

Commercializable Technologies from ICAR-CTCRI



Institute Technology Management Unit
ICAR - Central Tuber Crops Research Institute
Sreekariyam, Thiruvananthapuram - 695017, Kerala, India



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Compiled and edited by

Dr. P. Sethuraman Sivakumar

Principal Scientist & SIC-ITMU

Dr. M.S. Sajeev

Principal Scientist & Head, Crop Utilization

Dr. H. Kesava Kumar

Scientist, Crop Protection Division

Dr. V. Bansode

Scientist, Regional Centre of CTCRI, Bhubaneswar



Concept & Design

Dr. P. Sethuraman Sivakumar

Principal Scientist & SIC-ITMU

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The Director

ICAR-Central Tuber Crops Research Institute

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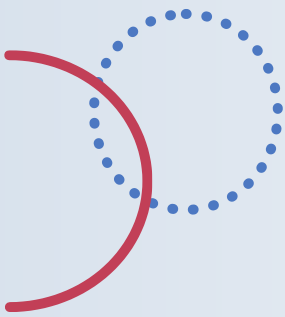
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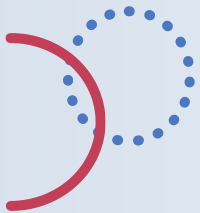


Who We Are?

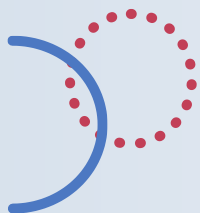
The ICAR - Central Tuber Crops Research Institute (ICAR-CTCRI), is a constituent institute under the Indian Council of Agricultural Research (ICAR) is the only research organization in the world dedicated solely to the research on tropical tuber crops.

ICAR-CTCRI has developed food and industrial products, farm and post-harvest machinery, speciality nutrients for crops, industry-focused varieties and eco-friendly pest and disease management technologies from tropical tuber crops.

The Institute Technology Management Unit (ITMU) of ICAR-CTCRI undertakes the technology Intellectual Property protection and licensing of technologies to interested companies and individuals.



At ICAR-CTCRI, we welcome you with open arms to meet your technology needs. After all, we expect you to use our technologies to bring smiles to the entrepreneurs' faces by effective backward and forward linkages.



Health and Wellness Foods

Fried snack foods and fried chips from Tapioca



Technology Details

- Technologies included - Tapioca hot fries, tapioca hot sticks, tapioca *pakkavada* (salty fries), salty delight, tapioca *murukku*, tapioca crisps, tapioca nutrichips (with egg) and tapioca nutrichips (without egg) and fried chips from tapioca and sweet potato.
- Prepared using composite flour based on cassava and have high nutritional and textural quality & longer shelf life.
- Low sugar content - sweet products 31-38%; salty and hot fries: 3-4%. Low fat - 15 to 26% for all products; 15-18% for sweet fries.
- High crude protein content - nutrichips/ *murukku*: 5-11%.

Technology Readiness level

- BIRAC TRL7 - Pilot Scale demonstration - 100 L or 100 kg scale

Target customers

- Startups, SMEs, SHGs, FPOs

Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Two years for production within territorial limits of India.
- The license fee for use in India: Rs. 25,000 + applicable taxes.
- Training support: Two Persons nominated by the Licensee shall be trained for the period of two days at ICAR-CTCRI. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.



Functional Noodles from Cassava/ Sweet Potato



Technology Details

- Functional noodles were prepared from sweet potato/ cassava starch by fortifying them with ingredients such as resistant starch and fibres. These noodles have a medium glycaemic index.
- Starch noodles developed from tuber starches such as cassava and sweet potato are essentially gluten-free and hence an ideal choice for celiac patients.
- A source of protein 20% retention in cooked sweetpotato noodles.

Technology Readiness level

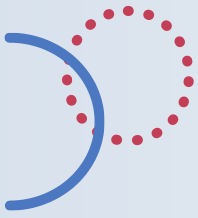
- BIRAC TRL 7 - Pilot Scale demonstration - 100 L or 100 kg scale

Target customers

- Startups, SMEs, SHGs, FPOs

Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Five years for production within India.
- License fee - India: Rs. Two Lakhs + applicable taxes; Overseas: Rs. Five Lakhs + applicable taxes
- Training support: Up to three persons nominated by the Licensee shall be trained for the period up to five days. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliance related to production, sales, transportation, storage are to be fulfilled by the Licensee.



