

Farmers from Kerala

Trainings organized by Techno Incubation Centre, ICAR-CTCRI

Seven hands on trainings on value added products from tuber crops were organized at the Techno Incubation Centre, ICAR-CTCRI, Thiruvananthapuram, which were attended by 113 participants. Technology for the production of fried snack food products from cassava was transferred to two entrepreneurs, viz., Ms. Beenamma, Grany Foods, Kozha, Kottayam and Mr. Anoop, Pothencode, Thiruvananthapuram, Kerala.

Training Programme on Effective Health Management for Enhancing Work Efficiency of ICAR Employees

A training programme on 'Effective Health Management for Enhancing Work Efficiency of ICAR Employees' for the staff members including contractual staff and students at the Headquarters, Thiruvananthapuram as well as at Regional Station, Bhubaneswar, Odisha was organized on 07 October 2020 through online mode. Facebook live streaming was also done

for the benefit of large number of participants. Dr. Vidhu Kumar K., M.D. (Psychiatry), Professor, Govt. Medical College, Ernakulam, delivered a lecture cum discussion on 'Mental wellbeing during Pandemic'. Dr. Anupama, S., BSMS (Siddha Medicine), Siddha Medical Practitioner, Thiruvananthapuram spoke on 'Stress management through Siddha'. Shri. Ramachandran, K., Sauparnika Gardens, Vattiyoorkavu, Thiruvananthapuram delivered an interactive lecture cum discussion on 'Art of Living for Spiritual health'. The participants had productive deliberations with the eminent speakers.

Trainings organized by RS ICAR-CTCRI Bhubaneswar

On campus training programmes

Training programme on 'Tuber crops and allied agricultural technologies for livelihood and nutritional security' was conducted at ICAR-CTCRI, Bhubaneswar, Odisha during 06-10 January 2020.

Details of other on campus training programmes are as follows:

Particulars of training	Date	Number and category of beneficiaries	Sponsoring Institute/ State
Training on 'Agro-techniques and value addition in tuber crops/soil health, nutrient management and its effect on crop production/ vermicompost production technology for sustainable crop production'	10 March 2020	27 progressive farmers along with 2 Agricultural Officers of Amudalavalasa, Burja and Vajrapu Kotturu Mandals of Srikakulam district, Andhra Pradesh	Farmers' Training Centre, Srikakulam, Andhra Pradesh
	09 December 2020	14 farmers of Parvatipuram Mandal, Andhra Pradesh	Department of Horticulture, Government of Andhra Pradesh

Off campus training programmes

- Training programme on 'Scientific methods of cultivation and value addition in sweet potato' was conducted at Horticulture Department Nursery Station, Gulugulapadar village, Simlipadar Gram Panchayat, Kantamal block, Boudh district, Odisha on 19 November 2020 in collaboration with Directorate of Horticulture, Government of Odisha under RKVY sponsored project 'Area expansion of sweet potato in Angul, Bolangir, Boudh, Deogarh, Keonjhar and Mayurbhanj districts of Odisha'.

- Training on 'Agro-techniques and value addition in tuber crops/soil health, nutrient management and its effect on crop production/vermicompost production technology for sustainable crop production' was organized for
  - 50 farmers of Tirtol block, Jagatsinghpur district, Odisha on 09 January 2020.
  - 50 farmers of Kujang block, Jagatsinghpur district, Odisha on 10 January 2020.
  - 50 farmers of Ramgarh and Hazaribagh districts, Jharkhand on 14 February 2020.

- 13 farmers of Kuchinda block, Sambalpur district, Odisha on 15 February 2020.
- 200 farmers of Lembucherra, Agartala, Tripura on 24 February 2020.
- 17 farmers of Sambalpur and Bolangir districts, Odisha on 02 March 2020.

The following training programmes were conducted under the sponsorship of CIP,

Particulars of training	Date	Beneficiaries
Training programme on 'Processing and value addition of sweet potato'	05-08 October 2020 03-04 December 2020 07-10 December 2020	SHGs and farmers in Khurda district, Odisha
	27-28 October 2020	Farmers in Angul district, Odisha
	02-03 November 2020	SHGs and farmers in Keonjhar district, Odisha
	04-05 November 2020	SHGs and farmers in Gajpati district, Odisha
	06-07 November 2020	SHGs and farmers in Rayagada district, Odisha
	19-22 December 2020	SHGs and farmers in Kandhamal district, Odisha

Training programmes at RS ICAR-CTCRI, Bhubaneswar

Professional attachment training of newly recruited ARS scientists

- Ms. Ana Raj, J., Scientist (Agricultural Extension), ICAR-National Research Centre on Equines (NRCE), Hisar, Haryana, has undergone professional attachment training on the topic 'Gender mainstreaming in cassava cultivation in Kanyakumari district of Tamil Nadu' during 21 May to 18 August 2020 under the guidance of Dr. D. Jaganathan and Dr. P. Prakash, Section of Extension and Social Sciences, ICAR-CTCRI, Thiruvananthapuram.
- Mr. Subeesh, A., of ICAR-Central Institute of Agricultural Engineering (CIAE), Bhopal, Madhya Pradesh has undergone Professional Attachment Training on 'e-Crop Based Smart Farming and Development of Data Driven Self-learning Model for Cassava Production System' during 04 June to 04 September 2020 under the guidance of Dr. V. S. Santhosh Mithra, Principal Scientist, Section of Extension and Social Sciences, ICAR-CTCRI, Thiruvananthapuram.
- Ms. Sona Charles, Scientist (Bioinformatics) at ICAR-Indian Institute of Spices Research, Kozhikode has undergone the three months Professional Attachment Training on 'Host Virus Interaction Prediction Using Machine Learning Techniques' during 10 September to 10 December 2020 under the Guidance of Dr. J. Sreekumar, Principal Scientist, Section of Extension and Social Sciences, ICAR-CTCRI, Thiruvananthapuram.

Professional Internship

- Professional internship training was given to three Ph.D. research scholars, one each from G. B. Pant University of Agriculture and Technology, Pantnagar, Uttrakhand; Department of Agricultural Extension, SASRD, Nagaland University, Nagaland and Kerala Agricultural University, College of Horticulture, Vellanikkara, Thrissur, Kerala.
- One PDF from IDP-NAHEP, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttrakhand and one SRF from ICAR-National Institute of Biotic Stress Management, Raipur, Chhattisgarh have undergone internship training on Methodologies for Impact Assessment.
- Two MSW Scholars of Christ University, Bengaluru and one Ph.D. Scholar from Kerala Agricultural University, College of Horticulture, Vellanikkara, Thrissur have undergone internship training on Innovation System Analysis.

Exposure visit cum training programmes

- One day exposure visit cum training on 'Improved technologies of tuber crops' was organized for the benefit of 330 farmers, 431 students and 30 officials across the nation at ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram. Exposure visits to the Institute were organized by state department of agriculture/farmers' organizations.
- A one day exposure visit cum training on tuber crops technologies was organized at ICAR-Central Tuber Crops Research Institute, Regional Station, Bhubaneswar, Odisha for 1472 persons comprising of farmers, students and officials.

Exposure visits of college students to ICAR-CTCRI

Resource person in Training programmes

- More than 150 classes on production, protection, processing and value addition aspects were handled through online and offline mode by the scientists of various divisions under different programmes within and outside the Institute beneficial to department officials, subject matter specialists, students and farmers all over the country. The specific topics covered were improved varieties, tissue culture, agro-techniques with special focus on organic management, integrated nutrient management, integrated pest management, integrated disease management, vermicomposting, bio-pesticides and bio-control strategies, post- harvest management and value addition.

PARTICIPATION IN EXHIBITIONS

ICAR-CTCRI Thiruvananthapuram and its Regional Station at Odisha participated in 7 exhibitions for the benefit of stakeholders.