Functional Pasta from Cassava



Technology Details

- The fortified pasta (whey protein, betanine, dietary fibre) prepared from cassava is gluten-free, has a medium glycemic index and provides 10 - 15% additional protein and fibre.

Technology Readiness level

- BIRAC TRL 7 - Pilot Scale demonstration - 100 L or 100 kg scale

Target customers

- Startups, SMEs, SHGs, FPOs

Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Five years for production within India.
- License fee - India: Rs. Two Lakhs + applicable taxes (For four variants); Rs 50,000 + applicable taxes for a single variant; Overseas: Rs. Five Lakhs + applicable taxes
- Training support: Up to three persons nominated by the Licensee shall be trained for the period up to five days. The training fee is included in the license fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.



Orange Fleshed Sweet Potato Pasta



Technology Details

- Orange-fleshed sweet potato is rich in β -Carotene, a precursor of Vitamin A. High carotene content can help to combat Vitamin A deficiency.
- Pasta made from orange fleshed sweet potato which has high β -carotene and lysine content compared to wheat pasta, good swelling index after cooking, and a high amount of resistant starch.



Technology Readiness level

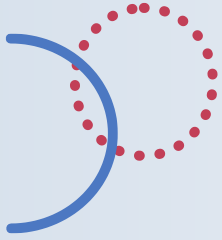
- BIRAC TRL 7 - Pilot Scale demonstration - 100L / 100kg scale

Target customers

- Startups, SMEs, SHGs groups, FPOs

Licensing terms

- Nature of License: Non-exclusive.
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 - License fee - India: Rs. Two Lakhs + applicable taxes; Overseas: Rs. Five Lakhs + applicable taxes
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 - All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.
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Healthy Food Ingredients

Cassava Resistant Starches - RS4 & RS5



Technology Details

Resistant starch (RS4) enhanced/ annealed cassava/ sweet potato starch

- A chemical modification technology for enhancing resistant starch (RS4) content of traditional cassava and sweet potato starches was developed. The RS4 starches are resistant to enzymatic digestion.
- The RS4 content in native cassava starch increased from 1.5% to 33% with an estimated Glycemic Index (GI) of 57-60. In native sweet potato starch, RS4 content increased from 3-5% to 35-37% with an estimated GI 55-57.

Resistant starch (RS5) - Amylose-lipid complex from cassava/ sweet potato starch

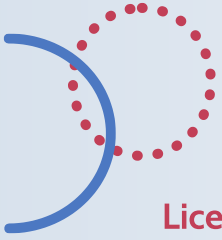
- In this method, the RS5 content in native cassava starch increased from 1.5 - 2% to 33-34%, GI reduced from 91-92 to 61-62. In native sweet potato starch, the RS content increased from 3 -4% to 33-34%, while the GI decreased from 87 to 60.

Technology Readiness level

- BIRAC TRL 3 - The concept proved and process parameters optimized at lab scale

Target customers

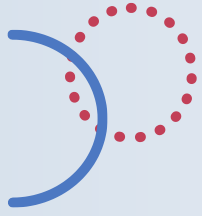
- Startups, SMEs, Large companies



Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Five years for production in India.
- License fee: Rs. One Lakh + applicable taxes (For each RS variant)
- Training support: Two persons nominated by the Licensee shall be trained for the period of five days at ICAR-CTCRI. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.





Technologies for Extending shelf-life of Tubers

Quick Cooking Dehydrated Tuber



Technology Details

- Quick-cooking dehydrated cassava and *Amorphophallus* tubers were developed to reduce bulkiness during export and to increase the shelf life of the product with a cooking time of only 3-6 minutes, depending on the tubers

Technology Readiness level

- BIRAC TRL 7 - Pilot Scale demonstration - 100 L or 100 kg scale

Target customers

- Startups, SMEs, Self-Help groups, FPOs

Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Three years for production within India.
- License fee for use in India: Rs. 25,000 + applicable taxes.
- Training support: Two persons nominated by the Licensee shall be trained for the period of two days at ICAR-CTCRI. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.



Wax Coating Technology for Cassava Tubers



Technology Details

- The surface coating of cassava roots is done by dipping them in hot/molten paraffin wax/other suitable wax and drying them on a bench before packaging them into boxes.
- The wax treatment provides a barrier for the exchange of gases such as oxygen, carbon dioxide and water vapour and keeps the roots fresh for up to a month or two.
- This technology helps the processors and traders to store, transport and sell fresh cassava roots to distant places for an extended period of time and increase profitability.