PUBLICATIONS

The details of publications and social media presentations are as follows.

- Research papers: 60
- Presentations in Symposia: 56
- Books: 5
- Book chapters: 9
- Popular articles: 59
- Technical bulletins: 4
- Folders/Leaflets/Pamphlets: 8
- Business models: 2
- Course/Training manuals: 18
- Annual reports (ICAR-CTCRI and AICRP TC): 2

- Other Institute publications: 9
- E-publications: 3
- Radio talks: 8
- TV talks: 4
- Facebook live: 9
- YouTube channel: 9
- Video:1

AWARDS

- The QRT report of ICAR-Central Tuber Crops Research Institute and AICRP on Tuber Crops got the grade of 'Outstanding' for the significant achievements in research, extension and overall performance during last five years period 01 April 2014 to 31 March 2019.
- The ICAR-CTCRI Institute Technology Management Unit bagged 'Best Entrepreneur Promotion Award' by the Incubation Centre, North Eastern Hill University, Tura, Meghalaya during March 2020 for the entrepreneurship promotion activities organized in the NEH region.

ICAR-CTCRI receives Best Entrepreneur Promotion Award by the Incubation Centre, North Eastern Hill University, Meghalaya

- ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram bagged first prize in the category of 'Best Exhibition Stall Award' in VAIGA 2020 during 04-07 January 2020 at Thekkinkadu Maidanam, Thrissur, Kerala.
- Two purple fleshed greater yam varieties viz., Sree Neelima and Da-340 enriched with anthocyanins and micronutrients were among the 17 biofortified varieties dedicated to the Nation by the Hon'ble Prime Minister on the occasion of World Food Day on 16 October 2020.

Anthocyanin rich greater yam varieties were dedicated to the Nation by Hon'ble PM on World Food Day

- ICAR-CTCRI received the 'Best Centre Award' in the 15th AGM of All India Network Programme on Organic Farming (AINPOF), held during 25-26 November 2020 (PI: G. Suja, Co-PIs: G. Byju, S. S. Veena, S. Sunitha, A. N. Jyothi and M. N. Sheela).

ICAR – Indian Institute of Farming Systems Research
Modipuram, Meerut – 250 110

CERTIFICATE

This certificate is presented to

ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram (Kerala)

in recognition of being the

Best Centre of All India Network Programme on Organic Farming (AI-NPOF)

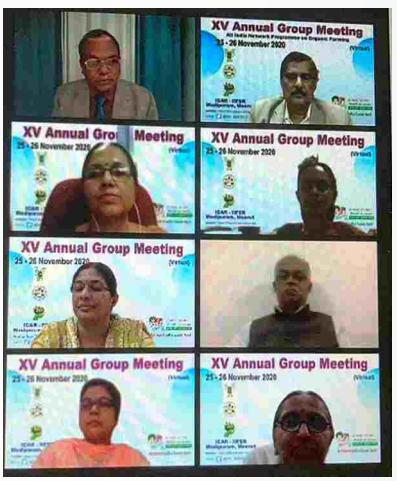
during 2019-20 under

ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut- 250 110

The team comprising of Dr. G. Suja as Principal Investigator and Dr. G. Byju, Dr. S.S. Veena, Dr. S. Sunitha, Dr. A.N. Jyothi and Dr. M.N. Sheela as Co-Investigators contributed for better performance of the centre including successful experimentation, publications and development of technologies for tuber crops (cassava-ground nut/vegetable cowpea, taro–blackgram/greengram) under organic production system. An integrated organic farming system model involving tuber crops and dairy also established, besides, geo-tagged characterization of 131 organic growers. The centre also contributed for human resource development by organizing model training course on organic farming, besides effective implementation of scheduled caste sub plan programme of the scheme.

(N. Ravisankar)
National PI, AI-NPOF & (PF (CU)

(A.S. Panwar)
Director



Best Centre Award of AINPOF

- Dr. P. Murugesan bagged the 'Distinguished Horticulture Scientist (2018)' award by the Society for Horticulture Research and Development on 14 February 2020 in recognition of significant contributions to Horticultural Sciences.
- The MM UP School, Peroor, Kilimanoor received the best Science Project Award at National Science Fest for their project on 'Green energy from cassava wastes' based on

technical and intellectual support provided by ICAR-CTCRI. Dr. G. Byju attended the School Annual Day and Science Fest as Chief Guest on 20 February 2020.

- Dr. Sabitha Soman and Dr. G. Byju received the best research paper award for the paper published in Current Horticulture in 2017 (Sabitha Soman and Byju, G. 2017. On-farm validation of site specific nutrient management in cassava (*Manihot esculenta*) in Thiruvananthapuram, Kerala, *Current Horticulture* 5(1): 20-29).
- Dr. T. Makeshkumar was conferred as Fellow of the Indian Virological Society, New Delhi on 02 February 2020.
- Dr. T. Krishnakumar bagged the Young Researcher Award 2020 by Institute of Scholars (InSc), Bengaluru, Karnataka (An ISO 9001:2015 certified institute by international accurate certification, accredited by UASL).
- Dr. N. Krishna Radhika was selected under the Indo-U.S. Genome engineering/Editing Technology Initiative (GETin) Overseas Fellowship programme module supported by the Department of Biotechnology (DBT), Govt. of India and implemented by the Indo-U. S. Science & Technology Forum (IUSSTF) for the proposal entitled 'Gene editing Indian cassava varieties to produce high value waxy starch' for a duration of six months under the U. S. Host, Dr. Nigel Taylor, Associate member and Dorothy J. King, Distinguished Investigator, Donald Danforth Plant Science Centre, St. Louis (MO), USA.
- Dr. Shirly Raichal Anil bagged the best poster award for the research paper titled Development of potato genotypes from heat tolerant true potato seed (TPS) crosses for combating climate emergency' (Authors: Gupta, V. K., Shirly Raichal Anil, Sunitha, S. and Chakrabarti, S. K.) in the Global Potato Conclave held during 27-31 January 2020 at Gandhi Nagar, Gujarat.
- Dr. P. Prakash bagged best oral presentation award for the research paper titled 'Economic evaluation of protected cultivation of capsicum in Maharashtra' (Authors: Prakash, P., Pramod Kumar, Amit Kar, Prabhat Kishore and Awani Kumar Singh) in National Conference on vegetable farmers' forum 2020 during 25-26 June 2020 organized by ICAR-Indian Agricultural Research Institute, New Delhi.
- Dr. P. Prakash was conferred 'Young Researcher Award 2020' in Agricultural Economics from Institute of Scholars, InSc units of SDPL, Bengaluru for the research paper entitled 'Status and impact of protected cultivation of horticultural crops in Maharashtra'.
- Dr. D. Jaganathan bagged best oral presentation award (Authors: Jaganathan, D., Sheela Immanuel, Prakash, P. and Sivakumar, P. S.) in National Conference on Agricultural Resource Management for Atma Nirbhar Bharat during 17-19 July 2020 organized by Central Agricultural University, Imphal, Manipur.
- Dr. D. Jaganathan bagged best oral presentation award (Authors: Ana Raj, Jaganathan, D., Prakash, P. and Sheela Immanuel) in National Workshop on Gender issues and Atma Nirbhar Bharat in Agriculture during 15-17 October 2020 organized by Central Agricultural University, Imphal, Manipur.