Technology Readiness level

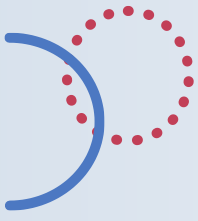
- BIRAC TRL 7 - Pilot Scale demonstration (100 L or 100 kg scale)

Target customers

- Startups, SMEs, SHGs, FPOs

Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Three years for production within India.
- License fee for use in India: Rs. 25,000 + applicable taxes.
- Training support: One or two persons nominated by the Licensee shall be trained for one day at ICAR-CTCRI. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.



Crop Management Technologies

Super Absorbent Polymer from Cassava Starch



Technology Details

- Semi-synthetic super absorbent polymer (SAP) prepared from cassava starch.
- The water absorbency of cassava starch-based SAP is about 400 g/g. The polymer is found to be effective in soil moisture retention and the watering interval could be prolonged by its application.
- The addition of hydrogel to the soil and irrigating field at an interval of once in three days could increase the porosity and water holding capacity of the soil while maintaining higher nutrient levels for better plant growth.
- The SAP is a useful soil additive during drought and other moisture-stress conditions.

Technology Readiness level

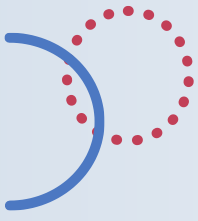
- BIRAC TRL 3 - Concept proved at lab scale. Optimization of parameters at lab scale

Target customers

- Startups, SMEs, Large Companies

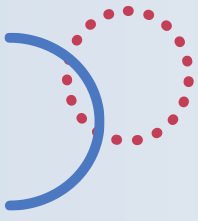
Licensing terms

- Nature of License: Non-exclusive.
- License fee for India: Rs. Five Lakhs + applicable taxes; Overseas: Rs. Seven Lakhs + applicable taxes



- Training support: Three persons nominated by the Licensee shall be trained for the period of five days at ICAR-CTCRI. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.





Micronutrient Foliar Formulations for Site-Specific Nutrient Management of Tropical Tuber Crops



Technology Details

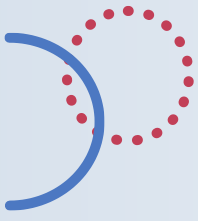
- Five micronutrient formulations were developed through soil inventorisation, analysis of soil and plant samples and Site-Specific Nutrient Management experiments and modelling studies conducted under different situations. They are
 - i. Cassava in acid soils (Zn, B)
 - ii. Cassava in neutral to alkaline soils (Fe, Mn, Zn, Cu)
 - iii. Elephant foot yam (Zn, B, Fe, Mn, Cu)
 - iv. Yams (Zn, B, Mn, Fe, Cu)
 - v. Sweet potato (Zn, B)
- Above five micronutrient formulations for different cultivation, domains were formulated to reduce the deficiencies based on sound principles of crop nutrition.

Technology Readiness level

- BIRAC TRL 3- Concept proved at lab scale and optimization of parameters completed at lab scale

Target customers

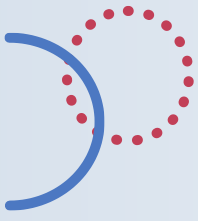
- Startups, SMEs, Large Companies and FPOs



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- License fee for India: Rs. 2,50,000 + applicable taxes without royalty.
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- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the Licensee.





CTCRI Bioformulations with Pesticidal Action



Technology Details

ICAR - CTCRI Bioformulation – 01 (Arbitrary name: Menma)

- The insecticidal principles isolated from cassava leaves were standardized for stem injection to manage borer insect pests of banana & coconut.

ICAR-CTCRI Bioformulation – 02 (Arbitrary name: Nanma)

- The formulations were made with a unique combination of bioactive principles isolated from cassava, neem oil and surfactant. Standardized its concentration and dose against pseudostem weevil (*Odoiporus longicollis* Oliver) in banana as a prophylactic measure and also against sucking pests.

ICAR-CTCRI Bioformulation-03 (Arbitrary name: Shreya)

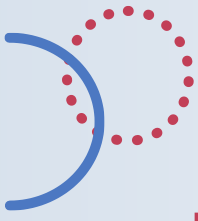
- The formulation was developed to dissolve the mealy substance of the mealy bug. Application of the bioformulation dissolve the mealy coating and subsequently kills the pest.

Technology Readiness level

- BIRAC TRL 7 - Scale demonstration of the technology - 100 L or 100 kg Scale.

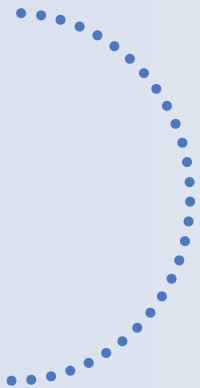
Target customers

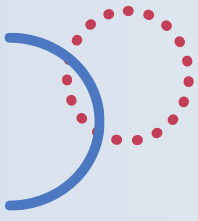
- Startups, SMEs, Govt agencies, Large Companies and FPOs



Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Seven years for production within India.
- License fee for India: Rs. 5.00 Lakhs (Basket of three technologies - Menma, Nanma & Shreya) + applicable taxes with 2% royalty on net sales.
- Training support: Upto three persons nominated by the Licensee shall be trained for the period up to five days at ICAR-CTCRI. The training fee is included in the license fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to registration of the product, production, marketing & sales, transportation and storage along with quality control (at all levels) shall be fulfilled by the Licensee. ICAR-CTCRI shall not be responsible for the performance of the product in the market and users.





ICT-enabled Agro-Advisory Systems

Electronic Crop (E Crop)



Technology Details

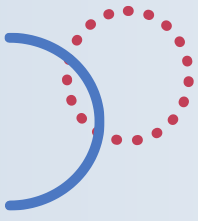
- The Electronic Crop (E Crop) is an IoT technology that simulates crop growth in response to weather and soil parameters and also generates an agro-advisory that is sent to the farmer's mobile by SMS. Based on the climate and soil data, it calculates the requirements of fertilizers, water, agronomic and cultural practices to be followed to get more yield.
- Using sensors, the solar-powered device collects real-time data on the maximum and minimum temperature, solar radiation, relative humidity, precipitation, soil moisture content, wind velocity, and wind direction. The data are sent to a central server through a modem and run through a simulator to generate the advisory.

Technology Readiness level

- BIRAC TRL 7 - Late stage Validation. Rigorous testing & validation by third parties

Target customers

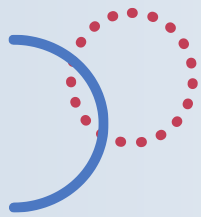
- Startups, SMEs, Govt agencies, Large Companies and FPOs



Licensing terms

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- Duration of the License: Global: One year; India (For research/academic use – Non-commercial Use – Three years)
- License fee: Global : ₹ 7.00 lakhs + applicable taxes, Royalty: 5% + applicable taxes on net-invoice value; India (For research/academic use – Non-commercial Use): ₹ 50,000/- + applicable taxes
- Training support: Upto two persons nominated by the Licensee shall be trained for the period up to three days at ICAR-CTCRI. The training fee is included in the licensing fee. The expenses for boarding and lodging and travel of the team shall be borne by Licensee.
- All statutory compliances related to production, sales, transportation, storage are to be fulfilled by the licensee. Minimum standards for the device/sensors to be used will be provided to the Licensee.





SPOTCOMS

Technology Details

- SPOTCOMS is a growth simulation model of sweet potato which predicts the crop phenology in response to environmental factors.
- It mimics the growth and development of sweet potato and helps to study crop growth and to calculate growth responses to the environment.
- This model is validated for nearly 30 Indian varieties and other varieties of Uganda, Indonesia, Vietnam, China and the Philippines.
- Used by Michigan State University, USA to study the impact of climate change on sweet potato in Eastern Africa.
- Used by CIP (International Potato Centre) for yield gap analysis of sweet potato
- Validated by AICRP (TC) to give agro advisories to sweet potato growers

Technology Readiness level

- BIRAC TRL 7 - Late stage Validation. Rigorous testing & validation by third parties

Target customers

- Startups, SMEs, Govt agencies, Large Companies and FPOs

Licensing terms

- Nature of License: Non-exclusive.
- Duration of the License: Global: Three years (For research/ academic use – Non-commercial Use)
- Licensee fee: Global : USD 3000 + applicable taxes (For research/ academic use – Non-commercial Use)
- Training support: Training will be provided on demand by the licensee and the fee will be charged as per the institute norms.
- All statutory compliances to be fulfilled by the licensee.