- Dr. P. Prakash bagged best oral presentation award for the paper titled 'Progress, perception and utilization by beneficiaries of PMKISAN scheme of Karnataka' (Authors: Kavitha, H. N., Pramod Kumar, Anbukkani, P., Burman, R. R. and Prakash, P.) in International e-conference on market led extension management: Focus on COVID-19 during 17-18 October 2020 organized by CCS National Institute of Agricultural Marketing, Jaipur and International Society of Extension Education, Nagpur at NIAM, Jaipur, Rajasthan.
- Dr. K. M. Senthilkumar was awarded the second best oral presentation award for the research work entitled 'Genome-wide identification, classification, collinearity and expression analysis of *MeHsp70* family genes in Cassava (*Manihot esculenta* Crantz.) (Authors: Senthilkumar, K. M., Pushpitha, P. and Sheela, M. N.) in the International E-Conference on 'Advances and Future Outlook in Biotechnology and Crop Improvement for Sustainable Productivity' held during 24-27 November 2020 organized by the Department of Biotechnology and Crop Improvement, College of Horticulture, Bengaluru.
- Dr. T. Makeshkumar bagged four best oral presentation awards for the research papers titled 'A protocol for the regeneration of cassava mosaic disease resistant variety' (Authors: Divya, K. and Makeshkumar, T.); 'Cloning of antisense sequence of replicase gene of Sri Lankan cassava mosaic virus' (Authors: Iype Praveen Thomas and Makeshkumar, T.); 'Identification of conserved microRNAs from a CMD tolerant cassava variety in response to cassava mosaic virus infection' (Authors: Summayya, M. and Makeshkumar, T.) and 'Production of disease free plants of elephant foot yam through tissue culture' (Authors: Merlin Graceson Cherian and Makeshkumar, T.) in the IPS-Virtual National Symposium 2020 on Advances in crop health management held during 01-02 December 2020.
- Dr. M. S. Sajeev bagged the 'Outstanding Achievement Award 2020' in 11th International Conference on Agriculture, Horticulture and Plant Sciences held at STA Office, New Delhi during 19-20 December 2020, organized by the Society of Tropical Agriculture.

IMPORTANT PROGRAMMES AND EVENTS

Event	Date
Tuber day at Kandhamal, a tribal dominated district of Odisha	17 January 2020

Tuber Day celebration at Tikabali, Kandhamal, Odisha

Quinquennial Review Team Meeting	24-26 January 2020

Stakeholders Interface organized during the final meeting of QRT

Training programme on 'Promoting tuber crops based rainbow diet for food and nutritional security' at ICAR-RC NEH, Kolasib, Mizoram	21-22 February 2020
Workshop cum Training on Promoting Rainbow Diet 'Achieving Food, Nutritional and Health Security through Tuber Crops' at ICAR-NEH Tripura Centre, Lembucherra, Agartala, Tripura	24 February 2020
Stakeholders cum Interface Meet on 'Promoting tuber crops based Rainbow diet for food, nutrition and health security' in Tripura	25 February 2020

Farmers awareness programme

Consumer awareness programme

Public rallies conducted in Khupa, Anjaw, Arunachal Pradesh and Tura, Meghalaya promoting tuber crops based rainbow diet

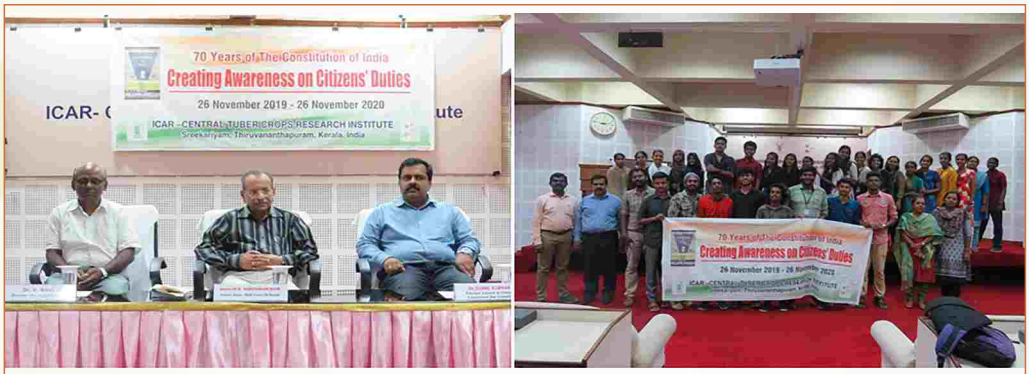
Event	Date
Social Entrepreneurship Meet (organized by ICAR-CTCRI ABI, in collaboration with North Eastern Hill University Incubation Centre, Tura, Meghalaya, ICAR-National Institute for Biotic Stress Management, Raipur, Chhattisgarh and ICAR-ABI, ICAR Research Complex for NEHR, Umiam, Meghalaya at Tura, Meghalaya	06 March 2020
46th Annual Institute Research Council Meeting	26-29 May 2020
The 20th Annual Group Meeting of ICAR-All India Coordinated Research Project on Tuber Crops	10-12 June 2020
Virtual Consultative Meet on Recent Progress in Germplasm Utilization and Breeding in Sweet Potato	14 September 2020

Virtual Consultative Meet

Event	Date
Training programme on Effective Health Management for Enhancing Work Efficiency of ICAR Employees	07 October 2020
International Webinar on Harnessing the Potential of Tropical Tuber Crops under Changing Climate (HPTTC 2020)	27 October 2020

Glimpses of HPTTC 2020

Vigilance Awareness Week	27 October 2020 to 02 November 2020
Constitution Year celebration	26 November 2019 to 26 November 2020
Constitution Day celebration	26 November 2020



Constitution year celebrations

Event	Date
World Soil Day	05 December 2020
Tuber Crops Day	07 December 2020
Third meeting of VIII RAC	16 December 2020
The XVII Institute Management Committee Meeting	18 December 2020
Hon'ble Prime Minister's address during PM Kisan money release-Live Web Telecast	25 December 2020

Hon'ble Prime Minister's address

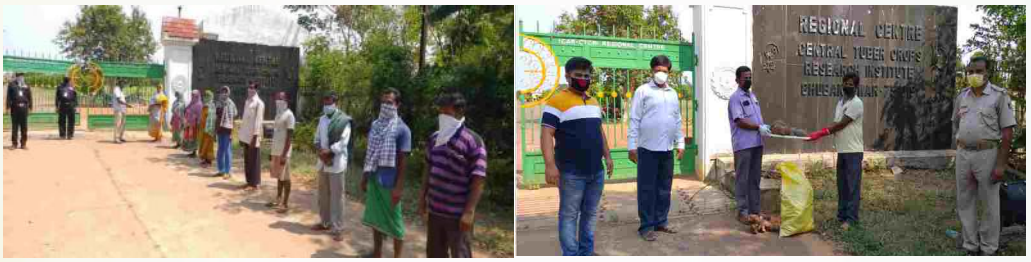
Tuber crops for food and nutrition security during COVID-19 pandemic crisis

Farm agro advisory on production technologies in English and regional languages have been uploaded in the Institute website for the benefit of farmers. The *Arogya sethu* app was given maximum publicity through Whatsapp and other social media to group of farmers and other stakeholders. ICAR-CTCRI developed an online marketing app 'HOMS' (Horticulture Online Marketing System) facilitating marketing of tubers, vegetables and fruits. Publicity about the availability of this app is also given in local newspapers. Being a consumer state, fear of a COVID-19 lockdown-triggered food shortage in the months ahead has prompted Kerala to go back to its 'roots' to guarantee food security. The Government of Kerala has already started implementing an action plan to boost agricultural production in the state to make it self-sufficient and has been named '*Subiksha Keralam*'. The massive, ambitious programme aims to boost farming of cassava, yam, elephant foot yam, sweet potato, taro and Chinese potato among agricultural clubs and Farming Groups utilizing fallow lands and at homestead-levels, promote food processing industries to develop small scale entrepreneurs and establish Food Processing Clusters in Kerala. In this regard, ICAR- CTCRI supplied planting materials worth of ₹2.7 lakhs to Govt. of Kerala for further multiplication in district agriculture farms under Department of Agriculture for distribution to farmers.

Supply of planting materials to Govt. of Kerala

During the COVID-19 pandemic period, ICAR-CTCRI, Thiruvananthapuram, Kerala and its Regional Station at Bhubaneswar, Odisha have donated 10 tonnes of cassava tubers, 100 kg elephant foot yam tubers, 260 kg yam tubers, 60 kg taro tubers and 60 kg sweet potatoes to 'Community Kitchens' run by nine group of beneficiaries including Municipal Corporation, Panchayats, NGOs, and poor people and farmers from nearby MGMG villages, police personnel inThiruvananthapuram and Bhubaneswar. Agro-advisories through TV, Radio, YouTube and Facebook were also given during the period to help tuber crop farmers during lock down period.

Supply of cassava to Panchayats and Municipal Corporation, Thiruvananthapuram



Supply of tuber crops to needy people at RS ICAR-CTCRI, Bhubaneswar

Infrastructure Development

Livestock Shed and Dairy Unit at ICAR-CTCRI

A Livestock Shed & Dairy Unit with 2 cows and 2 calves as a part of IOFS under AINPOF was established. It was formally inaugurated on 11 May 2020 by Dr. V. Ravi, Director (A), ICAR-CTCRI as a part of Integrated Organic Farming System Model of AI-NPOF. Integration of cereals, tuber crops, fodder, fruit crops, vegetables, pulses and oilseeds and cows in the IOFS would provide safe food, income, employment opportunities, and nutrient recycling. All the crop components have been established.

DISTINGUISHED VISITORS

- Justice Shri M. R. Hariharan Nair, Former Judge, High Court of Kerala
- Dr. P. Rethinam, Former ADG, ICAR; Chairman, CDB, GOI & Executive Director, APCC, Jakarta, Indonesia
- Dr. S. K. Naskar, Former Director, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram
- Dr. M. S. Palaniswami, Former Project Co-ordinator (AICRP on Tuber Crops), ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram
- Dr. Malavika Dadlani, Former Joint Director (Research), ICAR-Indian Agricultural Research Institute, New Delhi
- Dr. K. Vasuki IAS, Director of Agriculture, Government of Kerala
- Dr. R. V. S. K. Reddy, Director of Research, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh
- Dr. L. Pugalendhi, Dean, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu
- Dr. E. V. Soniya, Scientist G, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram, Kerala
- Mrs. Amrutha Rahim, Assistant Professor, Mar Gregorios College of Law, Thiruvananthapuram, Kerala

RETIREMENT

The following technical, administrative and skilled support staff retired from service during the year 2020.

- Smt. T. K. Sudhalatha, Assistant Chief Technical Officer
- Shri. S. Natarajan, Technical Officer, Farm
- Shri. N. C. Jena, Technical Officer, RS Bhubaneswar
- Shri. Bharat Kumar Sahoo, Technical Officer, RS Bhubaneswar
- Smt. V. Sathyabhama, U. D. C.
- Smt. M. Syamala, Skilled Support Staff
- Shri. Purna Samal, Skilled Support Staff, RS Bhubaneswar
- Shri. Fakir Charan Bhoi, Skilled Support Staff, RS Bhubaneswar

PROMOTION/NEW JOINING/TRANSFER/DEPUTATION

- Dr. R. Saravanan Raju was promoted to Principal Scientist (Plant Physiology)
- Dr. D. Jaganathan was promoted to Senior Scientist (Agricultural Extension)
- Dr. H. Kesava Kumar, Scientist (Nematology), Dr. Visalakshi Chandra C., Scientist (Genetics & Plant Breeding), Dr. Senthilkumar K. M., Scientist (Agricultural Biotechnology), Dr. Vivek Hegde, Scientist (Vegetable Science) and Dr. V. B. S. Chauhan, Scientist (Vegetable Science) were promoted to next grade with RGP 7000.
- Dr. Sirisha Tadigiri was transferred to Regional Station, ICAR-Directorate of Floriculture Research, Rajahmundry, Andhra Pradesh
- Dr. Namrata Ankush Giri was transferred to National Research Centre on Pomegranate, Solapur, Maharashtra
- Shri. R. Bharathan was transferred to ICAR-Indian Institute of Spices Research, Kozhikode, Kerala
- Smt. R. Anuja and Shri. N. Shiju were joined as skilled support staff at HQ, ICAR-CTCRI

EVENTS AND ACHIEVEMENTS AT A GLANCE

Events

Events	Date
Tuber day at Kandhamal, a tribal dominated district of Odisha	17 January 2020
Quinquennial Review Team meeting	24-26 January 2020
Training programme on 'Promoting tuber crops based rainbow diet for food and nutritional security' at ICAR-RC NEH, Kolasib, Mizoram	21-22 February 2020
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Stakeholders cum Interface Meet on 'Promoting tuber crops based Rainbow diet for food, nutrition and health security' in Tripura	25 February 2020
National Science day celebration	26-27 February 2020
International Women's Day 2020 celebration	10 March 2020
46th Annual Institute Research Council meeting	26-29 May 2020
The 20th Annual Group Meeting of ICAR-All India Coordinated Research Project on Tuber Crops	10-12 June 2020
Virtual Consultative Meet on Recent Progress in Germplasm Utilization and Breeding in Sweet Potato	14 September 2020
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Constitution Day celebration	26 November 2020
World Soil Day celebration	05 December 2020
Tuber Crops Day celebration	07 December 2020
Third meeting of VIII RAC meeting	16 December 2020
The XVII Institute Management Committee meeting	18 December 2020
Hon'ble Prime Minister's address during PM Kisan money release-Live Web Telecast	25 December 2020

Achievements

Particulars	No.
Institute projects	8
External aided projects	23
Tuber crops germplasm maintained in the field gene bank	5,713
Tuber crops varieties recommended for release	1
Technologies commercialized	3
ICT Apps developed	2
Revenue generated through technology commercialization and professional service functions (₹ lakhs)	22.55
B. Sc. students guided	44
M. Sc. students guided	50
Ph. D. scholars guided	9
Ph. D. awarded	5
Farmers visited the Institute	657
Students visited the Institute	398
Officers visited the Institute	69
Trainings conducted	41
Institute staff members trained	21
Publications in peer reviewed journals	60
Papers presented in conferences/seminars/symposia/workshops etc.	56
Books	5
Book chapters	9
Popular articles	59
Folders, Leaflets, Pamphlets	8
Radio talks	8
TV programme	4
Facebook live	9
Dignitaries visited the Institute	10
Exhibitions organized	7

QUALITY PLANTING MATERIAL PRODUCTION OF TUBER CROPS

Sl.No.	Name of the Crops	Varieties	Quantity
1.	Cassava (no. of stems)	Sree Vijaya	30,000
		Sree Jaya	25,000
		Sree Reksha	50,000
		Sree Suvarna	5,000
		Sree Sakthi	5,000
		Total	1,15,000
2.	Elephant foot Yam (tonnes)	Gajendra	37.50
		Sree Padma	0.50
		Total	38.00
3.	Greater Yam (tonnes)	Sree Shilpa	32.50
		Sree Roopa	
		Sree Keerthi	
		Sree Karthika	
		Sree Nidhi	
	White Yam (tonnes)	Sree Priya	3.00
		Sree Dhanya	
	Lesser Yam (tonnes)	Sree Latha	3.50
		Total	39.00
4.	Taro (tonnes)	Muktakeshi	2.50
		Telia	
5.	Sweet Potato (no. of vine cuttings)	Bhu Sona	5,50,000
		Bhu Krishna	5,04,000
		Kisan	4,00,000
		Sree Arun	2,000
		Sree Kanaka	2,000
		Gouri	2,000
		Total	14,60,000
6.	Chinese Potato (no. of vine cuttings)	Sree Dhara	30,000
7.	Yam Bean seeds (kg)	RM-1	200

‘Produce Tuber
Ensure food, nutrition and
livelihood security’

For further details please contact
Email: director.ctcri@icar.gov.in
Website : http://www.ctcri.org

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch