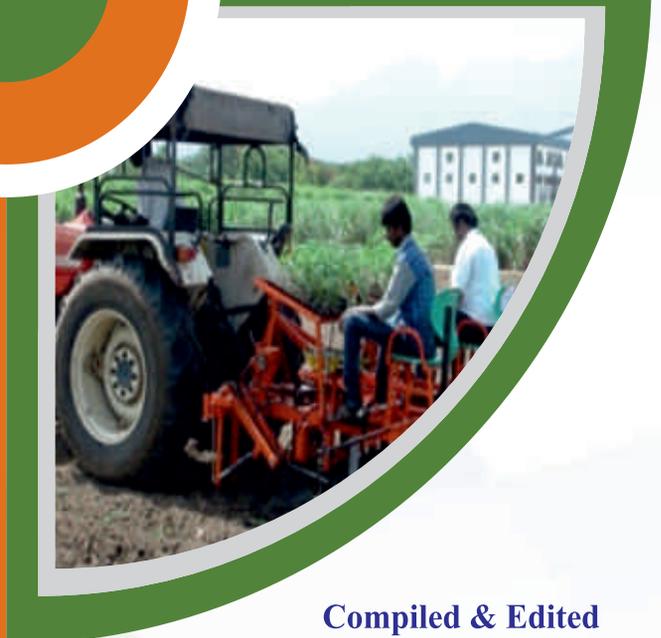


Technology Inventory from ICAR Institutes for Krishi Vigyan Kendras



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Compiled & Edited

- D.V. Kolekar
- B.T. Rayudu
- Thimmappa K
- M.J. Chandre Gowda
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- M.B. Hanji



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TECHNOLOGY INVENTORY FROM ICAR INSTITUTES FOR KRISHI VIGYAN KENDRAS

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ICAR-Agricultural Technology Application Research Institute
Zone-XI, Hebbal, Bengaluru

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उप महानिदेशक (कृषि प्रसार)

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Deputy Director General (Agricultural Extension)



FOREWORD

KVKs have been largely regarded as an institutional innovation that effectively link agricultural research and extension at the district level in India. KVKs play key role in the assessment of technologies to specific locations and demonstrating it on farmers fields. KVKs are doing yeoman service with required infrastructure and quality manpower for capacity development of farmers, farm women, rural youth and other stakeholders in agriculture.

In this backdrop, compilation of readily available technologies for dissemination in the form of publication entitled 'Technology Inventory from ICAR Institutes for Krishi Vigyan Kendras' is noteworthy. I am happy to learn that this publication has covered latest technologies from 24 ICAR Institutes which are having potential for enhancing productivity and production in agriculture and allied sectors.

I believe that the technologies presented in this publication will be useful to the KVK system for planning their programmes to address the needs of the farmers there by achieving adoption of modern technologies which results in improving the production system and ensure food, nutritional and livelihood security.

(A. K. SINGH)

Dated : 24.05.2022



ICAR-Agricultural Technology Application Research Institute, Zone XI

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Director

निदेशक



P R E F A C E

Agriculture continues to remain a major sector of the Indian economy. The National Agricultural Research System is taking responsibility for the promotion and coordination of agricultural education, research and extension in various branches of agriculture and allied sciences in the country. Many technologies are being developed by different organisations like ICAR, SAUs etc., under the umbrella of NARS from time to time to address the felt needs of farmers and other stakeholders. However, we are hearing quite often from different stakeholders that there is a time lag in reaching new technologies to the farmers thereby not harvesting the full benefit of the new technologies.

As KVKs are working at grass root level and addressing the farmers' issues through technological interventions in a cluster approach, it is felt that making available technological inventory from NARS to the KVKs will be effective in technology dissemination and also reduce the time lag in reaching the intended stakeholders. In this direction we have made an attempt to collect technologies from ICAR Institutes. It is a pleasure to mention here that a total of 24 ICAR Institutes shared their new technologies which are readily available to reach farming community and other stake holders through KVKs in the form of OFTs, FLDs and Capacity Development. Having received many new technologies from different ICAR Institutes, ICAR-ATARI, Bengaluru compiled and prepared a compendium of technologies in the form of this publication for the benefit of all partners in agriculture and allied sectors.

I take the opportunity to express my gratitude and indebtedness to Dr.Trilochan Mohapatra, Secretary, DARE and Director General, ICAR for constant source of motivation and guiding spirit behind present task as well as future endeavours. I also sincerely thankful to Dr.A.K.Singh, Deputy Director General (Agricultural Extension), ICAR for his valuable guidance and support in bringing out technology Inventory from ICAR Institutes. I also acknowledge and convey my thankfulness to the Directors of 24 ICAR institutes who have shared their technologies for inclusion in this publication.

Hope this publication provides a deep insight on latest technologies developed by ICAR Institutes and will be useful to different stakeholders in agriculture and allied sectors especially to farmers through Krishi Vigyan Kendras across the country.

(V. VENKATASUBRAMANIAN)

Dated : 24.05.2022

ACKNOWLEDGMENT

The technology inventory is the compilation of recent and improved technologies of 24 ICAR Institutes viz., CCARI, Goa; CCRI, Nagpur; CIRC, Meerut; CIAE, RC, Coimbatore; CIBA, Chennai; CIFT, Cochin; CIPHET, Ludhiana; CPRI, Shimla; CSSRI AICRP on SAS&USW, Gangavathi; DMR, Solan; IIHR, Bengaluru; IIRR, Hyderabad; IISWC, RC, Ballari; IISWC, RC, Udhamandalam; IISS, Bhopal; IIVR, Varanasi; NBAIM, Mau; NRCB, Trichy; NRCG, Pune; NRCIPM, New Delhi; NRCE, Hisar; NRCP, Solapur; NRCY, Dirang; NBAIR AICRP, Andhra Pradesh; NBAIR AICRP, Tamil Nadu; NBAIR AICRP, Telangana; and SBI, Coimbatore. Director of ICAR-ATARI, Bengaluru is expressing his thankfulness to Directors and Scientists of these ICAR institutes for promptly responding and sharing their technologies for the benefit of farming community through Krishi Vigyan Kendras as well as giving us an opportunity to compile technology inventory in the form of publication and the same is duly acknowledged.

V. VENKATASUBRAMANIAN

Director
ICAR-ATARI, Bengaluru

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PROLOGUE

The ICAR- Krishi Vigyan Kendras (KVKs) are nationwide network for undertaking frontline extension by Indian Council of Agricultural Research (ICAR), New Delhi. Agricultural Extension Division at the national level and ICAR-Agricultural Technology Application Research Institutes (ATARI) at Zonal level monitor and coordinate the activities of KVKs under the overall guidance and support of Deputy Director General, (Agricultural Extension), ICAR, New Delhi. The ICAR -ATARI, Bengaluru, Zone XI has established 48 KVKs of which 33 in Karnataka, 14 in Kerala and one in Lakshadweep under the administrative control of SAUs (33 KVKs), NGOs (8 KVKs) and ICAR Institutes (7 KVKs).

The ICAR-ATARI is being guiding KVKs in terms of technology and methodology backstopping for implementation of mandated activities through formulation of technical programmes every year. The National Agricultural Research System is the general source for technological backstopping to the KVKs for identifying and implementing various technological interventions. The process of facilitation of technology backstopping and HRD activities under ICAR-ATARI, Bengaluru are as follows:

- ❖ Providing technological backstopping through the Directorates of Extension under State Agricultural/Horticulture/Veterinary/Fisheries Universities and ICAR Institutes located in Zone-XI to the KVKs in the form of supply of various technological inputs like seeds, planting materials, bio-products, livestock breeds, poultry breeds and fish finger lings.
- ❖ Strengthening those Directorates of Extension having KVKs with financial support by the ICAR-ATARI, Bengaluru for conducting HRD programmes, seminars and workshops for the capacity development of KVK staff in their respective jurisdiction.
- ❖ Publishing technology inventory by State Agricultural Universities located in Zone-XI as references for KVKs while selecting technological interventions for addressing the specific problems in their respective operational areas.
- ❖ Conducting orientation courses by ICAR-ATARI, Bengaluru for newly recruited KVK staff as a part of human resources development.
- ❖ ICAR-ATARI, Bengaluru nominates its staff as well as KVKs for capacity development on various aspects of agriculture and allied sectors organized by various organizations/Institutions/agencies in the country to keep abreast with the latest technological developments in agriculture and allied sectors.
- ❖ ICAR-ATARI is structuring the technical programme of KVKs through conducting state level annual action plan workshops in association with the Directorate of Extension Education of State Agricultural Universities before start of kharif season every year wherein technical programmes for each KVK are discussed and finalized.
- ❖ ICAR-ATARI conducts Zonal Workshops with the cooperation and coordination of Directors of ICAR Institutes, Vice Chancellors and Directors of Extension, State Agricultural Universities and identified experts for Heads (Senior Scientists) and Scientists (Subject Matter Specialists) of KVKs in order to reach the appropriate technologies at right time to farming community.

- ❖ Accordingly, KVKs are implementing the approved action plan under the technical guidance of ICAR-ATARI and their respective Directorate of Extension and host organizations.

Keeping the above said technological backstopping, ICAR-ATARI is guiding KVKs in formulation and implementation of various programmes and extending all internal resources for its development and growth. Further, ICAR-ATARI plays a vital role in orienting the KVKs to function as knowledge and resource centres at the district level for serving the farmers, farmwomen, rural youth, extension functionaries and other stakeholders through fountain head of agricultural technologies.

To ensure broad conformity with the mandate of KVKs, ICAR-ATARI has structured the technical programme of KVKs into the core activities viz. technology assessment, frontline demonstrations, capacity development, extension activities and farm advisories, production and supply of technological products, specialized programmes from ICAR and externally aided projects from different sponsoring agencies.

In order to provide ready reckoner on the new technologies to the KVKs, ICAR-ATARI has planned to bring out compendium of latest technologies from ICAR Institutes in the Zone. Accordingly, readily available latest technologies from 27 ICAR Institutes were compiled Institute wise with contact details of Director/Scientist for each technology as in the form of this publication entitled 'Technology Inventory from ICAR Institutes for Krishi Vigyan Kendras' to solve the prioritized problems of farming in their respective KVK districts through employing appropriate agricultural extension approaches.

Technology : 1

Name of technology	Goa cashew-1
Year of release	1999
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew
Recommended for region	Goa

Details of technology

- ❖ A cashew variety for commercial cultivation.
- ❖ Suited for well-drained deep sandy loam and laterite soils. Hot humid conditions with temperature from 20 to 38°C, RH from 60 to 95 % and annual rainfall from 2000 to 3500mm.
- ❖ High yielding cashew variety with bold nut size, higher shelling percentage (30.04) of exportable grade kernels, bigger and juicy apples (74.18 g).

Features of technology with their benefits

- ❖ Average nut yield is 7.30 kg/tree (2 t/ha) and average nut weight is 7.80 g.
- ❖ Productivity of this variety is 3.8 times higher than the Goa state's average of 525 kg/ha.



Contact for further details

Director
 ICAR - Central Coastal Agricultural Research Institute,
 Ela, Old Goa - 403 402, Goa
director.ccari@icar.gov.in

Technology : 2

Name of technology	Goa cowpea 3
Year of release	2015
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cowpea
Recommended for region	Rice-fallow areas of Goa during <i>Rabi</i> season

Details of technology

- ❖ A high yielding grain type cowpea variety.
- ❖ It is a bold seeded variety with semi spreading habit.

Features of technology with their benefits

- ❖ Matures in 90-100 days. Seeds are light brown in colour with 100 seed weight of 23- 25 g.
- ❖ Grain yield is 16 to 18 q per ha.
- ❖ Generates an additional income of Rs 25000-3000/ha compared to the local varieties



Contact for further details

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Technology : 3

Name of technology	Goa dhan - 1 (KS - 12)
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Paddy
Recommended for region	Coastal saline soils of Goa

Details of technology

- ❖ A high yielding salinity tolerant rice variety.
- ❖ Salinity tolerant variety with medium duration (135 days).

Features of technology with their benefits

- ❖ Short bold grains. Yield potential is 30-35 q/ha under stress and up to 50 q/ha under normal condition
- ❖ Yield advantage is 35-40% over check variety


Contact for further details

Director
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Technology : 4

Name of technology	Goa dhan - 2 (KS - 17)
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Paddy
Recommended for region	Coastal saline soils of Goa

Details of technology

- ❖ A red kernelled high yielding salinity tolerant rice variety.
- ❖ Salinity tolerant variety with medium duration (130 days).

Features of technology with their benefits

- ❖ Long bold grains. Yield potential is 30-35 q/ha under stress and up to 40 q/ha under normal condition
- ❖ Yield advantage is 35-40% over check variety.



Contact for further details

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Technology : 5

Name of technology	Goa dhan - 3 (GRS - 1)
Year of release	2019
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Paddy
Recommended for region	Coastal saline soils of Goa

Details of technology

- ❖ A high yielding salinity tolerant rice variety.
- ❖ Salinity tolerant variety with medium duration (125 days).

Features of technology with their benefits

- ❖ Long bold grains. Yield potential is 35-40 q/ha under stress and up to 55 q/ha under normal condition.
- ❖ Yield advantage is 45-50% over check variety.


Contact for further details

Director
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Technology : 6

Name of technology	Goa dhan - 4 (JK - 234)
Year of release	2019
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Paddy
Recommended for region	Coastal saline soils of Goa

Details of Technology

- ❖ A high yielding red kernelled salinity tolerant rice variety.
- ❖ Salinity tolerant variety with medium duration (125 days).

Features of technology with their benefits

- ❖ Long bold grains. Yield potential is 35-40 q/ha under stress and up to 55 q/ha under normal condition.
- ❖ Yield advantage is 45-50% over check variety.



Contact for further details

Director
ICAR - Central Coastal Agricultural Research Institute,
Ela, Old Goa - 403 402, Goa
director.ccari@icar.gov.in

Technology : 7

Name of technology	Goa cashew-2 (Tiswadi - 3)
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew
Recommended for region	Goa

Details of technology

- ❖ An early-season jumbo nut size cashew variety.
- ❖ Suited for well-drained deep sandy loam and laterite soils. Hot humid conditions with temperature from 20 to 38°C, RH from 60 to 95 % and annual rainfall from 2000 to 3500 mm.
- ❖ An early season cashew variety with higher kernel recovery and bigger apple size (95-100 g).

Features of technology with their benefits

- ❖ Cashew nut yield potential is 1600 kg/ha.
- ❖ The productivity is > 3 times higher than Goa state's average 525 kg/ha.


Contact for further details

Director
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director.ccari@icar.gov.in

Technology : 8

Name of technology	Goa cashew - 3 (Ganje - 2)
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew
Recommended for region	Goa

Details of technology

- ❖ A mid-season high yielding cashew variety.
- ❖ Suited for well-drained deep sandy loam and laterite soils. Hot humid conditions with temperature from 20 to 38°C, RH from 60 to 95 % and annual rainfall from 2000 to 3500 mm.
- ❖ A mid-season cashew variety with bold nuts and higher shelling percentage.

Features of technology with their benefits

- ❖ Cashew nut yield potential is ≈ 3500 kg/ha.
- ❖ The productivity is 6.6 times higher than Goa state's average 525 kg/ha.



Contact for further details

Director
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Technology : 9

Name of technology	Goa cashew - 4 (KN - 2/98)
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew
Recommended for region	Goa

Details of technology

- ❖ A long-season cashew variety with bold nut size.
- ❖ Suited for well-drained deep sandy loam and laterite soils. Hot humid conditions with temperature from 20 to 38°C, RH from 60 to 95 % and annual rainfall from 2000 to 3500 mm.
- ❖ A high yielding cashew variety with bunch bearing characteristics.

Features of technology with their benefits

- ❖ Average yield potential is 2500 to 3000 kg/ha.
- ❖ The productivity is 5 times higher than Goa state's average 525 kg/ha.


Contact for further details

Director
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Technology : 10

Name of technology	Goa brinjal-1
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region	Goa

Details of technology

- ❖ A high yielding bacterial wilt resistant brinjal variety with a purple colour fruit, good keeping quality and less seeds.
- ❖ The fruit is medium in size and oval in shape with high consumer preference.

Features of technology with their benefits

- ❖ Resistant to bacterial wilt disease
- ❖ The average yield of the variety is 27.5-30.0 t/ha



Contact for further details

Director
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director.ccari@icar.gov.in

Technology : 11

Name of technology	Goa brinjal-2
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew
Recommended for region	Goa

Details of technology

- ❖ A high yielding bacterial wilt resistant brinjal variety with a purple colour fruit, good keeping quality and less seeds.
- ❖ Suited for well-drained deep sandy loam and laterite soils. Hot humid conditions with temperature from 20 to 38°C, RH from 60 to 95 % and annual rainfall from 2000 to 3500 mm.
- ❖ The fruit is medium in size and oblong in shape with high consumer preference.

Features of technology with their benefits

- ❖ Resistant to bacterial wilt disease.
- ❖ The average yield of the variety is 20.5-28.0 t/ha.


Contact for further details

Director
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Technology : 12

Name of technology	Goa brinjal-3
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region	Goa

Details of technology

- ❖ A high yielding bacterial wilt resistant brinjal variety with a purple colour fruit, good keeping quality and less seeds.
- ❖ The fruit is small in size and oval in shape with high consumer preference.

Features of technology with their benefits

- ❖ Resistant to bacterial wilt disease.
- ❖ The average yield of the variety is 15.0-22.0 t/ha.



Contact for further details

Director
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Technology : 13

Name of technology	Goa brinjal - 4
Year of release	2021
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region	Goa

Details of technology

- ❖ A high yielding bacterial wilt resistant brinjal variety with a purple colour fruit, good keeping quality and less seeds.
- ❖ The fruit is medium in size and long in shape with high consumer preference.

Features of technology with their benefits

- ❖ Resistant to bacterial wilt disease.
- ❖ The average yield of the variety is 25.0-30.0 t/ha.


Contact for further details

Director
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Technology : 14

Name of technology	Goa brinjal-5
Year of release	2021
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region	Goa

Details of technology

- ❖ A high yielding bacterial wilt resistant brinjal variety with a purple colour fruit, good keeping quality and less seeds.
- ❖ The fruit is medium in size and oblong in shape with high consumer preference.

Features of technology with their benefits

- ❖ Resistant to bacterial wilt disease.
- ❖ The average yield of the variety is 25.2-30.0 t/ha.



Contact for further details

Director
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Technology : 15

Name of technology	Goa brinjal- 6
Year of release	2021
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region	Goa

Details of technology

- ❖ A high yielding bacterial wilt resistant brinjal variety with a purple colour fruit, good keeping quality and Less seeds.
- ❖ The fruit is medium in size and oblong in shape with high consumer preference.

Features of technology with their benefits

- ❖ Resistant to bacterial wilt disease.
- ❖ The average yield of the variety is 23.0-27.0 t/ha.


Contact for further details

Director
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Technology : 16

Name of technology	Goa bhendi-1
Year of release	2019
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Bhend
Recommended for region	Goa

Details of technology

- ❖ Seven ridged Bhendi variety with long fruits (20-22 cm). Matures in 75 days. The fruits are tender with less fibre with average yield of 7-8 t/ha.

Features of technology with their benefits

- ❖ Premium price to the fruits compared to the other varieties generates additional income.



Contact for further details

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Technology : 17

Name of technology	Agonda Goan pig (Indigenous pig germplasm)
Year of release	2015
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Pig
Recommended for region	Suitable to hot and humid climate of the western coastal region

Details of technology

- ❖ Agonda Goan is an indigenous breed of pig found in Goa and adjoining coastal regions.
- ❖ It is the first registered livestock breed of Goa.

Features of technology with their benefits

- ❖ It is well adapted to coastal environment, mature early, has good mothering ability and can sustain on scavenging.
- ❖ This breed is suitable for crossbreeding with exotic breeds like Large White Yorkshire.


Contact for further details

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Technology : 18

Name of technology	Shweta Kapila (Indigenous cattle germplasm)
Year of release	2020
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cattle
Recommended for region	Suitable to hot and humid climate of the Goa and adjoining region.

Details of technology

- ❖ Indigenous cattle and second registered livestock breed of Goa.
- ❖ Short to medium stature, complete white colour. Strong adaptability to hot and humid coastal climate and Resistant to diseases.

Features of technology with their benefits

- ❖ Daily milk yield ranges from 1.80 to 3.40 kg with an average of 2.80 kg and lactation milk yield from 250 to 650 kg.
- ❖ Fetches premium price to the milk being indigenous cattle, and the dung and urine generates additional income with less management cost.



Contact for further details

Director
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Technology : 19

Name of technology	Cashew apple crunch
Year of release	2016
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew
Recommended for region	For cashew growing areas for effective utilization of cashew apple biomass

Details of technology

- ❖ The crunch is a sugar treated chewing, crunchy bites.
- ❖ It is prepared by utilizing the cashew apples and then treating the same in a various sugar concentration and then made in the form of chewing bites.
- ❖ Technology does not require costly equipment, easy and simple.
- ❖ The product stores well at room temperature for 12 months with simple packing without any synthetic preservatives.

Features of technology with their benefits

- ❖ Technology ensures additional return through cashew apple utilization and generation of employment opportunities.
- ❖ Even if 50% of cashew apple biomass (2.23 t/ha) is converted, this technology has the potential to earn an additional income of Rs. 3 lakh per hectare.
- ❖ Applied for patent (Process for preparing cashew apple crunch and resultant food product thereof).


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Technology : 20

Name of technology	Nutmeg pericarp taffy
Year of release	2016
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Nutmeg
Recommended for region	For nutmeg growing areas for effective utilization of nutmeg pericarp

Details of technology

- ❖ Nutmeg taffy is prepared by using nutmeg pericarp or rind (Nutmeg fruit has about 80-85% of pericarp), which otherwise is discarded.
- ❖ The product stores well at room temperature for about 12 months with simple packing without any synthetic preservatives.

Features of technology with their benefits

- ❖ Product is commercially acceptable and process is commercially feasible. It is a potential technology to earn additional income from the waste.
- ❖ This product fetches an additional income to farmers and entrepreneurs apart from the yield of nutmeg spice products- nutmeg seeds and mace.
- ❖ Through this technology, additional net income of Rs. 5,600 per tree can be realized.
- ❖ Applied for patent (Process for preparing nutmeg taffy and resultant food product thereof).
- ❖ Commercialized to M/s Tanshikar Spice Farm, Netravali Goa on 27th March, 2018, for fee of Rs. 2.60 Lakh and Goa State Biodiversity Board, Goa on 19th February, 2021, for fee of Rs. 3.00 Lakh, for duration of five years.



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Technology : 21

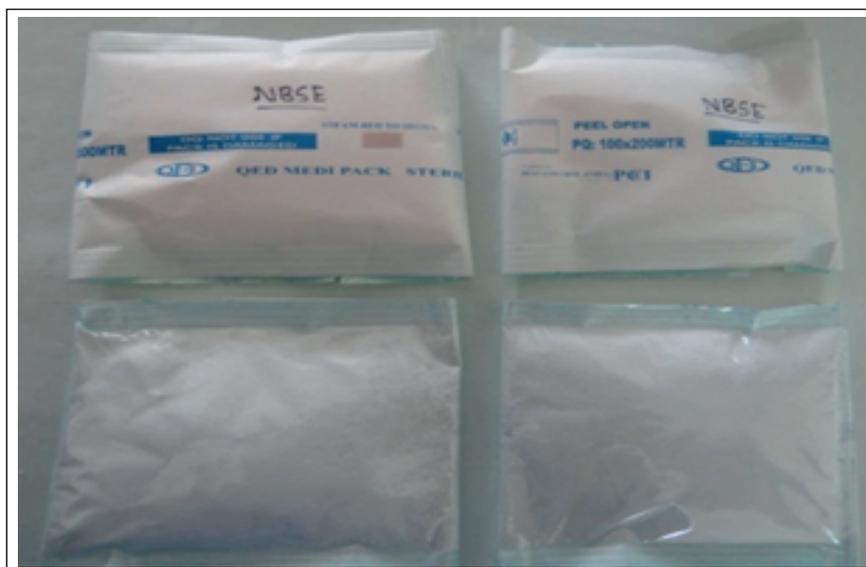
Name of technology	Boar semen extender for pig semen preservation
Year of release	2015
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Pig
Recommended for region	Potential areas are where the pig farming is practiced

Details of technology

A cost-effective technology which can preserve pig semen at 15-17°C for a minimum period of 3 days.

Features of technology with their benefits

- ❖ It is a formulation of chemical mixture in powder form, can be mixed with sterile distilled water and easy to use for diluting and storing pig semen intended for AI purpose.
- ❖ Patent granted on 1st January, 2021 (Patent No:355114).
- ❖ Technology has been evaluated by Agrinnovate India Ltd. and three industrialists have approached for transfer of technology.


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Technology : 22

Name of technology	Ornamental fish feed technology
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Fishery
Recommended for region	All over India

Details of technology

- ❖ A cost-effective fish feed formulation.
- ❖ The ornamental fish feed is low-cost and gives better growth and colour .
- ❖ It is a sinking type pellet (10 minutes for complete sinking, water stability 30-45 minutes) suitable for rearing ornamental fishes.
- ❖ Useful for most common freshwater ornamental fishes. The pellets are fed to ornamental fishes @1-6 pellets on the basis of size/type of the fish. The feed can be packed properly (vacuum) and stored at room temperature in dry place (5-6 months).

Features of technology with their benefits

- ❖ The ornamental fish feed increases net returns by 20-30%.
- ❖ Technology commercialized to M/s Jenix Aquarium Private Limited, Mapusa Goa on 12th March, 2018 for total fee of Rs. 2.50 lakh for duration of three years.



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Technology : 23

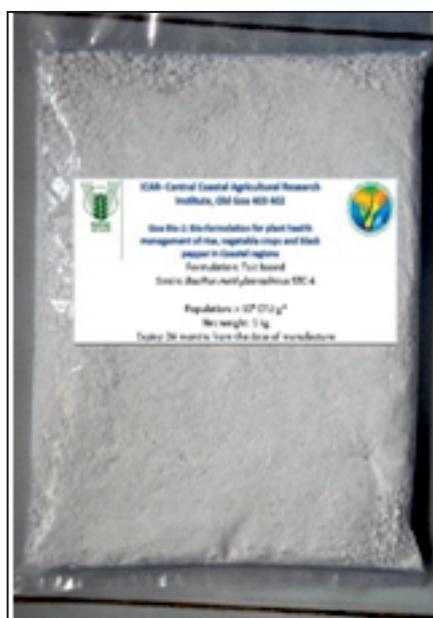
Name of technology	Goa bio-1 (Bio-formulation for plant growth promotion of paddy under salt-affected soils of coastal regions)
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice, vegetable crops, black pepper and paddy
Recommended for region	Suitable for paddy cultivated on coastal saline soils

Details of technology

It is a talc-based bio-formulation of salt-tolerant plant growth-promoting bacteria *Bacillus methylotrophicus* STC-4 with a population $>10^8$ CFU/g. Shelf life of 24 months.

Features of technology with their benefits

- ❖ Used for seed treatment (@ 40 g/kg and nursery application @ 50 g/sq. m. area) in paddy.
- ❖ Nursery application on 7th and 14th days after sowing.
- ❖ The product improved the net income by 28.60% over the farmers' practice besides reducing the amount of fertilizers (25%) and cost thereof.



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Technology : 24

Name of technology	Goa bio-2 (Bio-formulation for plant health management of field, vegetable crops and black pepper in Coastal regions)
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Vegetable crops and black pepper
Recommended for region	Coastal regions

Details of technology

Goa bio 2 is a talc-based bio-formulation (Bacillusmethylotrophicus RCh6-2b) for plant health management in vegetable crops (Brinjal, tomato, chilli and cucumber).

Features of technology with their benefits

- ❖ At the rate of 50 g/sq. m. as soil application or mix with water and apply if plants are established in nursery.
- ❖ Soil application – apply 1.0g/plant in vegetable crops while planting or within a week of planting; 50 g/plant in black pepper while planting.
- ❖ Application of Goa bio - 2 reduced the incidence of bacterial wilt in brinjal by 50-70%, soil borne diseases in chilli by 40-60%, foot rot of black pepper by 70-80% and mortality of mango in nurseries by 60-70%.



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Technology : 25

Name of technology	CCARI bio-3: Value added formulation of PGPB (STC-4) for vegetables
Year of release	2019
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice, vegetable crops and black pepper.
Recommended for region	Suitable for paddy cultivated on coastal saline soils and for vegetable crops in the coastal region.

Details of technology

It is a talc-based bio-formulation of salt-tolerant plant growth-promoting bacteria *Bacillus methylotrophicus* STC-4 with a population $>10^8$ CFU/g. Shelf life of 24 months.

Features of technology with their benefits

- ❖ Used for seed treatment (@ 40 g/kg and nursery application @ 50 g/sq. m. area) in paddy.
- ❖ Nursery application on 7th and 14th days after sowing).
- ❖ Vegetables: Nursery application @ 50 g/sq. m. area; Apply 1.0g/plant in vegetable crops while planting or with in a week of planting; 50 g/plant in black pepper while planting.
- ❖ Application of CCARI Bio-3 improved plant growth in vegetables.



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Technology : 26

Name of technology	CCARI bio-4: Value added formulation of PGPB (RCh6-2b) for vegetables
Year of release	2019
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Vegetable crops and black pepper
Recommended for region	Vegetable crops and black pepper cultivated areas of the coastal region.

Details of technology

It is a talc-based bio-formulation for plant health management in vegetables (*Bacillus methylotrophicus* RCh6-2b) with a population $>10^8$ CFU/g. Shelf life of 24 months.

Features of technology with their benefits

- ❖ Nursery application 50 g/sq. m.as soil application or mix with water and apply if plants are established.
- ❖ Soil application – apply 1.0g/plant in vegetable crops while planting or within a week of planting; 50 g/plant in black pepper while planting.
- ❖ Improved plant growth parameters, plant health and yield; reduced soil borne diseases incidence in brinjal, chilli and black pepper; important component in IPM strategy and eco-friendly hence fits in organic farming concept.



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Technology : 27

Name of technology	Controlled breeding technology in goats
Year of release	2021
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Goat
Recommended for region	Coastal states of Goa, Karnataka and Kerala.

Details of technology

Controlled breeding involving estrus induction, synchronization coupled with Artificial Insemination provides unique opportunity for improving reproductive efficiency in native goat breeds.

Features of technology with their benefits

- ❖ Standardized technique of estrus induction and synchronization employing double prostaglandin $F_{2\alpha}$ regimen combined with artificial Insemination (AI).
- ❖ Standardized protocol for AI involves use of buck semen in liquid state and diluted in Tris extender.
- ❖ Adoption of this controlled breeding technology in farmers field has the potential to improve reproductive efficiency.


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Technology : 28

Name of technology	Rice-based Integrated Farming System (IFS) model
Year of release	2019-20
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region	Lowland conditions in west coast region of Goa.

Details of technology

- ❖ Optimized rice-based farming system model (crop-dairy fishery) for 0.50 ha lowland situations of the west coast region.
- ❖ Different components of IFS includes rice followed by cowpea/green gram /vegetables/baby corn/sweet corn - 0.40 ha, forage grown on bunds (Hybrid Napier - 0.032 ha), dairy (24 m² - two crossbred cows, one female calf- 24 m²), FYM unit (10 m²) and kitchen garden (80 m²).

Features of technology with their benefits

- ❖ The net return from the 0.50 ha model was Rs. 1.39 lakhs and the highest contribution was from crops (56%) followed by dairy (32%) and fishery (12%).



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Technology : 29

Name of technology	Plantation crop based IFS model
Year of release	2020-21
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region	Upland conditions of west coast region in Goa.

Details of technology

- ❖ Optimized 0.80 ha IFS model with enterprises Cashew + Pineapple, Coconut + Pineapple + Noni + Tapioca, Arecanut+ Banana, Piggery, Poultry, Vermicompost unit & compost unit for upland situations of west coast region.
- ❖ The net return from the IFS model was Rs. 1.18 lakhs/0.80 ha.
- ❖ The highest contribution to the net profit was from the piggery unit (42%) followed by the cashew-pineapple system (25%).

Features of technology with their benefits

- ❖ The Institute demonstrated 60 IFS models covering an area of 75 ha, generating employment of \approx 1.19 lakh man-days translating to an income generation of Rs. 6.30 crore.
- ❖ The adoption of IFS models enhanced production by 43%, profitability by 62%, employment by 82%, and reduced production cost by 25% as compared to the farmer's practice. The Government of Goa implemented CCARI IFS models in 600 households with a financial outlay of Rs. 30 crore under RKVY.


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Technology : 30

Name of technology	Standardized soil and water conservation measures on sloping lands of coastal region
Year of release	2019-20
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew, mango and coconut
Recommended for region	Suitable for Western Ghats with high slope and rainfall

Details of technology

- ❖ High amount and intensity of rainfall during kharif and poor water availability during rabi season in the west coast are major drivers of soil erosion and poor productivity.
- ❖ A soil and water conservation measure, Continuous contour trenching + vegetative barrier (*Vetiveria zizanioides*) was standardized to reduce the soil and runoff losses in mango and cashew. The measure reduced the runoff and soil loss by 65.0 and 64.8%, respectively.
- ❖ The circular trenching was standardized in the coconut and it reduced soil and runoff loss by 35.6% and 34.8%.
- ❖ These soil and water conservation measures also improved the soil physical (available soil water), chemical (soil available macronutrients) and biological activity (Microbial biomass carbon and soil enzyme activities) in a long term of 13 years.

Features of technology with their benefits

- ❖ SWC measures applied to sloping lands under cashew cultivation have a significant potential to improve the soil organic carbon stock, microbial activities and soil quality.
- ❖ All the SWC measures were effective over the control conditions (without SWC measures). The most efficient measure was continuous contour trenches with a vegetative barrier with the potential to sequester more carbon up to a depth of 0.9 m by alleviating of microbial stress and improvement in the soil quality. The soil properties like soil available nitrogen, bulk density, basal soil respiration, soil pH, acid phosphatase activity and soil available boron formed the minimum dataset for the study.



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Technology : 31

Name of technology	Low-cost rain water harvesting ponds for lateritic soils under high rainfall areas
Year of release	2020-21
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew, coconut, arecanut and vegetables
Recommended for region	Goa

Details of technology

- ❖ The west coast region of India receives an annual average rainfall of 2700 mm, yet experiences the paucity of irrigation water during the post-monsoon season.
- ❖ The methodology for developing of water harvesting ponds in laterite soils was standardized and the cost for establishing different size ponds was estimated.
- ❖ To curtail the cost, smoothening of side slopes and bottom were done by using plaster prepared from garden soil and about 10-15 cm thick layer of paddy straw was laid along the sides of the pond to provide a smooth surface.
- ❖ Both the materials are locally available and are indigenous technology, thus reducing the cost and also protecting the lining material from damage caused by stones and other sharp materials.
- ❖ A 300 GSM thickness silpaulin polyfilm is recommended as lining material to avoid damage to the sheet.
- ❖ The total cost involved in establishing large size (3500 m³ with 3 m depth), medium size (1400 m³ with 2.5 m depth) and small size pond (300 m³ with 1.5 m depth) in laterite soils is about Rs. 6.6 lakhs, 4.7 lakhs and 2.5 lakhs respectively.

Features of technology with their benefits

- ❖ The cost of per litre harvested rainwater ranges Rs. 0.3-0.8. Methodology improved durability of ponds in laterite soils and at the same time reduced total cost. The technology has been transferred to farmers' fields in South Goa. The water harvesting ponds are also connected with the gravity-based drip irrigation system resulting in water saving upto 70%. The cropping intensity of the area increased to 200% from 100% due to the availability of irrigation water.


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Technology : 32

Name of technology	Standardized package of practices for paddy cultivation under salt-affected soils of coastal region
Year of release	2020-21
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Paddy under coastal saline soils
Recommended for region	North Goa, South Goa and coastal districts of Maharashtra and Karnataka

Details of technology

- ❖ The package of practice comprised of a method of seed treatment of seeds of salt-tolerant rice varieties (Goa dhan 1, 3 and 4).
- ❖ with Goa bio - 1 (a talc-based & salt-tolerant bioformulation of *Bacillus methylotrophicus* STC-4) at 40 g/kg seed, nursery treatment of the seedling at 50 g/m² and transplanting of 35-days old seedlings, application of revised and modified fertilizer recommendations of 120:30:0:4:2 N:P₂O₅:K₂O:Zn:B kg ha⁻¹ (omission of K to reduce the cost of fertilizer) and its split application and other plant production practices.

Features of technology with their benefits

- ❖ The demonstration of the technology on 29 ha area for two consecutive years generated a total income of Rs. 13 and 12 lakh respectively using the improved method of cultivation as against the farmer method with Rs. 9.53 lakh.
- ❖ The net income from the farmers' practice was Rs. 32,862/ha, whereas the improved practices yielded a net income of Rs. 45,275/ha, which amounted to an additional income of Rs. 12,413/ha, 38% higher than the farmers' practice.
- ❖ The technology has the potential to generate an additional net income of about Rs. 22 crore by covering 18,000 hectares of coastal saline soils in the state of Goa alone.



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Technology : 33

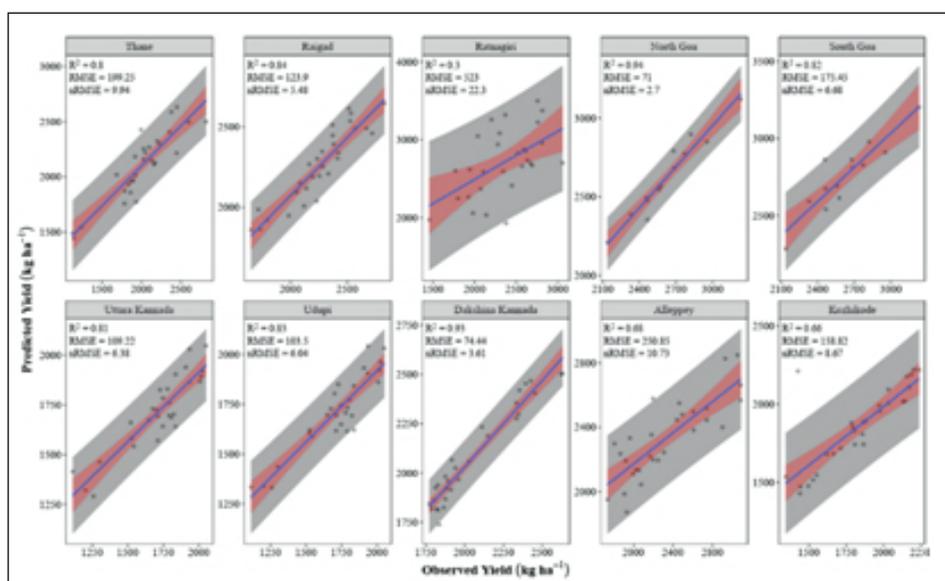
Name of technology	Weather based forecasting models to predict yield of major crops
Year of release	2019
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice, cashew and coconut
Recommended for region	Goa

Details of technology

- ❖ Yield forecasting models of rice, cashew and coconut have been developed by the Institute for the coastal region.
- ❖ For rice crop, the ranking of the models revealed that LASSO (2.63) was the best performing model followed by ENET (3.07).
- ❖ For coconut crop, the average ranking of the models on the basis of R^2 and RMSE of calibration and percentage error of validation were in the order of ENET > LASSO > SMLR > PCA-SMLR.

Features of technology with their benefits

- ❖ Institute is training state government officials regarding the use of these models to predict the yield of major crops in coastal region to plan technological interventions and formulate need based policy for hand holding of small and marginal farmers in the most vulnerable coastal ecosystem.


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Technology : 34

Name of technology	Grafting cultivated brinjal on wild brinjal: a promising technology to manage bacterial wilt
Year of release	2016
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Brinjal and tomato
Recommended for region	Coastal regions of India where bacterial wilt is severe

Details of technology

- ❖ Bacterial wilt is a serious disease in coastal region causing severe loss to brinjal.
- ❖ It is a simple eco-friendly management strategy with higher disease control efficiency. Susceptible brinjal plants grafted on wild brinjal do not allow the pathogen to grow from inside the system, thus imparting resistance.

Features of technology with their benefits

- ❖ Field evaluation indicated 100% protection from bacterial wilt in grafts, whereas 60-80% of seedling population was lost due to wilt.



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Technology : 35

Name of technology	Management of cashew stem and root borer
Year of release	2017-18
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Cashew and mango
Recommended for region	West-coast region

Details of technology

- ❖ Cashew stem and root borer (CSRB) is a serious pest of cashew crop and cause up to 100% damage if not treated timely.
- ❖ Formulated strategy for CSRB management to reduce the loss and revived the cashew trees.
- ❖ Prophylactic measures followed by chemical treatment with Imidacloprid (0.01) and Fipronil (0.005) was efficient in recovery of infested tress up to 50%.

Features of technology with their benefits

- ❖ 50% recovery of infested trees


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Technology : 36

Name of technology	Feedblock technology using locally available livestock feed resources
Year of release	2017
Source of technology	ICAR - Central Coastal agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Dairy animals and dairy enterprises
Recommended for region	Coastal regions of Goa and adjoining states

Details of technology

- ❖ Standardized a process of making plain and compound livestock feed blocks using locally available feed resources like wild dry grass (Karad) and paddy straw.
- ❖ Besides, effective utilization of feed resources, this technology offers other benefits like cheaper storage, easy transportation, easy handling and reduced cost.

Features of technology with their benefits

- ❖ The technology helps to reduce the use of concentrate as well as maintain the milk yield in cattle yielding up to 10 litre milk per day.



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Technology : 37

Name of technology	Standardized technology of Artificial Insemination in pigs
Year of release	2016
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Pig
Recommended for region	West-coast region

Details of technology

- ❖ An important reproductive technology for rapid genetic improvement of farm animals. The process involves collection of semen from healthy male animal, processing it and depositing into the reproductive tract of a receptive female animal artificially using insemination gun or catheter.
- ❖ The technology was standardized for indigenous pig reared under coastal climate

Features of technology with their benefits

- ❖ Currently AI technology in pigs has been performed in around 40 villages and 734 farmers were benefited generating employment of \approx 1.37 lakh man-days translating in to income generation to the tune of Rs 9.60 crore.


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Technology : 38

Name of technology	Crossbred pig production
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Pig
Recommended for region	West-coast region

Details of technology

- ❖ Technology was standardised for producing the crossbred pig using standardised Artificial Insemination.
- ❖ The crossbred pig produced by crossing Agonda Goan female with Large White Yorkshire male.

Features of technology with their benefits

- ❖ The crossbred pigs developed from this technique showed excellent results with respect to characters like average birth weight (820.34±38.16 g), weaning weight at 40 days age (5.42 kg), weight at 10 months' age (85 to 90 kg), average age of puberty (190 days), average age of sexual maturity (220 days), age of first farrowing (335 days) and better pork with (3.36 cm) back fat thickness.



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Technology : 39

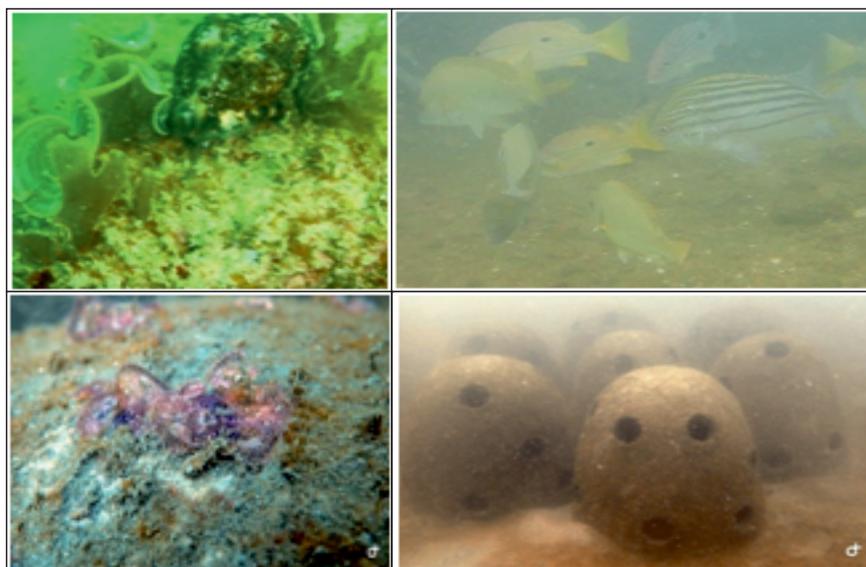
Name of technology	Designed and evaluated artificial fish habitats for fish farmers
Year of release	2018
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Fishery
Recommended for region	Coastal region of India

Details of technology

- ❖ The artificial fish habitats (AFH) were developed and evaluated to provide refuges and breeding sites for fish in the coastal region.
- ❖ Using underwater visual census (UVC) counted a total of 50 species were counted on the AFHs and species diversity and abundance were higher at deeper AFHs.
- ❖ The attachment of various communities like oysters, sponges and ascidia was highest on the deeper AFHs.

Features of technology with their benefits

- ❖ Institute technology supported conservation and aquatic diversity, besides increasing fish catch and net incomes of the fish farmers.


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Technology : 40

Name of technology	Low-cost capture based multi species culture system for coastal region
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Fishery
Recommended for region	Coastal region of India

Details of technology

- ❖ The culture system is designed to improve fish and mussel production in the coastal region using cage systems.
- ❖ The size of the cage: 2 m x 1.5 m x 2 m, Culture period: 8-10 months.
- ❖ Species cultured: Multi-species (red snapper, pearlspot, and green mussel).
- ❖ Mussel seeds collected from the wild were stocked in cotton mosquito net bags.

Features of technology with their benefits

- ❖ The net profit and BC ratio of the system was Rs. 34,000 and 2.40, respectively.



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Technology : 41

Name of technology	Standardized scientific practices of Agro-Ecotourism (AET) and established a AET model center
Year of release	2019-2020
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Arecanut, plantation crop based, traditional farming system
Recommended for region	West coast region

Details of technology

- ❖ A conceptual framework for agro-ecotourism development in coastal regions has been evolved for augmenting livelihood security sustainability of agro-ecotourism models in coastal region.
- ❖ A model AET center has been established at ICAR-CCARI to demonstrate various components of agro-ecotourism.

Features of technology with their benefits

- ❖ It acts as a centre for capacity development in the areas of agro-ecotourism for farmers, entrepreneurs, youth and policy makers.


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Technology : 42

Name of technology	Technology for long term preservation of boar semen
Year of release	2015
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Pig
Recommended for region	Coastal region

Details of technology

- ❖ Protocol for long term preservation of boar semen using of controlled-rate semen freezing, cryopreservation technology.
- ❖ Method involves controlled rate freezing of pig semen extended using indigenous semen diluent.
- ❖ Successfully evaluated for in-vivo fertility status in female pigs using deep intra-uterine insemination procedure and viable piglets were born from frozen semen AI.

Features of technology with their benefits

- ❖ Technology increased the overall conception rate by 47.37% and farrowing rate by 15.79%.



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Technology : 43

Name of technology	Fertilizer calculator – New
Year of release	2021
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice, vegetables, coconut, arecanut, cashew, spices etc.
Recommended for region	Goa and adjacent coastal districts

Details of technology

- ❖ It is an android-based mobile app to prescribe soil-test based fertilizer recommendations for different crops in Goa.
- ❖ The total number of installs by the users are > 7000.

Features of technology with their benefits

- ❖ Use of these ICTs has led to judicious use of costly fertilizer in puts in Goa.
- ❖ For details: Link:<https://play.google.com/store/apps/details?id=in.res.ccari.fertcalc>


Contact for further details

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Technology : 44

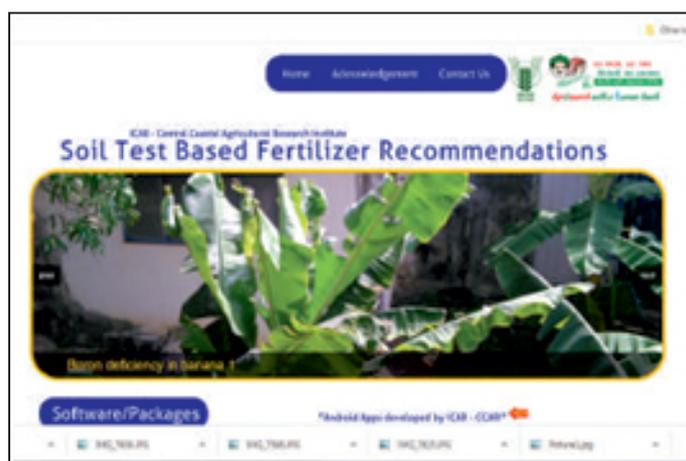
Name of technology	Soil health management web portal
Year of release	2015
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Rice, vegetables, coconut, arecanut, cashew, spices etc.
Recommended for region	Goa

Details of technology

- ❖ A web portal – Soil Health Management - Goa has been developed considering the importance of soil fertility, nutrient recommendation and soil health.
- ❖ It is an online web application using base data of about 20,000 analyzed soil samples.
- ❖ It generates information on village and taluka wise soil fertility status of all sampled village and taluka of Goa for important annual and perennial crops.

Features of technology with their benefits

- ❖ Digital tools developed by the Institute for soil test-based fertilizer recommendations to important crops of the region have received 75000 views. Balanced use of fertilizers reduced fertilizer cost up to 13.0%, with a 24.0-37.5% increase in paddy and coconut yield.
- ❖ The technology is being used by the farmers, line departments and stakeholders in the coastal region of Goa, Maharashtra and Karnataka. The webportal is also hosted on the website of the Directorate of Agriculture, Government of Goa.
- ❖ The additional income generated by the technology is Rs. 67.20 crore with 33% adoption by the users in rice and coconut crops in 3 coastal states.
- ❖ For details : Link: <https://ccari.icar.gov.in/soilgoa/index.php>



Contact for further details

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Technology : 45

Name of technology	ICAR-CCARI fish database
Year of release	2021
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Fishery
Recommended for region	Coastal region

Details of technology

- ❖ A dynamic database has been prepared on coastal fisheries resources with the information on status, catch, species (a total of 300 species with systematic, description, size, food and feeding, utilisation and gears used for fishing) and technology options for improving fish production in coastal ecosystems.
- ❖ The database acts as a decision support system to the coastal fishermen.

Features of technology with their benefits

- ❖ The total number of views/visitors to the data base are \approx 20000/annum.
- ❖ For details : Link: <https://kvknorthgoa.icar.gov.in/fishdb/>



ICAR - Central Coastal Agricultural Research Institute
(An ISO 9001:2008 Certified Institute)

A database on coastal fisheries resources

Home | Fish | Publications | Data | Contact Us

The database has been prepared on coastal fisheries resources with the information on status, catch, species (a total of 300 species with systematic description, size, food and feeding, utilization and gears used for fishing) and technology for improving fish production in coastal ecosystems. The database is prepared on the information available from the fish, fisheries and aquaculture resources. For the species with the information from the coastal region from north to south. The database is kept simple and it can be accessed from desktop, tablet and smartphone. The database provides the species name, description, size, food and feeding, utilization and gears used for fishing. The other comprehensive information on fish and fishing gears used and utilization for the species is collected through various data. The data being updated continuously in the species database and information user will be able to improve the database substantially.

Kalunder

Name: *Pseudotropheus mandahli*
Class: Actinopterygii
Order: Perciformes
Family: Cichlidae
Description: It is endemic to freshwater and brackish estuaries, lagoons and seagrass in southern India and Sri Lanka. The species



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Technology : 46

Name of technology	Comprehensive e- agriculture portal for information and knowledge sharing in Goa
Year of release	2019-2020
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	All major crops, livestock and fishery
Recommended for region	Goa

Details of technology

- ❖ E-agriculture portal is being developed as a comprehensive web portal for agriculture and allied sectors in Goa.
- ❖ Advanced technologies in agriculture, horticulture, animal and fishery sciences are available for farmers. Besides the various schemes available for farmers and information on source of various inputs have been furnished.
- ❖ The inspiring success stories available online will create interest in the minds of viewers. The weather data of six different talukas of Goa available on the site will be useful for scientists and farmers for academic purposes and efficient crop management respectively.

Features of technology with their benefits

- ❖ The total number of views/visitors to the webportals are ≈17000.
- ❖ For details : Link: <https://www.agrigoexpert.res.in/icar>



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Technology : 47

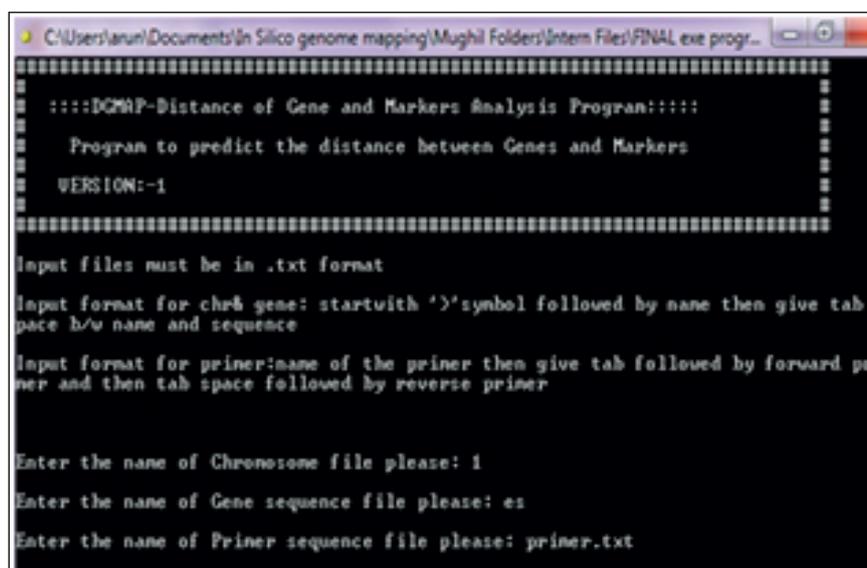
Name of technology	Bioinformatics software to map the primer sequences
Year of release	2017
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Genomics/molecular biology enterprises
Recommended for region	All regions

Details of technology

- ❖ A software DG-MAP was developed to map the primer sequences on whole genome sequences. The software works well specifically for RAPD and SSR markers and also works out the distance between the priming sites.
- ❖ It was validated using genome sequences of chromosome 1 of cucumber and F locus. The software predicted the known and existing markers closely linked to F locus.

Features of technology with their benefits

- ❖ It helps to map genes and markers on a fine physical map.



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C:\Users\anun\Documents\In Silico genome mapping\Mughil Folders\Intern Files\FINAL exe progr...
:::DGMAP-Distance of Gene and Markers Analysis Program::::
Program to predict the distance between Genes and Markers
VERSION:-1
Input files must be in .txt format
Input format for chr& gene: startwith ')'symbol followed by name then give tab
space b/w name and sequence
Input format for primer:name of the primer then give tab followed by forward pr
mer and then tab space followed by reverse primer
Enter the name of Chromosome file please: 1
Enter the name of Gene sequence file please: es
Enter the name of Primer sequence file please: primer.txt

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Technology : 48

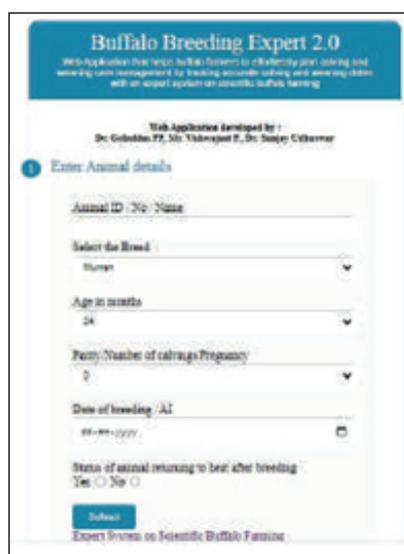
Name of technology	Web application- buffalo breeding expert
Year of release	2020
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Buffaloes
Recommended for region	Coastal region

Details of technology

- ❖ A web application- Buffalo breeding expert was developed for buffalo breeding and herd management. Application can assist farmers in determining reliable calving date and ideal weaning date for various breeds of buffaloes.
- ❖ Includes an expert system on scientific buffalo farming with information on good management practices and indigenous buffalo breeds suitable for coastal climate.

Features of technology with their benefits

- ❖ The total number of views/visitors to the webportal are 2000.
- ❖ For details : Link: <https://kvknorthgoa.icar.gov.in/buffalo/form.php>



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Technology : 49

Name of technology	Decision support system
Year of release	2013
Source of technology	ICAR - Central Coastal Agricultural Research Institute, Goa
Suitable for which crops/ animals/enterprises etc.	Agriculture and allied sectors
Recommended for region	Goa

Details of technology

- ❖ In order to bring out developments in information and communication technologies (ICT) to the benefit of farming community, Institute has developed Decision Support System (DSS).
- ❖ System provides comprehensive information on scientific practises of cultivation of major and important crops, livestock and fisheries of the region.

Features of technology with their benefits

- ❖ DSS helps farmers to take correct decision or access complete information on agricultural practises and to date total 25,51,934 views have been received.
- ❖ For details : Link: <https://ccari.icar.gov.in/dss/index.html>



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Technology : 1

Name of technology	Customized micronutrient mixture for Nagpur mandarin
Year of release	2021
Source of technology	ICAR-Central Citrus Research Institute, Nagpur, Maharashtra
Suitable for which crops/ animals/enterprises etc.	Nagpur Mandarin
Recommended for region	Central India (Citrus regions)

Details of technology

Areawide occurrence of micronutrient deficiencies in form of Fe, Mn, Zn and B were established based on an extensive survey of 18000 ha citrus growing areas of Vidarbha region of Maharashtra. Two types of micronutrient mixture (Micronutrient mixture I: Fe, Mn and Zn and Micronutrient mixture II: Fe, Mn, Zn and B) were customised based on leaf nutrient composition and fruit nutrient composition. These two micronutrient mixtures were prepared in such a way that they cater to the needs of multiple micronutrient deficiencies prevalent in citrus orchards of central India. Two micronutrient mixtures duly tested through laboratory-based incubation study, were tested for field response involving four treatments viz., T₁: Citrus special, IIHR Bangalore, foliar spray with RDF as soil application; T₂:Macronutrients as soil application of RDF + Micronutrients as foliar application; T₃: Micronutrient mixture-1 as soil application + Macronutrients as soil application of RDF and T₄: Micronutrient mixture-2 as soil application + Macronutrients as soil application of RDF, were evaluated during 2012-19. The customized micronutrient mixture II proved to be the best in terms of response on canopy volume, fruit yield, fruit quality parameters, plant available nutrients pool and leaf nutrient composition over rest of all other treatments.

Features of technology with their benefits

- ❖ Micro nutrients are customized based on prevalent frequency of micronutrient deficiencies.
- ❖ Customized micro nutrient mixture caters to metabolic requirements of these nutrients by Nagpur mandarin.
- ❖ Dose of customized micro nutrient mixture is much lower than individual dose of straight micro nutrient fertilizers.

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Technology : 2

Name of technology	Microbial consortium for Nagpur mandarin
Year of release	2021
Source of technology	ICAR-Central Citrus Research Institute, Nagpur, Maharashtra
Suitable for which crops/ animals/enterprises etc.	Citrus
Recommended for region	Central India (Citrus regions)

Details of technology

Exploiting microbial synergisms is one of the popular methods of substrate dynamics and associated changes in nutrient environment of rhizosphere, a robust index of production sustainability. Growth promoting microbes were isolated from rhizosphere (0-20 cm) for development of Microbial Consortium through extensive soil sampling (from the rhizosphere of as many as 110 plants) at the experimental site. The microbial diversity existing within (within top 0-20 cm) rhizosphere soil was isolated following standard procedures, and characterized the promising microbes for their nutrient mobilizing capacity through laboratory - based incubation study using the same experimental soil. The efficient microbes *Aspergillus flavus* (Mf113270) (P-solubilizer), *Bacillus pseudomycooides* (MF113272) (K- solubilizer), *Acinetobacter radioresistens* (Mf113273) (N-solubilizer), *Micrococcus yunnanensis* (MF113274) (P- solubilizer) and *Paenibacillus alvei* (MF113275) (P- solubilizer) were finally identified. Pure culture of these microbes in value added form was developed in broth, and prepared a mixture called Microbial Consortium (MC). The compatibility amongst these microbes was tested by thoroughly their population dynamics in consortium mode which showed no antagonism amongst them upto 90 days of laboratory oriented incubation study. The Microbial Consortium, developed was tested under different nursery as well INM-based combinations. In nursery, the microbial consortium was very effective in developing root biomass with additional resilience to soil. While field evaluation showed some exciting improvements in soil health in terms of microbial community build-up and microbial biomass nutrients besides crop growth and fruit yield. When field tested through INM-based module with as much as 30-40% saving on fertilizer use.

Features of technology with their benefits

- ❖ Contains as many five microbes complimenting each other.
- ❖ Improved carbon sequestration capacity of soil vis-à-vis soil health.
- ❖ Elevated the nutritional quality of crop.
- ❖ Reduced the dose of RDF by minimum of 30%.

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Technology : 1

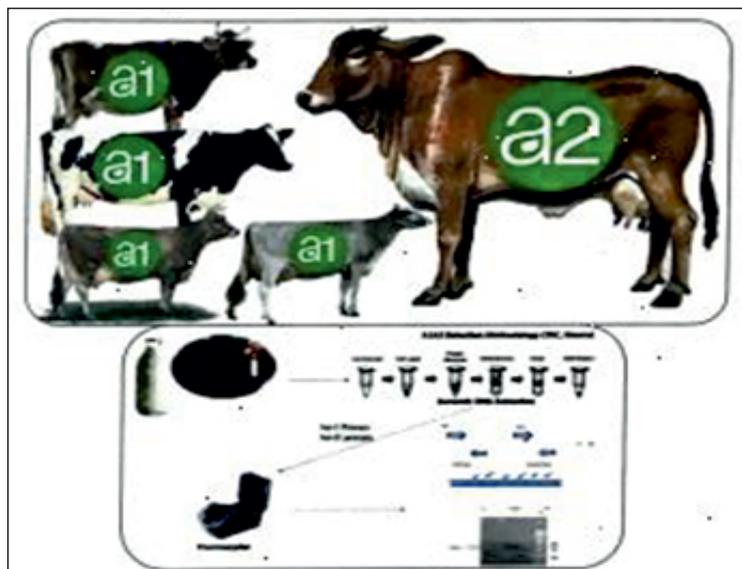
Name of technology	Genetic test developed for detection of A1, A2, Beta casein milk
Year of release	-
Source of technology	ICAR-CIRC, Meerut
Suitable for which crops/ animals/enterprises etc.	Cattle and Buffalo
Recommended for region	Allover India

Details of technology

ASPCR based technique has been developed to identify the genotype of individual animal for beta casein gene variants which has been associated with a number of human diseases like diabetes, heart diseases etc.

Features of technology with their benefits

This technology helps for identifying animals with A2 alleles in the cattle populations. Consuming A2 milk is suggested to be beneficial for the health while A1 milk is supposed to increase certain diseases.



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Technology : 2

Name of technology	CIRC-COWCAM assay kit
Year of release	2021
Source of technology	ICAR-CIRC, Meerut
Suitable for which crops/ animals/enterprises etc.	Cow and Camel
Recommended for region	All over India

Details of technology

Presently, due to high market demand and less supply of camel milk, it is being adulterated with cow milk. As it is well known, food adulteration is a global concern and developing countries like India are at higher risk. The CIRC-COWCAM assay kit is useful for detecting cow milk adulteration in camel milk as well and vice versa at a minimum level of 1%.

Features of technology with their benefits

The kit is less expensive, user friendly, rapid and specific in detection of adulteration of camel milk with cow milk and vice-versa. It will be useful for the dairy industry, NGOs and others take holders dealing with the sale of camel / cow milk.


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Technology : 3

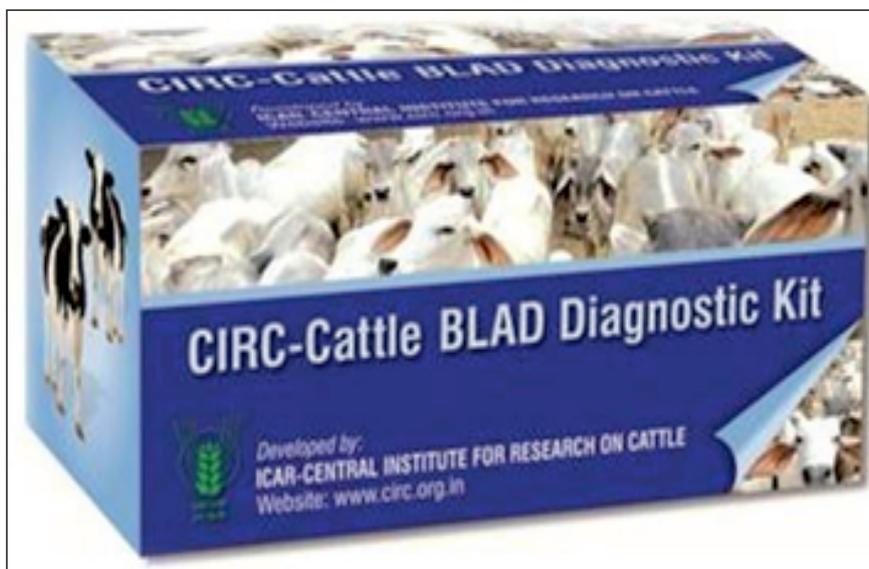
Name of technology	CIRC-Cattle BLAD diagnostic kit
Year of release	2020
Source of technology	ICAR-CIRC, Meerut
Suitable for which crops/ animals/enterprises etc.	Cattle
Recommended for region	All over India

Details of technology

PCR-RFLP based technique has been developed for identifying genetic disease has Bovine Leukocyte Adhesion Deficiency (BLAD).

Features of technology with their benefits

This technology helps for identifying carrier bulls for this genetic disease. Identified carriers animals are removed from the population and there by spread of the disease is controlled.



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Technology : 4

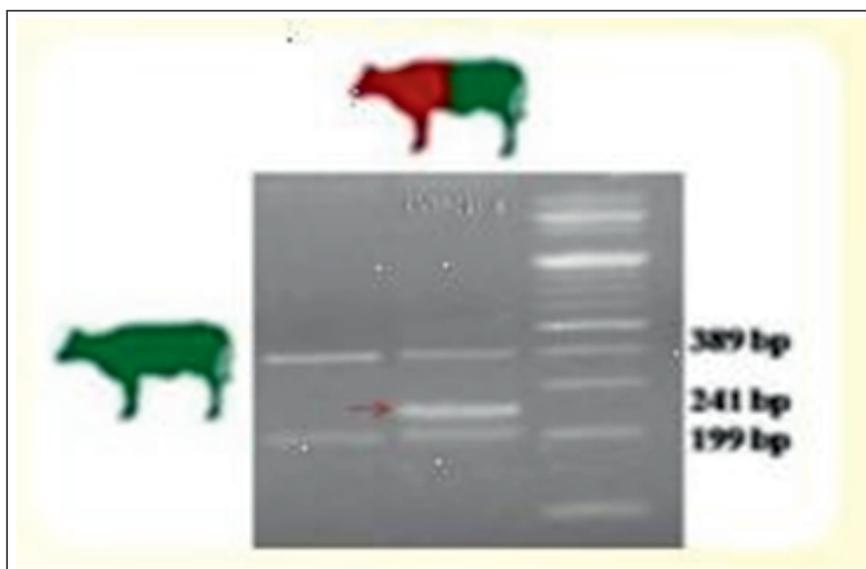
Name of technology	CIRC-Cattle CVM
Year of release	2021
Source of technology	ICAR-CIRC, Meerut
Suitable for which crops/ animals/enterprises etc.	Cattle
Recommended for region	All over India

Details of technology

The CIRC-Cattle CVM assay is used for early detection of Cerebral Vertebral Malformations (CVM) carrier animals. The test is earmarked with its rapidity, user – friendliness, economical and specificity. The assay may prove to be an effective tool for selecting CVM free animals especially young bulls at their early stage of life.

Features of technology with their benefits

This assay will be useful for the semen collection/ germplasm centres, research institutions, State Animal Husbandry Departments and NGOs involved in semen collection and processing of cattle and buffaloes.


Contact for further details

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Technology : 1

Name of technology	ICAR-CIAE-SBI Two-row tractor-drawn mechanical transplanter for sugarcane bud chip/single bud settlings raised in portrays
Year of release	2017
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region	All the sugarcane growing states

Details of technology

The equipment consists of main frame to be attached to the standard three-point hitch arrangement of a 40 hp tractor with adjustable arrangement for altering row to row spacing 90, 120 and 150 cm. Bud chip settlings to be dropped through the metering mechanism by two operators who are seated behind the equipment with adjustable arrangements for altering plant to plant spacing of 30, 45 and 60 cm. Furrow openers open the furrow, in which the settlings with soil are to be planted with adjustable arrangement for altering the depth of planting 2 to 6 cm. The same furrow is used for irrigation after the settlings have been planted for better establishment. The furrow closer which follows the soil opener closes the soil thereby giving stability to the settling plants. The field capacity of the equipment is 0.30 ha/h and the missing of 3 to 4 per cent at a working speed of 1.4 km/h. The plant establishment was more than 95%. The yield and quality parameters are on par with manual planting.

Features of technology with their benefits

- ❖ Saves 70 per cent in cost when compared to manual planting.



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Technology : 2

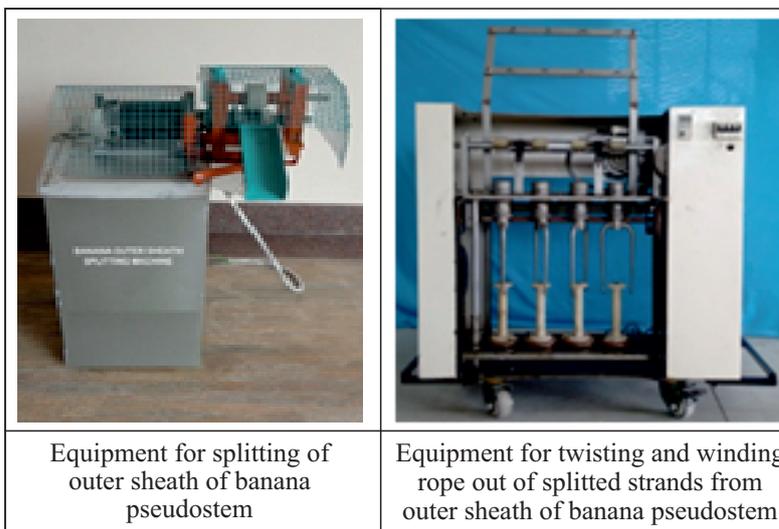
Name of technology	ICAR CIAE NRCB package of mechanisation equipment for making rope from the outer sheath of banana pseudostem
Year of release	2021
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Banana
Recommended for region	All banana growing states

Details of technology

Out of the 14-18 sheaths available in a pseudostem of banana, the outermost 4-6 sheaths yield coarse fibre, the outer 6-8 sheaths give soft lustrous fibre and the rest of the middle sheaths yield very soft fibres. The quantity of fibre in each sheath depends upon its width and its location in the stem, as does its quality. This waste from banana plantations can be turned into wealth by value addition to useful products. Ropes from the outer sheath of banana pseudostem are in high demand for different applications but are made labour intensive with hand spinning or by ratt machines.

Features of technology with their benefits

The twisted rope obtained from the outer sheath of banana pseudostem is used for the production of various eco-friendly handicraft materials like bags, window curtains, table mats etc which has huge demand both in the local and international market. thus generating additional revenue to farmers/entrepreneurs/processors The outer sheath of banana Pseudostem when processed for rope making would fetch about 2.40 lakh metre of banana sheath rope, valued at Rs 1.00 lakh/ha.



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Technology : 3

Name of technology	ICAR-CIAE-Mechanization package for juice extraction from <i>Garcinia Combogia</i> (Includes Juicer/grinder; juice squeezer and Juice concentration equipment)
Year of release	2017
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	<i>Garcinia Combogia</i>
Recommended for region	All <i>Garcinia Combogia</i> growing states

Details of technology

Garcinia Cambogia is minor forest produce which is excessively available in the western Ghats of the country. It is available certain belts of Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and other parts of the country. *Garcinia Combogia* plays a major role in health food and weight loss compound: *Garcinia cambogia* is well known component used in anti-obesity herbal supplement around the world for decades. Hydroxy citric acid (HCA), the principal acid in the fruits of *Garcinia cambogia*, is a competitive inhibitor of ATP-citrate lyase the enzyme responsible for fatty acid, cholesterol, and triglyceride biosynthesis. The outer rind obtained from tamarind is used as an alternative to tamarind in many areas. The Juice obtained from ripe *Garcinia Cambogia* fruit is converted to vinegar which is used as a souring agent after concentration. Package of Equipment viz, juicer/grinder, juice squeezer and juice concentration unit was developed to make vinegar for ripened *Garcinia Combogia* fruits .

Features of technology with their benefits

- ❖ The juice extraction by this package of equipment is hygienic, without direct contact of human hands and this helps to reduce contamination.
- ❖ It takes about 4 hours for juice (30 lit) to be converted to vinegar of about 4-5 litre.



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Technology : 4

Name of technology	ICAR-CIAE- SBI motorised double headed sugarcane single bud cutting machine
Year of release	2018
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region	All sugarcane growing states

Details of technology

Double head sugarcane single bud sett cutting machine has two pairs of two circular blades made of high carbon steel, which rotates at a speed of 2800 rpm. A spacer is provided between the two blades, which facilitate variation in the size of single bud sett as per the requirement. Two persons can operate simultaneously and can cut about 3000 single buds in an hour with the help of the developed unit. The machine can be operated by 0.75 kW (1 hp) electric motor which powers both the sets of cutting blades.

Features of technology with their benefits

By using single motor, two sets of cutting blades can be operated. The equipment developed is easy to operate. Further, as per the requirement, the required size of the single bud can be obtained by changing the spacer in between the two circular blades. Cost economics of adoption of single bud cutting machine gave savings in time and cost of 89 and 64 %.


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Technology : 5

Name of technology	ICAR-CIAE tractor operated cassava stake cutter planter
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Cassava
Recommended for region	All cassava growing states

Details of technology

A tractor operated single row cassava stake cutter planter consists of main frame, stake cutting system, stake planting mechanism, transmission system and ridger. The cutting system consists of two counter rotating shafts with two numbers of blades each placed at equal distance. The stake planting mechanism consists of a set of counter rotating rubber wheels. Both the stake cutting and stake planting mechanisms gets transmission from the Tractor PTO with suitable power transmission mechanism. The equipment when in operation (attached to a 35-40 hp tractor) forms a single ridge with the cassava stem cut in to stakes of 24 cm length and planted on top of the ridge vertically at a metered distance of 45 cm. The actual Field capacity of the planter is 0.18 ha h⁻¹.

Features of technology with their benefits

The cost of operation of cassava planter is Rs.3125/ha and it saves 60.40 per cent in cost when compared to manual planting. The cost benefit ratio and payback period of developed planter worked out are 2.06 and 4.31 year respectively.



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Technology : 6

Name of technology	ICAR-CIAE tractor operated cassava harvester cum lifter
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Cassava
Recommended for region	All cassava growing states

Details of technology

The harvester was developed with main frame, digging unit, conveying unit, transmission system and cluster breaking system. The conveying system consists of two endless gripper belt (counter rotating) of 3700 mm length. The power is transmitted from tractor PTO to transmission gear box through universal shaft. The power is then transmitted from gear box to conveying mechanism and cluster breaking blade through suitable belt drives. The equipment when in operation attached to a 50 hp tractor digs a single ridge and lift the tubers from the ground and convey to surface for manual collection. The Actual Field capacity of the planter is 0.22 ha h⁻¹.

Features of technology with their benefits

The cost of operation of cassava harvester is Rs.2265/ha and it saves 82.0 per cent in cost when compared to manual harvesting


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Technology : 7

Name of technology	Manually operated palmyra endosperm remover
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Palmyra
Recommended for region	Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, Goa, Maharashtra, Gujarat, Odisha, Bihar and West Bengal.

Details of technology

Palmyra endosperm also known as Ice Apple obtained from tender Palmyra fruit is widely consumed during the months of summer. It acts as a coolant and balances the minerals in the body and keeps the body hydrated from the scorching heat. At present, palmyra tender fruit is cut opened to remove the endosperm, by the road side vendors using traditional knife in an unhygienic way, which needs special skill and also labourious. Manually operated Palmyra endosperm remover has been developed for easy extraction of the endosperm. The manually operated Palmyra endosperm remover consists of the main frame, cutting assembly, tray holder with tray for endosperm collection and fruit waste dropping chute. The overall dimension of the equipment is 900x450x1600 mm, with a weight about 22 kg. The cutting assembly is provided with a flat blade of size 340x50x6 mm. The blade is fixed to a spring-loaded hand lever. A fruit holder frame of size 320x175 mm is also an integral part of the cutting assembly. At the left side of the equipment, there is a hollow bottom holder to keep the fruit for holding with a thin rod so that the hand doesn't come in contact with the blade while cutting the fruit. A stainless-steel tray is kept below the cutting platform to collect the endosperm. The cut fruit waste passes through an outlet chute and gets collected separately. The tender Palmyra fruit is held by a hand tool and kept on the cutting platform and by lowering the lever operated handle, the blade cuts open the first socket of the fruit having the endosperm. Similarly, the other two sockets are cut opened and the endosperm is scooped out of the fruit using a stainless-steel spoon. The capacity of the equipment is 50 fruits/h. The extraction efficiency was found to be 100 per cent.

Features of technology with their benefits

User friendly Does not require any specialised skill for cutting Safe method of operation Portable Hygienic method of extraction.



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Technology : 8

Name of technology	ICAR-CIAE- SBI Sugarcane rind removing equipment for juice making
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region	All sugarcane growing States

Details of technology

The sugarcane rind remover consists of four metallic brushes attached to the rotating shaft. When the sugarcane is inserted between the four metallic brushes, the upper, lower and two sides skin of the sugarcane is removed due to the rotation of the brushes (because of the abrasion action between the brushes and the sugarcane fed). The pair of metallic brushes are mounted on the shafted through the gear box so that the brushes rotate in the opposite direction at about 1050 rpm. The feeding arrangement is made of two nylon rollers rotating at about 270rpm, which enables retention of the canes to be peeled for sufficient time in the peeling zone. The power transmission is through 1.5 hp single phase/ three phase motor. The equipment is mounted on the wheel enabling easy transportation from one place to another. Capacity of the power operated sugarcane rind removing equipment is 240 canes/h and 175-200 kg/h.

Features of technology with their benefits

- ❖ A good and hygienic method for clean rind removing of sugarcane before juice extraction/ bottling.
- ❖ Capacity is 200-240 canes/hour.
- ❖ Rind removing is 6-7 % of weight of cane.


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Technology : 9

Name of technology	ICAR-CIAE-NRCB - double blade rotating grating type banana sucker paring equipment
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Banana
Recommended for region	All banana growing States

Details of technology

At present sucker paring is done by manually and it requires more labour and tedious operation. The equipment consisting of the two rotating grating blades rotating on a vertical plane. The blade is operated by a one hp motor. The banana sucker to be trimmed is held against the rotating grating blade (300 mm) and adjusted as per the area and the depth of the banana sucker to be trimmed. The speed of operation of the blades is 2400 rpm. The capacity of the equipment is 200-250 suckers h⁻¹.

Features of technology with their benefits

- ❖ Power operated is 1 HP.
- ❖ Best Suited for smaller size banana sucker.
- ❖ Double Headed circular blade of 300 mm dia.
- ❖ Capacity is 200-250 sucker per hour.
- ❖ Saving in cost is 82%.
- ❖ Saving in labour is 94%.



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Technology : 10

Name of technology	ICAR-CIAE-NRCB -trimming mechanism type banana sucker paring equipment
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Banana
Recommended for region	All banana growing States

Details of technology

At present sucker paring is done by manually and it requires more labour and tedious operation. The equipment consisting of the holder on which the banana sucker to be trimmed is placed. The spring-loaded holder from the top, gives the grip on the sucker to be trimmed and it can be locked in the required position. The holder is rotated with the help of 1 Hp motor at the required speed. The trimming knife is placed at the required position so that the Banana sucker placed on the rotating holder is trimmed to the desired shape to get the paired banana sucker ready for planting. Aa additional knife is mounted on the working platform, which can be used to cut the bottom roots before placing it on the holder for trimming. The equipment is best suited for large size suckers. The capacity of the equipment is about 120-150 suckers per hour.

Features of technology with their benefits

- ❖ Power operated is 1 HP .
- ❖ Best suited for bigger diameter banana suckers.
- ❖ Capacity is 120-150 sucker per hour.
- ❖ Saving in cost is 75%.
- ❖ Saving in labour is 90%.


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Technology : 11

Name of technology	ICAR-CIAE NRCB banana pseudo stem injector
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Banana
Recommended for region	All banana growing States

Details of technology

At present pseudostem injection is done by manually and it requires more labour and tedious operation. Hence, the project is proposed to develop pseudo stem injector for banana cultivation. Banana Pseudo stem injector has been developed for injecting chemicals in banana pseudo stem. It consists of chemical tank, peristaltic pump, control unit with non-return valve and injector. The injector is made of S.S Material 304 Grade of 7.5 cm length and 2 mm sharp tip. The chemical tank is made of plastic with storing capacity of 16 l. The peristaltic pump is attached to pump the liquid from chemical tank to injection system. The control unit is attached with electronic embedded system to control chemical quantity and depth of injection by 8mm I/P & O/P Screw Variable valve. The non-return valve (¼ Thread, one way valve) is attached with control unit to restrict the chemical back flow to the injector after injection. Quantity of liquid injected is 2-4 ml per tree ml, Coverage 140-150 trees per hour, Spillage percentage and Injector efficiency was recorded as 2% and 95% respectively.

Features of technology with their benefits

- ❖ Battery operated back pack model very easy to carry one tree to another tree.
- ❖ Injecting liquid quantity can adjusted precisely.



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Technology : 12

Name of technology	ICAR-CIAE NRCB tractor operated banana bunch harvester
Year of release	2020
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Banana
Recommended for region	All banana growing States

Details of technology

Banana bunch harvesting is typically carried out by only one person, partly by cutting the pseudostem with a machete, and lowering the bunches down slowly. To eliminate the human drudgery, a tractor operated banana bunch harvester has been developed. The unit consists of main frame (70 mm & 60 mm Square tube frame of length 145 cm), harvesting boom (70 mm & 60 mm Square tube frame of length 265 cm), bunch holding and bunch cutting system, hydraulic system and power transmission system. The main frame is designed to attach in front of the mini tractor chassis. Bunch harvesting boom is made to hinge the harvesting boom with main frame and hydraulic cylinder, which is used to lift and lower the harvesting boom. The hydraulic cylinder is provided for operating harvesting boom and bunch holding and cutting assembly. Power from tractor PTO is transmitted through 1: 5 step up gearbox to the Gear pump (clockwise, 27 lpm) to operate the hydraulic cylinders through two Double acting spring center directional control valves. The developed Bunch harvester is used for harvesting banana bunches.

Features of technology with their benefits

- ❖ Suitable for mini tractor.
- ❖ The height of reach is 1.1 to 2.7 m and weight of bunch was 18-25 kg.
- ❖ The coverage of harvester was 45-50 trees per hour.
- ❖ Cost saving is 23% when compared with manual harvesting.



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Technology : 13

Name of technology	ICAR-CIAE-CTRI- tractor operated tobacco seedling transplanter with spot application of water
Year of release	2021
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Tobacco
Recommended for region	All tobacco growing States

Details of technology

The equipment consists of mainframe which can be attached to standard three-point hitch arrangement of the tractor, the metering mechanism, operator's seat, furrow openers, seedling planting mechanism, Water tank, system for spot application of water and soil compaction wheel are mounted on the main frame with necessary supports. The nursery grown in the protrays can be dropped through the metering mechanism by two operators who are seated behind the equipment. A shoe type soil opener opens up the soil. The seedlings, which is dropped down from the seedling placement mechanism will be placed in the opened-up soil. The soil compaction wheels which follows the soil opener closes the soil thereby giving stability to the seedlings. The plant to plant spacing can be easily changed from 50, 60 and 75 cm. The row to row spacing can be changed from 65 cm, 70 cm and 100 cm to suit the different region demand. Both the seedling dropping mechanism and watering mechanism will be actuated through cam arrangement fitted in the transmission system to synchronize both seedlings dropping and watering. The spot application of watering system has been attached such way that, the after planting the watering will be done on the spot nearer to the seedling planted.

Features of technology with their benefits

The field capacity of the equipment is 0.2 to 0.3 hah-1 and the missing percentage is to the tune of 2-3 per cent at a working speed of 1.5 kmh-1. The quantity of water applied per plant is 200-250 ml. The plant establishment was more than 95 per cent. The savings in cost is 65 per cent. Saving in labour is 85 per cent.



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Technology : 14

Name of technology	ICAR CIAE-SBI- small tractor operated EPN applicator for sugarcane white grub management
Year of release	2021
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region	All sugarcane growing States

Details of technology

Majority of the farmers follow the spot application of EPN to control white grub by manually. The manual application was done by using crowbar to make 125 mm depth hole and drop the EPN solution to control white grub. Manual application method of EPN application involve more drudgery and non-uniform quantity of EPN solution in sugarcane root zone. Keeping the above view, a mini tractor operated EPN applicator has been developed by ICAR, Central Institute of Agricultural Engineering Regional Centre, Coimbatore in collaboration with ICAR Sugarcane Breeding Institute, Coimbatore. The developed small tractor operated EPN applicator consists of main frame, tank holding assembly, agitator, water pump, furrow opener and standard three-point hitch. A 150-liter tank was placed to carry the EPN solution. The tank consists of agitator and two EPN solution outlet flexible tubes. The agitator consists of two numbers of baffles at the end of vertical shaft. The agitator shaft was operated by 12 V high torque DC motor. The speed of the agitator shaft and discharge rate can be adjusted by using control units. The agitator provides continues agitation of EPN solution and avoid suspension of particles so that it results in uniform delivery of the EPN. Pumping of EPN solution was done by two numbers of 4.0 LPM / 12v DC Water Sprayer Motor Diaphragm pump and it was powered by 12 V Battery. The developed unit was field tested at ICAR-Sugarcane Breeding Institute field and M/s. Bannari Amman Sugars research and development farm field. The results indicated that the EPN delivery in the right side out let was 30 IJs/ml and left side out let was 32 IJs/ml . Similar trend was noticed in the Bannari amman field also where the EPN delivery in the right side out let was 35 IJs/ml and left side out let was 33 IJs/ml.

Features of technology with their benefits

- ❖ The average actual field capacity is 0.18 hah⁻¹.
- ❖ The cost of operation was worked out as Rs. 2550 per ha.



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Technology : 15

Name of technology	ICAR - CIAE-Millet Mill (Model-II)
Year of release	2021
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	All small millets
Recommended for region	All millet growing states

Details of technology

- ❖ Efficient in dehulling all small millets foxtail millet, little millet, kodomillet, proso millet, barnyard millet in a single machine.
- ❖ Comfortable height based on ergonomic data to suit the height of pan-Indian rural women.
- ❖ Sweeping wings to clear the dehulled mass in dehulling chamber towards the outlet chute.
- ❖ Flow deflector for better disposal of dehulled mass from the dehulling chamber by deflecting them towards outlet chute.
- ❖ Acrylic window to allow visual access into dehulling chamber.
- ❖ Enclosed components to avoid direct contact of workers with moving objects.
- ❖ Sturdy and compact.
- ❖ Ease of cleaning in dehulling chamber between different millet dehulling processes.

SPECIFICATIONS	
Mode of operation	Continuous type
Overall dimension	1118 x 900 x 1182 mm
Power requirement	1 hp (960 rpm) + 1 hp (2880 rpm) Single ϕ motor
Capacity	100 kg/h
Weight	150 kg (excluding motor)
Floor area	1118 x 900 mm
Purpose	Dehulling of millets (with/without bran)
Working principle	Gentle abrasion/ attrition & (aerodynamic)cyclone separation
Dehulling efficiency	> 90 %
Feed moisture	10-12 % wb

Features of technology with their benefits

- ❖ Dehulling Efficiency is > 90 %.



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Technology : 16

Name of technology	ICAR CIAE-Quinoa Pearler
Year of release	2021
Source of technology	ICAR-CIAE, RC, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Quinoa
Recommended for region	All quinoa growing States

Details of technology

For the removal of saponin which is mainly concentrated in the outer husk of the grain a Pearler was developed at CIAE RC, Coimbatore. Quinoa Pearler is a power operated continuous feed machine. It consists of dehulling chamber and husk aspirator. Dehulling chamber houses the main shaft, half of that is overlaid with pegs longitudinally in four rows to give impact force/ pounding action on the quinoa grains and the rest is coated with emery to provide polishing effect. It is powered by 2 hp single phase motor and the main shaft of the unit as well as the husk aspirator rotates at the speed of 1000 rpm. The capacity of the pearler is 35 kg/h and dehulling efficiency of the machine is 87% at 14% m.c. The overall dimensions of the machine are 875 x 975 x 1129 mm.

Features of technology with their benefits

- ❖ Effectively removes husk from quinoa. It provides a simple, economical and efficient method for dehulling quinoa.
- ❖ It reduces saponin content (bitter tasting component) from 40mg/100g to 28mg/100g which is organoleptically acceptable.



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Technology : 1

Name of technology	CIBA OXY ^{Plus}
Year of release	2020
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	<ul style="list-style-type: none"> ❖ Aquaculture water quality products manufacturers ❖ Aquaculture input manufacturers
Recommended for region	Coastal States

Details of technology

Successful aquaculture depends on the maintenance of optimum water quality. Among the water quality parameters, Dissolved Oxygen (DO) is one of the most important critical water quality parameter determines the success or failure of shrimp aquaculture. Under intensive shrimp aquaculture practices, water quality deteriorates by low DO levels, particularly during night and early morning resulting in the build-up of toxic metabolites. Even though mechanical aerators are commonly used for better aeration, under emergency situations especially during early morning hours farmers normally apply commercial oxygen enhancer products available in the market and whose efficiency is not known. Oxygen producing salts of sodium such as sodium percarbonate and perborate were used as active ingredients and addition of stabilizer enhanced the stability. The developed oxygen releasing compound was evaluated for its efficiency under laboratory as well as shrimp ponds in Tamil Nadu and Andhra Pradesh. The field trials proved its efficiency in improving the dissolved oxygen in aquaculture shrimp ponds.

Features of technology with their benefits

To synthesize oxygen releasing compound, active components of sodium salts, sodium per carbonate and sodium perborate were tested with the stabilizers in enhancing the stability in maintaining residual available oxygen. As the solubility of sodium perborate in water is low, activator was added to fasten the oxygen release. Addition of 20% was found to be effective in faster as well as higher amount of dissolved oxygen release from sodium perborate. DO levels with sodium per carbonate (SPC) based DO releasing products enhanced the DO level to 11.17 ppm immediately after application in 30 ppt salinity and sustained the DO level to 10.2 ppm upto 1 hr. Application of oxygen releasing compounds reduces the metabolites levels in the shrimp ponds.



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Technology : 2

Name of technology	CIBA pH kit
Year of release	2020
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

The pH kit is used for the onsite testing of water pH. The kit consists of one reagent. The interpretation is done using colour chart. The pH range from 6 to 11 can be read using the colour chart.

Features of technology with their benefits

This kit is used for the onsite analysis of pH in water based on the colour comparison method. The kit consists of one reagent P1 as 30 ml dropper bottle. Collect 5 ml water sample in the test tube with help of syringe provided in the kit. Add 5 drops of P1 in the test tube shake the test tube well. Compare the solution color with the given color chart.



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Technology : 3

Name of technology	CIBA Nitrite kit
Year of release	2018
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Nitrite kit is used for the onsite analysis of nitrite as nitrite - N in water of any salinity. The kit consists of one reagent. The interpretation is done based on the colour chart. The nitrite concentration from 0.05 to 1 ppm can be analysed using the kit.

Features of technology with their benefits

The kit used for the analysis of nitrite as nitrite - N in waters of varying salinity is based on the colour comparison method. The kit consists of one reagent (N1) provided as 30 ml dropper bottle. One ml of water sample has to be taken by the syringe in a 10 ml tube provided in the kit. One drop of N1 solution has to be added to the water sample, mix the contents thoroughly and allow the mixture for 5 minutes to develop the colour. Compare the colour with the colour chart provided and report the nitrite - N value in terms of ppm.



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Technology : 4

Name of technology	CIBA DO Kit
Year of release	2015
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

This kit is used for the onsite testing of dissolved oxygen in water. The kit consists of five reagents. The interpretation is done based on the number of drops used for the analysis and subsequent calculation as per the multiplication factor provided.

Features of technology with their benefits

This kit is used for the onsite analysis of DO in water based on the method of number of drops used to get the end point colour. The kit consists of five reagents D1, D2, D3, D4 and D5 as 30 ml dropper bottles. Collect water sample in the given 30 ml stoppered sample bottle without air bubbles inside the bottle. Add D1, 5 drops, re-stopper the bottle & mix by reverting the bottle. Add D2, 5 drops & mix the contents to develop a flocculent precipitate. Add D3, 7 drops, re-stopper the bottle & mix by reverting the bottle and transfer to the transparent 50 ml tube. Add D4, 5 drops then the color of water becomes blue. Add D5, drop wise until the blue color is just disappeared. Count the drops as number of drops & multiply with the factor to report DO in mg/l.



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Technology : 5

Name of technology	CIBA CMH Kit
Year of release	2016
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

This kit is used for the onsite analysis of calcium and magnesium minerals, and total hardness of water of any both low and high salinity. The kit consists of six reagents. The reagents are classified based on the salinity of water less than 15 ppt and more than 15 ppt. The interpretation is done based on the no.of drops used for the analysis and subsequent calculations as per the multiplication factor provided.

Features of technology with their benefits

This kit is based on the method of number of drops used to get the end point colour. The kit consists of six reagents CM1, CM2, CM3, CM4, CM5 and CM6. For waters with salinity range of 0 to 15ppt, for calcium estimation, to 5 ml water sample, add 5 drops of CM1 and one scoop of CM2. Add CM5 drop by drop until the solution changes from pink to purple, note the no. of drops. For magnesium estimation, to 2.5 ml water sample, add 5 drops of CM3, one scoop of CM4, add CM5 drop by drop until the solution changes from reddish tinge to blue, note the no. of drops. Swirl the container after adding each reagent. For waters with salinity range of 16 ppm and above, add CM5 instead of CM6. The no. of drops has to be multiplied with the factors to report in mg/l.



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Technology : 6

Name of technology	CIBA Ammonia Kit*
Year of release	2018
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Ammonia kit is used for the onsite analysis of ammonia in terms of total ammonia nitrogen (TAN) in waters of any salinity. The kit consists of four reagents. The interpretation is done based on the colour chart. The TAN concentration from 0.1 to 2 ppm can be analysed using the kit.

Features of technology with their benefits

The kit used for the analysis of ammonia as TAN in waters of varying salinity is based on the colour comparison method. The kit consists of four reagents A1, A2, A3 and A4 as 30 ml dropper bottles. One ml of water sample has to be taken by the syringe in a 10 ml tube provided in the kit. Two drops of each A1, A2, A3 and A4 solutions have to be added one by one to the water sample. After adding each solution, the contents have to be mixed well. After adding all the solutions, mix the contents thoroughly and allow the mixture for 10 minutes to develop the colour. Compare the colour with the colour chart provided and report the TAN value in terms of ppm.



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Technology : 7

Name of technology	CIBA-CBA Kit
Year of release	2017
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

This kit is used for the onsite testing of carbonate, bicarbonate and total alkalinity of water of any salinity. The kit consists of three reagents. The interpretation is done based on the no. of drops used for the analysis and subsequent calculation as per the multiplication factor provided.

Features of technology with their benefits

The carbonate, bicarbonate and total alkalinity estimation is based on the method of number of drops used to get the end point colour. The kit consists of three reagents C1, C2 and C3. Fill the container with 10 ml water sample using the syringe. Add 2 drops of C1. The appearance of pink colour indicates the presence of carbonate alkalinity. Immediately add C2, drop by drop until the pink colour disappears and note the no. of drops. To the same sample add 2 drops of C3. Immediately add C2, drop by drop until the solution changes from yellow to orange and note the no. of drops. If pink colour does not appear, directly add 2 drops of C3. Swirl the container after adding each drop by hand. The no. of drops has to be multiplied with the factors to report carbonate and bicarbonate in mg/l and total alkalinity in terms of mg/l as CaCO₃.



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Technology : 8

Name of technology	Captive maturation, induced breeding and larval rearing of grey mullet <i>Mugilcephalus</i>
Year of release	2017
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

The flathead grey mullet *Mugilcephalus* Linnaeus, 1758 is a cosmopolitan species of the family Mugilidae. The significant market demand, tolerance to wide salinity ranges and omnivorous feeding habit qualifies grey mullet as an excellent candidate species for brackishwater aquaculture. In India, although attempts to develop techniques for captive reproduction mullet was initiated in 1980's, a greater impetus was given in the recent years. ICAR-CIBA has standardized grey mullet captive reproduction using brood stock conditioned in tank system at east coast and using farm reared broodstock at west coast and completed the fry production. For brood stock development brood stock of grey mullets are sourced locally and transported in live condition in 1000 l plastic tanks with continuous oxygenation for stocking in broodstock holding tanks. The transported fish were initially quarantined in well aerated flow-through reinforced concrete cement (RCC) tanks, 25 t. The fish are treated with potassium permanganate (4 ppm, 1 h) initially and acclimatized for two weeks. Fish were gradually weaned to pellet feed. Prophylactic treatment (formalin 100 ppm, 45 minutes) was given before stocking into the brood stock tanks. Brood stock are maintained in 100 t RCC tanks provided with a water exchange rate of 300% per day. Fish are fed ad limitum two times (10.00 h; 16.00 h) with sinking pellet feeds (*Cephalus Brood^{phs}*), pellet size, 6 mm; crude protein, 38%; crude lipid, 10% formulated at ICAR-Central Institute of Brackishwater Aquaculture (ICAR-CIBA). Prophylactic bath treatment, formalin 100 ppm for 45 minutes was given on a monthly basis. Fish were tagged with passive integrated transponder tags (Biomark, USA) for individual identification. For promoting reproductive maturation, Fish were given intramuscular chronic release cholesterol pellets of LHRHa, 200 µg and silastic implants 17- α -methyl testosterone, 5 mg during the month of October every year and a fish maturation percentage upto 81% was obtained. On the east coast, induced breeding trails were conducted during November, the natural reproductive period of the species. Selection of females for induced spawning was done based on the average oocyte size (n=30) and selection of males was done based on expression of milt on applying gentle pressure on the abdominal region. Gonadal biopsy was done after anaesthetizing fish in 2-phenoxyethanol at 250 ppm. Female fish with oocyte diameter exceeding 520 micro-m were selected from broodstock tank, administered priming injection, human chorionic gonadotropin (hCG) (Fertigyn, India). The fish were transferred into FRP tank (capacity, 1000 L) provided with continuous flow of seawater (salinity, 35 ppt) and aeration. A sex ratio of 1:2 (female: male) was maintained in all trials. Resolving injection constituting leutinising hormone releasing hormone analogue (LHRHa)+ dopamine antagonist, metoclopramide (Sigma, USA) was given to female after 22 h interval. A hormone dose of hCG, 2000 IU was administered to males at the time of resolving dose to females only if the quantity of milt was low and not oozing freely. In case of natural spawning, spawned eggs were collected by passing surface water through an egg collection net (500 micro-m). Settled eggs in the tank were collected by gravity siphoning. In case of artificial fertilisation, female were sampled at intervals approximately 12 h after resolving injection to measure the oocyte size and check for the predominance of single of oil globule (>99%) and ovulation. Dry stripping was done and milt from three males were used for fertilisation. The eggs were transferred to cylindro-conical incubation tanks (500 l), stocked at approximately 250 no per litre were provided with continuous flow of seawater and aeration. Fertilisation percentage was estimated by taking two samples of 100 eggs from the incubation tank at about 20- 22 h of fertilization. Fertilised eggs are stocked in larval rearing tanks so as to obtain a larval stocking rate of 5-10 no per litre.

Features of technology with their benefits

Captive reproduction and hatchery based seed production technology of grey mullet is fundamental for development of sustainable aquaculture of the species. The key aspects of grey mullet captive seed production are I) brood stock development and captive maturation ii) induced breeding iii) larval rearing. Live brood stock of grey mullets sourced locally are transported in oxygenated tanks for stocking in broodstock holding tanks (100 t) after 2 weeks quarantine and prophylactic treatment. Fish are maintained in 100 t RCC tanks (water exchange, 300%/ day). Fish are fed ad limitum twice a day with CephalusBroodPlus. Monthly prophylactic bath treatment is given. Fish are tagged with PIT tags for identification. For promoting maturation, fish are given intra-muscular cholesterol pellets of LHRHa, and silastic implants 17- α -MT during the month of October and a fish maturation upto 81% is obtained. On east coast, induced breeding trails is conducted in November. Selection of females for induced spawning is done based on the average oocyte size ($>520 \mu\text{m}$) and selection of males is done based on expression of milt on applying gentle pressure on the abdomen. Female are administered priming injection, hCG and transferred into flow-through breeding tank (1-5 t). A sex ratio of 1:2/1:3 (female: male) is maintained. Resolving injection constituting LHRHa+ metoclopramide is administered to female at 22 h interval. A hormone dose of hCG, 2000 IU was administered to males only if the quantity of milt was low and not oozing freely. In case of natural spawning, eggs are collected by passing surface water through a collection net. In artificial fertilisation, female are sampled after 12 h for single of oil globule% and ovulation. Dry stripping is done using milt from three males for fertilisation. The eggs were transferred to incubation tanks and stocked @ 250 no per litre. Fertilised eggs are stocked in larval rearing tanks to obtain a larval stocking rate of 5-10 no./L. Larval rearing is done using a combination; phytoplankton *Nannochloropsisoculata*(2-5 lakhs/ml); rotifer *Brachionusplicatilis*, (5-10 no./ml) and *Artemianauplii* and high quality larval feeds.



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Technology : 9

Name of technology	Mystusgulio captive breeding and seed production technology
Year of release	2019
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Mystusgulio is a commercially important small indigenous species (SIS) of brackishwater environment for aquaculture diversification due to hardy nature, consumer preference and high price. Kakdwip Research Centre of ICAR-Central Institute of Brackish water Aquaculture (CIBA) has developed captive breeding and seed production technology of *M. gulio*, which involved broodstock development, induced breeding, larval rearing and fry production. It has peak spawning season ranging from May to August and individual fish spawns only once in a breeding season. During the month of April (before onset of spawning season), pre-mature brood-stocks of *M. gulio* are fed to satiation with broodstock diet (35% protein, 8% lipid) and chicken liver. Selected matured female (>150 g) and male (>50 g) distinguished by external morphological characteristics are induced with hormones for spawning. Single intramuscular administration of LHRHa (@ 5 µg/g) to female and half the dose to male result in good spawning after the latency period of 9-12 h. An ideal sex ratio of male to female is 2:1. Spawning tanks needed water flow of 8L/minute. Fertilized eggs are demersal and sticky, and demand provision of substrate in the form of nylon net fibre for their attachment. It is a low fecund fish and total fecundity ranges from 25000 to 150000 eggs depending on size of female. After 16-18 h of incubation, eggs hatch out. The newly hatched larvae start feeding from 2 days post hatching (dph) before the yolk sac gets absorbed in 3 dph. In larval rearing tank, larvae are fed initially with green algae and Artemianauplii (2-15 days post hatching, DPH), crumbled feed (15-30 DPH). In 30-35 dph, fry attain 48-50 mm size and cost of production for one fry was calculated as 30 Paise only.

Features of technology with their benefits

During peak spawning season of May to August, mature male and female fish are selected in sex form brood stock pond. Male and female in sex ratio of 2:1 is kept in spawning tanks, which has the provision of water flow and egg collector. Fishes are administered with inducing hormone LHRHa(@ 5 µg/g) to female and half the dose to male. Sticky eggs are collected from spawning tanks with the aid of egg collectors after 9-12 h of injection. Eggs are incubated in incubation tanks for 16-18 h. Larvae reared for 30 days, during rearing it is fed with green algae, newly hatched Artemianauplii and crumbled feed for 30 days. After larval rearing of 30 days fish attained the size of 48-50 mm, which can be used for nursery or growout



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Technology : 10

Name of technology	CIBA TANOX
Year of release	2021
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Accumulation of nitrogenous wastes in the shrimp culture ponds especially under zero water exchange system has become major factor creating stress leading the reduced production and mortality in extreme conditions. Chemolithotrophic ammonia oxidizing and nitrite oxidizing bacterial consortia are slow growing and they need to be established before the clinically observable improvement in the levels of TAN is recorded. CIBA TANOX has been developed using heterotrophic microbial consortia which can simultaneously use ammonia and nitrite more efficiently and much faster rate. This can be useful in recirculatory systems or intensive biofloc farming where the requirement of quick reduction in TAN levels needs to be achieved.

Features of technology with their benefits

CIBA TANOX is an indigenous water probiotic with a purpose to mitigate or remove toxic nitrogenous pollutants like ammonia and nitrite in the culture environment. The main components are heterotrophic bacterial consortia capable of simultaneous removal of ammonia and nitrite from different aquatic environments. The product will be available in liquid form can be used in both finfish and shellfish culture ponds, with varying salinity (5 – 45 ppt) preferably 5 – 30 ppt, temperature 20–40 °C (preferably 20-35 °C), pH 7-8.5 (preferably 7.5-8.5). The enrichments showed higher nitrification/denitrification rate removing 10-20 ppm of ammonia and nitrite under 24-48 hrs.

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Technology : 11

Name of technology	CIBAMOX
Year of release	2017
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

ICAR-CIBA developed microbial consortia CIBAMOX, which comprise ammonia oxidising bacteria (AOB), nitrite oxidising bacteria (NOB), and denitrifying bacteria (DNB). The product has been found to be effective when applied at 5 lit/ha /week in extensive filed trials in controlling the TAN and nitrite. Cost-effective mass-production of the enrichments was standardised. The product has already been commercialized to three private firms and being extensively used in major shrimp farming states. The technology is available for commercialisation at ICAR-CIBA, Chennai.

Features of technology with their benefits

The technology is a microbial consortium containing ammonia oxidising bacteria (AOB), nitrite oxidising bacteria (NOB) and denitrifying bacteria (DNB) to mitigate total ammonia nitrogen (TAN) in commercial *P. vannamei* shrimp farms. Oxidation rates of $\text{NH}_3\text{-N}$ and NO_2 due to with AOB and NOB enrichment in the spiked media was $1.57 \text{ ppm day}^{-1}$ and $1.46 \text{ ppm day}^{-1}$ respectively under experimental conditions. The nitrite reduction rate due to *Marinobacter* spp. in the DNB consortia was $3\text{-}4.5 \text{ ppm h}^{-1}$. The AOB and NOB consortia carried out ammonia oxidation and nitrite oxidation at salinities between 2 to 35‰ while DNBs were active above 15‰ salinity. DGGE analysis of the consortium showed the presence of eight AOB and 11 NOB and two DNB groups and metagenome analysis revealed the presence of more than 3000 OTUs at 97% similarity index. Eubacteria dominated the enrichment (>95%) while Proteobacteria were the predominant phylum. *Nitrosomonas* and *Nitrosococcus* (AOB) and *Nitrospira* (NOB) and ammonia oxidising archaea like *Nitrosopumilus* and *Nitrososphaera* were detected in addition to several unclassified species. Significant reduction in the levels of TAN ($p < 0.05$) was observed following application (@ $5 \text{ L ha}^{-1} \text{ week}^{-1}$) of the microbial consortia (formulation) in four commercial *P. vannamei* shrimp farming sites having the salinity between 15 and 62‰. Results of the study suggests that the AOB, NOB and DNB formulation developed microbial formulation developed in the study could efficiently mitigate the toxic ammonia species in commercial *P. vannamei* shrimp culture farms.



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Technology : 12

Name of technology	Lumiphage
Year of release	2017
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Luminescent bacteria belonging to *Vibrio spp* cause significant economic loss to shrimp hatcheries world over. Use of antibiotics to control vibriosis in aquaculture pose issues of tissue residues and antibiotic resistance and has necessitated the development of alternative safer technologies using bio-control agents. Biocontrol of luminescent bacteria in aquatic systems using bacteriophages is an important alternative. Bacteriophages or phages in short are viruses that selectively infect and kill bacteria. The technology developed uses lytic bacteriophages capable of selectively infecting and killing luminescent marine *Vibrio* species. Bacteriophages have been selected from a pool of over 35 phages having lytic activity against over 350 luminescent bacterial isolates. The product, Lumiphage, contains consortia of bacteriophages having broad spectrum activity against virulent luminescent vibrios. Culture conditions optimized for obtaining high yield of bacteriophages to the tune of 10^{12} pfu.ml⁻¹ in bioreactors. Efficacy was evaluated and proved in commercial shrimp hatcheries as prophylactic and therapeutic for control of luminescent bacterial disease and improved larval survival

Features of technology with their benefits

Field trials in commercial shrimp hatcheries were conducted to assess the efficacy of the Lumiphage consortium in controlling vibriosis. Trials resulted in 35% survival of larvae against 0% in the infected tank while an improvement of 5% production was ensured where no vibriosis was reported. Application of phage in the complete hatchery system ensured 55% shrimp PL production against 100% loss in the 2 earlier cycles.



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Technology : 13

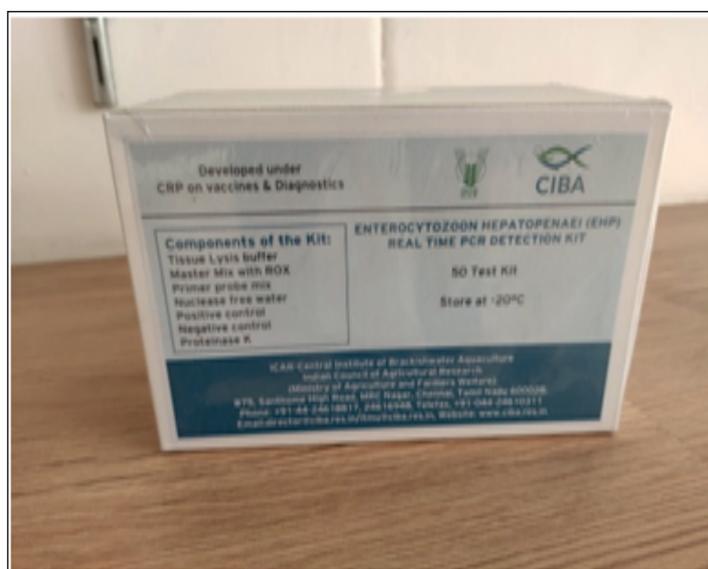
Name of technology	Enterocytozoon hepatopenaei (EHP) real-time PCR diagnostic kit
Year of release	2017
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal states

Details of technology

ICAR-CIBA has developed a rapid, EHP real-time (qPCR) kit for the diagnosis of EHP infection. This assay is designed for the detection of EHP as low as 2 copies of EHP DNA. This kit is cost effective, user friendly and does not require post PCR procedure. The primers were designed based on the EHP spore wall protein region. This EHP real-time (qPCR) kit is specific to EHP and did not cross react with other shrimp pathogen. This EHP real-time (qPCR) kit is rapid can detect the EHP pathogen within 90 minutes (including DNA extraction).

Features of technology with their benefits

ICAR- CIBA has developed a simple, cost-effective, rapid and sensitive diagnostic real time PCR assay kit. This assay is designed for the detection of EHP as low as 2 copies of EHP DNA. This kit is cost effective, user friendly and does not require post PCR procedure. This assay also includes a house keeping gene that will ensure perfectness of PCR assay and nullifies any chances of false negative results due to failure in DNA extraction and presence of PCR inhibitors in the DNA.



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Technology : 14

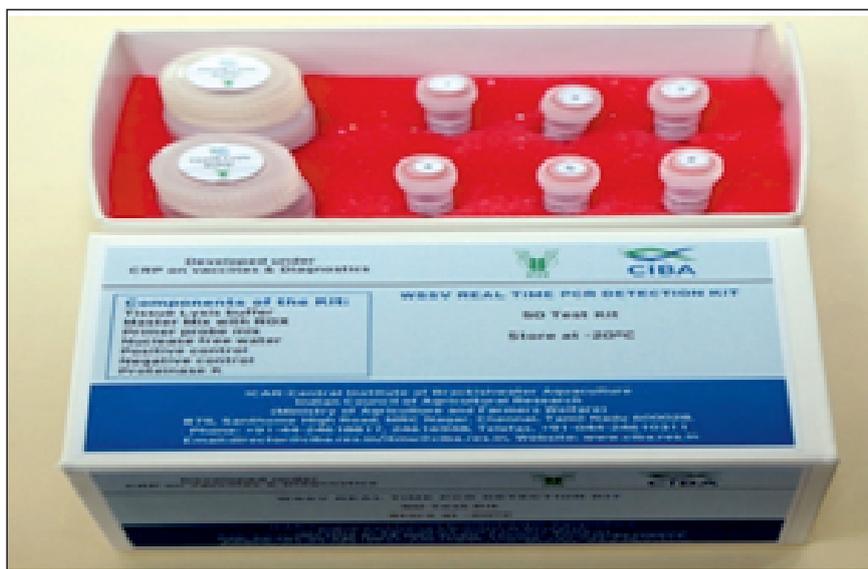
Name of technology	White spot syndrome virus (WSSV) real time PCR diagnostic kit
Year of release	2019
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

ICAR-CIBA has developed a rapid, WSSV real-time (qPCR) kit for the diagnosis of WSSV infection. This assay is designed for the detection of WSSV as low as 2 copies of viral DNA. This kit is cost effective, user friendly and does not require post PCR procedure. This WSSV real-time (qPCR) kit is specific to WSSV and did not cross react with other shrimp pathogen. This WSSV real-time (qPCR) kit is rapid can detect the WSSV pathogen within 90 minutes (including DNA extraction).

Features of technology with their benefits

ICAR-CIBA has developed a simple, cost-effective, rapid and sensitive diagnostic real time PCR assay kit. This assay is designed for the detection of WSSV as low as 2 copies of viral DNA. This kit is cost effective, user friendly and does not require post PCR procedure. This assay also includes a house keeping gene that will ensure perfectness of PCR assay and nullifies any chances of false negative results due to failure in DNA extraction and presence of PCR inhibitors in the DNA.



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Technology : 15

Name of technology	CIBASTIM
Year of release	2013
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Vibriosis is the major bacterial disease causing economic losses both in shrimp hatcheries and grow-out culture farms throughout the world. Use of antibiotics in shrimp aquaculture is banned due to safety issues and international trade restrictions. Stimulating the immune system of the host is one of the best approaches suggested to fight the infection in both animal and medical practice. In this line, a bacterial product was developed to stimulate the immune system and enhance the growth of shrimp both in larval stages in hatcheries and juveniles and sub-adult stages in grow-out cultures. The product “CIBASTIM” is applied @ 2×10^8 cfu/kg feed as feed top dressing and fed two times a week throughout the culture period. In addition to improve the immune functions of the host the product improves the survival, growth and productivity under field conditions. The technology has been validated both in yard experiments and the extensive field trials in commercial shrimp farms of Andhra Pradesh, Tamil Nadu, Gujarat, Odisha and West Bengal. This technology has brought the new method of preventing and management of biotic and abiotic stress through application of immune stimulating agents of microbial origin. This benefits the farmers by reducing the cost of disease management by application of drugs and chemicals which add to the cost of production and many times may not be effective. The use of this immune stimulating agent reduces the use of chemicals and other products for shrimp disease management which are harmful to environment and may affect the food safety through presence of residues in the edible tissue.

Features of technology with their benefits

The dose, schedule and route of application of CIBASTIM have been standardized successfully both under hatchery or pond culture conditions for *P. monodon* and subsequently for other commercially viable shrimp species (*F.merguensis*/*P. Vannamei*). Oral administration of formalin killed *Vibrio anguillarum* as feed top dressing at the concentration of 10^8 cfu per kg feed improved growth and survival of cultured shrimps and the cross protection from *Vibrio anguillarum* and *V. harveyi*. The oral administration as feed-top dressing in grow out culture ponds is easy, simple and cost-effective practical method for controlling the Vibriosis and improving health and production in commercial shrimp hatchery and grow-out systems. This is one of the first technologies of using bacterial products with extensive field demonstration and testing in different geo-ecological areas of shrimp aquaculture in India.



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Technology : 16

Name of technology	CIBA PARAcide
Year of release	2021
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Parasitic infestations are the major limitations in achieving optimal production in both food and ornamental fish farming. Presently agriculture insecticides are applied into fish ponds to control -parasitic infestation. These substances are harmful to the natural productivity of the pond and require repeated application. ICAR-CIBA has developed anti-parasitic formulation, CIBA PARAcide, for oral application. The product is applied @ 25 g/ton biomass/day for seven consecutive days as feed top dressing.

Features of technology with their benefits

Field studies in Andhra Pradesh, Gujarat and Tamil Nadu have shown that the CIBA- PARAcide is effective in treatment of Argulusspp., Caligusspp., Lernanthropsisspp., Lernaespp. in Asian seabass, pearlspot, grey mullet, rohu, catla, gold fish and koi carp. The withdrawal period of the drugs is estimated as 7 days. The product contains the internationally approved substance for application in aquatic animals. The technology is available for commercialisation at ICAR-CIBA, Chennai.



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Technology : 17

Name of technology	Enterocytozoon hepatopenaei (EHP) visual LAMP (loop mediated isothermal amplification) diagnostic kit.
Year of release	2020
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of Technology

ICAR-CIBA has developed a simple, rapid, field-deployable, visual loop mediated isothermal amplification (LAMP) kit for the diagnosis of EHP infection. The diagnostic kit is developed based on the EHP spore wall protein (SWP) gene. This protocol is designed for the specific and sensitive detection of EHP DNA with a detection limit of 10 copies of EHP DNA within 45 min. The diagnostic kit is user friendly and can be performed consistently with minimum laboratory skills. This assay can be performed with a simple dry bath and has a great potential for on-farm diagnosis under low-resource conditions.

Features of technology with their benefits

This kit is cost effective when compared with other commercial EHP qPCR kits available for the detection of EHP.



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Technology : 18

Name of technology	Indigenous shrimp feed technology
Year of release	2010
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Feed being a critical input in shrimp farming, this not only determines the growth performance of the shrimp, but also a key factor related to the cost of shrimp production and sustainability. In the beginning, the Indian shrimp farming sector was completely dependent on imported feeds. No single public or private entity was having the technology to manufacture pelleted sinking feed for shrimp. Visualizing this as a critical obstacle, ICAR-CIBA developed, tested and commercialized an indigenous feed manufacturing technology as pioneer in India.

Features of technology with their benefits

- ❖ Technology package involves establishing the feed mill, formulation, periodical auditing of the formula, the process of feed manufacturing, and evaluation of the processed feed.
- ❖ Indigenous machinery.
- ❖ Uses low cost locally available ingredients.
- ❖ Cost effective customizable formulation.
- ❖ For all the life stages of shrimps in different particle sizes.



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Technology : 19

Name of technology	Shrimp larval feed - shrimp larvi ^{plus}
Year of release	2015
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Functional feeds are formulated to have different biologically active compounds that can provide specific benefits to the farmed fish/shrimp, in addition to just nutritional. There is an increasing awareness and knowledge on use of functional feeds in commercial aquaculture, and stakeholders are looking for feeds with functional properties related to rapid maturation, larval growth and survival, high digestibility, and gut health. Larval feeds are currently imported and costing 1500 to 3000/kg. ICAR-CIBA has developed cost effective indigenous larval feed of superior quality. These feeds are import substitutes, saving valuable foreign exchange for the country.

Features of technology with their benefits

- ❖ Ingredients with high digestibility.
- ❖ Enriched with optimal EPA and DHA.
- ❖ Micro-particulate size of 200-300, 300-400 and 400-500 µm.
- ❖ Spheronized feed 300 and 500 µm.
- ❖ Tested in commercial vannamei hatcheries; performance at par with imported feeds.



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Technology : 20

Name of technology	Finfish poly culture feed- poly ^{Plus}
Year of release	2018
Source of technology	ICAR - CIBA, Chennai
Suitable for which crops/ animals/enterprises etc.	Aquaculture
Recommended for region	Coastal States

Details of technology

Poly culture of finfish is a traditional low input activity in India. Brackishwater aquaculture sector has tremendous resources and potential for sustainable development of aquaculture using polyculture models. Though feed will be a requirement in polyculture for linking the food chain with in the system, feed utilization will be complete compared to any other aquaculture system. ICAR-CIBA has developed Finfish poly culture feed- poly plus which is cost effective.

Features of technology with their benefits

- ❖ Suitable low cost feed for polyculture.
- ❖ Developed using locally available ingredients.
- ❖ Use of fish meal reduced to 10%.
- ❖ Shelf life of about 2 months.
- ❖ Uses simple processing methods.
- ❖ Highly suitable for small farmers.
- ❖ Productivity upto 4764 kg/ha, FCR 1.32 (325 days).



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Technology : 1

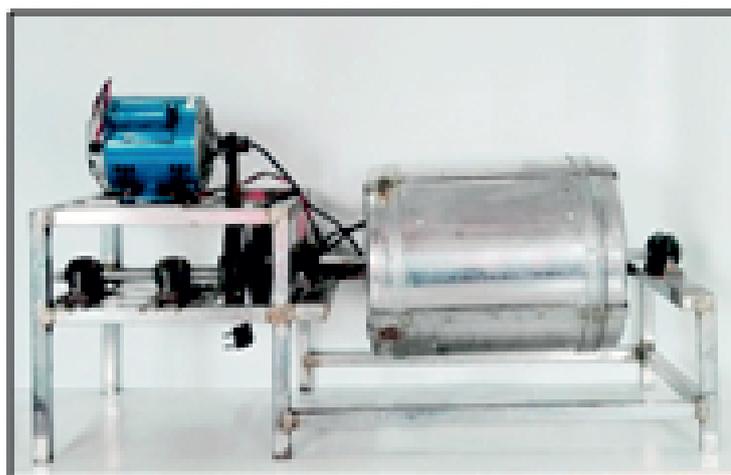
Name of technology	Motorised fish de-scaling machine with fixed drum speed
Year of release	2017
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	Ernakulam, Kerala

Details of technology

Fish de-scaling machine is designed and fabricated for removing the scales of fishes easily. This equipment can remove scales from almost all types/sizes/ species of fishes ranging from marine to freshwater species like Sardine, Tilapia to Rohu. This machine is made of SS 304 and has 5 kg capacity. It contains a 0.5 HP AC motor with proper belt reduction mechanism to achieve required drum speed of 20-30 rpm. Body is fabricated in dismantling type 1 inch square SS tube with a suitable covering in the electrical parts. The drum is made of perforated SS sheet fitted in a strong SS Frame having suitable projection to remove the scale and provided with a leak proof door with suitable lock. Specifications- Capacity 5 kg/ batch, Power Requirement 230V AC single phase for 0.5 HP, Materials used for making SS 304, Cost (2014 cost basis)50,000/-.

Features of technology with their benefits

- ❖ Smaller capacity is convenient for even local fish vending units.
- ❖ Reduces human drudgery.
- ❖ Faster descaling method.

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Technology : 2

Name of technology	Hand operated fish de-scaling machine
Year of release	2016-17
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	Ernakulam. Kerala

Details of technology

Fish de-scaling machine is designed and fabricated for removing the scales of fishes easily. This equipment can remove scales from almost all types/sizes/ species of fishes ranging from marine to freshwater species like Sardine, Tilapia to Rohu. This machine is made of SS 304 and has 5 kg capacity. Body is fabricated in dismantling type 1 inch square SS tube. The drum of 255.5 mm diameter and 270 mm length is made of perforated SS sheet fitted in a strong SS Frame having suitable projections to remove the scale and provided with a leak proof door with suitable lock. A pedal is fitted in the side to rotate the drum manually.

Specifications- Capacity: 5 kg/batch, Power Requirement: Manual, Materials used for making: SS 304, Cost (2014 cost basis):15,000/-.

Features of technology with their benefits

- ❖ Low cost and smaller capacity are convenient for even local fish vending units.
- ❖ Reduces human drudgery.
- ❖ Faster descaling method.
- ❖ Ideal for fish vending units.
- ❖ Target group ranges from SHG to Processing industry.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 3

Name of technology	Solar dryer with electrical back up
Year of release	2016
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	Ernakulam, Kerala

Details of technology

The dryer assembly comprised of solar flat plate collectors with an area of 8 m² for harnessing solar energy to heat the air. This hot air flows in to the drying chamber for drying the product. When solar radiation is not sufficient during cloudy/rainy days to heat the air for circulation, alternative electrical back up is automatically actuated. Drying is carried out under controlled temperature and humidity conditions. The complete process parameters of fish drying can be controlled by a Programmable Logic Controller (PLC) system.

Specifications- Heat absorbing area: 8 m², Total tray area: 5.4 m², Alternate energy back up: Electrical, Tray material: SS 304 Food Grade, Total drying time: 6-8 h, Loading capacity: 20 kg Approx., Cost : 1.5 lakhs (excluding installation charges).

Suitable products

- ❖ Fish and fish products, vegetables, fruits and agro-products.
- ❖ Ideal for drying fish, fruits, vegetables, spices and agro products.
- ❖ Target group ranges from SHG to Processing industry.

Features of technology with their benefits

- ❖ Green technology supplemented by electrical back up in case of shortage in solar radiation
- ❖ Faster drying rates aiding in less risk of spoilage
- ❖ The product is protected against flies, pests, rain and dust.
- ❖ Labour saving
- ❖ The quality of the product is better in terms of nutrients, hygiene and colour
- ❖ Hygienic drying conditions even during cold/rainy days
- ❖ All contact parts are made of food grade stainless steel



Contact for further details

Director,
ICAR-CIFT, Cochin
Ph: 0484-2666880

Technology : 4

Name of technology	Carboxymethyl chitosan
Year of release	2018
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

ICAR-CIFT has standardised cost-effective protocol for the production of Carboxymethyl chitosan at pilot scale. The protocol employs a substitution reaction of functional moieties of chitosan with monochloro acetic acid and crystallisation with methanol and acetone.

Features of technology with their benefits

- ❖ CMCS is considered as a very promising candidate for making feed, foliar spray and insecticide formulations, as it is soluble at neutral pH and exhibit superior functionalities.
- ❖ CMCS is a promising candidate for biomedical applications such as drug carriers, antimicrobial material, gene delivery systems and tissue regeneration devices.
- ❖ It is attractive option for its use in processing and preservation of wet and dry commodities.
- ❖ It is often projected as a dietary fibre which increases faecal mass, reduce the glycaemic response of the food, and lower the cholesterol level.
- ❖ CMCS is promissive option for water treatment.
- ❖ It can be well exploited and emphasized for cosmetic applications.
- ❖ It can be easily processed into nanoparticles, which are more functional than chitosan nanoparticles, hence has shown promise for drug delivery, bioimaging, biosensors and gene therapy applications.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 5

Name of technology	Collagen peptide
Year of release	2019
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

Bioactive collagen peptides prepared through enzymatic digestion of acid soluble fraction of skin collagen from hammerhead shark (*Sphyrnae mokkaran*) followed by subsequent column chromatographic fractionation has exerted potentiality to ameliorate high fat-alcohol induced hyper-lipidemia in rats.

Features of technology with their benefits

Experimental investigations on hepatoprotective activity of fish collagen peptides have shown that collagen peptides are capable of attenuating the microvesicular steatosis and inflammatory infiltration in high fat-alcohol induced hyperlipidemic rats. The protective action of collagen peptides is related to their antioxidant and hypolipidemic properties.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 6

Name of technology	Natural hydroxyapatite
Year of release	2018
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

Hydroxyapatite (HAp) is the major mineral phase of hard tissues of vertebrate animals and human beings. Chemically, HAp is a phosphate crystal of calcium with the empirical formula of $Ca_5(PO_4)_3(OH)$. It is one of the few materials, classified as a bioactive biomaterial that supports bone in growth and osseointegration when used in orthopaedic, dental and maxillofacial applications. A protocol was developed at ICAR-CIFT HAp for the simultaneous extraction of collagen peptide and HAp from fish scale and bone to achieve desired porosity and mechanical strength specific to each application. As this process yields two high value products from the same raw material, the economic viability of the process is justified. Cost of production is Rs.1300/kg @ 100% capacity.

Features of technology with their benefits

- ❖ Hydroxyapatite is frequently used in dental and maxillofacial applications, as the enamel is composed of numerous needle-like apatite crystals.
- ❖ HAp is an ideal implantor an implant component material in orthopaedic surgery.
- ❖ Hap is of high demand in fabrication of biocompatible ceramics, cosmetic preparations, fertilizer production, water purification and degradation of pollutants.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 7

Name of technology	Microencapsulated sardine oil
Year of release	2017
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

Oxidatively stable sardine oil powder was developed using chitosan derivative by emulsion and encapsulation technologies. The developed powder showed better oxidative stability during storage compared to other fish oil supplements available in the market. The powder is not having fish oil taste and hence can be incorporated to any food item. The polyunsaturated fatty acid content in the fish oil powder enables it as a health promoting agent especially in the case of cardio protection.

Features of technology with their benefits

A nutraceutical product PUFA-rich fish oil encapsulated in a bioactive wall material was developed. The wall material protects the PUFA from adverse oxidation process.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 8

Name of technology	Seaweed nutridrink
Year of release	2018
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

A sequential enzymatic extraction procedure was optimized for seaweed phytochemicals extraction from *Sargassum sp.* and was incorporated into grape juice to develop a fortified nutritional drink that had the bioactive molecules from seaweed. Biochemical properties of the sequentially extracted *Sargassum sp.* showed higher content of protein, phenolic compounds, carbohydrate and also higher total antioxidant capacity. Macroporous adsorbent resins are novel food grade materials (Approved by USFDA) were used while processing for bitterness removal and phytochemical purification. The resin treatment did not affect the phytochemical composition and Antioxidant activity of the extract. Approximate cost of production is Rs.30/litre.

Features of technology with their benefits

Calcium and Iron content of the seaweed extract were higher than the USDA nutritional database values. Blending seaweed extract with fruit juice improved its nutritional properties apart from imparting nutraceutical properties through unique sulphated polysaccharides and phenolics compounds. Taurine, a free amino acid with known nutraceutical properties were found in appreciable quantities in the seaweed extract. Taurine is not commonly found in terrestrial fruits and vegetables. Various major and trace elements were found to be present in the seaweed extract inappreciable quantity. Calcium and Iron content of the seaweed extract were higher than the USDA nutritional database values. Blending seaweed extract with fruit juice improved its nutritional properties apart from imparting nutraceutical properties through unique sulphated polysaccharides and phenolics compounds.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 9

Name of technology	Solar dryer with LPG back up
Year of release	2016
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

The technology introduces a hybrid solar drying system for hygienic production of dry fish by using environment friendly abundantly and freely available renewable solar energy. Continuous drying of fish is possible in this system with the help of LPG backup, where the fish can be dried in unfavourable weather conditions without spoilage and maintaining its nutritional values in this system water is heated with the help of solar collectors installed on the roof and collected in a calorifier tank. The water from the calorifier tank is circulated through the solar collectors using a pump. Axial flow fans are provided in the drying chamber for hot air circulation across the stainless-steel trays loaded with fish for drying. The circulating air is heated by the hot water passing through the heat exchangers. When solar radiation is not sufficient during cloudy/ rainy days to heat the water for circulation, LPG back up heating system will be automatically actuated to supplement the heat requirement. Thus, continuous drying is possible in this system without spoilage of the highly perishable commodity to obtain a good quality dried product. Drying is carried out under controlled temperature and humidity conditions. The complete process parameters of fish drying can be controlled by PLC system.

Specifications - Heat absorbing area : 10 m², Total tray area : 20 m², Alternate energy back up : LPG, Tray material : SS 304 Food Grade, Total drying time : 8-10 h , Loading capacity : 40 kg, Cost : 3.5 lakhs (excluding installation charges).

Features of technology with their benefits

- ❖ Ideal for drying fish, fruits, vegetables, spices and agro products.
- ❖ Target group ranges from SHG to Processing industry.
- ❖ Green drying technology.
- ❖ Hygienic drying conditions even during cold/rainy days.
- ❖ All contact parts are made of food grade stainless steel.
- ❖ Protection against dust, insects, birds, rodents and adverse climatic conditions.
- ❖ Reduction of drying time.
- ❖ Safe and uniform drying to storable conditions.
- ❖ Drying under controlled conditions of temperature and humidity.
- ❖ Improved product quality, preservation and nutritional properties.

Contact for further details

Director,
ICAR-CIFT, Cochin
Ph: 0484-2666880

Technology : 10

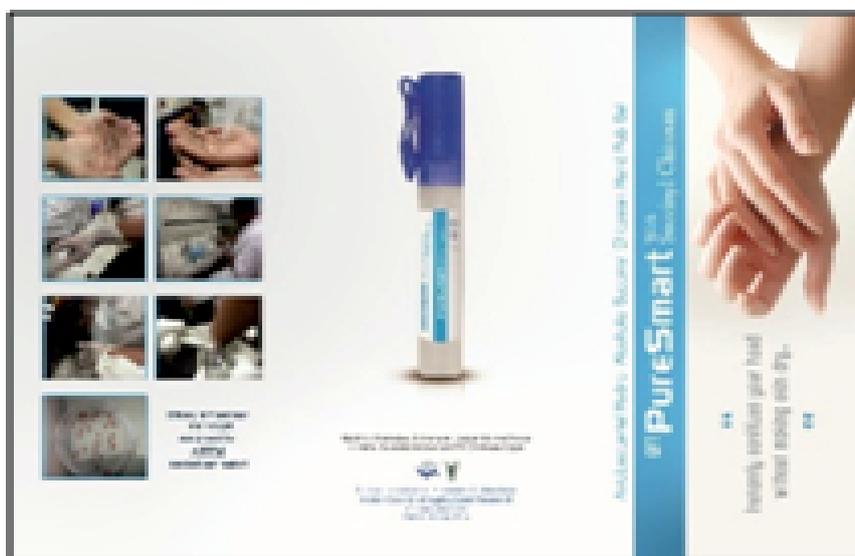
Name of technology	Succinyl chitosan based hydro-alcohol hand sanitizer
Year of release	2015
Source of technology	ICAR-CIFT, Cochin
Suitable for which crops/ animals/enterprises etc.	Fisheries
Recommended for region	NA

Details of technology

A formulation for hydro-alcoholic antibacterial hand sanitizer incorporating succinyl chitosan was developed. Succinyl chitosan gives the formulation required spreadability and leaves a moisturizing effect on hands. The hand gel contains 67% ethanol and 0.05% Coumaric acid. Coumaric acid was used as an ionic cross linker of the hand gel, as well as a natural antibacterial agent. Fragrance and vitamin E can be easily incorporated in the formulation for use in personal care. The efficacy of the product wastested using ASTM method for hand sanitizers with satisfactory result. The product does not contain any synthetic antimicrobial compound like Triclosan.

Features of technology with their benefits

- ❖ Easily adoptable technology.
- ❖ Cheaper cost of production.
- ❖ The hand sanitizer has no synthetic anti-microbial agents.
- ❖ The product can be marketed as a easy to carry pen-model and is expected to be consumer-friendly.



Contact for further details
 Director,
 ICAR-CIFT, Cochin
 Ph: 0484-2666880

Technology : 1

Name of technology	CIPHET-pomegranate aril extractor
Year of release	2017
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Telangana, Madhya Pradesh, Tamil Nadu and Rajasthan

Details of Technology

The system comprises the essential components such as pomegranate fruit breaking unit, drive unit, collection Trays where separated arils and extraneous matters are received, vibrating sieve unit; and the clean arils and Extraneous matter collection troughs. The fruit breaking unit consists of innovative mechanisms with knives arrangement to continuously break the fruit in such a way that the major portion (85-90%) of arils is safely separated out from the broken peels. The rest of the arils that is about 10-15% remains attached with the peels are further getting separated over the vibrating screen designed specifically for this purpose. The peels and other extraneous matter are separated out and yielding clean arils that can be used for further processing or for fresh eating/marketing.

Features of technology with their benefits

- ❖ Higher aril extraction capacity that is around 5.0 quintal per hour (approximately 35-40 fruit per minute).
- ❖ Aril extraction/separation efficiency is in the range of 90-94% depending on variety and Pomegranate characteristics with 2-4 % mechanical damage to arils.
- ❖ Man power required for safe and smooth running is 2-3 persons.
- ❖ Electrical power required- 0.75 kW (1.0hp).



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 2

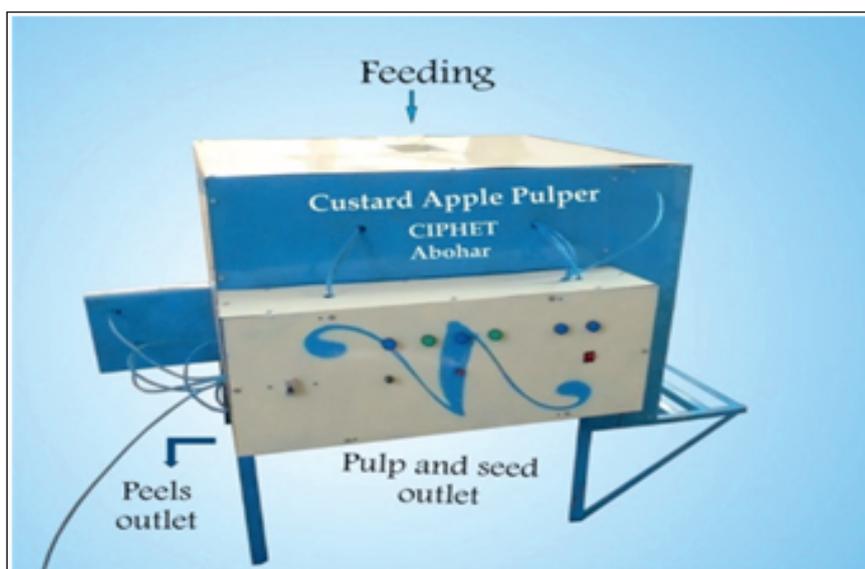
Name of technology	Automatic custard apple pulper
Year of release	2011
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Assam, Bihar, Telangana, Tamil Nadu, Madhya Pradesh, Maharashtra, Odisha and Rajasthan

Details of technology

Mostly custard apple fruit cultivation is in the form of unorganized farming. Due to unavailability of handling and processing machineries related with this fruit, it is being underutilized. This invention brings higher value for the fruits thus leads to get good income for the farmers. The custard apple pulper contains three mechanism viz. fruit cutting mechanism, fruit scooping mechanism and pulping mechanism. Fruit cutting and scooping mechanism are made with pneumatic actuators and electronic controls. This invention is fully automatic machine assisted with pneumatic power and electronically controlled.

Features of technology with their benefits

- ❖ Capacity : 120 kg/h
- ❖ Efficiency : 94% pulp recovery, 6% pulp wastage along with peels.
- ❖ Coarse / Intact Pulp recovery : 70-72%;
- ❖ Fine Pulp recovery : 28-30%
- ❖ Operating cost : Rs. 0.5 / kg of fruit



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 3

Name of technology	Automatic litchi peeler
Year of release	2011
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Bihar, Tripura, West Bengal, Uttar Pradesh, Punjab and Haryana

Details of technology

The machine consists of two stainless steel rollers rotating at differential speed towards each other. Stainless steel spikes are placed on one roller which pierce the peel of fruit and due to circular motion of the fruit, spikes cut the peel, whereas the other roller has knurled surface which restricts the movement of the fruit due to friction. Graded litchi fruits are fed between the rollers. Shear developed by differential speed, the peel is separated from the fruit, which passes through the rollers and goes down where as peeled fruit is conveyed ahead. A moving belt provided over the rollers produces sufficient compression in this process to generate friction and shear. After removal of peel, the friction force between roller and pulp is reduced and moving belt guides the peeled fruit towards outlet. The machine is suitable for small as well as large entrepreneurs and easy to operate. Peeling can be done economically using this machine.

Features of technology with their benefits

- ❖ Capacity is 120kg/h.
- ❖ Peeling efficiency is 96% with less than 4% loss of pulp.
- ❖ Operating cost is Rs. 10 / 100 kg of fruit.
- ❖ Reduces the trajectory of the labours involving in peeling
- ❖ Increases the hygienic condition of process.
- ❖ Helps the farmer to get high price for their products.
- ❖ Reduces the processing cost for litchi products.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 4

Name of technology	Makhana popping and decortication machine
Year of release	2013
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Bihar, Madhya Pradesh, Rajasthan, Jammu & Kashmir, Tripura and Manipur

Details of technology

The developed makhana popping machine is able to roast and pop the kernel at about 35-40kg raw wet seeds per hour and produce high amount of grade I popped kernel. It has replaced manual roasting and popping operations. The machine consists of a hopper, screw conveyor type roaster (having two continuous barrels, one roaster is heated with thermic oil and other roaster by mounting three band heaters. The screw is rotated by belt pulley drive with motor of 0.5 to 1hp power. The residence time of roasting in barrel is controlled by controlling the speed of belt and pulley drive. Working temperature of both roasters varies between 200-340°C. Power supply to all heaters should be controlled through individual switches. Temperature of both roasters should be controlled using good quality temperature controller cum indicators.

Features of technology with their benefits

- ❖ Capacity is 35-40 kg/h (Raw wet seeds).
- ❖ Decortication efficiency is 95%.
- ❖ Popping efficiency is 90-94%.
- ❖ Mechanized process.
- ❖ Reduces time of processing.
- ❖ Reduces the drudgery.
- ❖ Energy saving.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 5

Name of technology	Autoclavable microencapsulation system with multi stage break up two fluid nozzle for clean production of micro capsules
Year of release	2011
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Functional food processing

Details of technology

The microcapsules are produced using two fluid glass nozzle atomizers of different configurations in which the pressurized air or inert gas is used to break up the jet of matrix fluid (solution of sodium alginate/ chitosan/ carrageenan/combination of these alone along with some other filler material such as starch to impart controlled release properties). The kinetic energy of high pressure air or inert is used for breakup of matrix fluid jet. The small droplets produced fall in reaction vessel. The reaction vessel contains divalent cations or polycationic substances; which results in ionotropic gelification yielding microcapsules.

Features of technology with their benefits

- ❖ Useful in preparing functional foods and will ultimately lead to better health and nutrition.
- ❖ Capacity is 3 kg of wet alginate micro capsules per batch of 1500 µm down to around 50 µm size.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 6

Name of technology	CIPHET-Cryogenic spice grinding system
Year of release	2013
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Andhra Pradesh, Gujarat, Karnataka, Rajasthan, TamilNadu, Assam, Kerala, Madhya Pradesh, Maharashtra, Orissa, Uttar Pradesh and West Bengal

Details of technology

Indigenous cryogenic spice grinding system can be used for grinding of spices at cryogenic temperatures (<-50 C), thereby maintaining their flavour and medicinal properties. The cryo-ground powders can be used for better extraction (quantity) of medicinal components such as cuccumin in turmeric. There is a provision of collection of ground spice product (spice powder) through cyclone system and immediate sieving system for different grades of the powder.

Features of technology with their benefits

- Capacity : 30 to 50 kg/h depending on type of spice.
- Energy consumption : 0.4 kWh (at no load).
- Liquid nitrogen cylinder capacity : 185 litre (self-pressurised).
- Cryo- precooler capacity : 30-50 kg/h.
- Feed material size : 1 to 10 mm.
- Type of mill : Dual mill facility (pin mill and hammer mill).



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 7

Name of technology	Groundnut based flavoured beverage, curd and paneer
Year of release	2011
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra and Rajasthan

Details of technology

Manufacturing of groundnut based flavoured beverage, curd and paneer is carried out by firstly extracting peanut milk. The process involves the steps of deskinning peanut, steaming in autoclave, soaking in water, grinding of peanut kernels with hot water, filtration and then peanut milk is ready. Then for the preparation of peanut flavoured beverage other ingredients are added and milk is homogenized. Flavour is added after cooling and peanut flavoured beverage is ready for bottling. The process of peanut paneer involves boiling of peanut milk followed by coagulation, filtration through double layer muslin cloth, hanging for separation of whey, pressing under paneer pressing machine and then finally cutting into desired cube size. The developed products are excellent in taste and rich in nutritional quality. Imitation milks like peanut milk may serve as a boon for the countries where the supply of milk is inadequate. In developed countries, imitation milks can save the masses as heart ailments, which are considered safer than saturated fatty acid.

Features of technology with their benefits

- ❖ One kg of peanut kernel will produce 7 litre of peanut milk.
- ❖ One kg of peanut kernel can be converted into one kg of paneer.
- ❖ Twenty percent of (20%) okra is left during the process of conversion of peanut into milk. The okra can be Further dried and utilized in different sweets in different proportion.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 8

Name of technology	Ready to constitute makhanakheer mix
Year of release	2008
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Bihar, Madhya Pradesh, Rajasthan, Jammu & Kashmir, Tripura and Manipur

Details of technology

The developed ready to constitute makhanakheer mix is a new product using ground makhana and sugar as main ingredients. The mix is a homogeneous mass of ingredients, which cannot be separated easily as in case of a simple admixture of different ingredients. The grinding of makhana in developed process is done at normal room conditions without heating the makhana, whereas it is done after roasting the makhana in iron pan on fire in the conventional process. The developed process thus eliminates an operation and minimizes the energy consumption. Use of this mix for preparation of makhanakheer eliminates the cooking processes followed in the conventional household method. The developed ready to constitute makhanakheer mix has longer shelf life and can be transported at much lower cost as compared to that of raw popped makhana to anywhere for marketing for better remuneration. It saves time and energy in preparation of makhanakheer. Simple potable normal or hot/warm water is added in the mix and stir for a while and makhanakheer is ready to eat.

Features of technology with their benefits

- ❖ The developed mix is a homogeneous mass of ingredients, which cannot be separated as in case of a simple admixture of different ingredients.
- ❖ Use of this mix for preparation of makhanakheer eliminates the cooking processes followed in the conventional Household method and has longer shelf life.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 9

Name of technology	Mechanized system for primary roasting of raw makhana seeds
Year of release	2020
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Bihar, Madhya Pradesh, Rajasthan, Jammu & Kashmir, Tripura and Manipur

Details of technology

The system consists of roasting pan, heating system, power transmission system and agitation system. The developed machine can roast makhana of any grade between 5-8 mm effectively with subsequent popping of more than 90% seeds. The capacity of the developed system is about 60 kg/h (10kg/batch) which can easily be scaled-up or scaled-down.

Features of technology with their benefits

- ❖ The mechanized system for primary roasting of makhana is a cost effective system with high throughput capacity.
- ❖ Heating is done by LPG gas system and hence dependency on electricity is not there. The pan can be rotated manually.
- ❖ Maintains uniform temperature and heat supply can be enhanced immediately to reduce moisture loss, particularly at the end of roasting period. The other heating systems do not increase heat supply immediately.
- ❖ Unique system of unloading the hot roasted seeds where the seed is transferred into bags without touching.
- ❖ Roasting of all grades of makhana seeds is possible. Any batch size between 5-10 kg can be roasted in the machine.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 10

Name of technology	Rose petal jam
Year of release	2019
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal, Maharashtra, Rajasthan, Delhi and Haryana

Details of technology

In the conventional method, jam is produced using fruits including fruit juices, fruit pulp, fruit juice concentrate or dry fruit by boiling its pieces or pulp or puree with sweeteners namely sugar, dextrose, invert sugar, liquid glucose or artificial sweeteners to a suitable consistency. Moreover, this process does not yield a product similar to jam. A process for preparation of rose petal jam was standardized, which comprised of separation of petals from rose flower followed by washing of petals in potable water and surface water removal using basket centrifuge or shade drying for 3-4h. Thereafter, paste/slurry of fine particle size was prepared with sugar and water and cooking was done with stirring till the slurry reached to the desired TSS. Then hydrocolloids were added and cooking was continued till TSS reached to 68° Brix. Acidifying agent was added at this TSS level and the rose petal jam was hot filled in the sterilized glass jar/bottles followed by sealing.

Features of technology with their benefits

- ❖ Rose petal jam without using any fruit or vegetable or their powder or essence of rose or of any other flower.
- ❖ The jam is rich in dietary fibre, minerals, and antioxidant activity.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 11

Name of technology	Fat free flavoured makhana
Year of release	2019
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Food processing
Recommended for region	Bihar, Madhya Pradesh, Rajasthan, Jammu & Kashmir, Tripura and Manipur

Details of technology

The process comprised of preparation of flavouring extract in water at a specified temperature for a specified time, thereafter adding oleoresin and then guar gum with stirring, followed by its application using spraying technique in a rotary mixer with continuous mixing for 1-2 min for uniform application of flavouring materials on surface of makhana. Finally maltose is applied, product is dried up to >6% moisture content, cooled properly and packaged into water vapour barrier packets.

Features of technology with their benefits

- ❖ A new flavoured makhana products which is fat or oil free and have all the nutritional properties of makhana.
- ❖ The long shelf life of flavoured makhana with almost natural appearance.
- ❖ The product is almost fat free and hence it can be consumed by the obese and all health conscious people.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 12

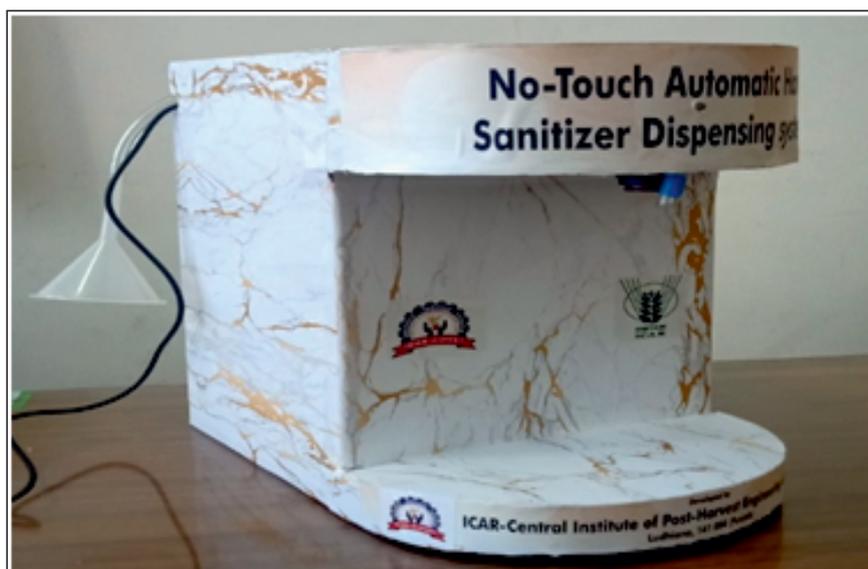
Name of technology	No-touch automatic dispenser for hand sanitization
Year of release	2020
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	NA
Recommended for region	Govt./private offices/ public places, hospitals, grocery stores, mandi and warehouses etc

Details of technology

The device comprises of two parts viz. hardware and software. Hardware includes a microcontroller, proximity sensor based on IR light, diaphragm pump, a plastic tank that is rated as compatible for storage of alcohol-based sanitizer, wiring, power source, and an outer casing made up of stainless steel. The software component includes integrated development environment (IDE) that provides comprehensive facilities to programming for software development. The device works on the principle of automatic obstacle detection with infra-red proximity sensor; and actuating the pump with the help of control unit/ microcontroller. This device dispenses the alcohol-based hand rub sanitizer from a 3.0-litre tank (adjustable capacity) using a small yet powerful diaphragm pump. The device operates on 12V DC electric power supply and made with unit cost Rs. 2500.

Features of technology with their benefits

- ❖ Sensor based.
- ❖ Touch-free.
- ❖ Portable.
- ❖ Low-cost, small and smart device.
- ❖ Dispense scientifically proven known volume of the hand sanitizer automatically to the users.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 13

Name of technology	No-touch automatic dispenser for hand sanitization
Year of release	2020
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	NA
Recommended for region	Govt./private offices/ public places, hospitals, grocery stores, mandi and warehouses etc

Details of technology

A smart, compact and portable surface disinfection system to help and fight against ongoing COVID-19 pandemic. In general, it is not feasible to disinfect each paper, file and similar items using the alcohol-based sanitizing gel. Thus, such a handy, smart and efficient system is needed to disinfect such items, in reducing the risk of infection among people. Unlike chemical sanitizers, UV-C does not leave a residue. It works as a mode of surface sterilization by destroying nucleic acid and disrupting the DNA of microorganisms.

Features of technology with their benefits

- ❖ UViC principally uses Ultraviolet-C exposure of 1.22 J/cm² (total dose) that exceeds well above the amount of exposure needed to inactivate SARS-CoV-2.
- ❖ The working capacity of the unit in terms of the total surface area of the objects to be treated is 25 × 25 cm². UViC guides the user to operate the system via messages on LCD and alarm unit. The system can be used in two modes.
- ❖ For lightweight removable objects : A drawer arrangement for placing objects, for example, purse, wallets, phones, currency notes, papers, packed groceries, files, and mask.
- ❖ For items which are fixed on surfaces: a hood-shaped arrangement that can be placed on fixed items. The developed system is unique, portable and cost-effective which can be installed in offices, homes, shops, hospitals, malls and other places.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 14

Name of technology	Portable Smart Ultraviolet-C Disinfection System (UViC)
Year of release	2020
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Fruits and Vegetables
Recommended for region	Govt./private offices/ public places, hospitals, grocery stores, mandi and warehouses etc

Details of technology

This portable system is an excellent ozonator which removes pesticides, bacteria, viruses and harmful chemical from the surface of fruits and vegetable, sea foods and meat making them hygiene. The system works on principle of silent “corona discharge method”. It uses electric discharge to produce ozone by splitting the normal oxygen molecules in the air into single atoms. These atoms recombine with air (i.e O₂) to form ozone (O₃) The device is compact in design, requiring a small space of 28 cm length, 24cm width and 10 cm height and weights only 1.8 kg. Its ozone output is 100-200 mg/h and its output air pressure is 0.2 kg/cm². The device operates on a 220 V-240 AC single phase power supply.

Features of technology with their benefits

- ❖ The developed system is portable and cost-effective which can be installed in and easy to use in every kitchen, hotels, small scale fruit vegetable processors and vendors where it can play a vital role in reducing the risk of infection especially during this pandemic period.
- ❖ Unlike chemical disinfectant Ozo-C does not leave a residue.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 15

Name of technology	Live fish carrier system and method of transportation of live fish therein
Year of release	2016
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Fish transportation
Recommended for region	West Bengal, Andhra Pradesh, Gujarat, Kerala and Tamil Nadu.

Details of technology

Live fish carrier system with water filtration, aeration and cooling system. The carrier system of the present LFCS reduces drudgery of fishers as well as handling stresses on fish while it increases survival of fish during transportation and it also ensures use of less water, vehicle stability and has low running costs.

Features of technology with their benefits

- ❖ The Live Fish Carrier System having automatic aeration, filtration and evaporative cooling system ensures continuous availability of good quality water to the live fish transported in the system providing healthy environment to fish and ensures animal welfare. LFCS reduces the requirement of water to more than 50% as compared to the traditional systems.
- ❖ The braking system of LFCS for the rear wheels along with hand brake provides good stability to the vehicle.
- ❖ Compartmentalization of water masses and/or the provision of water splash breaker in the vehicle reduces the chances of accidental overturn of the carrier vehicle.
- ❖ Stackable Self-Aerating Containers (SAC) are easy to handle and unloading of fish is handling stress free.
- ❖ Individual containers of SAC can carry different species and sizes separately in the same vehicle.
- ❖ LFCS is a complete environment friendly and zero polluting system, with less running cost & is woman-friendly and can be operated by one or two women.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 16

Name of technology	Wadi making machine
Year of release	2019
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Pulse processing
Recommended for region	Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka

Details of technology

The developed machine completely eliminates the hand operation. The capacity of the machine is estimated to be 150-300 kg/h which depends upon the weight of wadi to be made. The machine produces nine different shapes of wadi which will definitely increase the consumer appeal for the traditional product. The developed machine is an initiative in mechanizing the production of Indian traditional foods.

Features of technology with their benefits

- ❖ Capacity is 150 kg/h.
- ❖ Dropping size is 5g.
- ❖ Hygienic process.
- ❖ Uniformly shaped and sized wadis.
- ❖ Reduced human drudgery.
- ❖ Energy saving.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 17

Name of technology	Taro peeling machine
Year of release	2019
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Taro processing
Recommended for region	Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, Karnataka and Kerala

Details of technology

Taro contains alkaloid-containing mucus just behind the peel which causes itching to skin when in contact. Manual Peeling could easily lead to itchy skin besides that due to long contact time of peeled taro with air, oxidation takes place & taro becomes yellow which results in the change of colour and flavour. Manual peeling also leads to chopping off fleshy part of taro thereby leading to unnecessary wastage of the vegetable. A prototype for peeling of taro with low energy consumption and water consumption and low breakage rate with good peeling quality. The developed machine completely eliminates the hand operation thereby reducing drudgery. The machine has a peeling efficiency of 95% without damage to the fleshy portion of the taro thereby reducing the wastage. The capacity of the machine is estimated to be 100 kg/h.

Features of technology with their benefits

- ❖ Capacity is 100 kg/h.
- ❖ Large peeling volume.
- ❖ High efficiency (95%).
- ❖ Low energy consumption.
- ❖ Continuous cleaning.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 18

Name of technology	High-volume low-speed (HVLS) fan
Year of release	2019
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Animal shelter
Recommended for region	Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka

Details of technology

Ventilation of animal housing to remove moisture and odours and replacing them with fresh air is necessary for livestock productivity and also provides air movement that promotes cooling and improves air quality for confined animals. Achieving this with normal fans is expensive both in terms initial investment as well as operating costs. Also the air in shelter is stratified due to temperature gradients. HVLS fan with custom designed large paddle type blades move the air as one large cylinder (less drag as less interface area). The flow is in laminar regime resulting less energy loss in friction. The secondary flow of the fan after hitting the floor would further cover additional area. In this way one HVLS fan can approximately give performance equivalent to 6 normal fans. The power required to run the fan at low speed is significantly and results in low operational costs.

Features of technology with their benefits

- ❖ Energy efficient climate control solution. They use minimal energy to deliver airflow, which reduces both heating and cooling costs.
- ❖ Easy installation.
- ❖ Less maintenance cost.



Contact for further details
 Director
 ICAR-CIPHET, Ludhiana

Technology : 19

Name of technology	Jamun bar preparation process
Year of release	2020
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Fruits processing
Recommended for region	Maharashtra, Tamil Nadu, Gujarat, Assam and Rajasthan

Details of technology

Process technology comprised primary washing in potable water, final rinsing by chlorinated water, draining of surface water followed by extraction of pulp using fruit pulper (<1mm sieve size). Thermal pretreatment of pulp (85°C), followed by rapid cooling, addition of recommended Class II preservative, packaging in air tight container and storage of pulp at <8°C temperature. For Jamun bar preparation, taking out the Jamun pulp from cold store, keeping at room temperature for 2 hours, thermal pretreatment (to improve the colour and textural properties), followed by two stage drying (initially at slightly higher temperature followed by the temperature less than 50°C), shaping/strips cutting and packaging.

Features of technology with their benefits

- ❖ No artificial colour and table sugar/ sweetener are required in the developed process.
- ❖ Recovery of Jamun bar: about 3.75 kg per 25 kg fresh Jamun pulp.



Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 20

Name of technology	Process for Quality Protein Maize (QPM) based gluten free muffins
Year of release	2018
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Maize processing, bakery industries, health promoting food industries
Recommended for region	Andhra Pradesh, Karnataka, Rajasthan, Maharashtra, Bihar, Uttar Pradesh, Madhya Pradesh and Himachal Pradesh

Details of technology

QPM muffins are ready to eat snack food. This product has been developed from quality protein maize flour having essential amino acids viz. lysine and tryptophan twice than the normal maize. Product can be used by the persons allergic to wheat, as QPM is gluten free. For preparation of muffins different ingredients are mixed to make batter, batter is poured in muffin cups and placed in oven for baking. After cooling muffins are packaged in low density polyethylene (LDPE) packs. The machinery required includes weighing balance, planetary mixer, batter pouring machine, baking oven and packaging machine.

Features of technology with their benefits

- ❖ Gluten free.
- ❖ High in lysine and tryptophan.
- ❖ No artificial flavouring or added colour.

Contact for further details

Director
ICAR-CIPHET, Ludhiana

Technology : 21

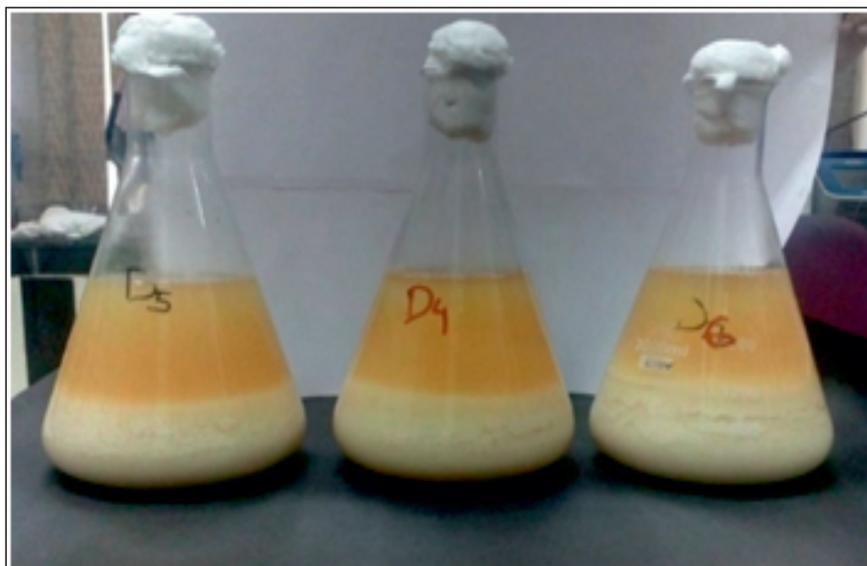
Name of technology	Microbial method for production of protein isolate/concentrate from oilseed cakes/meals
Year of release	2019
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Oilseed processing
Recommended for region	Maharashtra, Madhya Pradesh and Gujarat

Details of technology

Worldwide, alkaline extraction followed by acid precipitation or ultrafiltration method for preparation of protein isolates from oilseeds cakes/meals is followed. The strong alkaline and acidic conditions alter the functional properties of the protein, which adversely affects its quality. The process consists a microbial process in which microbes' produces mild acids through natural fermentation utilizing the extracted substrate (sugars and minerals or added nutrients) of the supernatant.

Features of technology with their benefits

- ❖ Microbial process is unique as it does not require any added acid in order to precipitate the protein. Hence, maintains almost native quality of protein with similar yield of protein as reported by alkali extraction and acid precipitation method.
- ❖ The method is convertible into purely chemical free process by extracting the protein using potable water (neutral pH) and precipitation by the said microbial culture with limited yield of protein but of superior quality.



Contact for further details
 Director
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Technology : 22

Name of technology	Pearl millet based extrudates, pasta
Year of release	2013
Source of technology	ICAR-CIPHET, Ludhiana
Suitable for which crops/ animals/enterprises etc.	Millet processing
Recommended for region	Rajasthan, Uttar Pradesh, Gujarat, Madhya Pradesh, Haryana, Maharashtra, Karnataka and Tamil Nadu

Details of technology

Pearl millet grains were cleaned and destoned using destoner. Then grains were pearled in a millet pearler and pulverized to form grits. Grits were mixed with other ingredients along with measured amount of water is extruded under pressure. The material was passed through die and cutter was attached to extruder. The extruded product was dried in hot air oven, cooled and then packed in low density poly ethylene bags (50 µ) and stored under ambient conditions in plastic containers. The extrudates and pasta were extruded through twin screw and pasta extruder respectively.

Features of technology with their benefits

- ❖ Efficiency for extrudates line (62 %), pasta line (60.4) and weaning mix (65%).
- ❖ These products are good source of energy, protein quality and easily digestible. Pearl millet products have wide health benefits, best suited for wheat allergic and intolerant people. Pearl millet regulates cholesterol level, cancer risk, and diabetes.
- ❖ The raw material left over in form of pearl millet flour can be used for other products like chapatti, complementary food base etc.



Contact for further details
 Director
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Technology : 1

Name of technology	Kufri FryoM (MP/04-578)
Year of release	2020
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Suitable for cultivation in north west and central plains or similar agro-ecologies

Details of technology

Kufri FryoM (MP/04-578) is a clonal selection from a cross between Kufri Chipsona-1 × MP/92-35. The plants are tall with vigorous and semi-compact canopy and field resistance to late blight. It produces white cream oblong tubers with shallow eyes and white flesh. It possesses very good keeping quality and moderate tuber dry matter (20%) and low reducing sugar (<150 mg/100).. Till date French fry processors had no other option than to opt for exotic processing varieties and there by paying the huge royalties. Therefore, the efforts were made to develop an indigenous early maturing French fry variety.

Features of technology with their benefits

- ❖ The variety yields 30-35 t/ha and >80% processing grade tubers.
- ❖ It will offer the profitable business opportunities in domestic and international markets.

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Technology : 2

Name of technology	Aeroponic system
Year of release	2012
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

Potato is a vegetative propagated crop and its virus free seed production has always been a serious issue. In traditional way of producing minitubers from tissue cultured plants, production in mere 5-7 tubers/plant which are of non-uniform size and many a times suffer from soil borne diseases. In this method huge area under insect proof netting is required which results into cost of production to the tune of Rs, 5-6 per minituber. Therefore, need of the time is to produce more minitubers per unit time per plant at reduced cost of production for meeting the huge seed potato requirement of India and many other countries. Aeroponic system is a technology of growing plants in an air mist environment without the use of soil or any other aggregate media. The basic principal is to grow plants in a closed environment by periodically spraying roots with a nutrient rich solution.

Features of technology with their benefits

- ❖ Seven to ten times more number of minitubers from in-vitro plantlets as compared to cultivation under net house conditions.
- ❖ Avoidance of tissue culture plants from soil exposure and hence a large number of pathogens.
- ❖ Freedom of multiple picking minitubers of desired size.
- ❖ Efficient regulation of nutrients & efficient use of water and nutrients.



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Technology : 3

Name of technology	Dehydration of potato tubers
Year of release	2014
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

Potato is an important part of the Indian diet and is used in combination with almost all vegetables and as snacks too. Being bulky and semi-perishable in nature, transportation of potatoes is very costly. Availability of fresh potatoes is a big problem in far-flung mountainous regions and hostile weather conditions where transportation facilities are not easily available, particularly for the Indian defence troops operating there. If potatoes can be made available in dehydrated form with higher nutritive value which can be preserved for up to 6 months under varying climatic conditions and can be restructured by simple rehydration/ cooking method, that will solve much of the problems of food availability and nutrition under adverse environmental conditions. The dehydrated products are also the preferred convenient food by working/young/older populations throughout India. The technology relates to a process for the preparation of high-quality dehydrated potato cubes and shreds comprising the steps of peeling cleaned raw potatoes, subjecting the same to the steps of dicing in varying sizes and shreds, followed by osmotic dehydration with chemicals for specific duration and short time dehydration at higher temperatures to obtain potato cubes/shreds with low moisture content.

Features of technology with their benefits

- ❖ The dehydrated products having long shelf life (up to 6 months) at ambient temperatures can be reconstituted by simple rehydration process/pressure cooking for use as curried vegetable, in soup or as snack.



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Technology : 4

Name of technology	Modular structure for covering an area with a net
Year of release	2018
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato and vegetables crops
Recommended for region	Throughout India

Details of technology

There are different kinds of designs of net houses available for raising indeterminate plants like tomato, cucumber etc. Structure of these net houses is usually around 6-7 m. Also structure is quite heavy to withstand load of plants and wind force especially in the summer months. Cost of construction of these net houses is to the tune of Rs 700-800/sq m. For the potato crop which doesn't require that much height and net is to be used only for 3-4 months in winter, use of these net houses is not economical. Therefore, considering these facts a new potato specific design of net house was developed for potato and other short height crops.

Features of technology with their benefits

- ❖ Structure suits potato and other short stature crops which don't require trellising.
- ❖ Structure is modular in nature and can be dismantled easily.
- ❖ Net covering is also foldable and can be removed or installed in short time.
- ❖ Life span of net is about twice the earlier designs.
- ❖ Cost of the unit is 50-60 less than the existing designs.
- ❖ Mechanization inside the net house is possible.

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Technology : 5

Name of technology	In vitro plant acclimatization
Year of release	2018
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

in vitro plant acclimatization typically involves slowly weaning the plantlets from a high humidity, low light, warm environment to what would be considered a normal growth environment. Traditionally hardening is performed in sterilized coco peat or peat moss or sand under natural sun light in fan pad cooled or other convenient hardening chambers. Issue with existing method is that plants hardened in coco peat or other solid media cannot be used in soilless method of cultivation like aeroponics. Solid media with the roots of plants will choke filters, nozzles and other passages. To avoid choking hardened *in vitro* plants are planted after cutting the roots. With cut roots there is lot of mortality and delay in normal growth of crop. Second issue was that with media like coco peat, plants cannot be hardened in indoor lab conditions under artificial lights in case traditional hardening units are unable to maintain required temperature, RH and day length conditions especially in warmer periods of the year.

Features of technology with their benefits

- ❖ Plants are hardened in synthetic material instead of coco peat.
- ❖ Plants with media are shifted to aeroponic culture panels along with the roots.
- ❖ Every plant root media block will hold 5-8 gm nutrient solution.
- ❖ This solution will help in very good growth of plants and will not let the plants get damaged even if misting over the roots is stopped for 4-5 hours.
- ❖ Transplanting of hardened plants with active roots (instead of stem cut plants) enhances crop productive days.
- ❖ There is no dispersing of media in the nutrient solution and hence no blockage of drains, nozzles and filters especially in closed hydroponic/aeroponics systems.
- ❖ Mortality during hardening is < 2% in these plants and it can be nil also. Similarly, mortality after shifting to culture panels in aeroponics/ hydroponics is also <2%.
- ❖ Absolutely clean environment in the grow boxes/culture panels as compared to coco peat and other loose media which disperse around and make it hard to run the unit.
- ❖ Elimination of one work phase of cutting roots before transplanting. Also, there is no spillage of coco peat in the operational area.
- ❖ Hardening possible even when outside temperature is high and hardening is not possible in traditional fan pad cooled hardening units.
- ❖ Plant hardening is possible in lab conditions as system is clean.

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Technology : 6

Name of technology	Device for hydroponic culture of plants
Year of release	2018
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato and vegetables crops
Recommended for region	Throughout India

Details of technology

For different kind of research areas in soilless environment we were facing some issues and we're looking for a soilless system/machine which- (a) Should be small in size so that can be shifted easily to desired location (b) Can be used both as aeroponic system and as deep culture hydroponic system (c) Can be transported easily to conduct experiments in indoor conditions or outdoor conditions (d) Should have sensors for temperature, EC, dissolved oxygen for research studies (e) Should have LED lights for indoor studies under artificial lights (f) Can also be used for kitchen gardening in urban areas. Keeping these criteria, device for hydroponic culture of plants was developed.

Features of technology with their benefits

- ❖ Unit is like a refrigerator or oven and can easily be moved to any place, indoor or outdoor.
- ❖ Machine can be used as deep culture or aeroponic system.
- ❖ Device can be used for research on plants having inbuilt facilities for recording temperature, root length, plant height, dissolved oxygen etc.
- ❖ Device has LED lights and other facilities for conducting research in indoor conditions.
- ❖ Nutrient solution can be heated or chilled as per requirement.
- ❖ Unit can be used as domestic machine for kitchen gardening in urban areas.

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Technology : 7

Name of technology	ICAR-CPRI advanced potato processing hybrids
Year of release	2021
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Processing grade tubers of potato
Recommended for region (Technology wise)	1.Suitable for northern, eastern and southern India 2.Suitable for southern (Telangana) India 3.Suitable for northern and eastern India 4.Suitable for eastern and southern India 5.Suitable for southern India 6.Suitable for eastern India

Details of technology

The salient characteristics of six advanced hybrids (6 no.) with processing traits are given below:

- (i) **MP/09-45:** White cream ovoid tubers with shallow medium eyes and cream flesh. Hybrid has low reducing sugars, 21% dry matter, medium maturity, moderate resistance to late blight and very good keeping quality.
- (ii) **MP/13-1045:** White cream ovoid tubers with shallow eyes and white flesh. Hybrid has low reducing sugars, 18-20% dry matter, early medium maturity, field resistant to late blight & hopper burn and very good keeping quality.
- (iii) **MP/13-662:** White cream ovoid tubers with shallow eyes and white flesh. Hybrid has low reduced sugars, 23% dry matter, medium maturity, resistant to late blight and very good keeping quality.:
- (iv) **MP/12-126:** White cream round tubers with shallow eyes and cream flesh. Hybrid has low reducing sugars, 21% dry matter, medium maturity, field resistant to late blight and very good keeping quality.
- (v) **MP/14-171:** White cream round tubers with shallow medium eyes and white flesh. Hybrid has low reducing sugars, 22% dry matter, medium maturity, moderately resistant to late blight and very good keeping quality.
- (vi) **MP/15-698:** Brown russet round tubers with shallow eyes and cream flesh. Hybrid has low reducing sugars, 20% dry matter, medium maturity, field resistant to late blight and very good keeping quality.

Features of technology with their benefits

- ❖ These advanced hybrids yield 30-35t/ha and >80% processing grade tubers.
- ❖ These hybrids offer the profitable business opportunities in domestic and international markets

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Technology : 8

Name of technology	Counting machine
Year of release	2020
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

Counting machine is a sensor based system used to count the potato minitubers and similar high value agricultural products.

Features of technology with their benefits

- ❖ Singulation of potato minitubers in different rows.
- ❖ Identification of minitubers (objects) with sensors.
- ❖ Accurate counting of potato minitubers and similar products to the pre-set value.

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Technology : 9

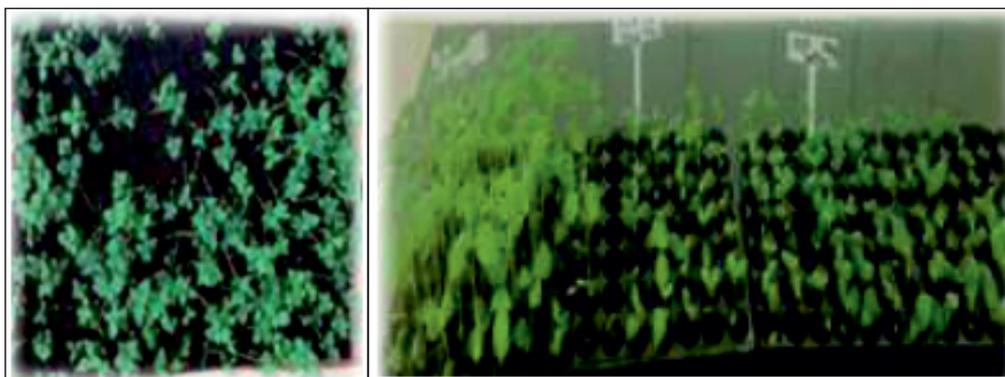
Name of technology	Potato apical rooted technology
Year of release	2021
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

Apical cuttings are rooted transplants produced in a glasshouse from tissue culture plantlets. Rather than allowing tissue culture plantlets to mature and produce minitubers. The initial tissue culture plants were planted in nursery beds or crates. After 10 days depending upon the plant growth, the first apical cutting was taken which was 2-3 long with two true leaves. These cuttings were planted in irrigated pro-trays filled with coco peat. Once the apical dominance was lifted, the lateral buds grow into new branches which were further used to increase the multiplication rate. In 4-5 weeks, 5 cuttings were taken which increased the multiplication rate at 1:7-8 times, respectively

Features of technology with their benefits

- ❖ This technology can be used for production of quality planting material at low cost in seed deficit areas.



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Technology : 10

Name of technology	Gluten-free potato cookies
Year of release	2019
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of echnology

- ❖ Protein, fibre, calcium and potassium rich cookies.
- ❖ Made from whole potato and legume flour.
- ❖ Shelf life is 4 months.

Features of technology with their benefits

- ❖ Gluten free.



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Technology : 11

Name of technology	Gluten-free potato semolina
Year of release	2021
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

- ❖ Protein, fibre, calcium and potassium rich, low sodium gluten free, semolina made from whole potatoes (with peel) with the shelf-life of up to 9 months.
- ❖ Can be used for preparation of *Upma*, *Halwa*, *Idli*, *Uttapam* and many more.
- ❖ Also suitable for gluten intolerant or wheat allergic population.

Features of technology with their benefits

- ❖ Gluten free



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Technology : 12

Name of technology	Plant holding and lifting mechanism
Year of release	2016
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

This technology relates to the field of aeroponics/ hydroponics, which is a soilless method of producing disease free potato minitubers. More specifically technology is related to holding and lifting of plant alongwith planting trays. It is a kind of mechanical structure which can hold plants upright and which can be attached to each other in plurality for desired length/size of use. The patent for the technology is in process with application no. i.e 201611022621

Features of technology with their benefits

- ❖ The structure holds the plants upright and there is no intermingling lodging of plants and blockage of pathways.
- ❖ Significantly enhanced yield (30-40%) because of better light interception and photosynthesis.
- ❖ Up to 960 plants can be raised up by a single person in 30-40 seconds, that way saving on time and manpower (30-40%).
- ❖ Greenhouse cooling is more effective as air movement is better through the walkways.



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Technology : 13

Name of technology	Lant holding unit
Year of release	2021
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

This technology relates to the field of aeroponics/ hydroponics, which is a soilless method of producing disease free potato minitubers. The technology is a kind of plug and jacket system which gives freedom of inserting plants with lot of roots for early completion of crop cycle. It will also provide a system for easy removal of stuck tubers from stem/plant holes so that plant stems are not compressed and planting tray is not damaged. The patent for the technology is in process with application no. i.e 201611024023

Features of technology with their benefits

- ❖ Damage free insertion/transplanting profusely rooted *in vitro* plants.
- ❖ Holding *in vitro* plants in planting trays/plate and does not allow them to fall down into grow box.
- ❖ Completing crop cycle 20 days earlier, as compared to presently adopted practice, which help in taking two crop cycles instead of one, in the same season.
- ❖ Lowering or raising up of plants moderately, to remove plant branches and tubers formed inside the stem holes.



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Technology : 14

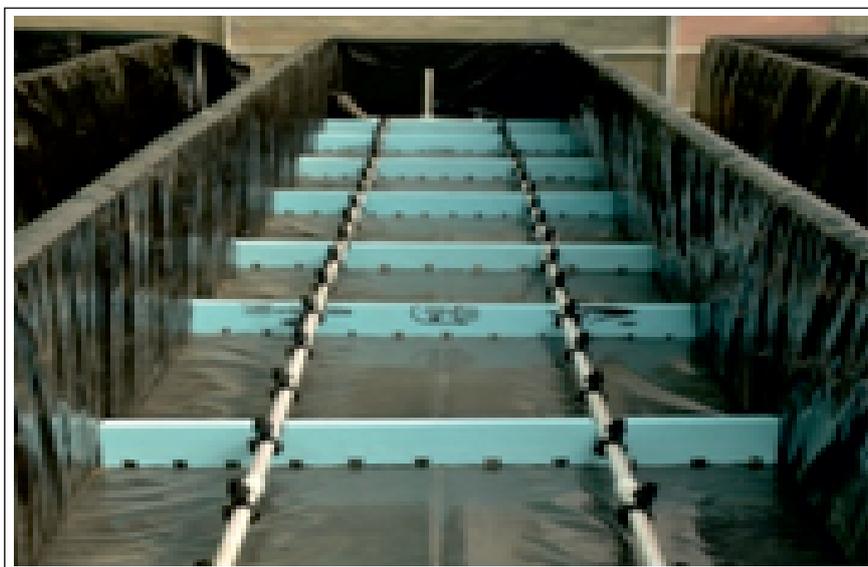
Name of technology	Grow box
Year of release	2016
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

This technology relates to is a reinforced brick-concrete structure developed for producing potato minitubers in aeroponic system. The patent for the technology is in process with application no. I.e 201611026123.

Features of technology with their benefits

- ❖ Because of high compressive strength and robustness in construction structure is not affected by any weather knockbacks.
- ❖ Tunnel/box can support heavy structure over the top to hold and lift plants and inside for fixing nozzles and pipes.
- ❖ Box is leak proof and can be cleaned by workers by entering inside.
- ❖ Top edge of box is of special design which prevents nutrient solution mist flow out of the box.



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Technology : 15

Name of technology	Biofertilizer cum biofungicide/ biobactericide composition B5
Year of release	2021
Source of technology	ICAR-CPRI, Shimla
Suitable for which crops/ animals/enterprises etc.	Potato
Recommended for region	Throughout India

Details of technology

The increased concern about the potential adverse environmental effects associated with use of synthetic plant protection and production agrochemicals, promising alternatives is the use of biofertilizers. Therefore, developed a bioformulation that controls soil and seed borne diseases and ensures early and uniform germination leading to yield improvement. The technology Biofertilizer cum Biofungicide/ Biobactericide Composition B5 is prepared from a bacterium namely *Bacillus subtilis* strain B5 having the ability to provide plant growth promotion and control of soil/seed borne pathogens of potato, vegetables and ornamental crop plants. It releases an antibiotic metabolite which is fungicidal, supports immune system, biosynthesizes siderophores, tRNA binder, stimulatory and decreases toxicity. It has a killing effect against pathogenic species of *Fusarium*, *Pythium*, *Phytophthora*, *Rhizoctonia*, *Solanacearum* and *Alternaria* in the form of cell lysis or antibiosis. It inhibits *R. solanacearum*, the cause of bacterial wilt of potato against which no chemical or a resistant variety is effective till date. The composition B5 is prepared in an inexpensive substrate which allows maximum production of viable cells in shortest time with a shelf life of one year at room temperatures (15-37°C) and gives best results when applied on seed or soil, safe for persons handling it and non target pathogens with no side effects on biodiversity. The technology is protected through patent (Patent No. 227691).

Features of technology with their benefits

- ❖ It controls soil and seed borne diseases up to 80%.
- ❖ Increases crop yield up to 25 %.
- ❖ Raw materials used in this formulation are indigenously available at affordable cost.
- ❖ Manufacturing process is simple and easy to adopt.
- ❖ It is compatible with systemic and contact fungicide viz. Bavistin, Benlate, Ridomil and Dithane M-45 and is ecofriendly with one year shelf life at room temperature.

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Technology : 1

Name of technology	Controlled sub-surface drainage system
Year of release	2019
Source of technology	ICAR-CSSRI AICRP on SAS&USW, Gangavathi
Suitable for which crops/ animals/enterprises etc.	Transplanted paddy
Recommended for region	Waterlogged saline vertisols in tail-end areas of TBP command area.

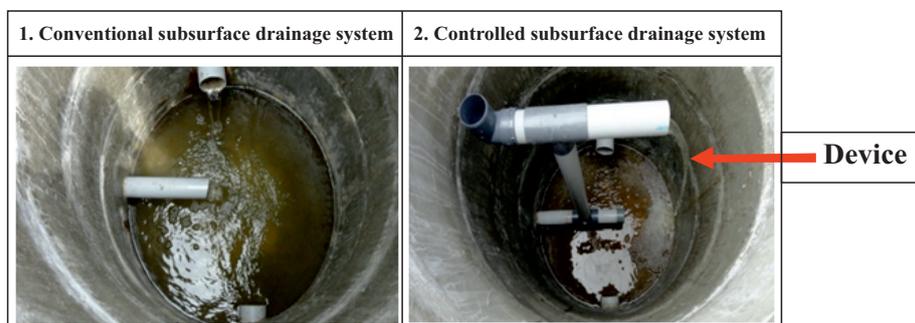
Details of technology

Tail-end farmers of Tunga Bhadra command area face acute shortage of irrigation water apart from water logging and soil salinity problem. Hence, farmers block the outlets of subsurface drainage to save water and reduce nutrient loss particularly at later stage of crop growth. To address this problem, AICRP on SAS&USW, Gangavathi introduced controlled SSD technology. It consists of a small device made up of PVC pipes which was fitted with outlet of lateral drain. It has three main components i) 80 mm PVC “T” pipe fitted with outlet of lateral drain pipe inside the man hole and other end of “T” pipe is closed with end cap. The riser with variable height, depending on the minimum water table depth desired in paddy field, is fitted to this “T” pipe. Again one more “T” pipe is fitted at top of riser pipe. This simple device made up of two PVC “T” pipes and one riser pipe is efficient in controlling water table at desired depth in paddy fields.

Introduction of this technology is recommended once the root zone soil salinity reaches within threshold limit.

Features of technology with their benefits

- ❖ Controlled subsurface drainage could save about 20 per cent (240 mm/ha) of irrigation water per season compared to conventional subsurface drainage system. By this saving of irrigation water for every 2.4 ha, an additional 0.4 ha paddy area could be irrigated.
- ❖ Controlled drainage could reduce loss of nitrogen to the extent of 50 per cent per season as compared to conventional subsurface drainage system.

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Technology : 2

Name of technology	Growing of cotton with drip irrigation and mulch in saline vertisols
Year of release	2015-16
Source of technology	ICAR-CSSRI AICRP on SAS&USW, Gangavathi
Suitable for which crops/ animals/enterprises etc.	Cotton
Recommended for region	Waterlogged saline vertisols

Details of technology

The study was conducted to know the response of cotton to fertigation through drip irrigation in saline soils under conservation agriculture practices at Agricultural Research Station, Gangavathi. The main treatments were with and without mulch and sub treatments were ET based water application through drip at 0.8, 1.0 and 1.2 ET. Paddy straw was applied as mulch @ 6.85 t/ha.

Features of technology with their benefits

- ❖ Paddy straw mulch with 1.2 ET drip irrigation not only reduced surface soil salinity but also increased the cotton yield.
- ❖ With this technology for every 8.0 ha cotton, additional 1.0 ha cotton could be grown.



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Technology : 3

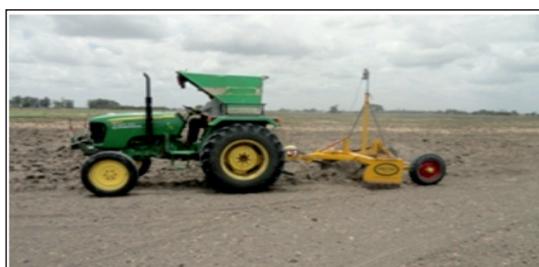
Name of technology	Laser land levelling technology under DSR method
Year of release	2015-16
Source of technology	ICAR-CSSRI AICRP on SAS&USW, Gangavathi
Suitable for which crops/ animals/enterprises etc.	Paddy
Recommended for region	Vertisols

Details of technology

A study was conducted to know the effect of laser land leveling on crop yield and water production efficiency of paddy consisting of four treatments viz., T1- puddled transplanting (PTR) in traditionally leveled land (control), T2 - direct seeded rice (DSR) in traditionally leveled land, T3 - PTR in laser leveled land, and T4 - DSR in laser leveled land.

Features of technology with their benefits

- ❖ Uniform distribution of water and fertiliser, even growth and maturity of crop.
- ❖ For every 4.0 ha puddled paddy an additional 1.30 ha DSR paddy with laser levelling could be cultivated.



Laser levelling operation before sowing of DSR



Direct Seeded rice in Laser Leveied Land



Direct Seeded rice in Normal Leveied Land

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Technology : 4

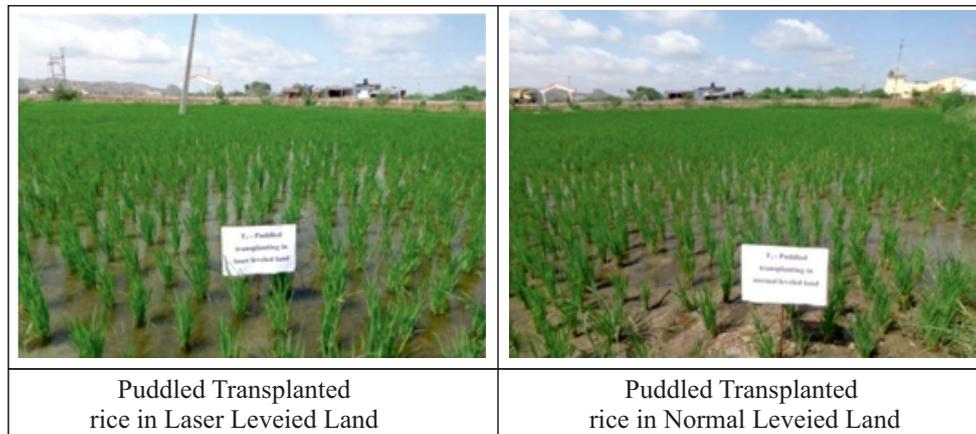
Name of technology	Laser land levelling technology under puddled transplanted condition
Year of release	2015-16
Source of technology	ICAR-CSSRI AICRP on SAS&USW, Gangavathi
Suitable for which crops/ animals/enterprises etc.	Paddy
Recommended for region	Vertisols

Details of technology

A study was conducted to know the effect of the laser land leveling on crop yield and water production efficiency of paddy consisting of treatments viz., T1- puddled transplanting (PTR) in traditionally leveled land (control), T2 - PTR in laser leveled land.

Features of technology with their benefits

- ❖ Uniform distribution of water and fertiliser, even growth and maturity of crop.
- ❖ For every 9.0 ha puddled paddy an additional 1.0 ha paddy could be cultivated.



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Technology : 5

Name of technology	Subsurface drip irrigation and salt tolerant sugarcane in saline Vertisols
Year of release	2018-19
Source of technology	ICAR-CSSRI AICRP on SAS&USW, Gangavathi
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region	Saline vertisols

Details of technology

The surface drip irrigation techniques are being followed in recent years for sugarcane. However, surface drip irrigation under saline soils is less effective as the water applied may not effectively leach down salts and also there might be shallow root system development as water is applied on the surface. To overcome these problems subsurface drip (SSDI) irrigation which is being practiced for sugarcane in non-saline soils can become complimentary for growing it under saline conditions as well. The study was taken up at Agriculture Research Station, Gangavathi under saline soils (4-6 dS m⁻¹) with different irrigation methods viz., surface drip, subsurface drip and furrow irrigation (control) as main treatments and with irrigation levels viz., 0.8, 1.0 and 1.2 evapotranspiration (ET) as sub treatments. The salt tolerant sugarcane variety Co-91010 (Dhanush) was procured from village Mudhol in Bagalkot district of Karnataka.

Features of technology with their benefits

- ❖ Higher soil moisture and more leaching of salts at the root zone, higher growth, yield and irrigation water use efficiency of sugarcane was found in the subsurface drip with 1.2 ET as compared to furrow method of irrigation.
- ❖ For every 7 ha sugarcane an additional 1 ha sugarcane with drip could be cultivated.



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Technology : 6

Name of technology	Saline water use in tomato crop under surface and subsurface drip irrigation
Year of release	2019-20
Source of technology	ICAR-CSSRI AICRP on SAS&USW, Gangavathi
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region	Vertisols with saline water use up to 2 dS/m

Details of technology

The experiment consisted of surface drip irrigation (M_0), subsurface drip irrigation (M_1) and furrow irrigation (control, M_2) as main plot treatments and five sub treatments viz. normal water (control, 0.65 dS/m), ECiw-2 dS/m, 3 dS/m, 4 dS/m and 5 dS/m respectively.

Features of technology with their benefits

Whenever, a good quality irrigation water is not available for the cultivation of tomato crop (Lakshmi F1 Hybrid) in black soils, we can use salt/saline water up to 2 dS/m through surface or subsurface drip irrigation techniques without affecting much (considerably) on the soil and yield of tomato crop.



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10 Directorate of Mushroom Research, Solan

Technology : 1

Name of technology	Cultivation technology for <i>Auricularia polytricha</i> (Black ear mushroom)
Year of release	-
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions.

Details of technology

Black ear mushroom has the oldest record of cultivation by the Chinese dating back to 600 A.D. It is commercially cultivated in some of the S.E. Asian countries. This mushroom ranks fourth among all cultivated edible mushroom. This mushroom is believed to cure sore throat, anaemia, certain digestive disorders especially piles on regular consumption. In India, this mushroom is collected and consumed in North-Eastern States. Proses of cultivation is given below:

- ❖ Fresh wheat straw of good quality soaked for 16-18 hours in water.
- ❖ Excess water is drained out.
- ❖ Add 5% wheat bran (w/w) in soaked wheat straw.
- ❖ Fill 2 kg substrate in each polypropylene bag and autoclave at 1.54675kg/cm² pressure for 1-1.5hour.
- ❖ On cooling, add spawn @ 2% dry weight basis.
- ❖ Incubate the spawned bags at 25-26°C.
- ❖ Spawn run will be completed in 20-25 days.
- ❖ On completion of spawn run give cross cut to give slits and hang the bags for fruiting at 25-26°C.
- ❖ Maintain high relative humidity (85-90%) by spraying water once or twice on the bags and in the room.
- ❖ Give diffused light and aeration for 1-2 hrs daily.
- ❖ Fruit bodies will emerge after 10-12 days after giving the cross cuts and will mature for harvesting in the next 4-5 days.
- ❖ Harvest mature fruit bodies which can be consumed fresh or can be dried.

Features of technology with their benefits

Use of waste wheat straw material as substrate which is an eco-friendly approach, eradication of malnutrition and also generation of employment.



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Technology : 2

Name of technology	Cultivation technology of paddy straw mushroom
Year of release	-
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions.

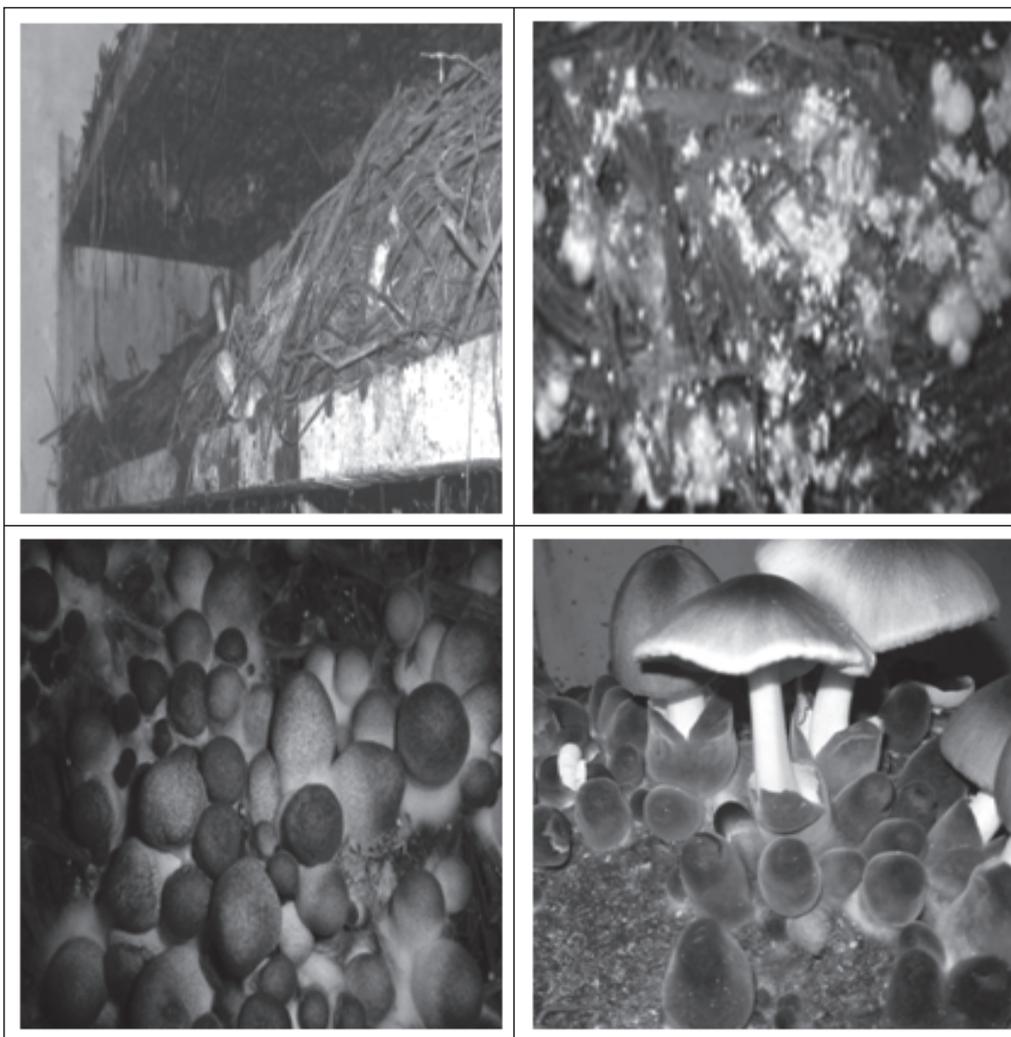
Details of technology

In India, this mushroom is cultivated in the States, e.g., Orissa, Andhra Pradesh, Tamil Nadu, Kerala and West Bengal. The excellent unique flavour and textural characteristics distinguish this mushroom from other edible mushrooms. The straw mushroom is known to be rich in minerals such as potassium, sodium and phosphorus. Potassium constitutes the major fraction of major elements followed by sodium and calcium. This mushroom can be cultivated on paddy straw and cotton ginning mill waste as substrate. The methodology is given below:

- ❖ Take Paddy straw as substrate for cultivation of paddy straw.
- ❖ Add cotton ginning mill waste to the substrate.
- ❖ Add 5% chicken manure.
- ❖ Wet thoroughly with 1.5% lime added water.
- ❖ Make pile of the mixed substrate.
- ❖ Give turning after three days.
- ❖ Re-stack and repeat the process for next three days.
- ❖ Pasteurize substrate at 60-62°C for 3-4 hours and then condition at 45-50°C for 2-3 days for complete elimination of Ammonia.
- ❖ Add spawn @1.5% on wet weight basis.
- ❖ Cover the beds with plastic sheet.
- ❖ Spawn run will be completed in 4-5 days at 32-35°C.
- ❖ Remove plastic sheets from spawned substrate.
- ❖ Maintain room temperature at 28-32°C, RH-80-85%.
- ❖ Give intermittent fresh air circulation and fluorescent light for 4-5 hours/day.
- ❖ Harvest first flush after 9-10 days of spawning.
- ❖ Harvest at button stage, packaging.
- ❖ Shelf life of mushroom is low hence fresh mushroom is consumed.

Features of technology with their benefits

Paddy straw and Cotton Ginning Mill waste as substrate which is eco-friendly and also generation of employment.



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Technology : 3

Name of technology	Cultivation technology of pink oyster (<i>Pleurotus djamor</i> var. <i>roseus</i>)
Year of release	-
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

Pink oyster mushroom (*Pleurotus djamor* var. *roseus*) has a light to dark pink colored cap and can readily colonize on any kind of agricultural waste including wheat or paddy straw, sugar cane bagasse. The texture of fruit body is hard compared to other species. This mushroom is suitable for month of April month in northern and for plain region middle states of India. The Biological efficiency of this species ranges from 50- 90%. Cultivation process is given below:

- ❖ Wet the substrate.
- ❖ Add one per cent lime and make pile.
- ❖ Give turning is on third day and re make pile.
- ❖ Keep the pile as such for two days.
- ❖ Pasteurize the substrate at 60°C for 4 hours.
- ❖ Add spawn @ 3% on wet wt basis.
- ❖ Fill 5 kg substrate per bag.
- ❖ Incubate bags at 22-25°C under dark conditions.
- ❖ Spawn run will be completed in 8-10 days.
- ❖ Make holes of one inch dia all over the surface of the bags.
- ❖ Spray water twice in the rooms.
- ❖ Provide light (600-1000lux) for 3-4 hours daily.
- ❖ The Pinning will start within 10-12 days.
- ❖ Harvest mature fruit bodies.
- ❖ Mushroom can be consumed fresh or sun dried.

Features of technology with their benefits

Use of waste wheat straw material as substrate which is an eco-friendly approach and also generation of employment.



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Technology : 4

Name of technology	Cultivation technology of <i>Agrocybe aegerita</i>
Year of release	-
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

Agrocybe aegerita (Brig.) Sing., commonly known as 'black poplar mushroom'. It has unique flavour and nutritive value. It is cultivated in Japan, Korea, Australia and China. It is an important valuable source possessing varieties of bioactive secondary metabolites such as indole derivatives with free radical scavenging activity, anticancer activity, and also agrocybenine with antifungal activity. It is cultivated on wheat straw or sawdust. Methodology is given below:

- ❖ Soak good quality wheat straw overnight for 16-18 hours and later remove the straw and drain out excess water.
- ❖ Mix 4-5 % wheat or rice bran on wet weight basis.
- ❖ Fill 2 kg substrate in each polypropylene bag.
- ❖ Autoclave filled bags at 1.0546kg/cm² for 1-2 hours.
- ❖ After cooling, spawn the substrate @ 4% aseptically.
- ❖ Incubate at 25 -28°C.
- ❖ Spawn run will be completed in 20-25 days.
- ❖ Cross cut or give slits and hang the bags for fruiting at 25°C with 85-90% RH.
- ❖ Spray water daily on bags and in the room.
- ❖ Small primordia will appear after 5-8 days after opening the bags which become ready to harvest in the next four days.
- ❖ Average weight of a single fruit body is 3.5g.
- ❖ Fresh mushrooms can be consumed or sun dried.
- ❖ Fruit bodies can be stored in the refrigerator for 7-10 days.

Features of technology with their benefits

Use of waste Paddy straw/wheat straw material as substrate which is an eco-friendly approach and also generation of employment.



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Technology : 5

Name of technology	Cultivation of winter mushroom flammulina on saw dust bags and in polypropylene (PP) bottle
Year of release	2017
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

Flammulina velutipes (winter mushroom; Enokitake) is one of the wood decaying fungi. It occurs all over the world in areas such as China, Siberia, Asia Minor, Europe, Africa, North America, Australia and Japan. This mushroom is particularly known for its taste and preventive as well as curative properties for liver diseases and gastroenteric ulcers. This mushroom has been reported to contain immunodo-modulatory, antitumor and antibiotic substances. Cultivation process is given below:

- ❖ Saw dust of mixed trees is wetted thoroughly with water for 16-18 hours.
- ❖ Add 5% wheat bran in the wetted saw dust.
- ❖ Fill two kg substrate in each polypropylene bags.
- ❖ Plug the bags with non-absorbent cotton by inserting ring at the mouth of the bag.
- ❖ Sterilize the filled bags in autoclave at 1.54675 kg/cm² pressure for 1-1.5hr.
- ❖ Inoculate cooled bags with wheat grain based spawn @ 4% dry weight basis.
- ❖ Incubate the spawned bags at temperature between 23 - 25°C for mycelial growth.
- ❖ After spawn run, keep the bags in the dark at a temperature of 10 -14°C and maintain the RH at 80- 85%.
- ❖ Primordia will form in 10-12 days after reducing the temperature.
- ❖ Harvest fruit bodies of 14-18 cm length.
- ❖ Harvested fruit bodies can be consumed fresh or can be sun dried.

Features of technology with their benefits

Use of waste wheat straw material as substrate which is an eco-friendly approach, eradication of malnutrition and also generation of employment.



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Technology : 6

Name of technology	Cultivation of <i>Grifola frondosa</i> Mushroom (Maitake)
Year of release	2019
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

Maitake (*Grifola frondosa*) is a popular mushroom in Asia for its tasty flavor and immunestimulating property. The following procedure is followed to cultivate Maitake (*Grifola frondosa*) mushroom:

- ❖ Mixed substrate was filled in Poly Propylene bags (1.2- 1.5kg wet/ bag)
- ❖ Bags sterilized in an autoclave at 22 psi for 90 min.
- ❖ Grain spawn was inoculated @3% (wet wt basis, top spawning) and bags incubated at 4 hr/20 hr light / dark cycles at 23-25°C. Spawn run took 40-45 days.
- ❖ White young mycelia penetrate throughout the surface of the substrate in the sealed bags. After a month (30 days), orange brown exudates indicating metabolic activities are observed to cause discoloration of the white mycelia. At the surface of the substrate, tighter mycelial growth gives rise to a surface mycelial mat toward later stage of the spawn run. The topography of the mycelial surface becomes uneven with grayish amorphous mass.
- ❖ After 40-45 days grayish primordia reaching 1-2" in diameter are formed on the substrate surface in the closed bags. Transfer these bags to a cropping room for fruiting-body development. After 2-3 days, open the top of the bags.
- ❖ The optimum temperature for fructification is between 18-20°C for induction of fruiting suitable temperature, High RH and good ventilation are required. Fruiting Body Development having three main stages i.e. primordia stage or brain stage, cauliflower stage and cluster flower stage.
- ❖ **The Brain Stage:** As the dark grayish black primordia grow, convoluted folds appear on the surface, as if a brain.
- ❖ **The Cauliflower Stage:** Further growth includes unfolding of the convoluted folds on the surface of the dark primordia into overlapping young pilei (caps) formed in a cluster. This is followed by elongation of the lateral stems, each with a young pileus (cap) on the upper portion. The stems are highly and repeatedly branched, sharing a short and chunky base. This stage is a "cauliflower" look alike when the colour of the fruiting body becomes lighter to almost white.
- ❖ **The Cluster Flower Stage:** As the mushroom continues to grow, overlapping fan-shaped caps in a cluster are developed along the elongated stems, creating the cluster flower stage. The colour of the mushroom becomes progressively lighter during the intricate morphogenesis from the dark grayish-black primordia.
- ❖ Maitake mushrooms fully formed, as if cluster flowers. Mushroom is ready to harvest, when the mushroom cluster has been fully formed and increases in size. The fan-shaped or semi-circular, irregularly-shaped petals (caps + lateral stems) extend outward like a cluster flower in bloom, reaching 80% in unfolding.

Features of technology with their benefits

Use of waste wheat straw material as substrate which is an eco-friendly approach and also generation of employment.



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Technology : 7

Name of technology	Cultivation of <i>Grifola frondosa</i> mushroom (Maitake)
Year of release	2019
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

Pleurotus eryngii, commonly known as the king oyster mushroom, has been used extensively in North Africa, Europe and Asia. This mushroom is also known as Kabul Dhingri due to its natural occurrence in high altitude regions of North West Himalayas. *Pleurotus eryngii* is a popular mushroom due to its excellent consistency of cap and stem, culinary qualities and longer shelf life. A great deal of work has been carried out on therapeutic potential of *Pleurotus eryngii*. The edible Fungi perform multiple bioactivities: anticancer, antiviral, antioxidant, antimicrobial, anti-leukaemia, hypolipidemic, immuno-modulating and estrogen-like activity. These bioactive properties depend on its bioactive compounds such as polysaccharides, eryngiolide A, ubiquinone-9, pentacyclic triterpenoid. Commercial cultivation of king oyster is done on wheat straw, paddy/ maize stalk/ saw dust supplement with organic nitrogen materials. The cultivation technology developed by ICAR-DMR is as follow:

- ❖ Substrate is wetted thoroughly for 16-18 hours.
- ❖ After wetting 20% wheat bran is added in the substrate and mixed thoroughly.
- ❖ Two kg substrate is filled per polypropylene bag or polypropylene bottles can be used.
- ❖ The bags are plugged with non absorbent cotton by inserting ring on the mouth of bags.
- ❖ The filled bags are sterilized in autoclave for 1.5 hours at 22 p.s.i.
- ❖ After the bags have been sterilized and cooled down to 20C, they are inoculated with wheat grain based spawn @ 3% dry weight basis.
- ❖ Inoculated bags are incubated at 22-25C.
- ❖ Spawn run will be completed in 15-20 days.
- ❖ PP bag is removed.
- ❖ Blocks are then placed in the cropping room at a temperature of 10-15C and relative humidity 80-85% maintained.
- ❖ Light (800-1000 lux) is provided for five hours for optimum development of fruiting bodies.
- ❖ Mature fruit bodies are harvested 3-4 days after pinning.
- ❖ Maize stalks and leaves with cotton seed cake @ 5% give 65% BE with supplementation.
- ❖ Un-supplemented wheat and paddy straw give 40% B.E.

Features of technology with their benefits

828g fresh mushroom from 1kg dry substrate (Wheat substrate) Use of waste maize stalk and leaves, cotton seed cake, paddy straw/wheat straw material as substrate which is an eco-friendly approach and also generation of employment.



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Technology : 8

Name of technology	Low cost ready to fruit bag developed in ICAR-DMR (Ghar-Ghar mushroom)
Year of release	2019
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

The main aim of this design is to provide the growing experience to the beginner growers and also to promote the mushrooms in urban and peri-urban areas. Low cost RTF technology is developed on oyster mushroom in 2017 by ICAR-DMR. The RTF is wheat straw based technology containing 2kg of wet substrate. The spawn requirement for bag is 4 % of wet weight basis. The bags come with handy hanging options so that it can be hanged in rooms. On optimum temperature and humidity, each bag can produce 300-500 g of mushroom in three flushes. The fruiting requires temperature around 24°C and humidity around 80-85%. After pin head formation, humidity is created by spraying the water on fruit body and bags so that fruit body won't dry. The technology is developed by ICAR-DMR is as follow:

- ❖ The technology is developed on non-woven rectangular cube-shaped bio-degradable bags.
- ❖ The bag is provided with 3 holes on 4 sides. The dimensions of the bags are 35cm (L) X 15cm (B) X 12cm (T).
- ❖ This bag is durable for at least 2 years.
- ❖ The technology is released for oyster mushroom (*Pleurotus sp.*). For pink oyster mushroom RTF bag the incubation period is of 13 days at 24°C.
- ❖ The crop fruits for three times with interval of 7-10 days at 24- 28°C. The pin development and fruiting require 75-85% humidity with minimum 200 lux light and optimum 800 lux light.
- ❖ The CO₂ of room must be below 5000ppm. Aeration is required for the crop development. The spraying of water should be done at 2-3 times depending of dry and humid weather.

Features of technology with their benefits

This design provide the growing experience to the beginner growers and also to promote the mushrooms in urban and peri-urban areas



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Technology : 9

Name of technology	Technology for early fruiting in Shiitake i.e. Lentinula edodes
Year of release	2019
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

The Shiitake (*Lentinula edodes*) mushroom is the most important edible medicinal mushroom with excellent nutritional value. Its nutritional components include bio-active polysaccharides such as β -D-glucan, heteroglucan, xylomannan, lentinan and eritadenine; free sugars including arabinose, arabitol, mannose, mannitol, trehalose and glycerol; vitamins (B2, B12, D2) and dietary fibre. Numerous bio-components present in *L. edodes* aid in its pharmacological potency against hypertension, hyper lipidemia and cardiovascular complications, depressed immunity, hepatic disorders and cancer. In addition, its anti-oxidative, anti-fungal and anti-microbial aspects have been duly attributed to its bio-functional. Traditionally shiitake has been grown on natural logs of various species of trees. Commercial cultivation of shiitake is done on sawdust of broad leaves trees (tuni, poplar, oak, mango etc.) enriched with the organic nitrogen source.

Cultivation is carried out on saw dust i.e. tuni, mango (100kg), wheat bran (20kg), $CaCO_3$ (1kg) and $CaSO_4$ (0.5kg). The mixed substrate is filled in Poly Propylene bags (1.2- 1.5kg wet/ bag). Bags are sterilized in an autoclave at 1.54kg/cm² 90 min. spawn is inoculated @3% (wet wt basis, Through Spawning) and bags incubated at 4 hr/20 hr light / dark cycles at 23-25°C. Spawn run took 36-40 days including bump formation and browning. Cold water treatment by immersing the spawn run synthetic logs in cold water (6-8 °C) for 10-15 minutes after removing Polypropylene bag. A room temperature of 20-22°C, RH (85-90%) and light for 10-12 hours were maintained. After 3-4 days of the cold water treatment small primordia developed which mature into full grown fruit bodies in next 3-4 days.

Features of technology with their benefits

The technique reduces the long period required for the first harvest from 75 days to 45 days. The biological efficiency is more than 100%.



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Technology : 10

Name of technology	Zero Energy Poly tunnel (ZEPT): A rapid composting method for Agaricus bisporus / Button mushroom
Year of release	2011
Source of technology	ICAR-DMR, Solan
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All over the country with controlled and standardized conditions

Details of technology

In order to reduce time, energy, cost and environmental problems of existing available composting methods, zero energy poly tunnels for button mushroom compost production was designed and developed. The compost prepared from the zero energy poly tunnel was tested at farmer fields (seasonal and commercial farms). The main benefit of ZEPT technique is that it reduces 50% and 37% compost production cost as compared to short and long methods respectively. In terms of time this method reduces 60% and 40% composting period as compared to the long and short respectively. This is a natural and environment friendly 12-15 days compost process requires only 2 manual turning without additional infrastructure. It was concluded that compost characteristics and design of zero energy tunnel were based on bioengineering properties of the compost ingredients. The present process/technique of composting is completely based on the natural principle of passive aeration and heat mass transfer. Heat generated during the composting is used for pasteurization and conditioning hence it is energy free process and techniques is named as zero energy poly tunnel. This method increases significant amount of compost production (3.5 times saw material) and mushroom yield (22-28%) as compared to existing composting methods.

Features of technology with their benefits

- ❖ Zero energy poly tunnel helps to reduces huge amount of time (60%-40%), cost(50-37%) as compared to short and long methods and infrastructure and environmental problems which directly helps to improve the button mushroom production of growers.
- ❖ This technology provides additional income to the mushroom growers and the landless labours.



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Technology : 1

Name of technology	Chilli F1 hybrid: Arka Khyati
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Central Varietal Evaluation Committee (CVEC) under AICRP (VC) recommended for its cultivation in Zone IV (Punjab, UP, Bihar and Jharkand). However yet to get notified.

Details of technology

High yielding F1 hybrid for fresh market, early, fruits 11-12 X 1.5-2.0cm; smooth and low pungent, light green and turn red on maturity, tolerant cucumovirus (CMV), yield: 80-100q/ acre (fresh) and 25q/ acre (dry).

Features of technology with their benefits

- ❖ High yield.
- ❖ Suitable for green and dry chilli market.
- ❖ Tolerant to cucumber mosaic virus (CMV).



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Technology : 2

Name of technology	Chilli F1 hybrid: Arka Swetha
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Central Varietal Evaluation Committee (CVEC) under AICRP(V) recommended for its cultivation in Zone IV (Punjab,UP, Bihar and Jharkand). However yet to get notified.

Details of technology

High yielding F1 hybrid for fresh market, early, fruits 11-12 X1.5-2.0cm; smooth and low pungent, light green and turn red onmaturity, tolerant cucumovirus (CMV), yield: 80-100q/ acre(fresh) and 25q/ acre (dry).

Features of technology with their benefits

- ❖ High yield.
- ❖ Suitable for green and dry chilli market.
- ❖ Tolerant to cucumber mosaic virus (CMV).



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Technology : 3

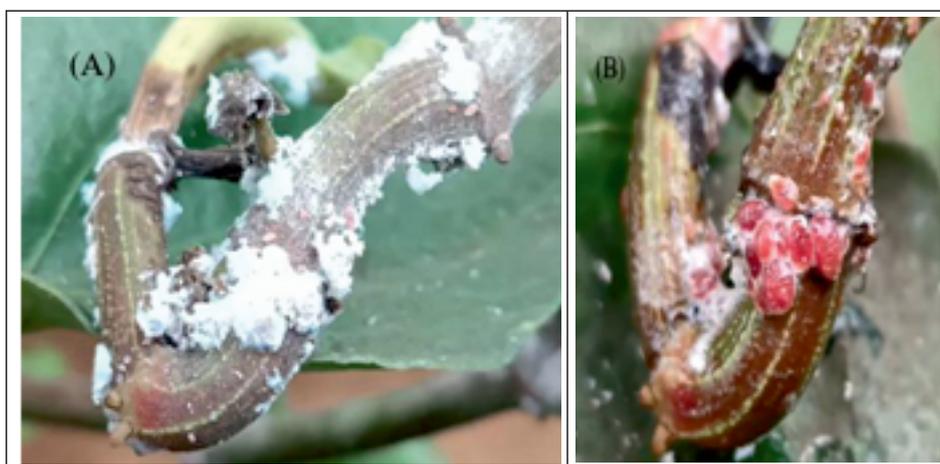
Name of technology	Arka Mealy Melt: Mealy bud wax solubilizer
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Spray Adjuvant
Recommended for region	Identified at Institute level

Details of technology

Keeping in view the difficulty to manage the mealybugs which are polyphagous and covered with mealy wax coating, the Arka-Mealymelt was developed to solubilize the wax coating around mealybugs, which acts as a barrier for insecticidal penetration. The blend has been evaluated on different horticultural crops infested with mealybugs.

Features of technology with their benefits

- ❖ A first of its kind formulation that dissolves the 'mealybug wax' covering its body that hinders insecticide penetration.
- ❖ Start-up spray as spot application.
- ❖ Can be rotated with botanical oils/insecticides depending on the severity of mealybug infestation.



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Technology : 4

Name of technology	Arka Shubhi: China Aster variety
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	China Aster
Recommended for region	Bagalkot, Bengaluru, Chikkaballapur, Dharwad, Mysore, Ramnagara and Tumakuru districts in Karnataka.

Details of technology

- ❖ Unique light pink flower colour (Red Purple group,65D, Fan 2).
- ❖ Average flower diameter: 5.04 cm.
- ❖ Average number of flowers per plant:56.
- ❖ Average stalk length: 47cm.
- ❖ Average vase life: 10 days.

Features of technology with their benefits

- ❖ Suitability: Cut flower, flower arrangement.



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Technology : 5

Name of technology	Arka Advika: China Aster Variety
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	China Aster
Recommended for region	Bagalkot, Bengaluru, Chikkaballapur, Dharwad, Mysore, Ramnagara and Tumakuru districts in Karnataka.

Details of technology

- ❖ Unique mutant with semi-double flower having short pseudo ray florets.
- ❖ Flowers are white in colour (White group, NN155D,Fan 4).
- ❖ Average number of flowers per plant : 36
- ❖ Average stalk length: 36 cm.
- ❖ Average vase life: 11 days.

Features of technology with their benefits

- ❖ Suitability: Cut flower, flower arrangement and bouquetmaking.



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Technology : 6

Name of technology	Arka Nirali: China Aster Variety
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	China Aster
Recommended for region	Karnataka (districts Bagalkot, Bengaluru, Chikkaballapur,Dharwad, Mysore, Ramnagara, Tumakuru)

Details of Technology

- ❖ Unique mutant with semi-double flower having short pseudo ray florets.
- ❖ Flowers are white in colour (White group, NN155D, Fan 4).
- ❖ Average number of flowers per plant : 36
- ❖ Average stalk length: 36 cm.
- ❖ Average vase life: 11 days.

Features of technology with their benefits

- ❖ Suitability: Cut flower, flower arrangement and bouquet making.



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Technology : 7

Name of technology	Arka Neelachal Pushti: Dolichos Bean variety
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Dolichos Bean
Recommended for region	Odisha and other Eastern regions with similar climatic conditions

Details of technology

- ❖ Bold seeded and attractive dark green pods at edible maturity stage.
- ❖ Medium size (7.5 x 1.5 cm) pods, weighing 30-40 g per 10pods, oval/cylindrical pods.
- ❖ High yield (24-25 t/ha).
- ❖ Rich in protein (4.61 g/ 100g) and micronutrients.

Features of technology with their benefits

- ❖ Bold seeded oval pods and culinary qualities of consumer' s preference.



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Technology : 8

Name of technology	Ridge gourd F1 hybrid: Arka vikram
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Ridge gourd
Recommended for region	Central Varietal Evaluation Committee (CVEC) under AICRP (VC) recommended for its cultivation in Zone IV(Punjab, UP, Bihar and Jharkand) and Zone VIII (Karnataka, Tamil Nadu, Andhra Pradesh and Kerala). However yet to get notified.

Details of technology

- ❖ Early flowering hybrid (46 days for first picking), green, long, tender fruits, and excellent cooking quality. Yields 34.0 t/ha in 120-135 days.

Features of technology with their benefits

- ❖ High yielding.
- ❖ Fruit quality.



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Technology : 9

Name of technology	Annona Based formulation for management of Aphids under organic production
Year of release	2021
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Vegetables (Okra, beans, bitter gourd, dolichos, cucumber etc.)
Recommended for region	Identified at Institute level

Details of technology

- ❖ Plant based EC (Emulsifiable concentrate) formulation is developed from *Annona squamosa*: A organic product, effective in controlling aphids @3.5ml/litre.

Features of technology with their benefits

- ❖ Very effective (up to 95-97%) even when pest out breaks.
- ❖ The developed technology very effective and can be used as both prophylactic and curative for the management of aphids.
- ❖ It's natural product/eco-friendly can be used under organic cultivation.
- ❖ Cost per litre: Rs. 1000.



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Technology : 10

Name of technology	Arka Haagarasa: Ready -to-serve (RTS) bitter gourd juice
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Bitter gourd
Recommended for region	Identified at Institute level

Details of technology

- ❖ The product is prepared by washing gourds, cutting into pieces, removal of seeds and inner fibrous material and blending in a mixer. Further depending on the requirement either it is sieved or unsieved and required ingredients such as- cucumber; om seeds lime, coriander leaves, pepper, etc were added and RTS juice prepared

Features of technology with their benefits

- ❖ It is less bitter than bitter gourd fruit and highly beneficial for persons suffering from diabetic.
- ❖ The product can be stored more than 6 months at room temperature.
- ❖ The product is highly profitable for Start-Up entrepreneurs, small and medium enterprises involved in fruit and vegetable processing and fruit beverage processing industry.



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Technology : 11

Name of technology	Arka Avocado chutney
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Avocado
Recommended for region	Karnataka (Coorg, Chikkamagalur, Hassan district); TamilNadu and Kerala

Details of technology

- ❖ The product is prepared from avocado fruit pulp after removing seeds and addition of different ingredients such as sugar, ginger, garlic paste, onion, salt red chilli powder, oil etc.

Features of technology with their benefits

- ❖ It can be regularly consumed as chutneys due to the incredible health benefits it has due to the butter fruit.
- ❖ The product is highly profitable for Start-Up entrepreneurs, small and medium enterprises involved in fruit and vegetable processing and fruit beverage processing industry.



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Technology : 12

Name of technology	Arka Avocado bread spread
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Avocado
Recommended for region	Karnataka (Coorg, Chikkamagalur, Hassan districts); Tamil Nadu and Kerala

Details of technology

- ❖ The product is prepared by washing ripe Avocado fruits, cutting, removal of seeds and peel, extraction of pulp and addition of powdered sugar followed by mixing and heating and addition of pectin, cocoa powder wherever required to adjust the acidity, and addition of preservative sodium benzoate and finally packing.

Features of technology with their benefits

- ❖ It can be regularly consumed as fruit jam or jelly due to the incredible health benefits it has due to the butter fruit.
- ❖ The product is highly profitable for Start-Up entrepreneurs, small and medium enterprises involved in fruit and vegetable processing and fruit beverage processing industry.



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Technology : 13

Name of technology	Gerbera variety: Arka red
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Gerbera
Recommended for region	All flower growing areas

Details of technology

- ❖ The flowers are bright red in colour.
- ❖ Double in nature.

Features of technology with their benefits

- ❖ It is best suitable for growing outside.
- ❖ It is suitable for both beds and cut flower.
- ❖ It yields 360 flower per sq meter per year.
- ❖ It can be planted anytime.



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Technology : 14

Name of technology	Arka sasya poshak ras: A liquid nutrient formulation for soilless Vegetable production
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Vegetables
Recommended for region	Entire country (especially in the urban and peri-urban agricultural space)

Details of technology

- ❖ The liquid nutrient formulation (comprising solutions A & B) is a unique balanced blend of the macro (N, P, K, Ca, Mg and S) and micro nutrients (Fe, Mn, Cu, Zn, B and Mo) which are required to support the growth of vegetables grown on cocopeat.

Features of technology with their benefits

- ❖ This nutrient formulation is suitable for most commonly grown vegetables (tomato, chilli, cabbage, zucchini, cucumber, ridge gourd, french bean, peas, cow pea, dolichos etc.) and leafy vegetables (amaranthus, coriander and palak etc.).
- ❖ It is highly suited for cocopeat based cultivation under balcony/terrace gardening/open and polyhouse condition.



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Technology : 15

Name of technology	Arka Herbiwash
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Fruits and vegetables
Recommended for region	All regions

Details of technology

- ❖ The product is a powder derived from plants.
- ❖ It is a simple and completely safe herbal product to be used to wash fruits and vegetables with, in order to remove surface residues of pesticides from fruits and vegetables to an extent of 30% or more, than that is possible by running water wash.

Features of technology with their benefits

- ❖ The product is also cheap and can be easily prepared.
- ❖ It was observed that best results are obtained when the product is used mixed in water with moderate agitation of water or accompanied by scrubbing action with hands.
- ❖ The extent of removal of surface residues of pesticides from fruits and vegetables using this product is 80 – 100% depending upon the type of pesticide.



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Technology : 16

Name of technology	Arka Viral Kit
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region	Identified at Institute level

Details of technology

- ❖ It is Loop-Mediated Isothermal Amplification (LAMP) kit to diagnose tomato leaf curl Bangalore virus (ToLCBV).
- ❖ It is superior to other molecular techniques like PCR, RT-PCR, and real-time PCR due to its high specificity, sensitivity, and rapidity.

Features of technology with their benefits

- ❖ It is user friendly method wherein, the process can be done simply by using water bath or dry bath.
- ❖ It is a cost effective technology as compared to other PCR based diagnosis kits.



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Technology : 17

Name of technology	Teasel gourd variety Arka Bharath
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Teasel gourd
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ It is a vigorous growing plant; vine grows up to 6 m tall and robust.
- ❖ Fruits are attractive, dark green, long oval fruit with soft seed and high quality edible pulp portion for culinary purpose.

Features of technology with their benefits

- ❖ Individual fruit weight is 110 g.
- ❖ The fruit yield potential is 10 t/h.



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Technology : 18

Name of technology	Ridge gourd variety: Arka Prasan
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Ridge gourd
Recommended for region	Karnataka State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Karnataka. However yet to get notified

Details of technology

- ❖ Open pollinated early variety (42-45 days for first picking), green, long, tender fruits, and excellent cooking quality.
- ❖ Yields 26.0 t/ha in 120-135 days.

Features of technology with their benefits

- ❖ High yielding.
- ❖ Fruit quality.



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Technology : 19

Name of technology	Avocado variety Arka Supreme
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Avacado
Recommended for region	

Details of Technology

- ❖ The fruits are oblong with 7.8° Brix TSS.
- ❖ The flowering behaviour of this variety falls under Type“ A ” category.
- ❖ Total fat content in the fruit is 20.0 %.

Features of technology with their benefits

- ❖ It is a regular bearing and high yielding genotype with spreading type growth habit.
- ❖ A fully grown tree gives the fruit yield about 370-400 kg/ plant with average fruit weight of 367-428 g.



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Technology : 20

Name of technology	Pummelo variety Arkachandra
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Pummelo
Recommended for region	Karnataka, Assam, Bihar and West Bengal

Details of technology

- ❖ It is a clonal variant of pummelo accession-18. The tree is medium size (2.0-3.0m), with spreading branches and bears fruits in two season in a year. The fruit weight ranged from 0.8-1.0kg, spheroid fruit shape and has creamy white pulp (White group 155 A), TSS (11-12°B), acidity (0.89%) and sweet in taste with low level of Naringenin (344.75 ng/ml) and a bitter principle and suitable for fresh consumption. It can yield an average of 35-40 fruits/plant/season after 4 years after planting) and average yield of 180-200kg/plant/year in 10 years old trees.

Features of technology with their benefits

- ❖ It is a medium vigorous, high yielding, less acidity, sweet in taste and suitable for fresh consumption.



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Technology : 21

Name of technology	Pummelo variety Arka Anantha
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Pummelo
Recommended for region	Karnataka, Assam, Bihar and West Bengal

Details of technology

It is a clonal variant of pummelo accession-25. The tree is medium size (2.0-3.0 m) with drooping branches and it bears fruits in two season in a year. The fruit weight ranged from 0.9-1.2 kg, oblique fruit shape and has pink pulp, TSS (11-12°B), acidity (1.2 %), sweet in taste with low level of Naringen in (156.64ng/ml) as a bitter principle and suitable for fresh consumption. It can yield an average of 80-90 fruits/plant/season after 4 years after Planting and average yield of 200-250 kg/plant/year in 10 years old trees.

Features of technology with their benefits

- ❖ It is a medium vigorous, high yielding, less acidity, sweet intaste and suitable for fresh consumption.



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Technology : 22

Name of technology	Jackfruit chocolate (ARKA JACHOLATE)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Jackfruit
Recommended for region	Karnataka (Tumkur, Chitradurga, Ramnagara, Dakshina Kannada, Bangalore Urban, Belgavi), Kerala and Maharashtra (Ratnagiri)

Details of technology

- ❖ Arka Jackolate is jackfruit seed powder and mushroom based chocolate developed by a ICAR-IIHR, Bengaluru. Seeds constitute 12-23% of a fresh jackfruit, which is thrown away as waste. Jackfruit seed contains 60-65% starch (RS-Type-2), 2% crude fibre and an array of phytochemicals reported to have antibiotic and anti-cancerous properties.

Features of technology with their benefits

- ❖ Technology has been developed to deliver such a wonderful natural product to the body through chocolate, which is most liked by all age groups. The technology comprises of packaging jackfruit seed powder with several other natural ingredients like mushroom, sesame, butter, etc., in certain proportion and wrapping it with chocolate.
- ❖ The product is highly tasty and nutritious with 5.0-6.0% protein, lesser fat and calorific value, higher fibre and antioxidant activity.



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Technology : 23

Name of technology	Jackfruit RTD beverage (ARKA HALASURAS):
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Jackfruit
Recommended for region	Karnataka (Tumkur, Chitradurga, Ramnagara, Dakshina Kannada, Bangalore Urban, Belgavi), Kerala and Maharashtra (Ratnagiri)

Details of technology

ICAR-IIHR, Bengaluru has for the first time developed, Arka Halasuras, an enzyme clarified Ready-To-Drink Jackfruit beverage. Jackfruit pulp (soft or firm types) is liquefied using a cocktail of enzymes and serum is separated. The separated serum is diluted with water in a particular ratio to adjust the total soluble solids in the desired range and stabilized. This beverage has no added sugar or acid or preservative and has a shelf life of 6 months in glass bottle under normal room temperature.

Features of technology with their benefits

This is a first of its kind product from any research lab in India. The product is nutritious with 15-18mg /100 ml vitamin C; 2.1- 2.4 mg/100ml total carotenoids, 1.1-1.2mg/100ml antioxidants. The sweetness is mainly due to its inherent fructose and sorbitol. The in vitro studies showed the jackfruit to have anti -bacterial activity. One kilogram of fruit can yield 2.5-3.0 litres of ready to drink juice.



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Technology : 24

Name of technology	Water melon Variety: Arka Shyama
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Watermelon
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ It is an icebox segment watermelon variety with dark greenish black rind, oblong fruit shape of 3-4kg weight, early (65-70 days to harvest) possessing dark red coloured, crispy, sweet (TSS-12%) flesh.

Features of technology with their benefits

- ❖ The yield potential is 62.8 t / h.



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Technology : 25

Name of technology	Arka Iron Fortified Mushroom
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All the states/districts of the country

Details of technology

- ❖ It is production of iron fortified elm oyster mushroom (*Hypsizygusulmarius*).
- ❖ The iron content of iron fortified mushroom has increased from 135.60 ppm in non-fortified mushroom to 338.15 ppm in iron fortified mushroom which is an increase of 149.37%.

Features of technology with their benefits

- ❖ The bio availability of iron from iron fortified mushroom is 21.68% which is very high as compared to iron bio availability from plant sources which is 5-8% or from inorganic iron supplements which is 10-12%.



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Technology : 26

Name of technology	Chilli F1 hybrid Arka Tejasvi (H 41)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ Suitable for dry small (Teja) segment, plants are medium tall & spreading, fruits are pendent, 7-8 x 1-1.1 cm, firm, highly pungent (90-95000 SHU), green and turn deep red (90-100 ASTA) on maturity medium wrinkled and resistant to powdery mildew and Ch LCV.

Features of technology with their benefits

- ❖ The yield potential is 30-35q dry chilli yield/ acre.



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Technology : 27

Name of technology	Chilli F1 hybrid ArkaYashasvi (H 8)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ Suitable for dry medium segment, plants tall & spreading, fruits pendent, 9-10 x 1.2-1.4 cm, firm, medium pungent (40-50000 SHU), green and turn deep red on maturity (90-100 ASTA), medium wrinkled and tolerant to powdery mildew, RKN (root knot nematodes) and resistant to ChLCV.

Features of technology with their benefits

- ❖ The yield potential is 30-35 q dry chilli yield/acre.



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Technology : 28

Name of technology	Chilli F1 hybrid Arka Saanvi (H 19)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Released at Institute. It is under multi location trials

Details of Technology

- ❖ Plants medium tall & spreading, fruits pendent, 8-9 x 1cm, firm, medium pungent, green and turns deep red on maturity, medium wrinkled and tolerant to begomovirus (ChLCV), yield potential 25-28 q dry chilli yield/ acre (or) 80-100 q green chilli yield /acre.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Suitable for green and dry chilli market.
- ❖ Tolerant to chilli leaf curl virus.



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Technology : 29

Name of technology	Chilli F1 hybrid Arka Tanvi (H 45)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ Suitable for dual medium segment, plants tall & spreading, fruits pendent, 9-10 x 1-1.1 cm, firm, medium pungent (60-65,000 SHU), green and turn deep red (90-100 ASTA) on maturity, dry fruits wrinkled and tolerant to powdery mildew, RKN (root knot nematodes) and resistant to ChLCV.

Features of technology with their benefits

- ❖ The yield potential 30-35q dry chilli yield/ acre (or) 100q green chilli yield / acre.



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Technology : 30

Name of technology	Chilli F1 hybrid Arka Gagan (H 30)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region	Released at Institute. It is under multi location trials

Details of Technology

- ❖ Plants medium tall and spreading, fruits 7-8 x 0.8-1cm, firm, highly pungent, green turns red on maturity, medium wrinkled and tolerant to begomovirus (ChLCV), yield potential 25q dry chilli yield/ acre (or) 80-100 q green chilli yield/acre.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Suitable for green chilli market.
- ❖ Tolerant to Chilli leaf curl virus.



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Technology : 31

Name of technology	Brinjal variety: Arka Avinash
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region	Central Varietal Evaluation Committee (CVEC) under AICRP (VC) recommended for its cultivation in Zone VIII (Karnataka, TN, AP and Kerala).

Details of technology

- ❖ High yielding with bacterial wilt resistant. Plant is tall and spreading. Fruits green long with fleshy green calyx. Very early in fruit maturity. It yields 40-42 t/ha in 95-115 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Green long fruits.
- ❖ Resistant to bacterial wilt.



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Technology : 32

Name of technology	Bottle gourd F1 hybrid: Arka Ganga
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Bottle gourd
Recommended for region	Identified for release at Institute and is under multi location trials

Details of technology

- ❖ F1 hybrid Arka Ganga is resistant to gummy stem blight (*Didymella bryoniae*) with a yield potential of 58 t/ha.
- ❖ Fruits are green and oblong / oval.
- ❖ This hybrid will be ready to first picking by 56 days after planting.
- ❖ It is an open pollinated variety.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruits short cylindrical.
- ❖ Resistant to gummy stem blight.



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Technology : 33

Name of technology	Bottle gourd variety Arka Shreyas
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Bottle gourd
Recommended for region	Identified for release at Institute and is under multi location trials

Details of technology

- ❖ Arka Shreyas resistant to gummy stem blight (*Didymella bryoniae*) with yield potential of 48 t/ha.
- ❖ Fruits are green and club shape.
- ❖ This variety will be ready to first picking by 60 days.
- ❖ It is an open pollinated variety.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Club shape fruits.
- ❖ Resistant to gummy stem blight.



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Technology : 34

Name of technology	Bottle gourd variety Arka Nutan
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Bottle gourd
Recommended for region	Identified for release at Institute and is under multi location trials

Details of technology

- ❖ Arka Nutan is moderately resistant to gummy stem blight (*Didymella bryoniae*) with a yield potential of 46 t/ha.
- ❖ Fruits are light green medium cylindrical.
- ❖ This variety will be ready to first picking by 56 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruits medium cylindrical.
- ❖ Resistant to gummy stem blight.



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Technology : 35

Name of technology	Arka Cucurlure
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Cucurbits
Recommended for region	All over India

Details of technology

- ❖ A novel kairomone blend for effective trapping of male melon flies, *Zeugodacus cucurbitae*.

Features of technology with their benefits

- ❖ This technology is based on a combinative plant volatile from cucurbitaceous fruits and cue lure.
- ❖ Attracts a large number of males (~50%) over conventional cue lure trap.



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Technology : 36

Name of technology	Marigold hybrids Arka Shubha (MOH 1-2)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Marigold
Recommended for region	Karnataka and Andhra Pradesh

Details of technology

- ❖ 'Arka Shubha' is a F1 hybrid of African Marigold identified for its carotenoid content.
- ❖ Plants are spreading type with an yield potential is 12-14 tons/acre.

Features of technology with their benefits

- ❖ Flowers are orange in colour (RHS colour orange group N25C) with shelf life of 5-6 days.
- ❖ Arka Shubha is rich with 3.25% (g/100g dry wt) carotenoid content.



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Technology : 37

Name of technology	Marigold Hybrids: Arka Vibha (MOH 5-3)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Marigold
Recommended for region	Karnataka and Andhra Pradesh

Details of technology

- ❖ Arka Vibha' is a F1 hybrid of African Marigold identified for its attractive flower shape and keeping quality.
- ❖ Yield potential is 10-12 tons/acre.

Features of technology with their benefits

- ❖ Flowers are highly compact and attractive orange colour (RHS colour orange group N25 C) with a shelf life of 8-9 day.



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Technology : 38

Name of technology	Marigold hybrids Arka Abhi (MYH 2-1)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Marigold
Recommended for region	Karnataka and Andra Pradesh

Details of technology

- ❖ Arka Abhi' is F1 hybrid of African Marigold identified for its attractive radiant lemon yellow colour.
- ❖ Flowers are large in size (7-8cm) with radiant bright lemon yellow colour (RHS Yellow group 5 A).

Features of technology with their benefits

- ❖ It is high yielding F1 hybrid with 10-11 t/acre with flowers having good shelf life (6-8 days).



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Technology : 39

Name of technology	Marigold hybrids Arka Bhanu (MYH 1-4)
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Marigold
Recommended for region	Karnataka and Andra Pradesh

Details of technology

- ❖ Arka Bhanu is a F1 hybrid of Marigold identified for its attractive flower shape and golden yellow colour (RHS Yellow group 12 B).

Features of technology with their benefits

- ❖ Flowers are compact with a shelf life of 7-8 days.
- ❖ Yield potential is 10-11 tons/acre.



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Technology : 40

Name of technology	Arka probio pineapple juice
Year of release	2020
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Pineapple
Recommended for region	West Bengal, Tripura, Kerala, Karnataka and Tamil Nadu

Details of Technology

Ready to serve Pineapple beverage was prepared using 70% pulp from cv. Kew and Queen with final sugar concentration made up to about 15% using sugar syrup.

Features of technology with their benefits

No acid or any other preservative was added into the beverage. As fructooligosachharides (FOS) act as prebiotic and gives a good mouth feel, it was added to the beverage prior to pasteurization. In addition to FOS, hydrocolloid at a specific concentration was added to the beverage to impart a good texture and body to the beverage. The beverage was pasteurized at 85°C for 5 minutes and transferred to pre-sterilized 200 ml glass bottles. The sealed bottles were pasteurized again at 80°C for 15 minutes and cooled.



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Technology : 41

Name of technology	Spray dried avocado powder
Year of release	2019-20
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Avocado
Recommended for region	Karnataka (Coorg, Chikkamagalur, Hassan districts); Tamil Nadu and Kerala

Details of technology

- ❖ Avocado is a seasonal fruit with important nutraceutical and cosmeceutical properties.
- ❖ This process technology involves spray drying avocado pulp homogenized with acidulant, emulsifier and encapsulating agent, at optimized conditions of in let temperature, feed flow rate and encapsulator concentration.
- ❖ High quality avocado powder, stable for more than three months at room temperature is obtained.

Features of technology with their benefits

- ❖ This product will ensure year round demand for avocado fruits, as also supply of the value added spray dried avocado powder, which is convenient to use and transport.
- ❖ There is a promising market both within India and abroad for this product.
- ❖ The Cost: Benefit ratio is 1:1.78.



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Technology : 42

Name of technology	Arka Neelachal Fertree drill
Year of release	2019-20
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region	In all the regions of India

Details of technology

- ❖ Application of fertilizers in the orchard of fruit crops is labour intensive and costly affair.
- ❖ Presently there is no power tiller attached fertilizer drill for fruit crops which can be used for efficient delivery of fertilizers within short spell of time.
- ❖ It is an efficient and cost effective power tiller mounted implement for fertilizer application in fruit crops.
- ❖ Suitability - Fruit/plantation crops.
- ❖ Fertilizer Delivery rate - 4-10 kg/minute.
- ❖ Depth of fertilizer placement – 20- 25 cm.
- ❖ Coverage area/day - 1 ha (planting density - 400/ha),2 ha (planting density - 100/ha).
- ❖ Cost of application/day- Rs. 1800/day.
- ❖ Cost effectiveness - Rs. 1800:4000 (222%).
- ❖ Labour/work efficiency- 3: 16 (533%) (planting density -100/ha).
- ❖ Cost effectiveness - Rs. 1800:4000 (222%) Labour/work efficiency- 3: 16 (533%).

Features of technology with their benefits

Drill has been designed in such a manner that it can be attached perfectly with the power tiller and could deliver fertilizer effectively in the feeder root zone of perennial fruit crops.



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Technology : 43

Name of technology	Embryogenic cell suspensions for mass multiplication of banana (cv Elakki bale)
Year of release	2019-20
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Banana
Recommended for region	All regions

Details of technology

Banana cv Elakki bale (AB) is one of the commercially grown cultivars in southern parts of India. Due to its low multiplication rate, the commercial propagation using apical meristems is unable to meet the growing demand for planting material

Features of technology with their benefits

- ❖ The large scale micro-propagation of elakki bale using embryogenic cell suspension (ECS) has been developed (one lakh plants/embryogenic calli) and field evaluation of embryo derived plantlets showed normal phenotype as compared to sucker or shoot tip plants. Hence the current embryogenesis protocol can be an alternative technique for mass propagation of elakki bale.



Fig: Regeneration of plantlets from embryogenic cells suspension (a) Embryogenic callus (b) ECS (c) Developed somatic embryos (d) Germinated plantlets (e) Rooted plantlets (f) Hardened plantlets

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Technology : 44

Name of technology	Solar power operated tricycle cart for vending ready to harvest Fresh mushroom
Year of release	2019-20
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region	All districts/states of the country

Details of technology

Technology relates to the vending of oyster mushroom by using Solar Powered tricycle cart for ready to harvest fresh oyster mushrooms to the customers at their doorstep. The overall dimension of the mushroom bags holding chamber is 1.5 x 1 x 1 m which is made up of aluminium frames and fittings. It is covered with nylon 40 mesh to protect the entry of insects and to facilitate the aeration. It is further covered with locally available gunny bag all around and it is wetted to maintain humidity inside the chamber. It can hold 36 Nos of 1 kg/2kg bags inside the chamber. A 30 W DC misting diaphragm pump with 10 nozzles of 0.1mm size to produce more than 100 bar pressure to get very fine misting inside the chamber. It can be operated either by electric power or using Solar power system with 300 W panel, inverter, 12V storage battery and a timer. The entire growing chamber is mounted on a tricycle frame. The tricycle is powered by a 48V, 750 W DC geared motor. A voltage controller and Lithium Ion battery of 24 Ah is used to store solar power to source DC power to geared motor and mist pump. The solar panels are mounted on the roof top of the frame.

Features of technology with their benefits

It takes the mushroom as fresh to the customers in a hygienic condition and gives the choice to the customer for selection. It will enhance the mushroom sale and its consumption among the rural and urban people. It can develop entrepreneur development in the fabrication and selling of these units to the growers. The women/small scale mushroom growers will be helped in growing mushroom at their home level in the rural and urban areas.



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Technology : 45

Name of technology	Mango hybrid: Arka Suprabath (Hybrid 14)
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mango
Recommended for region	All mango growing regions of India

Details of technology

It is a double- cross hybrid developed by using parents Amrapali (which is a cross of Dashehari and Neelam) and Arka Anmol (which is a cross of Alphonso and Janardhan Pasand). Arka Suprabath is a rare variety as it has got Alphonso shape with the pulp colour of Amrapali. Tastewise, it is sweet with less acidic properties (0.12%). Its deep orange firm pulp is less fibrous than other varieties. Alphonso tends to show irregular bearing after 15 to 20 years of cultivation, but Arka Suprabath grows consistently in bunches. It is a medium vigorous, regular bearing, high yielding (35-40kg/plant on 4th bearing year or 8th year of planting), fruit weight ranged from 200-250g, fruit shape is like Alphonso and has pulp colour of Amrapali, deep orange firm pulp, pulp recovery (>70%), TSS (>22°B), acidity(0.12%), carotenoids (21.10 mg/100g FW) and flavonoids (9.91 mg/100g FW) and it has got the shelf life of 8-10 days at room temperature.

Features of technology with their benefits

It is a medium vigorous, regular bearing, high yielding and free from spongy tissue.



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Technology : 46

Name of technology	Tomato F1 hybrid: Arka Aditya
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region	Notified for Zone VII (Madhya Pradesh, Maharashtra and Goa) and Zone VIII (Karnataka, Tamil Nadu, Andhra Pradesh and Kerala)

Details of technology

- ❖ High yielding F1 hybrid with triple disease resistance to Tomato Leaf Curl Disease ($Ty2+Ty3$), bacterial wilt and early blight. Plants are semi-determinate with dark green foliage. Fruits are firm, deep red, oblate round, medium large(90-100g). Suitable for summer, kharif and rabi cultivation. Bred for fresh market and yield potential 60 to 70 t/ha in 140-150 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.
- ❖ Resistant to LCV, BW and early blight.



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Technology : 47

Name of technology	Tomato F1 hybrid: Arka Vishesh
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ It has the yield potential of 750-800 q/ha. It is suitable for processing into puree, paste, ketchup, sauce, tomato crush.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality (suitable for fresh market & processing).
- ❖ Resistant to LCV, BW and early blight.



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Technology : 48

Name of technology	Tomato F1 hybrid: Arka Apeksha
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region	Released at Institute. It is under multi location trials

Details of technology

- ❖ It has the yield potential of 800-900 q/ha. It is suitable for processing into puree, paste, ketchup, sauce, tomato crush.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality (suitable for fresh market & processing).
- ❖ Resistant to LCV, BW and early blight.



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Technology : 49

Name of technology	French Bean: Arka Sharath
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	French bean bush type
Recommended for region	Notified for Karnataka

Details of technology

- ❖ Plants are bushy and photo-insensitive. Round, string less, smooth pods suitable for steam cooking. Pods are crisp, fleshy with no parchment and perfectly round on cross section. Pod yield is 18.5 t/ha in 70 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.



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Technology : 50

Name of technology	Cowpea: Arka Mangala
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Cowpea pole type
Recommended for region	Notified for Karnataka

Details of technology

- ❖ Plants tall (3-4 m), pods are very long (80 cm), light green, string less, round, tender with crisp texture and matures in 60 days. Suitable for kharif and rabi. Pod yield is 25 t/ha in 100 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.



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Technology : 51

Name of technology	Dolichos bean: Arka Supriya
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Dolichos bean Pole type
Recommended for region	Notified for Zone VII (MP, MH & Goa)

Details of Technology

- ❖ The pods are light green, flat and long and bearing in clusters. It is Photo-sensitive and suitable for Rabi season only. Yield potential of 272.1 q/ha.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.



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Technology : 52

Name of technology	Onion: Arka Bheem
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Onion
Recommended for region	Notified for Karnataka

Details of technology

- ❖ It is a tri-parental synthetic variety with Red to pinkish red elongated globe shaped bulbs. Average bulb weight is 120 g. Yield is 47 t/ha in 130 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.



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Technology : 53

Name of technology	Amaranthus : Arka Samraksha
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Amaranthus
Recommended for region	Notified for Karnataka

Details of technology

- ❖ It is a pulling type, rich in antioxidant activity (499 mg AEAC units), low in nitrates and oxalates, yields 10-12 t/ha in 30-35 days.

Features of technology with their benefits

- ❖ High yield with leaf quality.
- ❖ Rich in antioxidant activity.
- ❖ Low in nitrates and oxalates.



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Technology : 54

Name of technology	Amarnath : Arka Varna
Year of release	2019
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Amaranthus
Recommended for region	Notified for Karnataka

Details of technology

- ❖ It is a pulling type, rich in antioxidant activity (417 mg AEAC units), low in nitrates and oxalates, yields 10-12 t/ha in 30-35 days.

Features of technology with their benefits

- ❖ High yield with leaf quality.
- ❖ Rich in antioxidant activity.
- ❖ Low in nitrates and oxalates.



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Technology : 55

Name of technology	Management of DBM and aphids using neem seed powder formulations (Arka neem seed powder pellet formulation)
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region	Identified at Institute level

Details of technology

- ❖ The main limitation for using neem seed powder is cumbersome and time-consuming process and the resulting extract is highly unstable with a short shelf life. Thus the present talc-based neem seed powder pellets were developed for increased insecticidal efficacy and shelf life in ready-to-use form

Features of technology with their benefits

- ❖ The technology has significantly reduced the number of insecticide sprays from 20 applications in conventional practice to 7-8 using NSPPF.
- ❖ The farmer earned a profit of Rs. 98000/- from 0.5 acre of cauliflower by adopting ICAR-IIHR's NSPPF. While following chemical management practices he has earned around only Rs.55, 000/- profit.
- ❖ B: C ratio for NSPPF field was around 4.58 compared to 2.10 in case of chemical pest management. The net gain of Rs. 43000/- was mainly due to reduction from plant protection (insecticide) cost and higher remuneration from the pesticide free produce.



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Technology : 56

Name of technology	Arka Bactro+
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	IPM
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

With an objective to develop a novel single parapherom one synergistic to attract both *Bactrocera dorsalis* and *Bactrocera correcta*, this combination of synergist with para pheromone is developed to attract males of both the species.

Features of technology with their benefits

This technology attracts a large number of male flies of multiple species, mainly *B. correcta* (Guava Fruit fly) and *B. dorsalis*. The methodology is simple and involves the mixing of synergist with para-pheromone (ME) in an adjunct or emulsifier and the raw materials are also readily available.

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Technology : 57

Name of technology	Arka Dorsolure-F
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	IPM
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

Arka - Dorsolure-F containing a blend of kairomones (Product A+ Product B + Product C + suitable emulsifier and stabilizers) from plants that have electrophysiological excitation, impregnated in anovel designed septum to *Bactrocera dorsalis* females. This technology attracts a large number of females (upto 150/trap). This technology targets female *B. dorsalis* and mostly gravid (Proved in lab and field studies).

Features of technology with their benefits

The trapping of gravid females exponentially decreased the future generations of *B. dorsalis*, thereby, linking the potential of this technology in IPM, fruit fly control and eradication programs. As far as kairomone traps for *B. dorsalis* is concerned, this technology is the first of its kind in the world

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Technology : 58

Name of technology	Improved version of Sealer cum Healer for the control of Mango stem borer (Arka Borer control)
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mango
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

The innovated formulation consists of several inert materials to serve as carrier and herbal oils to be effective for one season without adding any insecticide. This formulation is mixed with water in a ration of 1:0.4 (approx) to bring down to gel form or melted ice cream consistency to be applied on mango stem using 2 or 3 inches brush. The swabbed formulation is allowed to dry on plant so that it works as repellent and as well as curative treatment to neutralize the eggs, early instars of larvae and grubs living on stem. The improved formulation of SCH was significantly superior to control by avoiding infestation up to 8weeks in laboratory trial. When the trial was continued further for 16 weeks the female beetle spent time up to 3.3 percent of its total time compared to 60.3% of its time in control suggesting its repellence effect up to 4 months. The product swabbed with older formulation and immersed in water for overnight lost nearly 52%of swabbed SCH but in new formulation the loss on solubility was less than 1%.

Features of technology with their benefits

The product is now made suitable for both low and heavy rain fall areas and also ovipositing deterrent for mango stem borer *Batocera rufomaculata* and hence can be applied as an effective prophylactic measure.

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Technology : 59

Name of technology	Management of Thrips on Capsicum by Entomo- pathogen, Metarhizium anisopliae
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Capsicum
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

Potential biological control agents such as entom. - pathogens were isolated and their bio efficacy was tested. The present biological control strategy developed by using Metarhizium Anisopliae which is effective and non-chemical, pesticide free, eco-friendly, conserves bio- diversity and no phytotoxicity was recorded. This is a naturally occurring organism that is prepared using chickpea, plant oil and adjuvants.

Features of technology with their benefits

Application of M.anisopliae @ 1×10^7 spores/ml resulted in significantly higher yield of capsicum (3.1kg/plant) and low incidence of thrips (3.6/plant) compared to the control (0.825kg/plant and 11.42 thrips/plant). This oil based formulation has more than a year of shelf life compared to the commercial formulations.

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Technology : 60

Name of technology	Arka mechanized raw jackfruit peeler
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Jack fruit
Recommended for region (Names of districts/states)	Tamil Nadu, Orissa and Kerala

Details of technology

The minimal processing of the jackfruit involving mechanised peeling of the skin using modified wood planer hastens the process of peeling by five times as compared to the manual traditional peeling by using knife. This hassle free and quick method of peeling can process 4-5 kg weighing jackfruit in less than five minutes. The mechanical peeling could not only reduce the drudgery involved in the manual peeling but also saved lot of time.

Features of technology with their benefits

The implement has two components like the peeling unit and the stainless steel box. The peeling unit is power operated. The box encloses the peeling unit and collects the peel scrapings. It is provided with bolt holes to secure it on a surface. The upper surface has the peeling base supported on SS square bars. The peeling base holds the peeling machine.



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Technology : 61

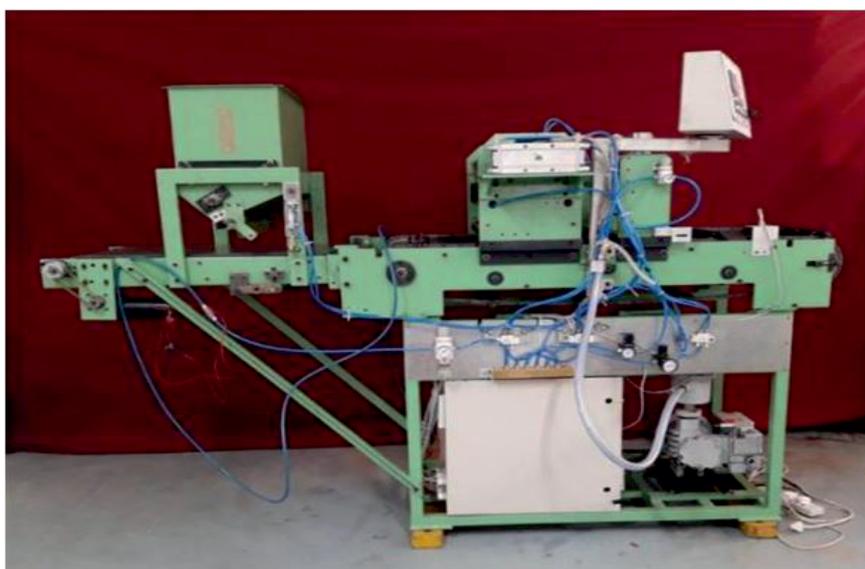
Name of technology	Arka automatic step seeder for vegetable nursery
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Vegetable nursery
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

The machine designed is suitable for 98 protray cell which is widely used for vegetable nursery raising. This system consisted of protray conveyor and indexing system, dibbling unit, seeds owing unit, penumatic systems, electronic controls, vacuum pump, compressor and programmable logic controller (PLC). About eight man hours are required to sow 10 trays /hr, where as with this machine 150 protrays/hr can be sown.

Features of technology with their benefits

- ❖ With this, the seedling production cost will be reduced which will lead to reduce in input cost of farming.
- ❖ The present machine was calibrated for sowing tomato, capsicum, brinjal and chilli seeds.
- ❖ There was 94% pick up by the machine sown trays and % germination by machine and manual methods were on par.


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Technology : 62

Name of technology	Integrated management of tomato moth <i>Tutaabsoluta</i> on tomato under polyhouse conditions
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

Tomato moth, *Tutaabsoluta* (Meyrick) (Lepidoptera: Gelechiidae) is one of the major invasive pests of tomato with a potential to incur 100 % yield losses particularly under tomato grown under poly house conditions. The effective package for the control of Tuta consists of use of incandescent bulb @ one bulb/150 m² + 1 pheromone trap/300 m² + need based spray of spinosad 0.25ml/l/flubendiamide @ 0.20 ml/l in rotation at 3 weeks interval. Coinciding with the peak emergence of the Tuta adults, spray of decamethrin 2.5 EC @ 1 ml/l for killing adults. Light traps are to be kept before transplanting of the crop itself.

Features of technology with their benefits

All the materials required are locally available, farmer friendly, economical & ecologically viable. With this package, number of eggs laid by Tuta was also significantly lower in IPM plots when compared to non-IPM plots (up to 30/leaf in IPM plots as against 0-2 eggs/leaf under IPM conditions).

Note (other points to be kept in mind in IPM plots): Light/pheromone traps are to be installed before transplanting of the crop itself for effective pest monitoring and management; remove and destroy the affected plant parts and alternate hosts etc.



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Technology : 63

Name of technology	Interspecific grafting- A strategy for mitigation of flooding stress in tomato
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

Tomato is most susceptible to flooding stress. Since there are no flood-tolerant tomato genotypes available, root-stock grafting is considered as an effective and simple technique to combat flooding conditions.

Features of technology with their benefits

- ❖ Different Brinjal genotypes were tried as root-stocks for Arka Rakshak and it was found that Arka Neelkant variety of brinjal is efficient and suitable root stock to combat flooding in tomato with lesser decline in the gas exchange parameters, photosynthesis rate (PN), stomatal conductance (gs) and internal CO₂ concentration (Ci), chlorophyll fluorescence, leaf water potential (L) and chlorophyll content, accumulated higher sugars, starch, better survival and plant yield as compared to self-grafted and un-grafted plants.
- ❖ Splice grafting under 85% RH has given 80-95% graft success.


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Technology : 64

Name of technology	Power operated Onion detopper
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Onion
Recommended for region (Names of districts/states)	Maharashtra, Karnataka, Madhya Pradesh and Gujarat

Details of technology

De-topping is one of the unique operations in cultivation of onion crop and it is tedious, laborious and time consuming operation demanding huge labour to the extent of 12.5 man-hrs/t. This power operated onion de-topper consists of a feed conveyor for feeding cured onion crop, de-topping rollers for shearing the leaves, separate collection chutes for the de-topped onion bulbs and leaves, main frame, power and power transmission system. The onion detopper was powered by a three phase, 2 hp, 900 rpm electrical motor with necessary speed reduction gear box.

Features of technology with their benefits

The performance parameters of onion de-topper were found to be 98 % de-topping efficiency, 0.98 effectiveness of de-topping, 2 % damage and 300 kg/hcapacity at 200 rpm with the machinery costing about Rs.1,50,000/- per unit.



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Technology : 65

Name of technology	Arka mushroom chutney powders
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region (Names of districts/states)	All districts/states

Details of technology

The Arka Mushroom chutney powder technology relates to the usage of dry oyster mushroom for the production of mushroom chutney powder or chutney podi which can be used for the nutrition enhancement of daily household diet both at rural and urban levels. Although mushrooms are very well known for their culinary medicinal properties, their consumption has been limited due to short shelf life, irregular availability and high cost. People are not aware about the usage of dry mushrooms and the ways in which mushrooms can be fortified in everyday diet to enhance its flavor and nutrition. The seven variants of Arka mushroom chutney powder combines the traditional taste and nutritive goodness of mushrooms with traditional healing herbs like Brahmi, Moringa leaves and traditional nutritive seeds like flax seeds, sesame seeds, ground nut and coconut. It is a novel product to be consumed daily as a daily food accompaniment with any traditional Indian food.

Features of technology with their benefits

- ❖ It is a ready to eat powder and can be easily adopted in mid day meals and defense food. It has a shelf life of 3 months in air tight containers/pouches at ambient temperature (26-28°C) which can be extended at lower temperature. It can be taken up as entrepreneurship by women SHGs, war widows, disabled soldiers and other rehabilitation programs.
- ❖ Hence this technology will be of immense importance to enhance nutrition if adopted under nutrition programs and also help in income enhancement of rural women, war widows and disabled people.


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Technology : 66

Name of technology	Solar power integrated outdoor mushroom growing unit
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mushroom
Recommended for region (Names of districts/states)	All districts/states

Details of technology

The present technology relates to the production of oyster mushroom by using low cost solar power integrated outdoor mushroom growing unit which can be at both rural and urban levels. The overall dimension of the growing chamber is 1.35 x 0.93 x 1.69 m which is made up of 1” CPVC pipes and fittings. It is covered with nylon 40 mesh to protect the entry of insects and to facilitate the aeration. It is further covered with locally available gunny bag all around and it is wetted to maintain humidity inside the chamber. A 30 WDC misting diaphragm pump with 10 nozzles of 0.1mm size to produce more than 100 bar pressure to get very fine misting inside the chamber. It can be operated either by electric power or using Solar power system with 300W panel, inverter, 12V storage battery and a timer. The entire growing chamber is fitted inside a mild steel frame of 1.08 x 1.48 x 1.8 (side height)x 2.2 (centre height) with mobile wheels for easy mobility and transport.

- ❖ The solar panels are mounted on the roof top of the frame and inverter and battery are mounted and supported in the frame. A 30 litre water tank is fitted at the bottom side of the frame along with the misting pump. It was evaluated by growing two varieties of oyster varieties viz., 20 bags (1 kg) of Elm oyster and White oyster mushroom were evaluated both at cropping room and outside chamber every month from 2016 to 2018.
- ❖ The average yield recorded during 2016 to 2018 showsthat there is an average increase of 108 % in Elm oyster yield in mobile chamber in comparison to the cropping room yield. Similarly, an increase of 51% mushroom yield was recorded in white mushroom yield.
- ❖ The average monthly mushroom yield from this structure is 25-28 kg

Features of technology with their benefits

Presently most of the growers are using permanent or semi permanent structures for growing these mushrooms. The newly designed outside mobile chamber is low cost in comparison to the permanent building and even during non favourable conditions like months of April and May, the mobile chamber gives a better environment for mushroom growing due to its evaporative cooling principal as compared to permanent structures. As the availability of the space and capacity of the investment is less, maintenance is easy and less costly for adoption. Such structures will help in developing entrepreneurship not only in mushroom cultivation but also to fabricate and sell the units to the needy growers. It enhances mushroom cultivation to make mushroom as a part of diet. Daily consumption which can help in mitigation of malnutrition and also additional income can be generated for entrepreneurship development especially among women.

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Technology : 67

Name of technology	Arka vertical garden structure
Year of release	2018-19
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Vegetables
Recommended for region (Names of districts/states)	Urban cities

Details of technology

The vertical garden structure is useful for safe growing of the selected vegetable requirement of a family and can be accommodated in sunlit utility area, balcony and terrace. This structure can also be used by anyone who desires to grow vegetables, medicinal and flower crops using vertical space. The vertical garden structure has three major sub structure viz., i) base frame, ii) main central support and iii) supports for pots/grow bags. Pots suitable for growing different vegetables, flowers and medicinal plants can be used with soil or soilless (cocopeat) growing medium. The advantages of this vertical structure are i) can be accommodated in floor area of one square meter, ii) fresh vegetables grown can be consumed, iii) different sizes of plantpots/grow bags can be accommodated, iv) consumer also controls the use of fertilizer, pesticide and in spective to its safe limit and he also knows what he consumes, iv) structure suitable for handling in terms of height of reach, mobility, requirement light available to all the pots and v) effective utilization of maximum area for growing plants.

Features of technology with their benefits

- ❖ Plants like tomato (pot size- 16" dia. and 12" height), chilli, brinjal, French bean, peas etc., (pot size- 12" dia. and 10" height) which need bigger size pot, grow to a height about 2 feet and require more growing media are placed at the base of the structure. Leafy vegetables like amaranthus, coriander, palak etc., (pot size- 26" x 8" x 6" (LxWxH)) and medicinal plants like brahmi, pudina, pepper mint, amruthaballi, doddapatre, madhnashini, thippali, ashwagandha, shatavari etc., (pots size -14" x8"x6" (LxWxH)) are placed upper levels.
- ❖ A 25 litre plastic container at the top of the structure with necessary drip laterals, micro tubes and drippers are also provided to water the plants. Yield of 200 g to 5 kg of produce (depending on the crop) can be harvested per crop cycle. The cost of vertical garden structure is Rs.22,000.



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Technology : 68

Name of technology	Arka Shubra
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Medicinal crops- Velvet bean (Mucuna pruriens var utilis)
Recommended for region (Names of districts/states)	Identified at Institute level suitable for all tropical regions

Details of technology

Mucuna pruriens commonly known as Cowhage, Kaunch, Velvetbean is an indigenous economically important medicinal plant found throughout the plains of India contains L-3,4-dihydroxyphenylalanine (L-Dopa) used in the treatment of Parkinson's disease. In addition to its medicinal uses, it adds 6-12 T/ha biomass above ground and more than 1 t of dried roots ha⁻¹ below ground and fixes Nitrogen to the tune of 80 to 170 kg ha⁻¹ making it an excellent choice for green manure crop and as cover crop. The wild types of Mucuna possess stinging trichomes on pods which causes severe dermatitis when come in contact with the skin . Hence lines with non-irritant trichomes different seed coat colours and with varying duration to fit in different cropping systems have been developed for commercial cultivation.

Features of technology with their benefits

- ❖ High yielding long duration (180-190 days) variety with non-irritant trichomes.
- ❖ Medium size seeds with white seed coat.
- ❖ It yields 2.25 to 2.75 t/ha under surface cultivation with.
- ❖ High L dopa content of 5.0 to 5.5%.



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Technology : 69

Name of technology	Arka Daksha
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Medicinal crops- Velvet bean (<i>Mucuna pruriens</i> var <i>utilis</i>)
Recommended for region (Names of districts/states)	Identified at Institute level suitable for all tropical regions

Details of technology

Mucuna pruriens Bak. Commonly known as Cowhage, Kaunch, Velvet bean is an indigenous economically important medicinal plant found throughout the plains of India contains L-3,4-dihydroxy phenylalanine (L-Dopa) used in the treatment of Parkinson's disease. In addition to its medicinal uses, it adds 6-12T/ha biomass above ground and more than 1 t of dried roots ha⁻¹ below ground and fixes Nitrogen to the tune of 80 to 170 kg ha⁻¹ making it an excellent choice for green manure crop and as cover crop. The wild types of *Mucuna* possess stinging trichomes on pods which causes severe dermatitis when come in contact with the skin. Hence lines with non-irritant trichomes different seed coat colours and with varying duration to fit in different cropping systems have been developed for commercial cultivation.

Features of technology with their benefits

- ❖ Non irritant trichomes.
- ❖ Medium duration: 150-160 days.
- ❖ Seed yield : 3.5 to 4 t/ha (under support) and 1.8 to 2.2 t/ha without support.
- ❖ L-dopa content (3.5 to 4.2%).
- ❖ Black seed coat/ Grey Brown mottling bold seeds.


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Technology : 70

Name of technology	Arka Charaka
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Medicinal crops- Velvet bean (Mucuna pruriens var utilis)
Recommended for region (Names of districts/states)	Identified at Institute level suitable for all tropical regions

Details of technology

Mucuna pruriens commonly known as Cowhage, Kaunch, Velvet bean is an indigenous economically important medicinal plant found throughout the plains of India contains L-3,4-dihydroxyphenylalanine (L-Dopa) used in the treatment of Parkinson's disease. In addition to its medicinal uses, it adds 6-12 T/habiomass above ground and more than 1 t of dried roots ha⁻¹ belowground and fixes Nitrogen to the tune of 80 to 170 kg ha⁻¹ making it an excellent choice for green manure crop and as cover crop. The wild types of Mucuna possess stinging trichomes on pods which causes severe dermatitis when come in contact with the skin. Hence lines with non-irritant trichomes different seed coat colours and with varying duration to fit in different cropping systems have been developed for commercial cultivation.

Features of technology with their benefits

- ❖ High yielding medium duration (155-165 days) variety.
- ❖ Non-irritant trichomes produces .
- ❖ Medium size seeds with black shiny seed coat.
- ❖ It yields 4.0 to 4.25 t/ha under support and 2.0 to 2.25t/ha under surface cultivation.
- ❖ High L dopa content (4.80 to 5.0 %).



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Technology : 71

Name of technology	Arka Shukla
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Medicinal crops- Velvet bean (<i>Mucuna pruriens</i> var <i>utilis</i>)
Recommended for region (Names of districts/states)	Identified at Institute level suitable for all tropical regions

Details of Technology

Mucuna pruriens commonly known as Cowhage, Kaunch, Velvet bean is an indigenous economically important medicinal plant found throughout the plains of India contains L-3,4-dihydroxyphenylalanine (L-Dopa) used in the treatment of Parkinson's disease. In addition to its medicinal uses, it adds 6-12 T/ha biomass above ground and more than 1 t of dried roots ha⁻¹ belowground and fixes Nitrogen to the tune of 80 to 170 kg ha⁻¹ making it an excellent choice for green manure crop and as cover crop. The wild types of *Mucuna* possess stinging trichomes on pods which causes severe dermatitis when come in contact with the skin. Hence lines with non-irritant trichomes different seed coat colours and with varying duration to fit in different cropping systems have been developed for commercial cultivation.

Features of technology with their benefits

- ❖ Medium duration (155-165 days) variety.
- ❖ Seed yield of 3.0 to 3.5 t/ha under support and 2.0 t/ha under surface cultivation.
- ❖ L dopa content of 3.50 to 4.2%.
- ❖ Medium bold size seeds with white seed coat.


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Technology : 72

Name of technology	Tomato F1 hybrid: Arka Abhed
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region (Names of districts/states)	Released at Institute. It is under multi location trials

Details of technology

- ❖ High yielding F1 hybrid with multiple disease resistance to tomato leaf curl disease (*ty2+ty3*), bacterial wilt, early blight and late blight (*ph2 + ph3*) plants are semi-determinate with dark green foliage, fruits are firm, oblate round & medium large (90-100g). Suitable for summer, kharif & rabi cultivation. Bred for fresh market & yields 70-75 t/ha in 140-150 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.
- ❖ Resistant to LCV, BW, early and late blight.



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Technology : 73

Name of technology	Bell pepper: Arka Athulya
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Bell pepper
Recommended for region (Names of districts/states)	Released at Institute. It is under multi location trials

Details of technology

- ❖ Bell pepper F1 hybrid with powdery mildew tolerance, indeterminate plant habit with green foliage cover, suitable for kharif and rabi season cultivation under open field conditions, fruits firm, blocky with 3-4 lobes, medium size (100-120g), suitable for fresh green market and yields 35-40t/ ha in 140-150 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Tolerant to powdery mildew.


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Technology : 74

Name of technology	Musk melon: Arka Siri
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Musk melon
Recommended for region (Names of districts/states)	Released at Institute. It is under multi location trials

Details of technology

- ❖ Cantaloupe type fruit with an appealing pattern of netting, plus green sutures on creamish orange rind background, sweet (TSS 12%), dark-orange flesh and a strong and musky aroma.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Fruit quality.



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Technology : 75

Name of technology	French Bean: Arka Sukomal
Year of release	2018
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	French bean pole type
Recommended for region (Names of districts/states)	Released at Institute. It is under multi location trials

Details of technology

- ❖ High yielding rust resistant pole bean variety. Pods stringless, oval, green and long (23 cm). Yield potential is 24 t/hain 100 days. Suitable for both kharif and rabi seasons.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Tolerant to powdery mildew.


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Technology : 76

Name of technology	Osmotically dehydrated Aonla segments with kokum juice
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Aonla
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

The osmotically infused aonla segments in kokum juice will have combined goodness of both fruits, with easy to eat product having good natural red colour, flavour and texture.

Features of technology with their benefits

The dried product (moisture 12-14 %) is micro biologically safe and meets the dehydrated fruit requirements standards of FSSAI. Aonla fruits of 4 to 5 kg and 2.0 Kg sugar are required for making 1 kg of osmotically dehydrated slices.



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Technology : 77

Name of technology	Osmotic dehydration of guava
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Guava
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Fruits are selected at optimum stage of ripeness (hard ripe stage), peeled, seed containing pulp is scooped out, made into slices and dipped in sugar syrup (50-70°Brix) containing citric acid, preservatives and other additives. Dried (moisture 15%) slices are packed in plastic punnets and can be stored at RT for six months to one year (pink fleshed).

Features of technology with their benefits

This technology can be adopted by small scale processor, SHGs and other entrepreneurs. Require about 7-8 kg of ripe fruits and 2 kg of sugar for making 1 kg of dehydrated slices.


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Technology : 78

Name of technology	Papaya fruit bar
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Papaya
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Papaya fruit bar preparation is a simple process involving operations like selection of ripe fruits, cleaning, washing, extraction of pulp, preservation of pulp. Mixing of pulp with sugar and citric acid and drying in hot air drier. However, the papaya fruit bar develops cracks and may not form sheet. Hence a process was developed to reduce water content in pulp and use the same for bar making with very good appearance and taste.

Features of technology with their benefits

The product is safe and meets the dehydrated fruit requirements standards of FSSAI. Ten kg of fruit pulp will yield 2.5 kg of fruit bar. This technology may encourage small scale processing units in rural areas.



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Technology : 79

Name of technology	Shelf life extension of fresh-cut green capsicum
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Capsicum
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Demand for Ready-to-eat (RTE/fresh cut) vegetables is on the rise due to change in life style as a result of high income levels and woman employment. Fresh cut capsicum spoils due to browning, flavor loss and drying of cut surface.

Features of technology with their benefits

Pre-treatment of the freshly cut green capsicum with calcium propionate and packing using PD 961 films maintain the shelf Life for 9-10 days at 8^oC. Chemicals with the Generally recommended as Safe (GRAS) status were used.


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Technology : 80

Name of technology	Shelf life extension of fresh-cut coriander leaves
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Coriander
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Pre-treatment of the freshly harvested, trimmed coriander leaves with 50 ppm kinetin and packaging using suitable semi-permeable films (25 micron thickness polypropylene) has resulted in the shelf life of 21 days at low temperature of 8 °C for varieties like Arka Isha.

Features of technology with their benefits

This technology can be adopted by the vegetable venders, supermarkets and also at household level.



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Technology : 81

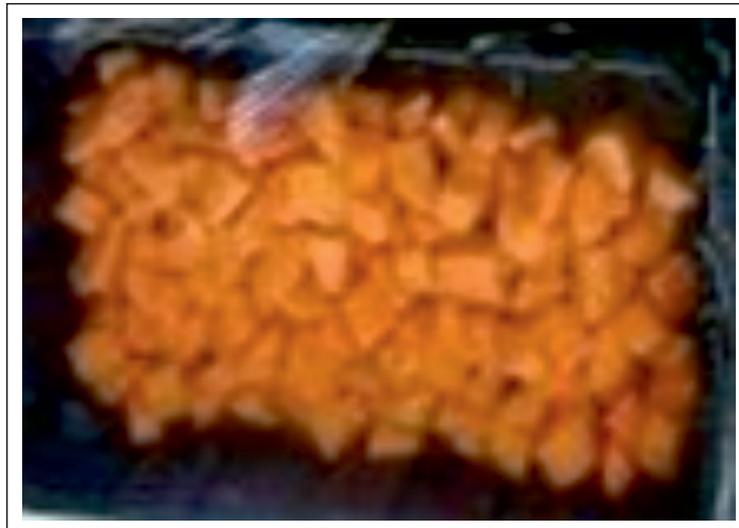
Name of technology	Shelf life extension of fresh-cut carrot
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Carrot
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Freshly cut carrot slices/cubes/ sticks are to be treated with edible coating (pectin) , air dried and to be packed in semi permeable flexible films (925 micron thickness) to obtain suitable modified atmosphere.

Features of technology with their benefits

Shelf life is 21 days for fresh-cut carrots prepared through this optimized protocol (at 8°C storage).


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Technology : 82

Name of technology	Shelf life extension of fresh-cut cucumber
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Cucumber
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Browning of the cucumber rings is prevented through pre-treatments of the freshly-cut cucumber with ascorbic acid and packaging using suitable semi-permeable cling film to obtain a shelf life of 6 days at 8°C.

Features of technology with their benefits

This technology can be adopted by the vegetable venders, supermarkets and also at household level.

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Technology : 83

Name of technology	Shelf life extension of fresh cut radish
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Radish
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Pre-treatments of the sliced radish with glucose and packing in a cling film or micro-perforated polypropylene films to retain near normal atmosphere has given a shelf life of 6-8 days at 8 °C in radish.

Features of technology with their benefits

Shelf life is 21 days for fresh-cut carrots prepared through this optimized protocol (at 8°C storage).


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Technology : 84

Name of technology	Shelf life extension of minimally processed (shredded)cabbage
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Cabbage
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Freshly shredded cabbage were treated with calcium salts, surface dried and packed in 35 micron thick polypropylene films. This technology provides methods/specific protocols for preparation of minimally processed cabbage with shelf life ranging from 19-21days at 8 °C storage..

Features of technology with their benefits

This technology uses low cost dip solutions, which are non-hazardous to health and available locally.



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Technology : 85

Name of technology	Shelf life extension of fresh-cut French beans
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	French Beans
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Pre-treatments of the freshly cut French beans (preferably varieties like Arka Sarath) with 100 ppm available chlorine in the form of sodium hypochlorite and packaging using suitable semipermeable films of different gas and vapour permeability were used to obtain an equilibrium modified atmosphere of 12-14 per cent oxygen and 5-6 per cent carbon dioxide with a shelf life of 9-10 days.

Features of technology with their benefits

Technology is cost effective.


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Technology : 86

Name of technology	Shelf life extension of peeled garlic
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Garlic
Recommended for region (Names of districts/states)	Identified at institute level suitable for all regions

Details of technology

Pre-treatments of garlic cloves in hot water and packaging in BOPP films or equivalent were given to maintain high humidity and modified atmosphere. The product has a minimum shelf life of 3 days at ambient temperature (approx. 28°C), and up to 15-18 days at low temperature storage (8°C).

Features of technology with their benefits

It reduces problems of sprouting, browning and softening and the protocol does not involve any chemical treatment.

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Technology : 87

Name of technology	Chilli variety: Arka Neelanchal Prabha
Year of release	2017
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region (Names of districts/states)	Odisha State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Odisha. However yet to get notified

Details of technology

A mid- season variety suitable for both green and redchilli. Fruits are medium long, first harvesting starts at 65-70 days of planting. It is moderately tolerant to anthracnose and yields 10-12t/ha.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.


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Technology : 88

Name of technology	Brinjal variety: Arka Neelanchal Shyama
Year of release	2017
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region (Names of districts/states)	Odisha State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Odisha. However yet to get notified

Details of technology

It is an early variety, suitable for rabi season. Fruits are round and green with light purple shade, weighing up to 190-200g per fruit. It is moderately tolerant to Phomopsis blight and yields 34t/ha.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.



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Technology : 89

Name of technology	Okra: Arka Nikitha
Year of release	2017
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Okra
Recommended for region (Names of districts/states)	Released at Institute. It is under multi location trials

Details of technology

- ❖ Early flowering first flower appears at 9th node and take 37-39 days for flowering. First picking starts at 43-45 day after sowing. Fruits are dark green, tender, smooth free from spines. Yields 21-24 t/ha in 125 to 130 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.


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Technology : 90

Name of technology	Onion variety: Arka Yogith
Year of release	2017
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Onion
Recommended for region (Names of districts/states)	Released at Institute. It is under multi location trials

Details of technology

- ❖ White onion variety developed for dehydration. Bulbs are flat globe shape, weight 60-80 g, TSS 18-20 per cent, dry matter content 18-20 per cent, diameter 4.5-5cm. Bulb yield is 25-30 t/ha in 110-120 days.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.



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Technology : 91

Name of technology	Spine gourd variety: Arka Neelanchal Shanti
Year of release	2017
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Spine gourd
Recommended for region (Names of districts/states)	Odisha State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Odisha. However yet to get notified

Details of technology

- ❖ It is developed through hybridization between spine gourd and teasel gourd, naturally pollinated, high yielding (15-16 kg/vine) with medium sized fruit (20g), moderately tolerant to fruit borer, anthracnose and downy mildew.

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.


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Technology : 92

Name of technology	Arka high humidity storage box for shelf life extension of Green leafy vegetables
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Green leafy vegetables
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

A high humidity storage box of size 740x515x210mm made of transparent acrylic sheet of 6mm thickness was designed, fabricated and evaluated for freshness retention of coriander leaves. Green leafy vegetables stored in novel high humidity storage box which maintained a temperature of 20°C and 95% RH had a shelf life of 3 days under ambient condition as compared to 2 days under commercial practice.

Features of technology with their benefits

Samples stored in the high humidity storage box had higher freshness retention compared to those stored in commercial practice. Moreover, green leafy vegetables stored in these boxes showed lesser physiological loss in weight (PLW%) better retention of ascorbic acid, iron and calcium compared to those stored under commercial practice. Therefore, novel custom designed zero energy high humidity storage box hold potential for storage and shelf life extension of green leafy vegetables.



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Technology : 93

Name of technology	Liquid formulations of Bacillus pumilus
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

Though Bacillus species are promising bio-agents controlling soilborne pathogens and nematodes, till now in India there are no commercial products of these bio-agents with good shelf life and CFU are available for application in the field. Hence a protocol of mass production of Bacillus pumilus, was standardized using liquid based formulations which are more advantageous to farmers due to higher shelf life.

Features of technology with their benefits

This bioagent cultured in Nutrient broth is added at the rate of 20 ml to '1' lit of liquid fermentation medium. Liquid fermentation is carried out at $30 \pm 1^\circ\text{C}$ for a specific period of 4 – 5 days. Bacillus pumilus was the most efficient species which has resulted in 89.73 per cent reduction in hatching of eggs, 88.5 per cent mortality of juveniles of *M. incognita* and 15.48 per cent increase in yield of carrot.

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Technology : 94

Name of technology	Teasel gourd variety: Arka Neelanchal Gaurav
Year of release	2017
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Teasel gourd
Recommended for region (Names of districts/states)	Odisha State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Odisha. However yet to get notified

Details of technology

- ❖ Fruits are attractive, uniform lush green round-oval fruit with soft seed and high-quality edible portion for culinary purposes and soft seeded. It is reported to be tolerant to downy mildew and anthracnose. It yields 18-20 t/ha

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.



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Technology : 95

Name of technology	Power operated on farm onion size grader
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Onion
Recommended for region (Names of districts/states)	Maharashtra, Karnataka, Madhya Pradesh and Gujarat

Details of technology

An onion size grader for common onion with capacity of 2 ton/hwas developed. It has the components namely i) feeding chute, ii) grading drum, iii) collection chute and iv) power transmission system. The grader has three portions in which cushioned rods were mounted with a constant gap to grade onion less than 40mm, 40.1 – 60 mm and 60.1 – 75 mm.

Features of technology with their benefits

The oversize onions greater than 75.1 mm size are collected at the other end of grading drum whereas, other three grades are collected through the cushioned outlets mounted below the grading drum. One 2 hp geared motor with 50 rpm speed and four rollers mounted on the frame used to rotate the grading drum. The cost of grading was 10 times lower than manual grading.


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Technology : 96

Name of technology	Minimally processed onion
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Onion
Recommended for region (Names of districts/states)	Maharashtra, Karnataka, Madhya Pradesh, Gujarat and Urbancities in all states

Details of technology

It is a ready-to-cook convenient product for use in salad and culinary preparation. Presently only ready-to-cook peeled multiplier onion is available in market which has a limited shelf life (2-3 day only). The uniqueness of this process is that pre-treatment developed retains the freshness, flavour and quality for longer time (12 days at 8°C). Moreover, much time saving in pre-preparation of onion.

Features of technology with their benefits

Very much suitable for usage of onion in bulk for culinary recipes in hotels, marriages and other functions, hostels, street fast food vendors, and also for working couples in urban areas.



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Technology : 97

Name of technology	Portable vegetable dicing tool
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Vegetables
Recommended for region (Names of districts/states)	Urban cities

Details of technology

Vegetable cutting in bulk is laborious and time consuming. Presently only kitchen dicing tool is available in market or dicing of vegetables in small quantities (house hold use) For cutting of vegetables in large quantities power operated vegetable slicers are available but not hand operated. This portable vegetable dicing tool is heavy duty, sturdy, long lasting and could be used for continuous dicing in bulk in places with no power consumption..

Features of technology with their benefits

- ❖ The efficiency of cutting of the tool was 97.23 per cent. The cost saving in operation over conventional methods was 44 per cent and time saving in operation over conventional method was 71 per cent.
- ❖ Suitable for street fast food vendors, marriage food caterers, restaurants, etc.


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Technology : 98

Name of technology	Fruit and vegetable vending van
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Fruits and vegetables
Recommended for region (Names of districts/states)	Identified at Institute level

Details of technology

- ❖ The van consists of an evaporating cooling system for providing higher humidity required to maintain the freshness in fresh fruits and vegetables even under normal conditions.

Features of technology with their benefits

- ❖ The designed evaporative cooling system helps in retaining the freshness in fruits and vegetables up to 36-48 hours or even more depending on the produce being stored and the weather conditions.

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Technology : 99

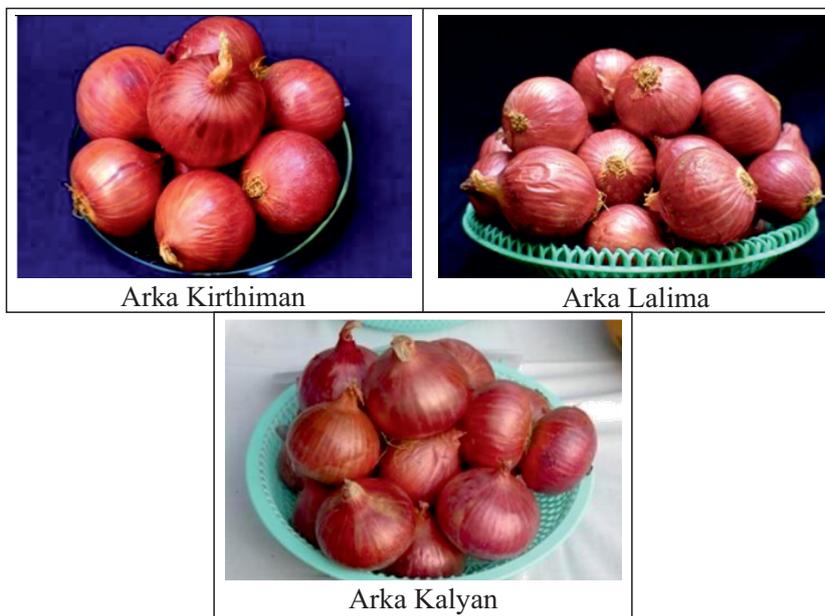
Name of technology	Onion hybrids-Arka Kirthiman, Arka Lalima and variety-z Arka Kalyan are suitable for paste preparation
Year of release	2017-18
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Onion
Recommended for region (Names of districts/states)	Arka Kalyan for Bihar, Panjab, Gujarat; Arka, Kirthiman, Arka Lalima for Eastern dry regionz of Karnataka

Details of technology

- ❖ Arka Kirthiman: High yielding F1 hybrid suitable for paste making. TSS -12.4⁰Brix and dry matter-13.5 per cent.
- ❖ Arka Lalima: High yielding F1 hybrid suitable for paste making. TSS -11.8⁰Brix and dry matter-12 per cent.
- ❖ Arka Kalyan: High yielding variety suitable for paste making. TSS -13⁰Brix & dry matter-12.6 per cent.

Features of technology with their benefits

- ❖ Arka Kirthiman : Yields 37 t/ha in 140 days.
- ❖ Arka Lalima : Yields 40 t/ha in 140 days.
- ❖ Arka Kalyan : Yields 40 t/ha in 140 days.


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Technology : 100

Name of technology	Continuous hot water treatment unit to control fruit fly and anthracnose infections in mangoes
Year of release	2016-17
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Mango
Recommended for region (Names of districts/states)	Bengaluru in Karnataka and Raygada in Odisha

Details of technology

- ❖ ICAR-IIHR designed and developed a semi-automatic system (500 kg capacity) and the system is validated at Bengaluru in Karnataka and tribal mango growing region in Raygada in Odisha.

Features of technology with their benefits

- ❖ The system is cost effective.

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Technology : 101

Name of technology	Tomato F1 hybrid: Arka Samrat
Year of release	2016
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region (Names of districts/states)	Zone VIII – Karnataka, Tamil Nadu, Andhra Pradesh and Kerala

Details of technology

- ❖ First F1 Hybrid with triple disease resistance to ToLCV, BW and early blight. Fruits oblate to high round, large (90-110g), deep red and firm. Suitable for fresh market. Yields 80-85 t/ha. in 140 days.

Features of technology with their benefits

- ❖ High yielding.
- ❖ Fruits oblate to high round.
- ❖ Resistant to ToLCV, BW and early blight.


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Technology : 102

Name of technology	Ivy gourd variety: Arka Neelanchal Kunki
Year of release	2016
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Ivy gourd
Recommended for region (Names of districts/states)	Odisha State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Odisha. However yet to be notified

Details of technology

A dual-purpose (salad as well as cooked) early variety with high yield (20-25 t/ha). Fruits are extra-long (8.39cm), weighing around 15-20g, uniform, cylindrical with attractive stripes. It produces around 800 fruits in a season with yield potential of 15-20 t/ha

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.



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Technology : 103

Name of technology	Ivy gourd variety: Arka Neelanchal Sabuja
Year of release	2016
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Ivy gourd
Recommended for region (Names of districts/states)	Odisha State Varietal Evaluation Committee (SVEC) recommended for its cultivation in Odisha. However yet to get notified

Details of technology

The plants are very vigorous (>10m long) and produce high biomass. Fruits are dark green in appearance with fractured stripe and conical in shape. It gives 70-80 harvest per season (10-11 months) and yield up to 20-25 t/ha

Features of technology with their benefits

- ❖ High yielder.
- ❖ Quality fruit.


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Technology : 104

Name of technology	Arka neem soap for management of sucking pests in horticultural crops
Year of release	2004
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region (Names of districts/states)	At institute level

Details of technology

- ❖ Soft soaps prepared from respective oils and are in the form of concentrates.
- ❖ Can be diluted easily and sprayed as alternative to insecticides.
- ❖ Effective against a wide range of insect pests in vegetable crops and fruits.

Features of technology with their benefits

- ❖ User friendly Botanical formulation from Neem oil.
- ❖ Neem soap is effective for the management of wide range of insect pests like diamond back moth, leaf webber, hopper ,aphids, red spider mites, thrips, scales, white fly, leaf miner etc.
- ❖ Low residual toxicity.
- ❖ Better keeping quality.



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Technology : 105

Name of technology	Arka pongamia soap for management of sucking pests in horticultural crops
Year of release	2004
Source of technology	ICAR-IIHR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region (Names of districts/states)	At institute level

Details of technology

- ❖ Soft soaps prepared from respective oils & are in the form of concentrates
- ❖ Can be diluted easily and sprayed as alternative to insecticides
- ❖ Effective against a wide range of insect pests in vegetable crops and fruits .

Features of technology with their benefits

- ❖ User friendly botanical formulation from pongamia oil.
- ❖ The soap sprays can be used as a substitute for syntheti cinsecticides and can be used as a component of IPM inmany vegetable crops and as organic input.
- ❖ Low residual toxicity.
- ❖ Better keeping quality.


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Technology : 1

Name of technology	DRR dhan-45
Year of release	2017
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region (Names of districts/states)	Tamil Nadu, Karnataka and Andhra Pradesh

Details of technology

DRR dhan-45 is a biofortified semi-dwarf, medium duration (125 days) variety with non-lodging plant type and long slender grains for irrigated conditions. It is the first high zinc rice variety notified at national level with over all mean zinc content of 22.6 ppm (24.0 ppm in AP, KA & TN) in polished rice, developed through conventional breeding without compromising yield using the material from Harvest Plus. Based on high zinc content and yield performance over 5 t/ha, it is released for the states of Tamil Nadu, Andhra Pradesh and Karnataka. It has good cooking quality with desirable amylose content (20.7%).

Features of technology with their benefits

- ❖ It is moderately resistant to blast, sheathrot and ricetungro virus.
- ❖ The variety is a proof of concept for Biofortification and can address the hidden hunger or mineral malnutrition, thus targeting nutritional security of the nation.

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Technology : 2

Name of technology	DRR dhan-46
Year of release	2016
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under Irrigated and transplanted conditions, under normal and high fertility situation both in Kharif and Rabi.
Recommended for region (Names of districts/states)	Bihar, Madhya Pradesh, Maharashtra

Details of technology

DRR dhan-46 is a nearly duration, high yielding, long slender grain variety suited to transplanted conditions. It has good cooking quality with high yield, early duration and high Zn content, hence acceptable to the farmers and consumers. It yielded significantly higher than most of the varieties used as local check in the states it proposed. Hence it may help in increasing the rice production.

Features of technology with their benefits

- ❖ Yield potential: 65-70 quintals /ha.
- ❖ Daystomaturity: 110-115 days.
- ❖ It has long slender grains, good cooking quality and 65% head rice recovery.
- ❖ Moderate resistance to leaf blast, neck blast, brown spot, BLB sheath rot, BPH and WBPH.
- ❖ It can be grown under boro cultivation.



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Technology : 3

Name of technology	DRR dhan-47
Year of release	2018
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop can be cultivated in irrigated and low fertile areas. A suitable heat tolerant variety for Rabi season.
Recommended for region (Names of districts/states)	Telangana, Andhra Pradesh, Kerala, Puducherry and Karnataka

Details of technology

DRR dhan-47 (IET-23356) can be cultivated in irrigated and low fertile areas. A suitable heat tolerant variety for rabi season. It exhibited resistance to blast and also shown yield superiority under drought conditions across the country in multi-location trials of All India Coordinated Rice Improved Project (AICRIP) with lodging resistance and has distinguishable morphological features like strong culm, light green foliage, creamish septum, long white split ligules, stigma non-pigmented, late senescence, erect and wide flag leaf, compact heavy and well exerted panicles, long bold grains and 90 day flowering duration.

Features of technology with their benefits

- ❖ DRR dhan-47 is a long bold rice variety with distinguishable morphological features like lodging resistance, non-shattering and drought tolerance with blast resistance.
- ❖ Total duration is 110 to 115 days.
- ❖ DRR dhan-47 yields 6.0 t/ha.


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Technology : 4

Name of technology	DRR dhan-48
Year of release	2016
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop similar torice varietie of medium and late duration, which are cultivated in irrigated / transplanted areas.
Recommended for region (Names of districts/states)	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and Kerala

Details of technology

DRR dhan-48 (IET-24555) is a biofortified high Zn (24 ppm) variety with around 6 per cent and 41 per cent higher yield than Samba Mahsuri and IR-64. The average zinc content in seed samples collected from farmer's field ranged from 25.2 to 27.4 and 22.2 to 23.3 ppm in brown and polished rice respectively. It possesses three major bacterial blight resistance genes *Xa21*, *xa13* and *xa5* and exhibited high level of resistance to bacterial blight across the country in multilocation trials of All India Coordinated Rice Improved Project (AICRIP).

Features of technology with their benefits

- ❖ DRR dhan-48 is a high yield, zinc rich and bacterial blight resistant variety with medium slender grain.
- ❖ Total duration is 135 to 140 days.
- ❖ It yields 6.0 to 6.5 t/ha.



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Technology : 5

Name of technology	DRR dhan-49
Year of release	2018
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region (Names of districts/states)	Gujarat, Maharashtra and Kerala

Details of technology

DRR dhan-49 is a high yielding variety with high zinc content. This variety contains very high Zinc content of 25.2 ppm which is higher than checks like Kalanamak and Chittimuthyalu. In addition to superior grain yield and high Zinc, it also possesses strong culm there by having tolerance to lodging. It contains erect and wide flag leaf which improves its photosynthetic ability. It is also having the desirable grain type of medium slender which is mostly accepted and consumed in the states of Telangana, Andhra Pradesh, Karnataka and Tamilnadu.

Features of technology with their benefits

- ❖ Rice is a staple food in India and if we use bio fortified rice variety like DRR dhan-49 with high Zinc content, it will reach the poor, undernourished segment of the society. It will be very useful for pregnant women and children to overcome malnutrition.
- ❖ Since it is high yielding and having Medium slender grain type, tolerant to lodging, it is easily acceptable by farmers of Southern states Telangana, Andhra Pradesh, Karnataka and Tamilnadu.
- ❖ If this variety is multiplied in large scale and final polished rice is distributed through Public distribution system, it will reach the poor and malnourished people easily.


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Technology : 6

Name of technology	DRR dhan-50
Year of release	2018
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region (Names of districts/states)	Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Bihar, Odisha, Chhattisgarh, Uttar Pradesh, Madhya Pradesh

Details of technology

DRR dhan-50 is a NIL variety with submergence QTL (*qSub1*) and drought tolerant QTLs (*qDTY2.1+qDTY3.1*) of late duration with high yield under irrigated / rainfed condition, submergence, water logged and drought conditions at reproductive stage, identified for release in Samba Mahsuri growing areas in the state of Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Bihar, Odisha, West Bengal, Uttar Pradesh and Madhya Pradesh. It is moderately resistant to leaf blast and BLB. It has high milling recovery (69%) and head rice recovery (64%). It has medium slender grains, with 4.76mm kernel length and 1.83mm kernel breadth, 3.0 L/B ratio. It has intermediate AC (23%) and ASV (4.0), hard GC (27 mm) and very translucent grains indicating good cooking quality.

Features of technology with their benefits

- ❖ Moderate resistant to BLB and blast.
- ❖ Lodging resistance, drought tolerant, submergence tolerance.
- ❖ Good cooking quality and medium slender grain type.



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Technology : 7

Name of technology	DRR dhan-51
Year of release	2018
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under
Recommended for region (Names of districts/states)	Uttar Pradesh, Gujarat, Telangana, Chhattisgarh

Details of technology

DRR dhan-51 is a Near Isogenic line (NIL) of Swarna having *Pi2* (a blast resistant gene). It shares 95.6 per cent genome with Swarna. Maturity of DRR dhan-51 is 135 days, which is 5 days earlier than to recurrent parent Swarna. It showed superiority yield on recurrent parent Swarna. It is tall plant type, erect, high tillering and non C plant habit. Resistance to blast disease.

Features of technology with their benefits

- ❖ Highyielding, early maturity and resistance to blast disease.
- ❖ Resistance to blast disease.
- ❖ Grain type short bold.


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Technology : 8

Name of technology	DRR dhan-52
Year of release	2019
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region (Names of districts/states)	Haryana, Gujarat, Bihar and Odisha

Details of technology

DRR dhan-52 is a high yielding drought and heat tolerant variety with lodging and blast resistance DRR dhan -52 (IET- 23354) is a reproductive stage heat tolerant culture with high yield under elevated temperature up to 5-8°C, it recorded significant increase in chlorophyll and carotenoid content during heat stress at vegetative as well as reproductive stages. It has distinguishable morphological features like strong culm, basal leaf sheath pigmented, tip of lemma pigmented, stigma pigmented. It exhibited resistance to blast and moderate resistance to neck blast, sheath rot, sheath blight, brown spot and Rice tungro disease in multilocation trials of All India Coordinated Rice Improved Project (AICRIP).

Features of technology with their benefits

- ❖ It is along bold grain variety and has heat tolerance.
- ❖ Moderate resistance to neck blast and leaf blast with desirable cooking quality.
- ❖ Maturity 110-115 days.



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Technology : 9

Name of technology	DRR dhan-53
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under Irrigated eco system
Recommended for region (Names of districts/states)	Andhra Pradesh, Telangana, Chhattisgarh, Maharashtra, Jharkhand, Odisha, Bihar, Gujarat and Maharashtra.

Details of technology

Bacterial Blight (BB) of rice caused by *Xanthomonas oryzae* pv. *oryzae* is one of the major production constraint specially in irrigated and rainfed low land ecosystem in India. It is primarily a disease of monsoon season of high yielding rice varieties grown under heavy nitrogen fertilization resulting in yield loss up to 50 per cent. IIRR, Hyderabad has released a high yielding fine-grain type rice variety named as DRR dhan-53 through marker assisted backcross breeding which is highly resistant to bacterial blight of rice. DRR dhan-53 can be cultivated in areas with assured irrigation and has inbuilt bacterial blight resistance. It possesses the major bacterial blight resistance genes, *Xa21+xa13+xa5+Xa38* with seed to seed maturity of 130-135 days and average yield of 5.50-6.0 t/ha. The variety has semi-dwarf stature and non-lodging habit, with long deflexed panicles which are completely exerted (100% exertion).

Features of technology with their benefits

- ❖ DRR dhan-53 is a high-yielding, durable bacterial blight resistant, fine-grain type rice variety.
- ❖ It possesses medium-slendergrain type with very good HRR.
- ❖ It is highly suitable for bacterial blight endemic areas and can replace bacterial blight susceptible varieties.



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Technology : 10

Name of technology	DRR dhan-54
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under aerobic conditions
Recommended for region (Names of districts/states)	Bihar, Odisha, Telangana, Jharkhand, Haryana and Gujarat.

Details of technology

- ❖ ICAR-Indian Institute of Rice Research (ICAR-IIRR), Hyderabad has developed a high yielding multiple disease resistant culture with desirable grain quality traits suitable for cultivation under direct seeded aerobic conditions in water limiting areas with short bold premium grain and cooking quality, named as DRR dhan-54 through pedigree breeding.
- ❖ DRR dhan-54 has thick and strong culm with semi dwarf stature which accounts for lodging resistance, medium green foliage and deflexed compact panicle with strong secondary branching. Mild pubescence is observed on lemma and tip of the lemma is yellowish. The variety has multiple disease resistance across the country in multi-location trails of All India Coordinated Rice Improved Project (AICRIP).

Features of technology with their benefits

- ❖ It is a high yielding short bold grain variety.
- ❖ Resistant to multiple diseases under direct seeded aerobic conditions in water limiting areas.
- ❖ Total duration is 115 to 120 days.
- ❖ It has resistance to multiple diseases like leaf blast, sheath rot, rice tungro disease and false smut and moderately resistant to neck blast, bacterial blight, brown spot and glume discoloration.



Contact for further details

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Technology : 11

Name of technology	DRR dhan-55
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under irrigated ecosystem
Recommended for region (Names of districts/states)	Bihar and Chhattisgarh.

Details of technology

Breeding rice for aerobic condition is an essential requirement due to dwindling water resources and irregular rainfall under a rapidly changing climate. DRR dhan-55 is a high yielding early aerobic rice variety. It was evaluated in multi-locational trials i.e. Aerobic trials during Wet seasons of 2016-2019 under AICRIP. It is a semi dwarf, high yielding, long bold grained variety and resistant to major insect pests and diseases such as leaf blast and neck blast.

Features of technology with their benefits

- ❖ DRR dhan-55 is a high yielding early aerobic rice variety.
- ❖ It exhibited moderately resistant to leaf blast, neck blast, gall midge, rice thrips and plant hoppers.
- ❖ Total duration is 115-120 days.


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Technology : 12

Name of technology	DRR dhan-56
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under aerobic conditions
Recommended for region (Names of districts/states)	Punjab and Haryana

Details of technology

As a part of “Green Super Rice (GSR) for the Resource-Poor of Africa and Asia- Phase III” from IRRI, Philippines, this culture evaluated at ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad under station trial and identified considering semi dwarf plant height, early duration, long slender grain type and yield. This variety is early duration, tall erect, highly vigorous, non-lodging, non-shattering variety recommended for the states of areas of Punjab and Haryana.

Features of technology with their benefits

- ❖ All plant parts dark green, erect and highly vigorous with good biomass, long panicle, and long slender grain with white kernel.
- ❖ Days to 50% flowering is 89 days.
- ❖ Early duration variety suitable for Irrigated transplanted cultivation.



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Technology : 13

Name of technology	DRR dhan-58
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under irrigated eco system
Recommended for region (Names of districts/states)	Telangana, Andhra Pradesh, Tamil Nādu, Karnataka, Chhattisgarh, Odisha, Jharkhand, Bihar, Gujarat and Maharashtra.

Details of technology

A high yielding fine grain variety tolerant to salinity and resistant to bacterial blight IIRR, Hyderabad has developed an improved version of Improved Samba Mahsuri tolerant to seedling stage salinity, bacterial blight resistant, high yielding, fine grain variety possessing premium grain and cooking quality, named as DRR dhan-58, through the deployment of marker assisted selection for the first time in South India. It can be cultivated in areas with assured irrigation especially in coastal are as where fine grained rice varieties are preferred and widely cultivated. It possesses seedling stage salinity tolerance QTL, *Saltol* along with three major bacterial blight resistance genes *Xa21*, *xa13* and *xa5* and exhibited good tolerance to salinity in coastal areas and high level of resistance to bacterial blight across the country in multi- location trials of AICRIP.

Features of technology with their benefits

- ❖ It possesses excell entgrain and cooking quality features on par with improved Samba Mahsuri.
- ❖ Similar to rice varieties of medium and late duration, which are cultivated in irrigated areas.
- ❖ Total duration is 130 - 135 days.
- ❖ It yields 5.50 t/ha and significantly under saline conditions gives 24 per cent more yield and 8per cent under normal conditions than the susceptible varieties.



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Technology : 14

Name of technology	DRR dhan-59
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under aerobic conditions
Recommended for region (Names of districts/states)	Telangana, Andhra Pradesh, TamilNadu, Karnataka, Jharkhand

Details of technology

DRR dhan-59 is developed as an improved, bacterial blight resistant, high yielding, long-bold grain type variety possessing premium grain and cooking quality, through the deployment of Marker assisted selection for the first time in South India. It can be cultivated in areas with assured irrigation, where long bold rice varieties are preferred and widely cultivated. It possesses a major bacterial blight resistance gene *Xa33* and exhibited high level of resistance to bacterial blight a cross the country in multi-location trials of All India Coordinated Rice Improved Project (AICRIP).

Features of technology with their benefits

- ❖ It is similar to rice varieties of medium and late duration, which are cultivated in irrigated areas.
- ❖ Total duration is 130-135days.
- ❖ It yields 5.0-5.5 t/ha and significantly under conditions of bacterial blight infestation, it gives 11-12 per cent more yield than any other bacterial blight susceptible variety.
- ❖ It also possesses excellent grain and cooking quality features.



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Technology : 15

Name of technology	DRR dhan-60
Year of release	2021
Source of technology	ICAR-IIRR, Hyderabad
Suitable for which crops/ animals/enterprises etc.	Rice crop under Irrigated ecosystem
Recommended for region (Names of districts/states)	Telangana, Andhra Pradesh, Tamil Nādu, Karnataka, Chhattisgarh, Odisha, Jharkhand, Bihar, Gujarat and Maharashtra.

Details of technology

- ❖ ICAR-IIRR, Hyderabad has developed an improved version of improved Samba Mahsuri to lerant to low soil phosphorous, bacterial blight resistant, high yielding, fine grain variety possessing premium grain and cooking quality, named as DRR dhan-60, through the deployment of marker assisted selection for the first time in South India.
- ❖ It can be cultivated in areas with assured irrigation especially in coastal areas where fine grained rice varieties are preferred and widely cultivated. It possesses low soil phosphorous tolerance QTL, *Pup1* along with three major bacterial blight resistance genes *Xa21*, *xa13* and *xa5* and exhibited good tolerance to low soil phosphorus and high level of resistance to bacterial blight across the country in multi-location trials of All India Coordinated Rice Improved Project (AICRIP).

Features of technology with their benefits

- ❖ DRR dhan-60 yields 5.19 t/ha.
- ❖ Total duration is 125-130 days.
- ❖ It possesses excellent grain and cooking quality features.



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Technology : 1

Name of technology	Dugout pond for deep black soils in deccan plateau region
Year of release	2008
Source of technology	ICAR-IISWC, Research Centre, Ballari
Suitable for which crops/ animals/enterprises etc.	The technology provides life saving / supple mental irrigation to crops and plantation under rainfed conditions.
Recommended for region (Names of districts/states)	Semi-arid regions of Andhra Pradesh, Telangana and Karnataka

Details of technology

Dugout farm pond has tremendous potential to enhance agriculture production in low rainfall semi-arid black soil region. Since this region receives low rainfall of about 500-700 mm mostly in the rabi season and efficient utilization of this excess runoff through dugout pond from every 10 ha catchment is required to stabilise the crop production. The capacity of designed pond depends upon the catchment size and factors affecting its water yield. In general, capacity of pond may be 250 m³ per ha of catchment and the average cost of construction of storage worked out to be Rs. 70 per cum storage.

Features of technology with their benefits

- ❖ Harvesting of excess runoff through dugout pond for supplemental life saving irrigation to increase crop production in semi-arid vertisols.
- ❖ Pond meets the water requirement for domestic and livestock use.
- ❖ Water harvested through dugout pond augment groundwater recharge.
- ❖ Improves moisture status of the soil profile and reduce soil erosion.
- ❖ Due to pond, 30 to 40 per cent of catchment area gets recharged with moisture and yield increases between 55 per cent and 90 per cent and gross returns by 55 per cent and 86 per cent with 5 cm and 10 cm of additional water respectively.
- ❖ Net benefits also increased with different levels of supplemental irrigations with pond to crops.



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Technology : 2

Name of technology	Bio-fencing in vertisols of semi-arid region
Year of release	2008
Source of technology	ICAR-IISWC, Research Centre, Ballari
Suitable for which crops/ animals/enterprises etc.	It is suitable for poor, small and marginal farmers to protect their cultivated agricultural fields from human and animal encroachment. Due to financial constraints, poor farmer can't go for high cost barbed wire fencing, and hence bio-fencing may be a viable technology to be followed in agricultural fields in the rainfed region.
Recommended for region (Names of districts/states)	Semi-arid rainfed agro-eco system

Details of technology

Bio-fence species may be planted on the ridge or field bunds at a spacing of 50 cm x 50 cm in two staggered rows. *Agave sisilana* and stem cuttings of *Euphorbia tirucallis* may be used as planting material on the bund.

Features of technology with their benefits

- ❖ Bio-fence all along the road protects the crops from dust especially in the mining area and reduces the crop yield loss from 5 to 10 per cent .
- ❖ *Agave sisilana* and *Euphorbia tirucalli* reduced the runoff by 56 per cent and 58 per cent , and soil loss by 73 per cent and 75 per cent respectively over control (without bio-fence).
- ❖ Incorporation of bio-fence species pruned biomass into the soil improves the soil fertility and increases crop yields.



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Technology : 3

Name of technology	Energy efficient solar pump with drip irrigation system using rainwater harvesting
Year of release	2020
Source of technology	ICAR-IISWC, Research Centre, Ballari
Suitable for which crops/ animals/enterprises etc.	Suitable for high value crops like vegetables and cash crops.
Recommended for region (Names of districts/states)	Semi-arid vertisols of south India (Andhra Pradesh, Telangana, Maharashtra and Karnataka)

Details of technology

Rainwater is harvested in a farm pond, and an energy efficient DC Solar pump is used with drip system replacing earlier diesel pump for irrigating the field crops in place of traditional flooding method.

Features of technology with their benefits

- ❖ Using this technology, farmer's net income increased by 71 per cent over traditional method and it increased B: C ratio of 4.08.
- ❖ Apart from increasing the crop yields, solar pump with drip irrigation has saved the energy of 545 kW that reduced his farm expenditure to the tune of Rs. 7603 towards fuel cost and CO₂ emission of 357 Kg.
- ❖ Irrigation through solar pumps are eco-friendly, energy efficient and viable options to replace diesel/electricity run pumps in order to reduce farm expenditure and environmental pollution under climate changing scenario.
- ❖ Solar pump based drip irrigation helps the farmer to reduce over exploration of groundwater resource and decrease the dependency on fossil fuels for irrigation purpose.



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Technology : 1

Name of technology	Cover crops for improving soil health and vegetable productivity in the hilly region
Year of release	2020
Source of technology	ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Udhagamandalam
Suitable for which crops/ animals/enterprises etc.	Crops in the hilly region
Recommended for region (Names of districts/states)	Temperate hilly areas of India

Details of technology

- ❖ Crop rotation is the key to agricultural sustainability in climate change scenario, inclusion of cover crops gives many benefits.
- ❖ In the hilly areas cover crops like buckwheat, fodder oats, lupin and mustard can be grown in between cash crops in rotation for improving crop productivity, soil health and other benefits.
- ❖ For example these cover is grown during winter fallow (November-February) after the harvest of cash crops potato (March to June) and carrot (July to October).
- ❖ Soon after the harvest of cash crops, buck wheat (40-50 kg), lupin (80-100 kg), fodder oats (100-125 kg), and mustard can be broadcasted per hectare and it should be followed by one pass of cultivator.
- ❖ These cover crops are incorporated during 50 per cent flowering using disk harrow/ plough or using herbicide. Buck wheat, lupin, fodder oats and mustard comes to flowering during 35-40 days, 90-95 days, 60-65 days and 45-50 days respectively.

Features of technology with their benefits

- ❖ At ICAR-IISWC, RC, Ooty inclusion of cover crop increased the.
- ❖ Buck wheat, lupin, fodder oats and mustard added biomass (2.2 to 4.5 t/ha) and added 50-70 kg N, 12-15 kg P and 10.5 to 28 kg K/ha to the soil.
- ❖ Reduced weed intensity by 70 per cent.
- ❖ Increased soil aggregate stability and sustainable yield index.



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Technology : 2

Name of technology	Multiple use of harvested rain water in hilly regions
Year of release	2018
Source of technology	ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Udhagamandalam
Suitable for which crops/ animals/enterprises etc.	Small farmers of hilly region having average land sizes of 2.0 ha
Recommended for region (Names of districts/states)	The Nilgiris, Tamil Nadu

Details of technology

Multiple water use system model integrating water resources, soil conservation measures, live stock, fish, crop and composting .

Crops with soil conservation measures: Tea in upper reach, vegetables in middle reaches with Bench terraces, grasses and vegetables in lower reaches,

Live stocks: Geese unit with 6 geese ; Rabbit unit with 10 rabbits.

Water Recourses: Farm pond with fish culture.

Composting: One unit of vermi composting.

Features of technology with their benefits

Harvesting rainwater and usage through multiple uses for various components will enhance the land and water productivity. Farmers' income will be increased to 50 per cent.



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Technology : 3

Name of technology	Jute geo textiles as bioengineering measure for slope stabilization
Year of release	2017
Source of technology	ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Udhagamandalam
Suitable for which crops/ animals/enterprises etc.	Slope stabilization in all slopes including mine dumps and landslide mitigation
Recommended for region (Names of districts/states)	North East Himalaya, including Darjeeling and Sikkim Himalaya; 14.0 Mha falls in North West Himalaya (Uttarakhand, Himachal Pradesh and Jammu & Kashmir); 9.0 million ha in Western Ghats and Konkan hills (Tamil Nadu, Kerala, Karnataka, Goa and Maharashtra) and 1.0 Mha in Eastern Ghats of Aruku area in Andhra Pradesh. Cast Mining Industries.

Details of technology

- ❖ Stabilization on 60 and 90 per cent slopping degraded land showed that 700 GSM (Gram per Square Metre) Open Weave JGT with grasses are more effective in reducing runoff and soil loss, nutrient loss and increasing soil moisture retention.
- ❖ 500 GSM JGT is more effective for slope stabilization with tea plants hence 500 GSM JGT is recommended for tea plantations in unstable slopes.

Features of technology with their benefits

- ❖ Protection of slopes in road and railway embankments, bridge approaches, terrace risers in hilly terrains.
- ❖ Stabilization of sand dunes, mine spoils, mine dumps in open cast iron, PFA dumps in thermal power plants and slag heaps.
- ❖ Rehabilitation of mass eroded lands due to cyclones, earthquakes and landslides.
- ❖ Lake, canal and river bank stabilization.
- ❖ Slope stabilization in farm and forestry areas.
- ❖ Green wards developments in parks, airports and housing estates.



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Technology : 1

Name of technology	Integrated Nutrient Management in finger millet in Alfisols
Year of release	2017
Source of technology	AICRP on LTFE, Bangalore centre
Suitable for which crops/ animals/enterprises etc.	Finger millet
Recommended for region (Names of districts/states)	Karnataka

Details of technology

100 % NPK + FYM @ 7.5 t ha⁻¹ + Lime (Based on LR)

Features of technology with their benefits

Use of optimal dose of fertilizer integrated with organics (FYM) would help in maintaining sustainability in production of finger millet and better soil health condition.

Contact for further details

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Technology : 2

Name of technology	Integrated Nutrient Management in maize in Alfisols
Year of release	2017
Source of technology	AICRP on LTFE, Bangalore centre
Suitable for which crops/ animals/enterprises etc.	Hybrid maize
Recommended for region (Names of districts/states)	Karnataka

Details of technology

100 % NPK + FYM @ 10 t ha⁻¹ + Lime (Based on LR)

Features of technology with their benefits

Use of optimal dose of fertilizer integrated with organics (FYM) would help in maintaining sustainability in production of maize and better soil health condition.

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Technology : 3

Name of technology	50 % Recommended dose of Phosphorus application in P build up soils
Year of release	2015
Source of technology	AICRP on LTFE, Bangalore centre
Suitable for which crops/ animals/enterprises etc.	P build up soils
Recommended for region (Names of districts/states)	Karnataka

Details of technology

100 % NK + 50% P + Rec. FYM + Lime (Based on LR).

Features of technology with their benefits

- ❖ Continuous use of optimal dose of phosphorus indicated build-up of soil phosphorus.
- ❖ Half the recommended dose of phosphorus in such soils would be sufficient to meet the requirement of the crop without reduction in yield.
- ❖ Use of this technology would save 50 per cent cost on phosphatic fertilizers.

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Technology : 4

Name of technology	Rhizobium biofertilizer
Year of release	2021
Source of technology	ICAR All India Network Project on Soil Biodiversity Biofertilizers, Centre – VNMKV, Parbhani
Suitable for which crops/ animals/enterprises etc.	Legumes
Recommended for region (Names of districts/states)	Marthwada district, Parbhani, and other districts of Maharashtra

Details of technology

- ❖ A rhizobium biofertilizer technology has been developed for various legumes of Maharashtra. The biofertilizer improves crop yield by 10-28 per cent.
- ❖ Details of technology and its application can be found from ICAR Krishi portal : <https://aicrp.icar.gov.in/biofertilizers/technical-bulletin-2/>

Features of technology with their benefits

- ❖ It contains nitrogen-fixing bacteria Rhizobium for different pulse and legume crops like moongbean, urdbean, pigeonpea, soybean, pea, chickpea, berseem and groundnut.
- ❖ The liquid formulation has self-life more than 6 months and carries high microbial load of 10^{10} - 10^{12} cfu/ml.
- ❖ They are very easy to handle, store and to transport in the field for the application.



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Technology : 5

Name of technology	Azotobacter biofertilizer
Year of release	2021
Source of technology	ICAR All India Network Project on Soil Biodiversity Biofertilizers, Centre – VNMKV, Parbhani
Suitable for which crops/ animals/enterprises etc.	Most non legumes crops, vegetables etc
Recommended for region (Names of districts/states)	Marthwada district, Parbhani, and other districts of Maharashtra

Details of technology

- ❖ Azotobacter biofertilizer technology has been developed for various crops of Maharashtra. The biofertilizer improves crop yield by 5-25 per cent .
- ❖ Bioformulation provides different growth hormones and protects plants from pathogens. Germination is also increased by the use of bioformulation.

Features of technology with their benefits

- ❖ Azotobacter biofertilizers are used for the cereals and non-legume crops like wheat, maize, pearl millet, sorghum, mustard, cotton, fruit and vegetables.
- ❖ The liquid formulation has self-life more than six months and carries high microbial load of 10^8 - 10^{10} cfu/ml.
- ❖ They are very easy to handle, store and transportation in the field for the application.
- ❖ It can add 15-20 kg/ha of nitrogen and also increases the crop yield.



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Technology : 6

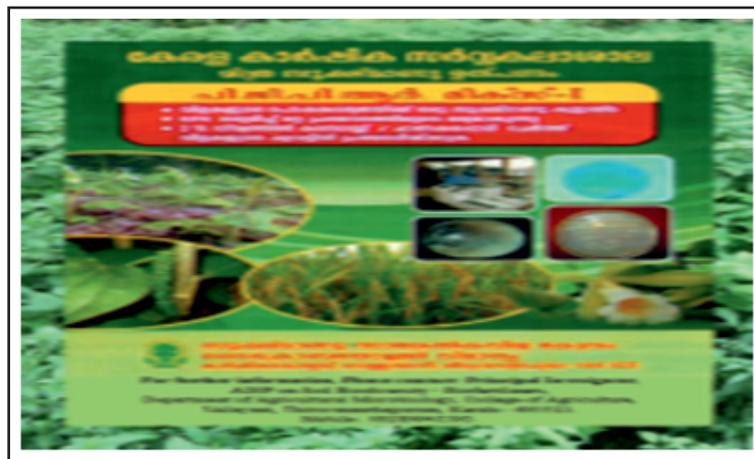
Name of technology	Biofertilizer
Year of release	2021
Source of technology	ICAR All India Network Project on Soil Biodiversity Biofertilizers, Centre – KAU Vellayani
Suitable for which crops/ animals/enterprises etc.	Vegetables
Recommended for region (Names of districts/states)	Kerala

Details of technology

- ❖ The biofertilizer product is a consortium “PGPR Mix – 1” for NPK requirement. The consortium consists of Azotobacter sp., Azospirillum sp., and Bacillus spp.

Features of technology with their benefits

- ❖ Biofertilizer “PGPR Mix – I” is effective for vegetable crops including brinjal, chillies, tomato, cowpea, cucurbits, onion and cool season vegetables including cauliflower cultivated under irrigated condition.
- ❖ The formulated product increases vegetables yield by 20-25% and saves use of chemical fertilizer up to 25 per cent
- ❖ The PGPR Mix – I is available at Department of Agricultural Microbiology, College of Agriculture, Vellayani, Thiruvananthapuram, Kerala.



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Technology : 7

Name of technology	Biofertilizer
Year of release	2021
Source of technology	ICAR All India Network Project on Soil Biodiversity Biofertilizers, Centre – KAU Thrissur
Suitable for which crops/ animals/enterprises etc.	Spices
Recommended for region (Names of districts/states)	Wayanad district, Kerala

Details of technology

- ❖ A biofertilizer developed for spices using novel nitrogenous biofertilizers viz; Microbacterium, Cellulosimicrobium, Paenibacillus and Azospirillum zeae.

Features of technology with their benefits

- ❖ Biofertilizer improves crop yield due to intrinsic PGPR activities of the strains.
- ❖ It improves crop yield by 10-25 per cent.


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Technology : 8

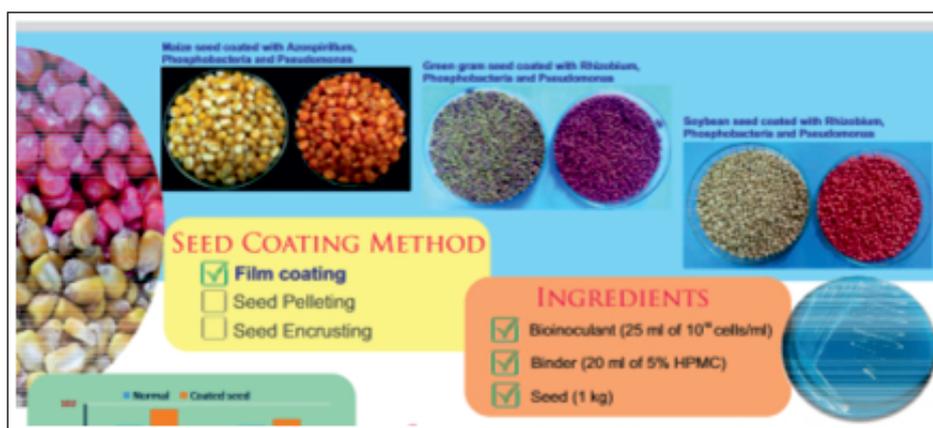
Name of technology	Seed coat biofertilizer formulation
Year of release	2021
Source of technology	ICAR All India Network Project on Soil Biodiversity Biofertilizers, Centre – TNAU Tamilnadu
Suitable for which crops/ animals/enterprises etc.	All major crops
Recommended for region (Names of districts/states)	Tamil Nadu

Details of technology

- ❖ A seed coating technology developed where biofertilizers can be coated on seeds as per recommendation or requirement. Seeds can have high density of inoculants.

Features of technology with their benefits

- ❖ Thin film of biofertilizers coated on the surface of the seeds.
- ❖ Customized biofertilizers coating using Rhizobium, Azospirillum, Phosphobacteria, mineral solubilizers.
- ❖ Seed coating ensures effective delivery of biofertilizers to the crop plants.
- ❖ Easy to apply for any annual crop seeds.
- ❖ Economic as it reduces the inoculants dosage and ensures proper application.
- ❖ Dust free biofertilizer and ready to use product with less environmental pollution.
- ❖ Seeds are individually coated and free flow product for easy application.
- ❖ No interference with seed viability and germination.
- ❖ Biofertilizer strains can survive up to 90 days in the coated seeds. Compatible with mechanized sowing.



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Technology : 9

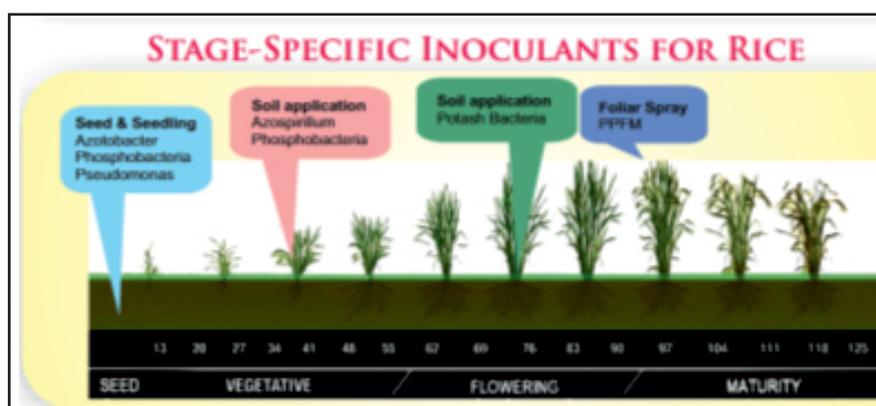
Name of technology	Liquid biofertilizer
Year of release	2021
Source of technology	ICAR All India Network Project on Soil Biodiversity Biofertilizers, Centre – TNAU Tamilnadu
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region (Names of districts/states)	Tamil Nadu

Details of technology

- ❖ The biofertilizer packages developed for rice growth stage specific requirements.
- ❖ It contains different microbial strains for particular nutrient requirement.
- ❖ Product helps in nutrient acquisition and stress abatement.

Features of technology with their benefits

- ❖ It contains strains for nutrient mobilization Nitrogen - *Azospirillum lipoferum*, Phosphorus - *Bacillus megaterium*, Potassium - *Bacillus mucilaginosus*, Zinc - *Pseudomonas chlororaphis*, Drought mitigation - *Methylobacterium sp.*



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Technology : 1

Name of technology	Ash gourd variety Kashi Ujwal
Year of release /identification/notification	2006
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Ash gourd
Recommended for region (Names of districts/states)	Uttar Pradesh, Bihar, Jharkhand, Punjab, Karnataka, Tamil Nadu and Kerala

Details of technology

- ❖ Less seeded fruits.
- ❖ Average fruit weight is 10-12 kg.
- ❖ Fruit shape is globular.
- ❖ Fruit yield is 400-500 q/ha.



Contact for further details

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Technology : 2

Name of technology	Chilli variety Kashi Sinduri (IVPBC-535)
Year of release /identification/notification	2012
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region (Names of districts/states)	Karnataka, Tamil Nadu and Kerala

Details of technology

- ❖ Plants determinate.
- ❖ Moderately resistant to anthracnose and 50 per cent flowering in 30-35 days after transplanting.
- ❖ Fruits colour green and dark red ripe.
- ❖ Non-pungent and high oleoresin content (15%).
- ❖ Green fruit yield 200-225 q/ha and red ripe fruits yield is 140 q/ha.



Contact for further details

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Technology : 3

Name of technology	Dolichos bean variety Kashi Haritima
Year of release /identification/notification	2012
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Dolichos bean
Recommended for region (Names of districts/states)	NEH Region, Uttar Pradesh, Bihar, Punjab, Madhya Pradesh, Maharashtra, Karnataka, Tamil Nadu and Kerala

Details of technology

- ❖ Pole type and 250-300 pods per plant.
- ❖ Average pod length of 14-15 cm.
- ❖ Pods colour green, soft in texture.
- ❖ Free from parchment layer.
- ❖ Yield is 350-375 q/ha.


Contact for further details

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Technology : 4

Name of technology	Tomato variety Kashi Amul
Year of release /identification/notification	2018
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region (Names of districts/states)	Karnataka, Tamil Nadu and Kerala

Details of technology

- ❖ Fruits round and firm with pericarp thickness of 6-6.5 mm.
- ❖ Average fruit weight 90-115 g in initial three pickings.
- ❖ Fruits mature in 85-90 days post transplanting.
- ❖ This variety has shown high level of ToLCV resistance in artificial screens and field tests in disease hot spot at IIVR, Varanasi.
- ❖ Average yield is 500-600 q/ha.



Contact for further details

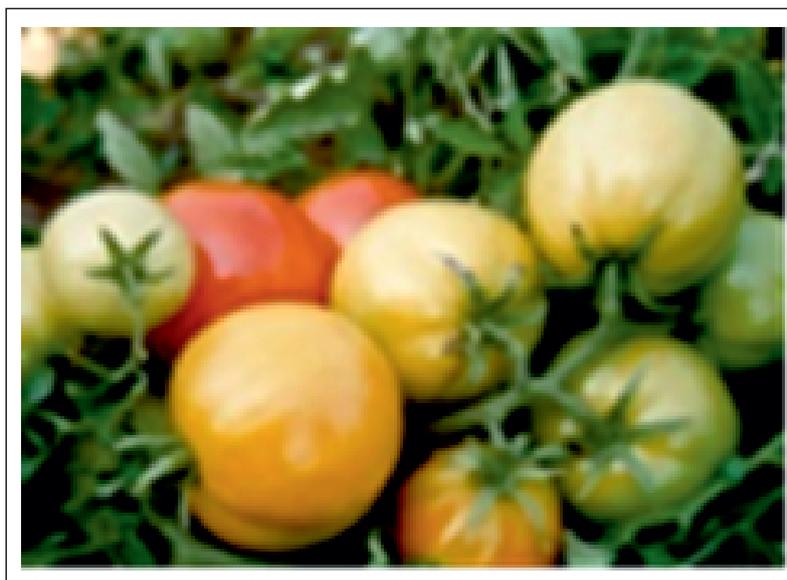
Director
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Technology : 5

Name of technology	Tomato variety Kashi Vishesh
Year of release /identification/notification	2006
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Tomato
Recommended for region (Names of districts/states)	J&K, Uttaranchal, Punjab, U.P., Bihar, Jharkhand, Chhattisgarh, Odisha, A.P., Karnataka, Tamil Nadu and Kerala

Details of technology

- ❖ Determinate.
- ❖ Red fruit, spherical shape and medium to large size.
- ❖ Resistant to tomato leaf curl virus.
- ❖ Yield is 400-450 q/ha.


Contact for further details

Director

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Technology : 6

Name of technology	French bean variety Kashi Baingani
Year of release /identification/notification	2021
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	French bean
Recommended for region (Names of districts/states)	J&K, HP, Uttarakhand, MP, Goa, Maharashtra, Karnataka, TN, Kerala and Puducherry

Details of technology

- ❖ Purple-podded variety.
- ❖ Green pods for first 5-7 days and turn completely purple in the next 8-10 days.
- ❖ Pod length is 14-15 cm.
- ❖ Average pod yield is 160 q/ha.



Contact for further details

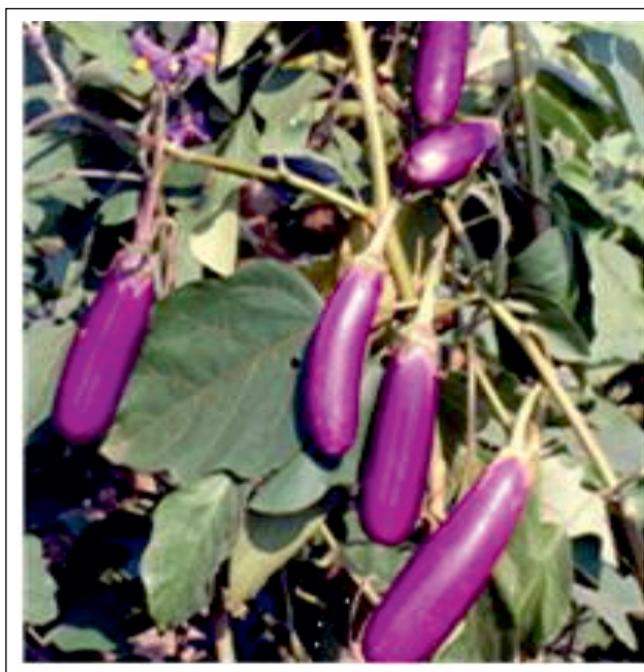
Director
 ICAR-IIVR, P.O. Jakhini (Shahanshahpur), Varanasi-221305.
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Technology : 7

Name of technology	Brinjal hybrid. Kashi Komal
Year of release /identification/notification	2004
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Brinjal
Recommended for region (Names of districts/states)	All brinjal growing area of the country

Details of technology

- ❖ Plant height is 80-90 cm tall.
- ❖ Picking starts 65-70 days after transplanting.
- ❖ Fruits small are (6-7 cm long).
- ❖ Colour is purple and each fruit weighing is 60-65 g,
- ❖ Yield is 500-550 q/ha.


Contact for further details

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Technology : 8

Name of technology	Chilli hybrid. Kashi Early
Year of release /identification/notification	2005
Source of technology	ICAR-IIVR, Varanasi
Suitable for which crops/ animals/enterprises etc.	Chilli
Recommended for region (Names of districts/states)	Punjab, Uttar Pradesh, Bihar, Jharkhand, Chattisgarh, Odisha, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala

Details of technology

- ❖ Indeterminate and 80-100 cm in height.
- ❖ Fruits colour is green.
- ❖ Suitable for green chilli production.
- ❖ Tolerant to thrips, mites and viruses.
- ❖ Green fruit yields 300-350 q/ha.



Contact for further details

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17

National Bureau of Agriculturally Important Microorganisms (NBAIM), Mau

Technology : 1

Name of technology	Bio NPK liquid formulation
Year of release	2016
Source of technology	ICAR-NBAIM, Mau,UP.
Suitable for which crops/ animals/enterprises etc.	Cereals, millets,pulses, vegetables and oil producing commercial crops.
Recommended for region (Names of districts/states)	All

Details of technology

A unique formulation of NPK providing bacteria was developed that consists of a nitrogen fixing (*Azotobacter chroococcum*), P-solubilizing (*Paenibacillustylopilii*) and K –solubilizing (*Bacillus decolorationis*) bacteria.

Features of technology with their benefits

- ❖ Inoculation with this single product can help to augment 20-25 kg N, 15-20 kg P₂O₅ and 5-10 kg K/ ha.
- ❖ All three cultures maintain a high CFU count throughout its storage.
- ❖ The formulation is more suited for soils with pH in the range of 6.5 to 8.5.
- ❖ The formulation has a shelf life of 12 months.
- ❖ For treating seeds for one acre of land area, a bottle of 100 ml to be diluted to 1000 ml with water and poured over seeds and mixed thoroughly so as to have a uniform coating.
- ❖ The formulation has a shelf life of 12 months.
- ❖ Its application can result in a net saving of Rs. 2500 per hectare.



Contact for further details

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Technology : 2

Name of technology	BIOGROW
Year of release	2015
Source of technology	ICAR-NBAIM, Mau,UP
Suitable for which crops/ animals/enterprises etc.	Vegetables particularly tomato and other solanaceous crops.
Recommended for region (Names of districts/states)	All

Details of technology

BIOGROW has been developed using consortium of bacterial species viz. *Bacillus* sp. BC39, *Bacillus* sp. RC25, *Pseudomonas* sp. K30 and *Pseudomonas* sp. K31, endowed with phosphorus solubilization, IAA and siderophore production attributes.

Features of technology with their benefits

- ❖ Application of BIOGROW increased the yield by 25- 30%.
- ❖ Nutritional quality of vegetables also increased upon application of BIOGROW.
- ❖ The formulation is more suited for soils with pH in the range of 6.5 to 8.5.
- ❖ The formulation has a shelf life of 12 months.
- ❖ It is convenient to use.
- ❖ Formulation can be applied as seed treatment and root dip method for seedling during transplantation. Dilute 100 ml of formulation with one litre of water and apply on seed required for one acre of field. The treated seeds can be sown after 30 minutes.



Contact for further details

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Technology : 3

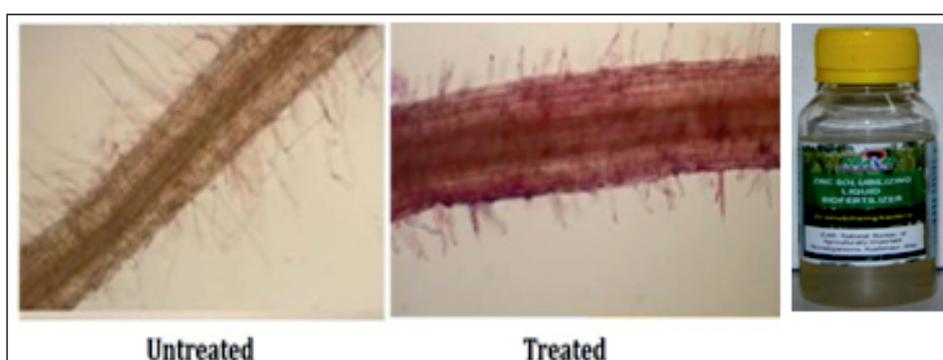
Name of technology	Bio Zn liquid formulation
Year of release	2016
Source of technology	ICAR-NBAIM, Mau, UP
Suitable for which crops/ animals/enterprises etc.	Cereals, millets, pulses, vegetables and oil producing commercial crops
Recommended for region (Names of districts/states)	All

Details of technology

Zinc solubilising bacteria play crucial role in dissolution or insoluble source of zinc through secretion of organic acids and other metabolites. When applied to soil, it converts insoluble form of Zn to soluble form and makes it available to the plant. Liquid formulation contains Zn solubilising bacterium *Bacillusendophyticus*, suitable for different soiltypes.

Features of technology with their benefits

- ❖ Inoculation of Zn solubiliser helps to augment 2 to 5 kg Zn ha⁻¹, and also improves yield by 5-10 per cent.
- ❖ The formulation has a shelf life of one year. No loss in plant growth promoting activities in formulation even on long storage and can be stored at elevated temperature.
- ❖ The formulation is more suited for soils with pH in the range of 6.5 to 8.5.
- ❖ Inoculation can be done through seed treatment, root dip for seedlings and soil application for tree plants. Dilute 100 ml of formulation with one litre of water and apply on seed required for one acre of field. Seeds can be sown after 30 minutes.



Contact for further details

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Technology : 4

Name of technology	Bio Phos (Kluyveracryocrescens)
Year of release	2016
Source of technology	ICAR-NBAIM, Mau
Suitable for which crops/ animals/enterprises etc.	Cereals, millets and pulses.
Recommended for region (Names of districts/states)	All

Details of technology

Phosphorus solubilising bacteria when applied to soil, it converts insoluble form of P to soluble form and make it available to the plant. BioPhos is a liquid formulation of P-solubilizing bacterium containing *Kluyveracryocrescens*. Phosphorus solubilising bacteria when applied to soil, it converts insoluble form of P to soluble form and make it available to the plant. BioPhos is a liquid formulation of P-solubilizing bacterium containing *Kluyveracryocrescens*.

Features of technology with their benefits

- ❖ It has a longer shelf life (12 months) without loss of microbial populations and properties upon exposure to high temperature.
- ❖ Inoculation of P solubilizer helps to augment 15 to 20 kg P₂O₅ ha⁻¹.
- ❖ Keep soils biologically active and helps in soil health maintenance.
- ❖ It is convenient to use.
- ❖ Inoculation can be done through seed treatment, root dip for seedlings and soil application for tree plants. Dilute 100 ml of formulation with one litre of water and apply on seed required for one acre of field. Seeds can be sown after 30 minutes.



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Technology : 5

Name of technology	Bio Phos ⁺ (<i>Paenibacillustylopi</i>)
Year of release	2016
Source of technology	ICAR-NBAIM, Mau
Suitable for which crops/ animals/enterprises etc.	Cereals, millets, pulses, vegetables and oil producing commercial crops.
Recommended for region (Names of districts/states)	All

Details of technology

Phosphorus solubilizing bacteria when applied to soil, it converts insoluble form of P to soluble form and make it available to the plant. Liquid formulations of P-solubilizing bacterium containing *Paenibacillus tylopi*.

Features of technology with their benefits

- ❖ Inoculation of P solubilizer helps to augment 15 to 20 kg P₂O₅ ha⁻¹. Keep soils biologically active and helps in soil health maintenance.
- ❖ It has a longer shelf life (12 months) without loss of microbial populations and properties upon exposure to high temperature.
- ❖ Inoculation can be done through seed treatment, root dip for seedlings and soil application for tree plants. Dilute 100 ml of formulation with one liter of water and apply on seed required for one acre of field. Seeds can be sown after 30 minutes.



Contact for further details

Director,
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Technology : 6

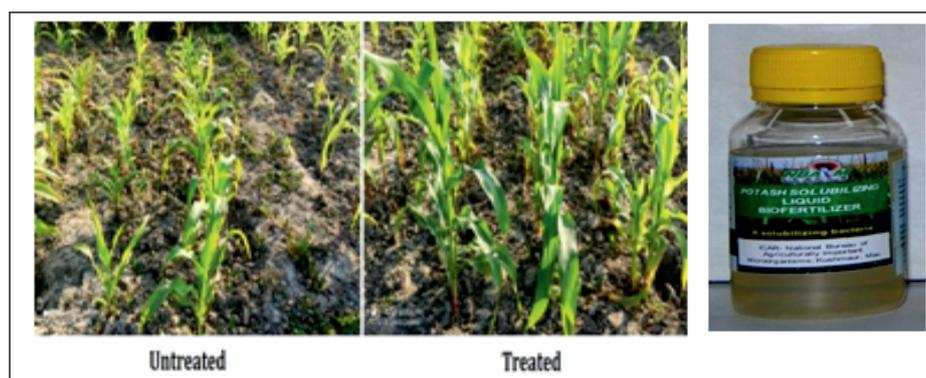
Name of technology	Bio Potash liquid formulation
Year of release	2016
Source of technology	ICAR-NBAIM, Mau
Suitable for which crops/ animals/enterprises etc.	Maize, wheat, mustard and potato.
Recommended for region (Names of districts/states)	All

Details of technology

- ❖ Aliquid formulation having highly efficient K-solubilizing bacterium *Bacillus decolorationis*.

Features of technology with their benefits

- ❖ It can be used in different types of soils.
- ❖ The culture maintains a high CFU count throughout its storage. It helps plant to utilize K fixed in soil.
- ❖ The formulation has a shelf life of 12 months
- ❖ Inoculation of K-solubilizer helps to augment 10-15 kg K ha⁻¹.
- ❖ Inoculation can be done through seed treatment, root dip for seedlings and soil application for tree plants. Dilute 100 ml of formulation with one litre of water and apply on seed required for one acre of field. Seeds can be sown after 30 minutes.



Contact for further details

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Technology : 7

Name of technology	Bio-Bacter liquid formulation
Year of release	2019
Source of technology	ICAR-NBAIM, Mau
Suitable for which crops/ animals/enterprises etc.	All plants to supply biologically fixed nitrogen.
Recommended for region (Names of districts/states)	All

Details of technology

The formulation contains effective strain of *Azotobacter* which is free living nitrogen fixer. It is a multipurpose strain and not only contributes nitrogen but also produces IAA and can also solubilise little amount of P.

Features of technology with their benefits

- ❖ Bio-Bacter when applied as seed inoculant can save 20-25 kg N/ha.
- ❖ It enhances the yield of wheat and maize by 5-7 per cent as compared to uninoculated control.
- ❖ The formulation has a shelf life of 12 months.
- ❖ Inoculation can be done through seed treatment, root dip for seedlings and soil application for tree plants. Dilute 100 ml of formulation with one litre of water and apply on seed required for one acre of field. Seeds can be sown after 30 minutes



Contact for further details

Director,
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Technology : 8

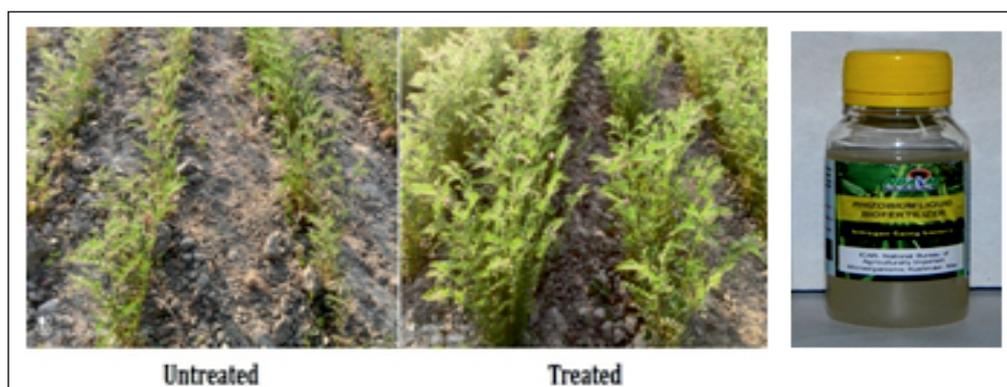
Name of technology	Rhizo NBAIM liquid formulation
Year of release	2016
Source of technology	ICAR-NBAIM, Mau
Suitable for which crops/ animals/enterprises etc.	Chickpea, pigeonpea, mungbean, urdbean, groundnut, pea and lentil
Recommended for region (Names of districts/states)	All

Details of technology

Rhizobia are specific for leguminous crops. A liquid formulation having highly efficient nitrogen fixing rhizobial strains specific to chickpea, pigeon pea, mung bean, urd bean, groundnut, pea and lentil have been developed for seed inoculation.

Features of technology with their benefits

- ❖ The formulation contains strain of Rhizobia which contributes about 30 kg N ha⁻¹.
- ❖ The application of this formulation can reduce the use of chemical nitrogen fertilizer, and enhance the yield by 7-10 per cent over uninoculated control.
- ❖ The formulation has a shelf life of 12 months.
- ❖ Inoculation can be done through seed treatment, before sowing of the crop. Dilute 100 ml of formulation with one litre of water and apply on seed required for one acre of field. Seeds can be sown after 30 minutes.



Contact for further details

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Technology : 1

Name of technology	Kaveri Kalki
Year of release	2018-19
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable for which crops/ animals/enterprises etc.	Banana

Details of technology

Dwarf dessert banana (2-2.4 m which is 40 per cent lesser height than local Kapuravalli) with 90 cm circumference and hence no propping is required. Leaves are almost erect in position. Short duration (60-70 days lesser duration than local Kapuravalli), suitable for annual cropping system and high-density planting.

Features of technology with their benefits

High TSS content (10 per cent higher TSS content than local Kapuravalli). Highly fertilizer and water responsive variety. Highly resistant to leaf spot disease.

***Contact for further details***

Director
ICAR, NRCB, Thogamalai road, Thayanur
Trichirapalli

Technology : 2

Name of technology	Kaveri Saba
Year of release	2018-19
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

Dual purpose variety recommended for release both by SVRC and CVRC. It produces 20 per cent higher yield and 20-25 days earlier than Monthan. Tolerant to moisture deficit stress (drought). Suitable for saline sodic soils. High market preference and fetches premium price in the market owing to its high keeping quality with a green life of 7-8 days.

Features of technology with their benefits

Tolerant to Fusarium wilt Race 2. It is suitable for flour making and resistant starches which could be used in health and soup mixes, bakeries and extruded products like pasta, noodles etc.



Contact for further details

Director
ICAR, NRCB, Thogamalai road, Thayanur
Trichirappalli

Technology : 3

Name of technology	Kaveri Sugantham– A new variety from ICAR-NRCB
Year of release	2018-19
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

NRCB identified a high yielding selection from tissue cultured plants of cv. Manoranjitham, probably a positive variant by name Kaveri Sugantham. Yield potential of 22 kg bunch as against normal 15 kg bunch (60 per cent more yield). Plant stature is robust and the height of plant ranging from 4- 4.5 m height and 90 cm girth. It is tolerant to Eumusae leaf spot disease. Pulp is cream in colour, sweet with good aroma. Crop duration is 13-14 months.

Features of technology with their benefits

This is recommended for cultivation in higher altitudes especially for Kolli hills and Palani hills.


Contact for further details

Director
ICAR, NRCB, Thogamalai road, Thayanur
Trichirapalli

Technology : 4

Name of technology	Kaveri Haritha
Year of release	2018-19
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

Clonal selection from Bangrier recommended for release by the CVRC and 20-25 days earlier than Monthan. Fruits are elongated with pointed tip, thus the wastage of fruit parts is lesser in Bangrier than Monthan. High and stable yield in both main and two ratoon crops.

Features of technology with their benefits

Suitable for all types of soil including marginal soils. Suitable for Tamil Nadu, Kerala, Andhra Pradesh, Odisha and West Bengal.



Contact for further details

Director
ICAR, NRCB, Thogamalai road, Thayanur
Trichirapalli

Technology : 5

Name of technology	Kaveri Kanya
Year of release	2018-19
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

Clonal selection from tissue cultured clones of FHIA 03. Dual purpose variety recommended for release by the CVRC. It is a medium tall and robust plant with plant height ranging from 2.40 to 2.70 m and pseudostem girth of 80-95 cm. Crop duration of 365-380 days. The fruit pedicel attachment is strong. Field tolerant to Foc race 1.

Features of technology with their benefits

Best suited for staggered harvesting of individual hands in a bunch and hence suitable for kitchen and backyard gardens. This variety is suitable for cultivation in Tamil Nadu, Kerala, Andhra Pradesh, West Bengal and Karnataka.


Contact for further details

Director
ICAR, NRCB, Thogamalai road, Thayanur
Trichirappalli

Technology : 6

Name of technology	Macro-propagation for multiplication of traditional varieties
Year of release	2016-17
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

It is a rapid method of multiplication of true to type plantlets of a variety of choice, elite clonal selections and new hybrids. By choosing a healthy mother plant, macropropagation can produce healthy planting material to replace the diseased plants of the same variety in a short span of time. However, the success of macropropagation depends on the method followed, variety tried and the choice of initiation media in case of ex situ multiplication. Good alternative in between conventional and tissue culture technology. It is a farmer friendly, handy and rapid method of banana spp multiplication resulting in true to type plantlets of a variety of choice.

Features of technology with their benefits

Technically less demanding with the availability of mother plants, the user can kick start the production of planting materials to meet his own requirements and sell. About 40 - 45 shoots could be produced per sucker in a short time span of 3-4 months.



Contact for further details
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 Trichirapalli

Technology : 7

Name of technology	Banana Shakti
Year of release	2007
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

The Banana Shakti contains iron (4.75%), zinc (5.25%), boron (2.50%), manganese (4.50%) and copper (2.40%). It corrects the micronutrient deficiency and increases the availability of macro and micro nutrients to banana crop, thereby increases the productivity by 15-20%. Increases the TSS of fruit by 2°Brix (without BS-TSS is 28°Brix and with BS - TSS is 30.4°Brix) and decreases the acidity of fruit by 0.03 per cent (without BS -acidity is 0.23 per cent and with BS- acidity is 0.20 per cent). In Ney Poovan banana leading to improvement in fruit taste, sweetness, flavor and aroma.

Features of technology with their benefits

Additional profit accrued per hectare with usage of Banana Shakti in varieties of banana: Grand Naine (Rs. 2.0 lakh), NeyPoovan (Rs. 3.0 lakh), Red Banana (Rs. 2.5 lakh), Karpuravalli (Rs.1.5 lakh), Poovan (Rs.1.5 lakh), Nendran (Rs. 1.2 lakh), Rasthali (Rs. 1.2 lakh), Monthan (Rs. 1.0 lakh).



Contact for further details
 Director
 ICAR, NRCB, Thogamalai road, Thayanur
 Trichirappalli

Technology : 8

Name of technology	Banana fibre extraction and fibre-based products
Year of release	2018-19
Source of technology	ICAR-NRCB, Tiruchirappalli
Suitable enterprises	Banana

Details of technology

Among the horticulture crops, banana generates huge volume of biomass after the harvest of the bunches. India is the top most banana cultivator and it has about 0.83 million ha under banana cultivation. For every 30-40 kg of banana bunch there is 50-60 kg of waste that needs to be get rid off. Technology for fibre extraction, degumming and making utility products:

Features of technology with their benefits

Among the banana fibre extraction methods (chemical, mechanical and biological methods), mechanical method is considered to be efficient with 20-30 kg of fibre could be extracted in a day when compared to 4 kg manually.



Contact for further details
 Director
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 Trichirapalli

Technology : 1

Name of technology	<i>Bacillus subtilis</i> bio formulation
Year of release	2020
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	Grapevine and other crops .
Recommended for region (Names of districts/states)	All agro-ecological zones

Details of technology

Bacillus subtilis bio formulation contains efficient *Bacillus subtilis* DR 39 strain and having bacterial population 1×10^9 CFU/g which enhance the degradation of pesticide. Inoculation can be done by foliar spraying.

Features of technology with their benefits

Bacillus subtilis DR-39 bio formulation has shown distinct response in the farmer's field with respect to pesticide degradation. Application of *Bacillus subtilis* DR 39 to grapevine enhanced degradation of the 10 studied pesticides by 12.73-65.55% in ICAR-NRCG vineyards. Similar enhanced degradation was observed in farmer's fields at four locations. In addition, it gave an excellent control against powdery mildew disease.

**Contact for further details**

Director
ICAR-National Research Centre for Grapes, Manjari Farm PO,
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Technology : 2

Name of technology	<i>Trichoderma asperelloides</i> strain 5R (liquid and solid formulations)
Year of release	2020
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	Mainly used against the various diseases of grapevine.
Recommended for region (Names of districts/states)	All agro-ecological zones

Details of technology

- ❖ Liquid and solid bio-formulations of *Trichoderma asperelloides* strain 5R with 5×10^{11} spores per ml and 1.6×10^{11} spores per gm respectively; enhances the disease resistance of grapevines to various foliar diseases, especially powdery mildew.

Features of technology with their benefits

- ❖ Soil drenching of *Trichoderma asperelloides* 5R culture in the form of liquid / solid enhances the disease resistance of grapevines to various foliar and soil borne diseases.
- ❖ Its application in alternation with the sulfur remarkably reduces powdery mildew severity in grape vineyards and number of applications of fungicides.
- ❖ *Trichoderma asperelloides* 5R induces systemic resistance in vines and increases its tolerance to various plant pathogens.
- ❖ Long term application of *Trichoderma asperelloides* 5R in liquid / solid form leads to the reduction of over wintering inoculum in vineyards.
- ❖ As number of fungicide applications is minimized, consequently the grapes conform to 'zero' residue levels. Out of the 59 random samples analyzed in 2019-20, 53 conformed to zero residue levels and out of these 36 conformed to the EU standards.



Contact for further details

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Technology : 3

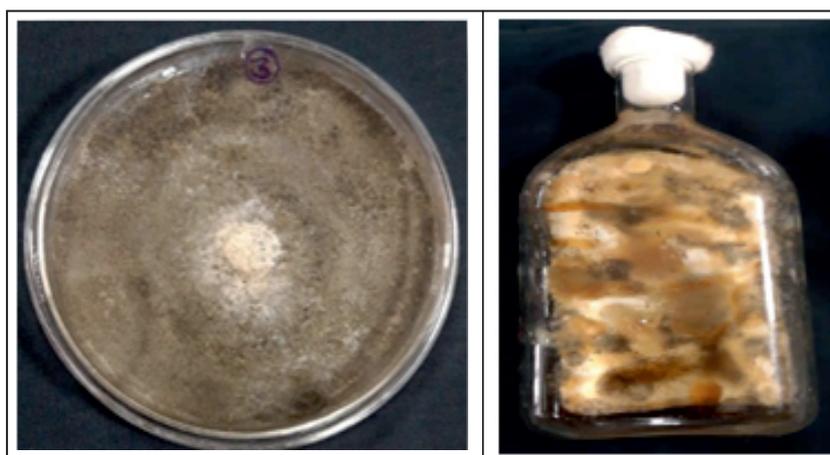
Name of technology	<i>Trichoderma afrohurzianum</i> (NAIMCC-F-01938) liquid formulation
Year of release	2020
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	Mainly used against the various diseases of grapevine.
Recommended for region (Names of districts/states)	All agro-ecological zones

Details of technology

Trichoderma afrohurzianum (NAIMCC-F-01938) liquid formulation is a simple formulation which contains 5×10^8 spores / ml. It helps in reducing the disease incidence on grapevines. Inoculation can be done by foliar application.

Features of technology with their benefits

- ❖ Foliar spray application of *Trichoderma afrohurzianum* liquid formulation enhances the disease control in grapevines to various fungal diseases.
- ❖ Its spray application in alternation with the sulfur remarkably reduces powdery mildew severity in grape vineyards and number of applications of fungicides.
- ❖ Its need based foliar application along with soil drenching of *Trichoderma asperelloides* 5R minimizes the downy mildew incidence in vineyards.
- ❖ As number of fungicide applications is minimized, consequently the grapes conform to 'zero' residue levels.
- ❖ Out of the 59 random samples analyzed in 2019-20, 53 conformed to zero residue levels and out of these 36 conformed to the EU standards.



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Technology : 4

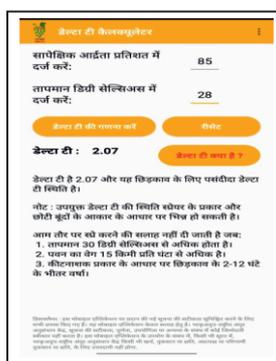
Name of technology	Delta T Calculator- Android mobile application
Year of release	2020
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	Mainly used against the various diseases of grapevine.
Recommended for region (Names of districts/states)	All over India

Details of technology

Delta T is an important indicator to evaluate conditions suitable for spraying in agricultural and horticultural crops. Delta T is the difference between the wet bulb temperature and the dry bulb temperature. This mobile application calculates the Delta T value for the given temperature and relative humidity for farmers on their fingertips on Android mobile phone to easily calculate it without needing dry and wet bulb thermometers. URL: <https://play.google.com/store/apps/details?id=in.gov.icar.nrcgrapes.deltatcalculator>

Features of technology with their benefits

- ❖ Spraying within optimum Delta T conditions will increase input use efficiency and reduce environmental contamination.
- ❖ If the Delta T value is too high (more than 10), then the spray droplet will evaporate very fast. If the value is very low (less than 2), then droplet survival will be longer and leading to increased potential for drift or washing off in case of rains.
- ❖ The wet bulb temperature is calculated from the value of relative humidity.
- ❖ This App is in four languages, viz., Hindi, English, Bengali and Marathi.
- ❖ This app is free and has been kept very small in size.
- ❖ How to use: The app requires values of air temperature in degree Celsius and relative humidity in per cent as inputs. These can be obtained from any weather app for the given location. Enter the values of temperature and relative humidity in the app and submit. It will calculate the value of Delta T and information about the suitability for spraying operations.



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Technology : 5

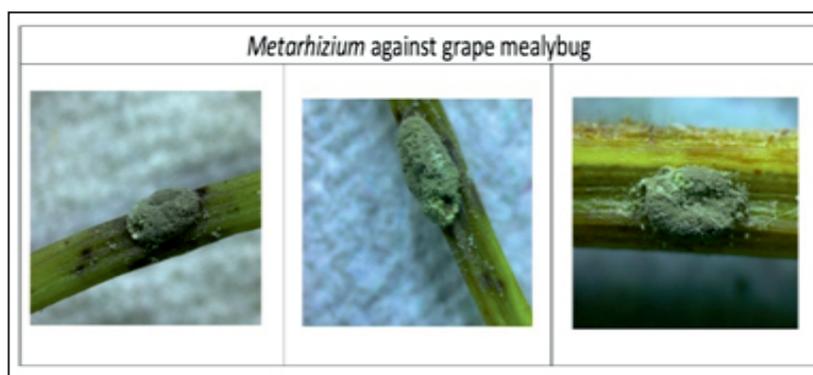
Name of technology	Bio-intensive disease and pest management strategies for safe and sustainable quality grape production
Year of release	2019
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	Grapes
Recommended for region (Names of districts/states)	Maharashtra, Karnataka, Andhra Pradesh, Telangana

Details of technology

Bio-intensive disease and pest management module based on minimum use of pesticides, induction of systemic resistance in vines, use of naturally occurring biological control agents and conservation of natural enemies was developed and validated for production of residue compliant quality grapes.

Features of technology with their benefits

- ❖ Diseases and pests incidences are lesser even if the conditions are favourable for their incidence/infestation.
- ❖ Regular application of biocontrol agents reduces the disease inoculum and pest population over a period of time which in turn reduces the number of application of pesticides and this will have a direct influence on the input cost of the growers.
- ❖ Initially the cost of biocontrol agents may be high but their application will eventually reduce the cost of production by lowering the cost of pesticide application.
- ❖ During 2018-19, many growers who were growing grapes for domestic markets also adopted the bio-intensive strategy. Multipesticide residue analysis of the grapes harvested from 59 such farmers, showed that 53 samples complied to EU MRLs, while a large number had 'Zero residues' in the sense that the number of detections were <5, the residue value of each detected pesticide was < 1/3 of EU MRL, and the cumulative value of the residues was < 1 ppm.



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Technology : 6

Name of technology	<i>Metarhizium brunneum</i> , effective biocontrol agent against <i>Dervishiya cadambae</i> infesting grapes
Year of release	2020
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	Grapes and teak
Recommended for region (Names of districts/states)	All over India

Details of technology

Metarhizium act by degrading cuticle of the insect and produces mucolytic enzymeto control the pest. *Dervishiya cadambae* causes extensive damage to the sapwood and heartwood of grapevine stem and reduces both vitality and productivity of thevines. A green muscardine fungus was isolated from the field infected larvae of *D.cadambae*. The pathogenicity test confirmed Koch's postulates. The fungus was identified as *Metarhizium brunneum* (Petch), which proved to be an efficient antagonist of this pest. *D. cadambae* succeeded in spreading to new host species *V.vinifera*. It emerged as a new pest threat by not only reducing vitality and productivity but also causing mortality of the grapevines in Maharashtra, India. It has potential to spread to grapes in Karnataka and Tamil Nadu states of India where the pest is already reported as a major pest of *T. grandis*. There are no effective management strategies developed so far for this pest. In grapevines, younger larva remains under bark before boring inside main trunk or cordons. Regular monitoring, removal of loose bark and application of *M. brunneum* on main stem and cordons when the young larvae are feeding under loose bark was found as effective management strategy for *D. cadambae*.

Features of technology with their benefits

- ❖ IPM strategies are broadly developed to minimise the substantial use of chemical pesticides by combining biological control agents.
- ❖ These biological agents reduce the pest population significantly.
- ❖ Entomopathogenic fungi, *Metarhizium* is broadly used as biocontrol agent.
- ❖ Mass multiplication and production of liquid formulation of the entomopathogens is simple.
- ❖ Microbial pathogens were not feasible for developing management strategy due to difficulties in their application as the larva had habit of boring into the heartwood where infection of the larva was difficult. However, when *D. cadambae* larva infests grapevines, they remain under the loose bark of the plant for a considerable period of time.
- ❖ Removal of loose bark and trunk wash with the isolated *M. brunneum* has been found as effective management strategy.



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Technology : 7

Name of technology	Compatibility of insecticides with <i>Metarhizium brunneum</i> and <i>Beauveria bassiana</i> for bio-intensive pest management
Year of release	2019
Source of technology	ICAR-National Research Centre for Grapes, Pune
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region (Names of districts/states)	All over India

Details of technology

Metarhizium brunneum (Petch) and *Beauveria bassiana* (Bals.) are broad spectrum entomogenous fungi which help in managing a wide range of insect pests for biological control. Knowledge of compatibility of these fungi with insecticides is important for farmers to plan bio-intensive pest management strategy. The compatibility of seven insecticides (emamectin benzoate, tolfenpyrad, imidacloprid, clothianidin, buprofezin, fipronil, spirotetramat) with these entomopathogens was evaluated. Compatibility studies based on sporulation, germination and vegetative growth of fungi showed that imidacloprid and emamectin benzoate were most compatible followed by clothianidin and buprofezin with both the fungi. Tolfenpyrad and spirotetramat were highly incompatible with both the entomopathogens. Fipronil at field recommended dose was compatible with *M. brunneum* and incompatible with *B. bassiana*.

Features of technology with their benefits

- ❖ Compatibility of different insecticides studied with these fungi would help farmers in planning bio-intensive IPM programme for pest management



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Technology : 1

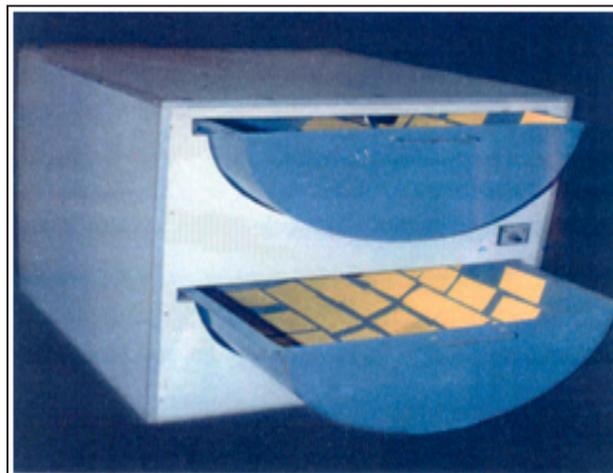
Name of technology	UV sterilization chamber for <i>corcyra</i> E
Year of release	2002
Source of technology	ICAR-NCIPM, New Delhi
Suitable for which crops/ animals/enterprises etc.	To sterilize <i>Corcyra cephalonica</i> eggs. The sterilization of <i>C. cephalonica</i> eggs is required to prepare Trichocards.
Recommended for region (Names of districts/states)	All regions

Details of technology

It consists of two chambers/drawers. A total of 75 trichocards can be exposed to UV at a time in each drawer. Since the source of light is at the centre of the curvature, the exposure to UV rays is uniform on the surface of the cards. Since there are two drawers, the time required to arrange the cards in one drawer is sufficient to sterilize the trichocards in other drawer. Thus 75 trichocards per 10 minutes can be sterilized using the drawers alternately. The timer ensures to prevent over exposure or under exposure of the trichocards.

Features of technology with their benefits

- ❖ Since the trichocards are exposed to UV radiation in a closed box/drawer, the undesired exposure to UV radiation is ruled out in the structure.



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Technology : 2

Name of technology	IPM in <i>Basmati</i> rice
Year of release	1998
Source of technology	ICAR-NCIPM, New Delhi
Suitable for which crops/ animals/enterprises etc.	Field crop (<i>Basmati</i> rice)
Recommended for region (Names of districts/states)	Village-Bambawad, District-Gautambudhnagar, U.P. and validated in other Northern areas.

Details of technology

- ❖ IPM module emphasizes on prevention, careful monitoring of pests, augmentation and conservation of natural enemies and need based application of pesticides with label claims.

Features of technology with their benefits

- ❖ Economics of area wide impact of IPM implementation indicated that an IPM farmer of the area earned more over farmers' practice.



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Technology : 1

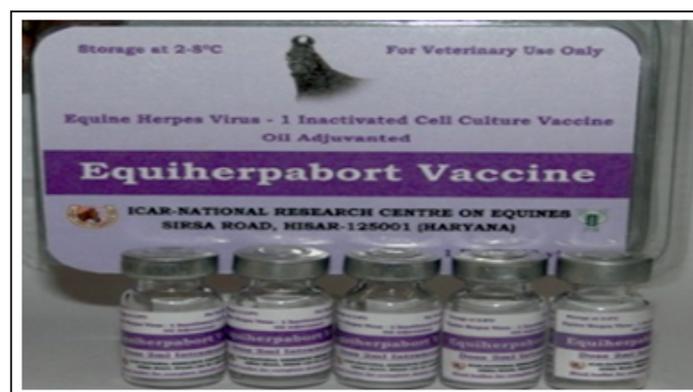
Name of technology	Equine Herpes Vrus-1 vaccine (Equiherpabort)
Year of release	2015
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

EHV-1 vaccine has been developed for control of herpesvirus-1 infection in horses. This vaccine was developed using field strain of equine herpes virus-1. EHV-1 is responsible for heavy economic losses to the equine industry. Healthy horses acquire infections mostly through respiratory tract. In a national assessment of EHV-1 infection amongst equidae in India, 13.50 per cent serum samples were found seropositive.

Features of technology with their benefits

- ❖ This vaccine is intended for all equine species especially for pregnant mares. Protective immunization response of this vaccine was recorded in experimental field trials conducted in pregnant mares.
- ❖ This vaccine will help in decrease in occurrence of abortions, paralysis, perinatal foal mortality and respiratory disease due to EHV-1.
- ❖ This vaccine will serve as an alternative for control of the disease.

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Technology : 2

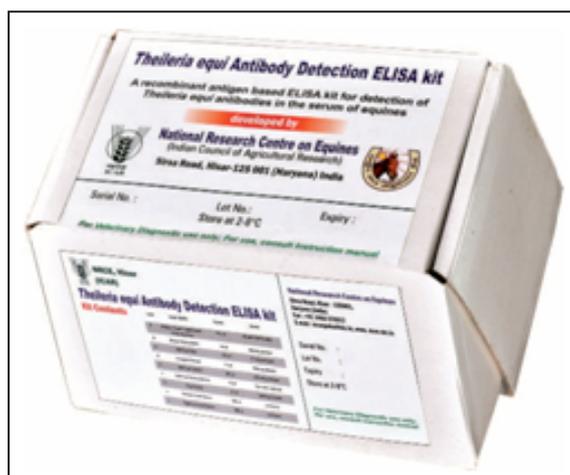
Name of technology	Recombinant antigen based ELISA kit for diagnosis of equine piroplasmosis (<i>Theileriaequi</i> ELISA kit)
Year of release	2015
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

Equine piroplasmosis - also called equine babesiosis - is an acute, sub-acute or chronic tick-borne disease of equids, caused by an intra-erythrocytic protozoa, *Theileriaequi* (*T. equi*) or *Babesiacaballi*. Sero-prevalence of equine piroplasmosis is up to 35 per cent in the indigenous equid population. Recently, NRCE has developed recombinant antigen based ELISA kit for diagnosis of equine piroplasmosis

Features of technology with their benefits

- ❖ *Theileriaequi* ELISA kit, is a recombinant erythrocyte merozoiteantigen (EMA-2) based plate ELISA for detection of antibodies against *Theileriaequi* infection in equine.
- ❖ The kit has ready-to-use ELISA plate onto which serum samples can be loaded after proper dilution. The results can be obtained in 1hr 30 min times after application of serum samples.
- ❖ This kit is highly sensitive and helps in early detection of disease along with r-ELISA gave uniform results and no batch to batch antigen variation is observed.



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Technology : 3

Name of technology	Updated Equine Influenza Vaccine against Equine Influenza virus (EIV)
Year of release	2016
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

Equine influenza - commonly known as 'Horse Flu' - is a viral disease of horses caused by Equine Influenza virus (EIV) subtype H3N8. The disease resulted in heavy morbidity and led to huge economic loss. For making the vaccine a recommended OIE strain i.e. indigenous equine influenza virus {A/eq/Katra-Jammu/06/08 (H3N8)} belonging to Clade 2 of Florida sublineage, was used. The vaccine was made from the seed stock of EIV grown in bulk in 9-11 days old embryonated chicken eggs and the allantoic fluid was harvested, purified by ultracentrifugation and inactivated by formalin. For vaccination, aseptically administer one 1-mL dose intramuscularly when animals are above 6 months of age followed by a booster vaccine after 4-5 weeks and repeated annually or after monitoring the titers by Haemagglutination inhibition assay (HI titres below 64- repeat vaccine).

Features of technology with their benefits

- ❖ This vaccine is intended for immunization of horses, mules and donkeys.
- ❖ The vaccine was tested as per the standard procedures laid down by OIE, European Pharmacopoeia and European Medicines Agency (EMA) and showed protective immune response against EIV.
- ❖ The vaccine was tested as per the standard procedures laid down by OIE, European Pharmacopoeia and European Medicines Agency (EMA) and showed protective immune response against EIV.



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Technology : 4

Name of technology	Recombinant gG-based type-specific ELISA for differentiation of EHV1 & 4 Infection
Year of release	2017
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

- ❖ Equine herpesvirus-1 (EHV1) and equine herpesvirus-4 (EHV4) together responsible for 'Equine Rhinopneumonitis', an OIE listed disease of equines.
- ❖ EHV-1 in addition is foremost cause of abortions, neurological disorders and perinatal foal mortality.
- ❖ Disease is endemic across the globe including India.
- ❖ The differential diagnosis of EHV-1 and EHV-4 viruses is often complicated due to antigenic cross-reactivity between the two viruses.
- ❖ A recombinant glycoprotein G based ELISA for differentiation and diagnosis of EHV1 and EHV4 was developed by NRCE and the kit is being routinely use in sero-surveillance at the Centre

Features of technology with their benefits

- ❖ The kit developed is a recombinant protein based ELISA kit for differentiation and diagnosis of EHV1 and EHV4 infection.
- ❖ The kit has capacity to test 32 samples, with a shelf life, from date of manufacture, of more than 4 months. For the test to be positive for EHV1/4, the OD of the serum sample must be more than >0.300.
- ❖ The validation of the kit has been done both internally and externally using field serum samples. The test is useful for assessment of herd immunity in equine breeding farms where vaccination is undertaken against EHV-1.
- ❖ Thus, this kit will help in timely diagnosis, differentiation and control of EHV1 and EHV4 infection.

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Technology : 5

Name of technology	Lateral flow assay for detection of antibodies to equine piroplasmosis
Year of release	2017
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

Equine piroplasmosis is an acute, sub-acute or chronic tick-borne disease of equines, caused by an intra-erythrocytichaemo-protozoa *Theileriaequi* or *Babesiacaballi*. Significant segment of the Indian equine population (~35%) is latently infected and diagnosis of these animals is of more relevance to prevent spread of the parasitic infection to naïve animals. In an effort to provide a farmer friendly field test kit, the Centre has successfully developed lateral flow assay (LFA) for diagnosis of *T. equi* infection.

Features of technology with their benefits

- ❖ The kit is based on a recombinant *T. equi* merozoite surface antigen (EMA-2) conjugated with gold-nano particles.
- ❖ LFA kit results were comparable with ELISA, cELISA (VMRD, USA format), MASP *in vitro* culture and PCR. The diagnostic sensitivity (Dsn) and specificity (Dsp) of LFA vis-à-vis ELISA were 0.945 and 0.916, respectively, indicating its applicability on the field samples.
- ❖ LFA kit offers many advantages as compared to ELISA, such as no equipment or trained personnel needed and visually readable results obtained within 10 minutes.



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Technology : 6

Name of technology	Glanders ELISA Kit
Year of release	2019
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

Glanders is a fatal bacterial disease of equines caused by non-motile gram-negative bacterium *Burkholderia mallei*. Because of zoonotic importance of the glanders and frequent occurrence of the disease in parts of Africa, the Middle East, South America, and Asia, glanders has attracted renewed research interest and is increasingly recognized worldwide as potential biological weapons. Glanders ELISA Kit is based on three recombinant proteins i.e. Hcp1, TssA and TssB. This kit was made by combining the higher sensitivity of the ELISA and specificity of the CFT.

Features of technology with their benefits

- ❖ The kit was evaluated with large number (n= 2000 to 15000) of equine serum samples obtained from glanders free as well as glanders endemic areas.
- ❖ The diagnostic specificity of the assays were found to be 90-100% and sensitivity of the three assay ranges from 90-99%, respectively.
- ❖ Glanders ELISA Kit has been validated internationally by OIE-Referral Laboratory on Glanders, Germany according to OIE principles and methods of validation of diagnostic assays.



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Technology : 7

Name of technology	EIA ELISA Kit
Year of release	2019
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

Equine infectious anaemia (EIA) - a chronic and debilitating retroviral disease of equids. The diagnosis of the disease is mainly based on identification of inapparent carriers by detection of antibodies against EIA virus (EIAV) by imported kits of the agar gel immunodiffusion (AGID) test (or Coggin's test) and ELISA albeit with high cost and hassles. EIA diagnosis is routinely done with imported Agar Gel Immunodiffusion (AGID) kit. AGID generally takes 18-24 hrs (sometimes 48 h) for interpretation of results. As an alternative, NRCE has developed an indirect ELISA kit for faster detection of EIA. EIA ELISA kit is a recombinant antigen (p26) based indirect ELISA for diagnosis of equine infectious anaemia.

Features of technology with their benefits

- ❖ The test will detect antibody specific to EIA virus, which takes only about 3-4 hrs to complete the assay and result interpretation.
- ❖ This kit has high relative sensitivity (100%) and specificity (98.7%) in comparison with AGID assay.
- ❖ EIA ELISA kit has been validated internationally by OIE-Referral Laboratory.
- ❖ This kit has test capacity of 45 samples per plate with a shelf-life of one year at 4°C.
- ❖ The kit is efficient, fast and cost-effective as compared to the imported kit and thus helpful in eradicating/declaring EIA-free nation which will be invaluable in terms of exporting our equines in EIA free country.


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Technology : 8

Name of technology	Equine Japanese Encephalitis Virus Antibody Test Kit, iELISA
Year of release	2020
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

- ❖ Japanese encephalitis (JE) is a mosquito-transmitted viral disease caused by the JE virus belonging to family *Flaviviridae*. It is among the most important viral causes of encephalitis, especially in rural and suburban areas where rice cultivation and pig farming coexist. JEV causes disease in equines, pigs, and humans. It is prevalent in eastern and southern Asia, including India. It has spread to Indonesia, northern Australia, Papua New Guinea, and Pakistan. It may infect a number of other domestic animals including cattle, sheep, goat, dogs and cats, with asymptomatic infection. JEV infected equines develop signs such as fever, anorexia, depression, impaired locomotion, impaired vision, paresis, and paralysis. The affected horse may collapse, fall in a coma and eventually die with mortality rate between 5 per cent and 30 per cent. ICAR-NRCE has produced a recombinant protein-based indirect ELISA (iELISA) for specific diagnosis of JEV antibodies in equines.

Features of technology with their benefits

- ❖ This assay gives specific results in less than 3 hours.
- ❖ Antigen specific antibodies present in serum are captured by a recombinant antigen coated on to the solid surface. Detection of bound antibodies is done by adding secondary antibodies that are conjugated with horse radish peroxidase (HRP) enzyme.
- ❖ The shelf life of the kit is for 6 months when stored at 2-8°C until use. The 96 well antigen coated microtiter plate/ strips once opened, can be stored in refrigerator (2-8°C) only for one month.



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Technology : 9

Name of technology	Monoclonal antibody based immunoassay for detection of equine influenza (H3N8) antigen
Year of release	2021
Source of technology	ICAR-NRC on Equines, Hisar
Suitable for which crops/ animals/enterprises etc.	Animals (Equines)
Recommended for region (Names of districts/states)	Throughout India

Details of technology

Equine influenza commonly known as 'Horse Flu' is a viral disease of horses. It is an acute viral highly contagious respiratory disease of equines (horses, ponies, mules and donkeys) which spreads very fast. Equine Influenza virus (EIV) is known to cause severe clinical disease in equines, characterized by pyrexia, dyspnoea, dry hacking cough, serous nasal discharge that becomes mucopurulent due to secondary bacterial infections and loss of appetite. The disease is caused by Influenza A virus belonging to family *Orthomyxoviridae*. Belonging to two subtypes H3N8 and H7N7, however, EI outbreaks due to H7N7 subtype have not been reported for more than four decades. Various diagnostic assays are utilized for its detection which include serological assays, nucleic acid detection assays (RT-PCR and qRT-PCR), virus isolation etc. These assays are either time consuming or require good laboratory settings. We at ICAR-NRCE have developed a monoclonal antibody based enzyme immunoassay which can detect H3N8 antigen.

Features of technology with their benefits

- ❖ The assay is easy to perform and available in form of kit which can be stored at 4°C for one year.
- ❖ It can detect H3N8 antigen across various lineages at very low detection levels (0.25HA units).


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Technology : 1

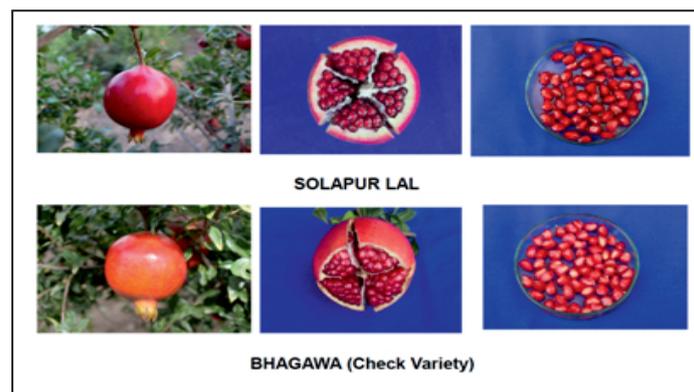
Name of technology	Solapur Lal: New bio fortified variety of pomegranate
Year of release	2017
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate
Recommended for region (Names of districts/states)	Pomegranate growing states of India (Maharashtra, Karnataka, Andhra Pradesh, Telangana, Gujarat, Rajasthan)

Details of technology

- ❖ This is an hybrid pomegranate variety developed by crossing Bhagawa X {(Ganesh X Nana) X Daru}.
- ❖ This variety is suitable for table purpose and processing.

Features of technology with their benefits

- ❖ 15-20 days early maturity than Bhagawa with deep red Aril colour and medium textured seeds.
- ❖ 15-20% higher yield potential than Bhagawa.
- ❖ 17.5-17.7 TSS (Brix) which is higher than Bhagawa (15.7-19.9).
- ❖ 19.4-19.8 Vitamin-C (mg/100g) and Anthocyanin 385-395 which is more than Bhagawa 14.2-14.6 and 355-365 respectively.
- ❖ Contains higher Iron 1.40-1.50 mg/100g of fresh arils than Bhagawa (0.87-0.97).

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Technology : 2

Name of technology	Solapur Anardana
Year of release	2017
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate
Recommended for region (Names of districts/states)	Arid and semi-arid regions Pomegranate growing states of India (Maharashtra, Karnataka, Andhra Pradesh, Telangana, Gujarat, Rajasthan, Himachal Pradesh)

Details of technology

This variety is released by NRCP in 2017 for anardana purpose.

Features of technology with their benefits

- ❖ Solapur Anardana is a High Yielding Variety suitable for anardana purpose.
- ❖ It yields about 20-22 tons/ ha; titrable acidity 4.8 per cent and higher anthocyanin content (465 mg/100g).
Fruit maturity: 148 days.
- ❖ Arils are deep red in colour with red fruit surface. Medium textured seeds; suitable for anardana purpose with high anardana recovery.
- ❖ Superior to Amlidana (Check variety).



Contact for further details

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Technology : 3

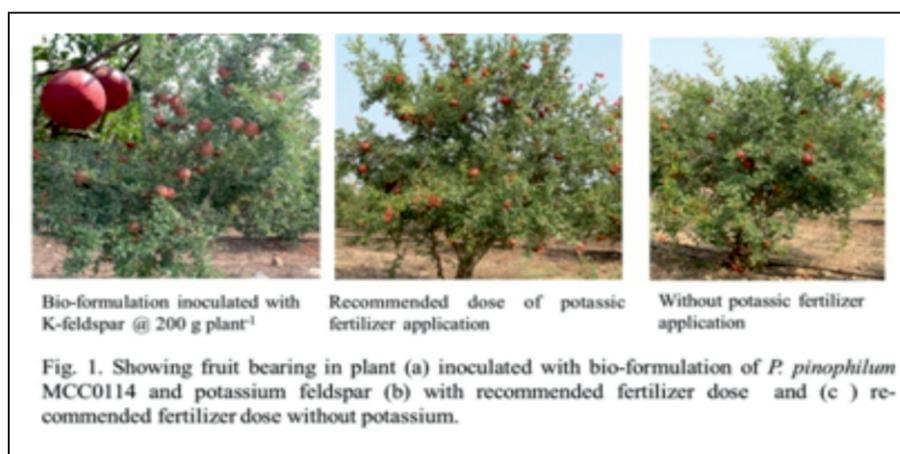
Name of technology	Novel bio-formulation for potassium fertilizer supplement in pomegranate
Year of release	2018
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate
Recommended for region (Names of districts/states)	Arid and semi-arid region of India viz. Maharashtra, Karnataka, Gujarat, Andhra Pradesh and Rajasthan

Details of technology

A carrier based potassium and phosphate solubilizing bio-formulation of *Penicillium pinophilum* MCC 0114 as active ingredient

Features of technology with their benefits

- ❖ Capacity to supplement 70 per cent requirement of potassic fertilizers in pomegranate. If used with 200 g potassium feldspar per tree, it can totally replace the potassic fertilizer requirement of pomegranate tree and increases K uptake by 47.47 per cent and P uptake by 63.44 per cent.
- ❖ Approximately 24 - 35 per cent increase in economic yield with better fruit quality of pomegranate.
- ❖ Prevent incidence of wilt disease in pomegranate caused by *Ceratocystis fimbriata*.
- ❖ Survive well under semi-arid agro-climatic condition as it is native to this agro-climatic condition.
- ❖ Method of multiplication is very easy and rapid.



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Technology : 4

Name of technology	Quality planting material through <i>in vitro</i> propagation of pomegranate cv. Bhagwa including biohardening.
Year of release	2014
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate
Recommended for region (Names of districts/states)	Pomegranate growing states of India

Details of technology

- ❖ Large scale multiplication of disease free (Bacterial blight / wilt) planting material having systemic resistance to diseases, better establishment and growth of pomegranate plants.
- ❖ The *in vitro* propagation protocol in cv. Bhagawa with culture establishment of 80.00 % and rooting success of 72.00 % was achieved using nodal segments and shoot tips.
- ❖ Root colonization, population of beneficial microbes in rhizospheric soil, growth, physiological and biochemical parameters of *in vitro* raised plants were found to be improved by bio-hardening.

Features of technology with their benefits

- ❖ The technology significantly improves plant establishment and rooting.
- ❖ The biohardening process enables the better root colonization, population of beneficial microbes in rhizospheric soil, growth, physiological and biochemical parameters of the plants.



Contact for further details

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Technology : 5

Name of technology	Juice and RTS beverage from pomegranate
Year of release	2014
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate processing industry
Recommended for region (Names of districts/states)	Pomegranate growing states of India

Details of technology

- ❖ The process protocol for pomegranate Juice and Ready-to-serve beverage development was standardized.
- ❖ The process was optimized for reduction in microbial count, optimum retention of bioactive compounds, and acceptable sensory quality.
- ❖ The product can be stored for 6 months with acceptable colour, microbial and sensory quality.

Features of technology with their benefits

- ❖ Capacity to supplement 70 per cent requirement of potassic fertilizers in pomegranate. If used with 200 g potassium feldspar per tree, it can totally replace the potassic fertilizer requirement of pomegranate tree and increases K uptake by 47.47 per cent and P uptake by 63.44 per cent.



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Technology : 6

Name of technology	Two step hardwood cutting protocol of pomegranate including bio hardening
Year of release	2014
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate
Recommended for region (Names of districts/states)	Pomegranate growing states of India

Details of technology

- ❖ Hard wood cutting following complete sanitation protocol was optimized
- ❖ This includes pre-treatment with fungicide, antibiotics and surface sterilization followed by inculcation with plant beneficial microbes (biohardening).
- ❖ The final cutting success was found to be 82.50 per cent.

Features of technology with their benefits

- ❖ The cuttings after sterilization using this technology, was found to be disease free and their biohardening increase the success after planting under field condition.



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Technology : 7

Name of technology	Minimal processing and packaging of pomegranate arils
Year of release	2017
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate processing
Recommended for region (Names of districts/states)	Pomegranate growing states of India

Details of technology

- ❖ Process protocol for minimal processing of pomegranate arils including washing, aril extraction, pre-treatment, packaging and storage at low temperature was standardized.
- ❖ The shelf life of arils was improved up to 14 days with acceptable quality and increased convenience for consumption.

Features of technology with their benefits

- ❖ The shelf life of arils was improved up to 14 days with acceptable quality and increased convenience for consumption.


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Technology : 8

Name of technology	Stem solarization/ Six steps for managing bacterial blight
Year of release	2016-17
Source of technology	ICAR-National Research Centre on Pomegranate, Solapur
Suitable for which crops/ animals/enterprises etc.	Pomegranate
Recommended for region (Names of districts/states)	All pomegranate growing regions preferring Mrig/early Hasta Bahar crop

Details of technology

Step 1: Pruning, pasting and application of recommended organic manures, bioformulations and fertilizers soon after harvest in December-January

Steps 2: Irrigating the crop for 2 -3 months till March/April and taking sprays of 1% Bordeaux mixture every 10 -15 days

Steps 3: Stopping irrigation for 1.5 to 2 months (April-May) and putting the crop on stress for complete defoliation

Steps 4: Exposure of the defoliated naked stems to solar radiation for 10-20 days in June followed Light pruning of upper 10-15 cm stems. Due to high temperature and low moisture, the bacteria residing safely in the nodes (source of infection in next season) of the naked stems will desiccate and die.

Steps 5: Light pruning, applying recommended manures, fertilizers and bioformulations followed by irrigation for taking rainy season crop.

Steps 6: Following need based sprays for fungal diseases and insect pest management. Blight in 99 per cent cases not observed, if observed 2 -3 timely sprays of copper based formulation

Features of technology with their benefits

- ❖ To be done in community approach in the selected location. All BBD Affected orchards to adopt the technology for 100% Result
- ❖ 100% BBD control if unseasonal rains not there during Step 4 Stem Solarization. Ev
- ❖ No use of antibiotics like Streptomycin sulphate + Oxytetracycline are proposed to be banned from 2024.
- ❖ Reduced cost of production, More Benefit:Cost Ratio
- ❖ Increase in quality fruit yield several folds



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Technology : 1

Name of technology	Cryo-preservation of yak semen for fixed time Artificial Insemination
Year of release	2006
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Yak, Yak cattle hybrid and highland cattle
Recommended for region (Names of districts/states)	All Yak rearing states of the country

Details of technology

In the Artificial Insemination (AI) process yak semen is collected from superior bulls, processed, stored and thawed to deposit in the genital tract of a female displaying estrus. There are many steps involved in the artificial insemination programme, which include selection of superior bulls, semen collection, semen processing, cryopreservation (at -196°C in liquid nitrogen), thawing and insemination. AI technology is being regularly used at NRC on Yak Farm and is being attempted to extend to yak farmers. First yak calf (August 17, 2006) and first hybrid calf (March 26, 2007) were produced using yak frozen semen. A pilot study was undertaken to evaluate the suitability of yak frozen semen (Fixed time AI) for production of yak hybrids under field conditions. This pilot study indicated the suitability of producing hybrids using fixed time AI under field conditions using frozen yak semen.

Features of technology with their benefits

The artificial insemination technology using frozen yak semen as expected to reduce inbreeding and improve the yak germplasm besides its utility in producing hybrids for the overall benefit of the farmers at mid altitude and betterment of their socio-economic conditions. In accessible hilly terrains, fixed time AI using yak frozen semen will be a boon to produce hybrids and has got tremendous potential to improve socio-economic status of yak keepers. This technology has been propagated and 800 frozen yak semen straws were distributed to AH Departments of Arunachal Pradesh, Sikkim and J&K for use to upgrade their yaks and reduce inbreeding.

**Contact for further details**

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Technology : 2

Name of technology	Synchronization of estrus and ovulation for fixed time Artificial Insemination
Year of release	2009-10
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Yak, Yak cattle hybrid and highland cattle
Recommended for region (Names of districts/states)	All Yak rearing states of the country

Details of technology

The institute has identified following protocols effective in induction of estrus and synchronization of ovulation for fixed time Artificial insemination (AI) in yaks by eliminating the tedious process of estrus detection.

- ❖ Heat synch protocol to induce estrus and synchronize ovulation for fixed time AI in an-estrous yaks.
- ❖ Ovsynch protocol for synchronization of estrous and ovulation for fixed time AI in yaks.
- ❖ Progesterone impregnated vaginal sponge for synchronization of estrus and subsequent Artificial Insemination in Yak.

Features of technology with their benefits

Accurate heat detection is essential for timely breeding of animals and economic output of the herd. But, poor manifestation of behavioral estrus in yak often leads to silent or non-detected estrus, one of the major problems in yak reproduction, hampering its overall productivity. Therefore, various breeding management regimens/protocols have been developed for improving the reproductive efficiency of yak. Estrus and ovulation synchronization protocols suitable for timed AI in yaks reared under traditional system of transhumance and semi-sedentary system of yak farming.



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Technology : 3

Name of technology	Embryo transfer technology in Yak
Year of release	2008-09
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Yak, Yak cattle hybrid and highland cattle
Recommended for region (Names of districts/states)	All Yak rearing states of the country

Details of technology

- ❖ In this process the embryos developed through in vitro fertilization of oocytes which retrieved from the donor yaks by ultrasound guided ovum pick up (OPU) technique. Then the cryo-preserved yak embryo is transferred in surrogate yaks to produce calves.

Features of technology with their benefits

- ❖ Embryo transfer techniques (ETT) allow elite female livestock to have a greater influence on the genetic advancement of a herd for improved productivity. ETT is also used for producing number of elite animals from a single superior.
- ❖ The Institute has successfully developed in vivo and in vitro embryo production technology aiming at ex-situ conservation and multiplication of elite yak germplasm for improving the animal productivity through genetic up-gradation.
- ❖ 'MISMO' born on June 27, 2005, was the first female yak calf produced through MOET, at the Institute and followed by the world's first test tube yak calf "NORGYAL" born on July 15, 2013.



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Technology : 4

Name of technology	Complete Feed Block (CFB) for Yaks
Year of release	2006
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	All types of ruminant animals
Recommended for region (Names of districts/states)	All over India especially during lean period

Details of technology

Complete feed block (CFB) is an intimate mixture of processed ingredients including roughages and concentrates designed as the sole source of feed in compressed form. All the processed feed ingredients inclusive of roughages and concentrates are mixed in a uniform blend and compressed at high pressure, ensuring the supply of diet of same composition. Depending upon the physiological need of the animals their compositions may varied starting at Roughage :Concentrate = 60 :40 level with possibility to incorporate up to 30% of tree leaves and molasses at the rate of 3-10 per cent for proper binding and maintaining palatability.

Features of technology with their benefits

Conserved feed in the form of complete feed block is an efficient management option to supplement feeds besides traditional grazing to ensure optimum production and management of the highlander animals during winter.

Feed and fodder scarcity especially during winter is one of the biggest hindrances in sustainable livestock production at high mountain areas. Yaks loses up to 25 per cent of their body weight due to scarce of feed/fodder availability, hence the productivity of milk also affected which may comes almost nil. Conserved feed in the form of complete feed block is an efficient management option to supplement feeds besides traditional grazing to ensure optimum production and management of the highlander animals during winter. The Complete Feed Block technology is the latest development of feed technology to exploit the potentiality of locally available animal feed resources besides using non-conventional feed resources in a better way that makes livestock farming an economically viable enterprise.



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Technology : 5

Name of technology	Polybag silage for highland animals
Year of release	2016-17
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	All types of ruminant animals
Recommended for region (Names of districts/states)	All over India especially during lean period

Details of technology

Surplus green forage from fodder crops like maize, hybrid napier and fast Salix tree leaves and tender twigs can be conserved into silage in polypropylene silage bags at high altitude areas. Silage preparation using poly bags is advantageous in high altitude areas due to its suitability for making small batches of silages depending upon the availability of green fodder and ease of transportation. Therefore, to get a good quality silage, a care must be taken at every stage of ensiling as detailed below:

- ❖ Crop should be harvested at the stage when it contains maximum nutrients.
- ❖ Wilting of fodder crop to retain 60-70 per cent moisture content is desirable to reduce the loss due to excess effluent.
- ❖ Forage should be chaffed (size of 4-5cm) which helps in compressing the contents in the silage bag to remove the entrapped air and also increases the surface areas for microbial fermentation.
- ❖ After properly filling and pressing the chopped forage contents in bag, it should be sealed to airtight for promoting aerobic fermentation.
- ❖ Bags should be opened for removing the required quantity of silage for feeding and immediately tied properly to prevent the contact of the remaining silage with the air.

Features of technology with their benefits

Feed and fodder scarcity especially during winter is one of the biggest hindrances is sustainable livestock production at high altitude. High altitude animals like lose up to 25 per cent of their body weight due to winter feed and fodder scarcity which hampers their productivity. Therefore, conserved forages if form of silage, is an efficient management option for supplementation of the required nutrition during winter to ensure optimum health and production of highland animals. This technology has been popularized among the highland farmers and other stakeholders of Arunachal Pradesh, Sikkim and Ladakh during following training programs and field demonstrations.



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Technology : 6

Name of technology	Functional paneer from Yak milk
Year of release	2008-09
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Milk based enterprises, stakeholders related to Yak husbandry mainly the Yak farmers and entrepreneurs
Recommended for region (Names of districts/states)	All Yak rearing states

Details of technology

- ❖ Fresh yak milk is processed with chemicals like acetic acid, boiled and converted into paneer.
- ❖ Supplementation of dietary fibre during the process is taken in this process.

Features of technology with their benefits

Yak milk paneer is usually prepared with full fat milk having as high as 8.50 per cent fat resulting in 25-30 per cent fat in paneer. Increasing concerns among health conscious consumers demand development of low fat paneer. Interestingly, low fat paneer prepared from yak milk having 1 per cent fat has very hard texture. Therefore, the effect of dietary fibres in improving the product quality of low fat paneer along with enhancement of dietary fibre content of the low fat paneer was undertaken. Increased fibre content in the product may have the health benefits like prevention against cardiovascular diseases and colon cancer.



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Technology : 7

Name of technology	Yak Wool Jute blended Fabric
Year of release	2015-16
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Wool based enterprises, stakeholders related to Yak husbandry mainly the Yak farmers and entrepreneurs
Recommended for region (Names of districts/states)	All Yak rearing states

Details of technology

Yak jute blended fabric cloths are prepared from coarse yak hair fibre blended with Jute and cotton (40:40:20) with beautiful computer designs and made in newly installed Fabric machinery. This commercially viable blended yarn of jute and yak wool can be used for different products namely Man Over coat, Table liner, Man Jackets, bag and file cover.

Features of technology with their benefits

Yak hair is the unique animal fibre which could provides warmth and protect against extreme climatic condition in harsh climatic condition at high altitude. However, because of its coarseness and slippery nature it's difficult to make fabrics. ICAR-NRCY in collaboration with ICAR-NINFET developed the Yak Jute blended Fabric which can utilize for making different garments of choice. Yak farmers could earn higher profit margin up to 120-150% through these blended products over their conventional products.


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Technology : 8

Name of technology	Ripened Yak cheese
Year of release	2018-19
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Milk based enterprises, stakeholders related to Yak husbandry mainly the Yak farmers and entrepreneurs
Recommended for region (Names of districts/states)	All Yak rearing states

Details of technology

- ❖ Ripened Yak cheese developed by the institute is a semi hard cheese prepared by processing Yak milk with supplementation of certain additives.

Features of technology with their benefits

- ❖ The ripened Yak cheese is an off-white milk product and has a characteristic sharp flavour.
- ❖ It has unique characteristic taste, flavour, texture and ease of storage and transportation.
- ❖ This cheese will be an addition to the wide variety of cheeses of the world and has a great potential for commercialization and profit margins for the yak rearers of the country.



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Technology : 9

Name of technology	Flavoured <i>Churkam</i>
Year of release	2007-08
Source of technology	ICAR-National Research Centre on Yak, Dirang, Arunachal Pradesh
Suitable for which crops/ animals/enterprises etc.	Milk based enterprises, stakeholders related to Yak husbandry mainly the Yak farmers and entrepreneurs
Recommended for region (Names of districts/states)	All Yak rearing states

Details of technology

- ❖ The viscous and sweetish Yak milk processed into *Churkam*, a hard candy type product which is highly relished by the people living in high altitude areas.
- ❖ The Yak milk is processed for a long period with low flame to make it semi-solid and allowed to make it hard afterward.

Features of technology with their benefits

- ❖ *Churkam* has a great potential for commercialization and profit margins for the Yak rearers of the country. It provides a slow and continuous supply of energy to the consumer. It's generally used by the Yak herders during their migration to high altitude pastures. There is a high demand for the product among the locals. Whereas, addition of various flavours likes chocolate, ginger and kiwi have further extended its utility among the tourists and other consumers. Therefore, the product has a great potential for commercialization.


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Technology : 1

Name of technology	Biological suppression of Rugose spiralling whitefly in coconut.
Year of release	2020-21
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Coconut, Oil palm
Recommended for region (Names of districts/states)	All the coconut and oil palm growing districts of Andhra Pradesh.

Details of technology

- ❖ Foliar application of *Isaria fumosorosea* NBAIR (pfu-5) @ 1×10^8 cfu/ml @ 5 gr/lt. (Two sprays at 15 days intervals).

Features of technology with their benefits

- ❖ The application of *Isaria fumaso rosea* @ 5g per litre of water at 15 days interval found effective against Rugose spiralling whitefly in reducing the egg spirals/leaflet to 66.45 per cent and nymphs / leaflets to 74.97 per cent.



Contact for further details

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Technology : 2

Name of technology	Biological management of invasive whiteflies in coconut and oil palm
Year of release	2019-2020
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Coconut, Oil palm
Recommended for region (Names of districts/states)	All the coconut and oil palm growing districts of Andhra Pradesh.

Details of technology

- ❖ Clipping of predator *Apertochrysa astur* @ 300 eggs per palm at 15 days interval (at low infestation).

Features of technology with their benefits

- ❖ The clipping of predator *A. astur* @ 300 eggs per palm at 15 days interval at low infestation (Fewer than 10 egg spirals per leaflet, presence of sooty mould encrustation in 5- 6 lower most fronds) was found to be effective against Rugose spiralling whitefly in reducing the egg spirals/leaflet to 86.91 per cent and nymphs / leaflets to 80.29 per cent after 28 days after release.
- ❖ Against Bondar nesting whitefly too about 40 to 60 per cent reduction in eggs was observed after release of *A.astur* @ 300 eggs per palm at 15 days interval.



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Technology : 3

Name of technology	Bio-intensive pest management in rice
Year of release	2020
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Rice
Recommended for region (Names of districts/states)	Rice growing districts Andhra Pradesh state

Details of technology

- ❖ Seed treatment with *Pseudomonas fluorescens* @ 10 g/lt spraying *Pseudomonas fluorescens* @ 5 g/lt against foliar diseases (blast, sheath blight) two times from 30 -40 days after transplanting.
- ❖ Field release of biocontrol agent, egg parasitoid, *Trichogramma chilonis* z@ 50,000/ha, 3 times for leaf folder and *Trichogramma japonicum* @ 50,000/ha/ release, 3 times for stem borer from 25 days after rice transplanting in rice after monitoring the adults.

Features of technology with their benefits

- ❖ This technology gave reduction in pest damage i.e., leaf folder damage by 78.7 per cent ; stem borer damage by 85.9 per cent and sheath blight incidence by 42.16 per cent resulted in 14.97 per cent yield increase compared to farmers practice.



Contact for further details

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Technology : 4

Name of technology	Management of white grub, <i>Holotrichiasppin</i> sugarcane using entomopathogenic fungus, <i>Metarhizium anisopliae</i> (NBAIR Ma 4)
Year of release	2018-19
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Krishna, Godavari , Vizianagaram districts of Andhra Pradesh

Details of technology

- ❖ Soil application of entomopathogenic fungus, *Metarhizium anisopliae* (NBAIR Ma 4) @2.5 kg/ ha enriched in 250 kg farmyard manure per hectare two times at one month interval or at onset of monsoon rains (June/ July months)

Features of technology with their benefits

- ❖ Soil application of entomopathogenic fungus, *Metarhizium anisopliae* (NBAIR Ma 4) effectively reduced the grub population (85-86%) and plant damage (91-92%) resulted in increased cane yield (60- 61%) with 56.5 t/ha additional yield over untreated control.



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Technology : 5

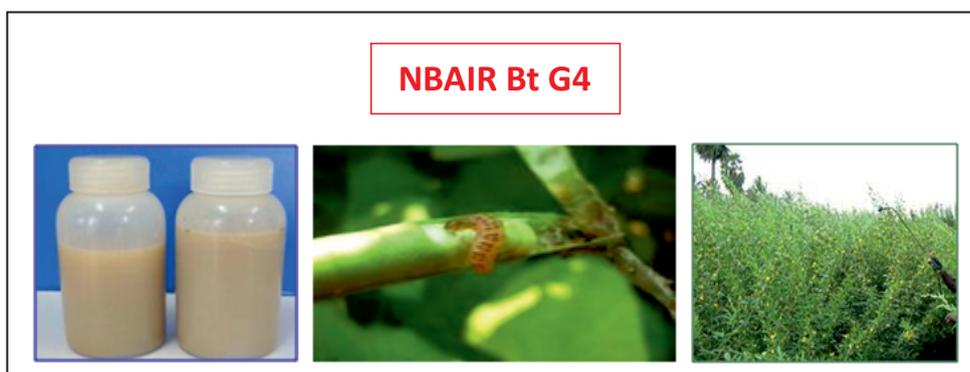
Name of technology	Evaluation of <i>Bacillus thuringiensis</i> (NBAIR-BtG4) on pigeon pea against pod borer complex
Year of release	2018-19
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Redgram
Recommended for region (Names of districts/states)	Redgram growing areas in Andhra Pradesh

Details of technology

- ❖ Spraying *Bacillus thuringiensis* (NBAIR BtG4) 2 per cent as three sprays at preflowering, flowering and pod formation stages in pigeon pea against pod borer complex.

Features of technology with their benefits

- ❖ Foliar spray with ICAR-NBAIR *Bacillus thuringiensis* Bt G4 @2 ml/lit , 3 times effectively reduced *Maruca* leaf webber damage (37.9%); Pod borer damage (22.88%) resulted in 48.62 per cent yield increase and chemical sprays (Chlorpyrifos @ 2.5 ml/lit, Acephate@ 1.5 g/lit , Chlorantraniliprole @ 0.3ml/lit) gave 37.76 per cent Leaf webber damage ; 10.69 per cent. Pod borer damage and 40.79 per cent yield increase compared to untreated control .



Contact for further details

Director
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Technology : 6

Name of technology	Management of fall army worm in maize using biocontrol agents and biopesticides
Year of release	2020-21
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Maize
Recommended for region (Names of districts/states)	Srikakulam, Vizianagaram, Visakhapatnam, Godavari, Krishna, Guntur, Chittore districts in Andhra Pradesh

Details of technology

- ❖ Release of biocontrol agent, *Trichogramma chilonis* @ 50,000/ha from 7 days after seedling emergence, 2 times and spraying biopesticides, *Bacillus thuringiensis* (NBAIR Bt 25) @ 2 ml/lt or *Metarhizium anisopliae*(NBAIR Ma 35) @ 5 g/lt from 20 days after seedling emergence 3 times at 10 day interval for the management fall army worm, *Spodoptera frugiperda* in maize.

Features of technology with their benefits

- ❖ Egg parasitoid, *Trichogramma chilonis* releases 2 times +*Bacillus thuringiensis* NBAIR Bt25, NBAIR Bt 25 @ 2ml /lt 3 times resulted in 34.39 per cent reduction in FAW with 85.52 per cent yield increase and Egg parasitoid, *Trichogramma chiloni* sreleases 2 times +*Metarhiziuman isopliae* NBAIR Ma 35 @5 g/ 3 times resulted in 34.23 per cent reduction in FAW with 83.85 per cent yield increase.



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Technology : 7

Name of technology	Management of coconut Rugose spiralling whitefly using entomopathogenic fungus, <i>Isaria fumosorosea</i> and <i>Encarsia guadelouae</i> parasitoid
Year of release	2020-21
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Coconut
Recommended for region (Names of districts/states)	Srikakulam, Vizianagaram, Godavari, Nellore districts in Andhra Pradesh

Details of technology

- ❖ *Isaria fumosorosea* (NBAIR- Pfu5) @ 5 g/lt with sticker @ 10 ml/lt two sprays + release of parasite, *Encarsia guadelouae* at 15 days after *Isaria fumosorosea* first spraying.

Features of technology with their benefits

- ❖ *Isaria fumosorosea* (NBAIR- Pfu5) two sprays with *Encarsia guadelouae* parasite release gave 70 - 75 per cent reduction of rugose spiralling whitefly in coconut compared to Neem formulation (Azadirachtin 10000 ppm) as two sprays (19-22% pest reduction).
- ❖ Noticed good field multiplication of parasite *Encarsia guadelouae* in *Isaria fumosorosea* sprayed orchards.



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Technology : 8

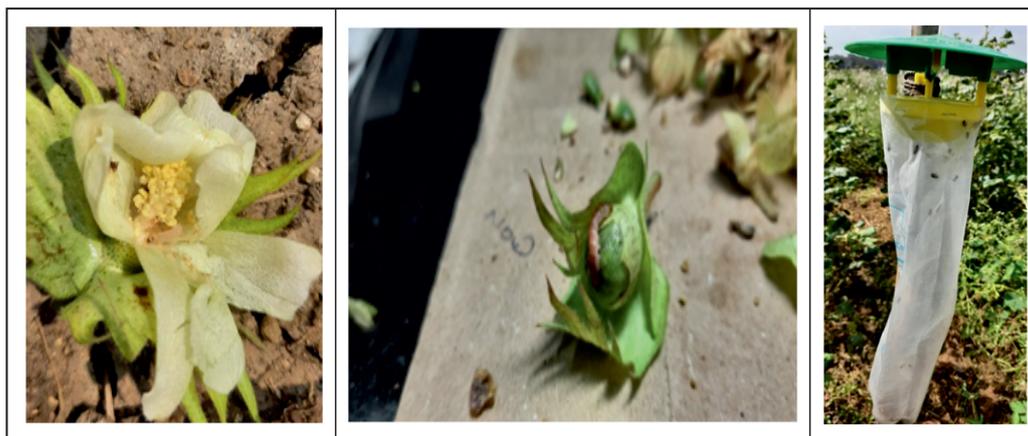
Name of technology	Biointensive pest management practices for management of pink bollworm in <i>Bt</i> cotton
Year of release	2022
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Cotton
Recommended for region (Names of districts/states)	Andhra Pradesh

Details of technology

- ❖ Erection of pheromone traps (Funnel type) @ 15/acre.
- ❖ Releases of *Trichogrammatoidea bactrae* 100,000/ha/release, 6-8 releases starting from 55 days after germination.
- ❖ Application of azadirachtin 1500 ppm at ETL.
- ❖ Need based chemical insecticide, Emamectin benzoate @0.4g/L spray or 80g/acre.

Features of technology with their benefits

- ❖ An integrated approach is required to manage the pink bollworm which turned out to be a devastating pest in the recent past.
- ❖ Pheromones are method of physically making the moths unavailable for mating and this reduces egg load in the crop.
- ❖ *Trichogrammatoidea bactrae* is egg parasitoid and reduces the larval number in the field.
- ❖ Azadirachtin in the form of neem oil helps to deter the moths from ovipositing in the field and is a safe way to avert the adult from the crop. It also acts as an ovicide.



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Technology : 9

Name of technology	Entomofungal agents and botanicals for management of sucking pests in cotton
Year of release	2022
Source of technology	AICRP on Biological control and ICAR-NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Cotton
Recommended for region (Names of districts/states)	Andhra Pradesh

Details of technology

At the first appearance of hoppers, foliar spray of Neem oil (Azadirachtin 1500ppm) @ 5ml/Litre or *Lecanicilliumlecanii* NBAIR V18 @ 5ml/L were given. This was repeated at 10-day interval for effective management of leaf hoppers. Four sprays were found to reduce hopper incidence and recorded higher yields.

Features of technology with their benefits

- ❖ Neem oil containing Azadirachtin acts as an ovicide and as a repellent and hence has a negative effective on the leafhoppers.
- ❖ *Lecanicillium lecanii* is an effective biopesticide effective against the sucking pests especially the leafhoppers and whiteflies. Foliar sprays of the above non-chemical agents.



Contact for further details

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Technology : 1

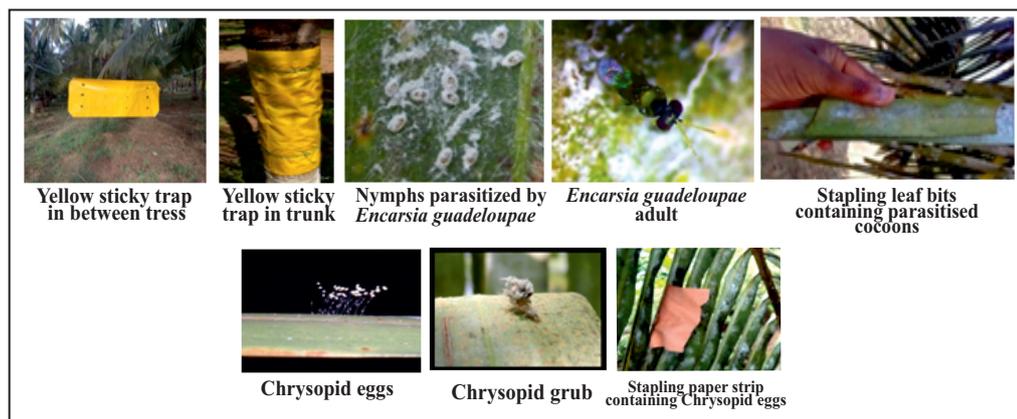
Name of technology	Management of coconut Rugose spiralling whitefly on coconut
Year of release	2019
Source of technology	AICRP- Biological Control Tamil Nadu Centre and ICAR- NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Coconut
Recommended for region (Names of districts/states)	Coconut growing Districts of Tamil Nadu

Details of technology

- ❖ Setting up of yellow sticky traps/ sheets smeared with castor oil (5 x 1.5 ft) @ 8 sheets / ac at 6 feet height in between coconut trees or on the trunk to monitor and mass trap adult whiteflies. Smearing of castor oil to be done once in 3 – 4 days.
- ❖ Natural suppression by *Encarsia guadeloupeae* and predators to an extent of 40-70% has been observed in coconut gardens and many predators viz., *Apertochrysa astur*, *Cybocephalus* spp., *Cryptolaemus montrouzieri* Muls., *Chilocorus nigrita*(Fabricius), *Cheilomenes sexmaculata* (Fab.), *Curinus coeruleus* (Mulsant), *Chrysoperla zastrowi sillemi* (Esben – Petersen), praying mantis and spiders were also recorded as natural enemies of *A. rugioperculatus* in Tamil Nadu. Hence, spraying of synthetic insecticides is not recommended to conserve the natural enemies.
- ❖ If, predators and parasitoids are not observed in the gardens, release *Encarsia guadeloupeae* by stapling leaflets containing *Encarsia* parasitised whitefly puparia on the under surface of the infested leaflets and release *Chrysoperla zastrowi sillemi* / *Apertochrysa astur* eggs @ 1000/ha.

Features of technology with their benefits

- ❖ Eco -friendly method for the management of coconut Rugose spiralling whitefly on coconut.



Contact for further details

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Technology : 1

Name of technology	Biological suppression of Rugose spiralling whitefly in coconut.
Year of release	2020-21
Source of technology	AICRP- Biological Control Telangana Centre and ICAR- NBAIR, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Coconut and oil palm
Recommended for region (Names of districts/states)	All the coconut and oil palm growing districts of Telangana.

Details of technology

- ❖ Foliar application of *Isaria fumosorosea* NBAIR Pfu-5 @ 1×10^8 cfu/ml @ 5 gr/lt (Two sprays at 15 days intervals).

Features of technology with their benefits

- ❖ The application of *Isaria fumosorosea* @ 5g per litre of water at 15 days interval found effective against Rugose spiralling whitefly in reducing the egg spirals/leaflet to 66.45 per cent and nymphs /leaflets to 74.97 per cent.



Contact for further details

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Technology : 1

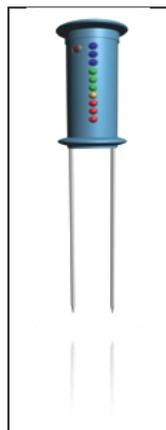
Name of technology	Soil moisture indicator
Year of release	2015
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	All crops
Recommended for region (Names of districts/states)	Not region specific

Details of technology

This device was developed with the active participation of farmers and sugar factory personnel across three agro-climatic zones of Tamil Nadu through the Farmers' Participatory Action Research Project (FPARP) during 2008-10. This device was tested by the farmers' in their fields, comparing with the already known irrigation scheduling device 'tensiometer'. From farmers experience, it was found that tensiometer has many inherent problems like permanent installation of multiple units in different places of the field, blocking of ceramic cup, regular filling of water in the reservoir tube immediately after irrigation, vacuum leakage problems and chances for breaking the ceramic cup of the field installed tensiometer.

Features of technology with their benefits

Based on the farmers' experiences, it was found that scheduling irrigations based on soil moisture status require 36 irrigations per sugarcane crop (12 months) compared to conventional farmers practice which require about 42 irrigations. This reduction in the number of irrigations did not affect the cane yield while saving precious irrigation water. But, on irrigation was quantified about 5 lakh litres per hectare, totaling about 30 lakh water is saved per hectare. The feedback from the cane growers of this device has been encouraging. This user-friendly device is already included in government schemes to improve the irrigation water use and scheduling irrigations based on soil moisture status.

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Technology : 2

Name of technology	Sugarcane sett treatment device
Year of release	2016
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane and vegetative propagated crop
Recommended for region (Names of districts/states)	Not region specific

Details of technology

This novel technique has principle of creating negative pressure followed by absorption. This method of sett treatment is an improved method over conventional application as sett soaking at different periods of time. This method of mechanized short-term treatment has advantages viz., rapidity, effectiveness, less cumbersome in handling material, capable of delivering more than one agrochemical/ microbes/ endophytes, uniform treatment with evenly dispersed chemical, economical as it consumes less chemical and suitability for large scale application under farmer's field condition. Besides above all, it is possible to adopt this technology for treating planting materials of other vegetatively propagated field and horticultural crops viz. tubers, stem cuttings, corms etc.

Features of technology with their benefits

The solution can be of any agrochemicals viz., fungicide/ insecticide/ growth regulator/ adhesives/ nutrients or microbials prepared in water. The container was closed airtight with its lid and the outlet from the lid was connected to the vacuum pump. Then the vacuum was applied slowly @ 100 to 300 mmHg for 15 to 20 min. depending on the size of the machine, setts and combination of agro-inputs. Under vacuum, it removes air in the container and setts i.e. it creates negative pressure and then the vacuum was released slowly for 5-10 minutes which led to absorption of surrounding solution inside the tissue. The absorption was confirmed by tissue bioassay in the decreasing order of buds, rind, cut ends, nodal and internodal stalk tissue. The absorption was found to be equal as overnight soaking. Then the same solution was repeatedly used for treating the next batches of setts on the same day and confirmed similar effect.



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Technology : 3

Name of technology	Two row tractor drawn mechanical planter for sugarcane bud chip settlings raised in portrays
Year of release	2017
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

Conventional method of sugarcane planting requires 7 to 8 tonnes of seed cane per hectare and this is the main reason for slow rate of seed and varietal replacement. Sugarcane bud settling planting is a new method of sugarcane planting and is gaining popularity. In this technique, the bud along with a portion of the nodal region is chipped off and planted in raised bed nurseries / portray / polybags filled with FYM or press mud, soil and sand at 1:1:1 proportion. Seed material required under this technique is only 1 to 1.5 t/ha and the remaining cane after taking bud chips can be sent for milling /jaggery. It also facilitates easier handling and transportation.

Features of technology with their benefits

The equipment consists of

- ❖ Mainframe to be attached to standard three point hitch arrangement of a 40 hp tractor with adjustable arrangement for altering row to row spacing 90, 120 and 150 cm.
- ❖ Bud chip settlings to be dropped through the metering mechanism by two operators who are seated behind the equipment with adjustable arrangements for altering plant to plant spacing of 30, 45 and 60 cm.
- ❖ Furrow openers open the furrow, in which the settlings with soil are to be planted with adjustable arrangement for altering depth of planting 2 to 6 cm. The same furrow is used for irrigation after the settlings have been planted for better establishment.
- ❖ The furrow closer which follows the soil opener closes the soil thereby giving stability to the settling plants.



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Technology : 4

Name of technology	ICAR-SBI EPN biopesticide formulation
Year of release	2020
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane, Groundnut, Brinjal, Chick pea , Potato, Maize, Cabbage, etc.,.
Recommended for region (Names of districts/states)	Not region specific

Details of technology

A novel EPN powder formulation was developed first of its kind for storing EPN. The EPN formulation can be stored at room temperate of 30±5°C in a sealed aluminium lined high-density polyethylene sachets. The process for the formulation of entomopathogenic nematode-based biopesticide includes Heterorhabditis and Steinernema spp. The formulations containing Heterorhabditis have a shelf life of nine months with 92o/o survival of nematodes at a temperature range of 30±5°C. The formulations containing Sfeinernema have a shelf life of 12 months with 90 per cent survival of nematodes at a temperature range of 30±5°C, The ICAR-SBI EPN formulation can be effectively used as a potential biopesticide against various insect pests and white grubs.

Features of technology with their benefits

- ❖ EPNs are biopesticide, completely non toxic and safe to the environment.
- ❖ Effective control of insect pests especially white grubs.
- ❖ ICAR-SBI EPN Formulation has longer shelf life with commercial potential and cost effective.
- ❖ EPN can be easily mass produced on Galleria larvae with a cost effective diet.
- ❖ Can be commercially scaled up to different capacities depending on the requirements.
- ❖ No special costly equipments and materials are needed for the EPN production and formulation.
- ❖ No special containers needed to store the formulation as locally available aluminum lined high density polyethylene sachets are sufficient.
- ❖ Can be easily applied in the field by broadcast, spot application, spraying with normal sprayers and water based application methods.



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Technology : 5

Name of technology	Cane jam production from sugarcane juice
Year of release	2021
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

ICAR-SBI has developed a novel process for production of jam wholly from sugarcane juice. The process and methodology has been standardized for various processing parameters such as juice filtration, arresting the anti-browning effect by the addition of anti-browning agents, temperature controlled boiling of juice, dissolution of thickening agents in acidified medium, fixing the juice Brix and boiling temperature for addition of thickening agents and final setting point of jam. For flavored variants of cane jam, any permitted natural flavoring agent can be added to the product. The final cane jam product developed has a Brix content of 61-70 per cent. The titratable acidity of the cane jam product was 0.57 per cent which is comparable with fruit jams (0.3-1.0%) available in the market. Water activity of cane jam was around 0.8 aw which is lesser than commercial fruit jams (around 0.9 aw). Moisture content in cane jam was 8.39 per cent which is far below compared to fruit jams which are generally around 20-30 per cent.

Features of technology with their benefits

Advantage of low moisture content and water activity is better shelf life. Total sugars in the cane jam were estimated to 46.5 per cent which is below compared to fruit jams (50-65%). No addition of sugar in cane jams except sugarcane juice whereas in fruit jams, 50:50 ratio of fruits and sugars, are being used for jam preparation. Total calorific value of cane jam was 262 kcal which is slightly lesser than commercial jams (272 kcal). Cane jam is rich in minerals namely sodium (28.4mg/100grams), potassium (747.7mg/100grams), calcium (7.2mg/100gm), phosphorus (70.9mg/100g), zinc (1.1mg/100g) and copper (0.09 mg/100g). When compared to commercial fruit jams (77mg/100g), cane jam is ten times rich in potassium content whereas rest of the minerals were on par. Cane jam is also rich in vitamin B complex (57 mg) and vitamin E 5.73 mg. Benefit cost analysis of cane jam technology was worked out and found advantageous for commercial production.



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Technology : 6

Name of technology	Production of cane dietary fibre food products
Year of release	2021
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

Sugarcane bagasse, an abundant agricultural lignocellulosic by-product, is a fibrous residue of cane stalks left over after extraction of the juice from the sugarcane. Bagasse, obtained as a by-product of sugarcane processing, is composed of fiber, pith, insoluble solids and water. Its morphological structure is not strong in comparison with other fibers such as wood. An important advantage is that it is directly obtained and concentrated in the sugar factory as a process of by-product, thus simplifying its handling and transport operations. Thousands of tonnes of waste by products from the sugar industry are generated annually in the form of bagasse. Bagasse is an excellent source of dietary fiber, both soluble and insoluble fibers. Bagasse flour can be introduced along with wheat flour, and can be used to prepare variety of food products. Bread, Rusk and Cookies are considered as a vehicle for combating malnutrition especially in the developing world. It is to be fortified with fiber of acceptable cooking quality.

Features of technology with their benefits

The present study was under taken to develop bakery products from the composite flour containing wheat flour, bagasse flour and other important ingredients along with the analysis of its physico-chemical characteristics. Bread, Rusk and cookies were produced in different combinations of cane fiber content. The invention mainly focused on developing the process and methods to use cane fiber as source of dietary fiber in various food products. Finely ground sugarcane bagasse fiber was pretreated with alkaline solution (01-05%) and cell wall degrading cocktail enzymes (Cellulases, hemicellulases, pectinases and ligninases, 1-5U) to soften the fiber thickness, texture and solubility. Further, pretreated cane fiber was thoroughly washed in the hot water and used in varies concentration (1-20%) as a source of dietary fiber to produce various food products. Developed products were further characterized for their physicochemical properties.



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Technology : 7

Name of technology	The Production of spray dried sugarcane juice
Year of release	2011
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

ICAR-SBI has developed a process to produce a dry product of sugarcane juice having longer shelf life and suitable for commercial applications. The overall process involves filtered sugarcane juice added with bulking agents and spray dried to a dry product following standardized process parameters. The dry product thus obtained may be blended either with natural or permitted synthetic food flavours, colour, stabilizer and anti-caking agents. Further downstream processing carried out by applying dry extrusion and spheronization/granulation to produce a spheroid/granule product. The critical problem associated with spray drying is that sugarcane juice is high sugar material, and the sugars, due to its low glass transition temperature, results in a sticky or candy like material, not a powder product. With the standardized process and downstream processing the juice will result in to a product with very low moisture content, good flow ability and low hygroscopicity and has good shelf life when stored in ambient conditions and exposure to atmospheric air. The dry product can be stored about six months under ambient conditions. If stored under refrigerated conditions can be stored for more than a year. Compositional analysis indicated that this product retains all the flavour components, sugars, protein, ash, minerals, vitamins, phenol, flavonoids and antioxidant activity. Organoleptic test indicated that the product is comparable with fresh sugarcane juice.

Features of technology with their benefits

ICAR-SBI has developed a process to produce a dry sugarcane juice product that has good shelf life and commercial advantages.


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Technology : 8

Name of technology	ICAR-SBI standardised liquid jaggery process
Year of release	2020
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

Liquid jaggery or semi liquid syrup is obtained as an intermediate product during evaporation of filtered and clarified sugarcane juice during the process of solid jaggery making. The short shelf life of the traditional products resulted in the indiscriminate use of preservatives to prolong the shelf life. Apart from the addition of preservatives, other chemicals like hydros(sodium hydrosulphite) are added for better colour and appeal of the product. Hence, liquid jaggery making procedures without any addition of chemicals is an urgent need to produce good quality jaggery for community health and to double the income of farmers cum small entrepreneurs supported on sugarcane. The present method for the preparation of the liquid jaggery was a standardized procedure to get appreciable good gloss and shelf life of the final product. The sugarcane juice obtained from both matured and immature canes with age varying from 7 - 12 months could be conveniently used for the preparation of liquid jaggery. The good sugarcane juice had the density of 1.07 – 1.10 g/ml. The good clarity was achieved by the removal of impurities by initial filtration of sugarcane juice, removal of heat coagulated suspension and floating impurities during two stages to get the final product. Heating facilitates the separation of dissolved colloidal albumins, wax and gum in the form dark coloured waxy coagulated matter floating on the surface. Product pH range was 5.0 to 6.8 and the moisture content less than 12 per cent. Sugarcane juice obtained from 11-12 month old cane.

Features of technology with their benefits

The liquid jaggery technology can be made with a hassle free process without any chemical additives like clarificants, coloring agents and preservatives thereby ensuring the production of a healthy sweetener. Further extension of shelf life if required can be met with the addition of permissible level of preservatives. This can also form an adulterant free healthy raw material for various confectionery items and in Ayurvedic Medicines



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Technology : 9

Name of technology	Process for the production of freeze dried sugarcane juice
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

ICAR-SBI has developed a process to produce a dry product of sugarcane juice having longer shelf life and suitable for commercial applications. The process involves freeze dried sugarcane juice product by employing freeze drying or lyophilization process to dry the filtered sugarcane juice followed by (a) blending natural and permitted synthetic food flavours, colour, stabilizers, anti caking agents etc., (if needed) (b) applying dry extrusion to prepare dry extrudes, (c) applying spheronization/granulation on dry extrudes to produce spheroid/granule product and (4) packing the spheroid/granule product. Dried product is highly hygroscopic and glistening flaky or dry lumps in nature, with a water activity of about 0.3 aw. The critical problem associated with freeze dried product is very low moisture content, poor flow ability and high hygroscopicity leads to agglomeration and formation of lumps when stored in ambient conditions and exposure to atmospheric air. To get better quality product the dried freeze dried product is compacted manually or by employing machinery like dry extruder to produce dry extrudes. This granulated product can be produced as per the requirement; however, a 0.5 to 3.0 mm spheroid diameter may be preferred for regular sweetener or instant juice use. This granulated product has low hygroscopicity, low lump formation, good flow ability and better shelf life. The dry product can be stored about six months under ambient conditions and about two years if stored under refrigerated conditions.

Features of technology with their benefits

This product can be used for preparation of instant sugarcane juice or as a regular sweetener. This dry sugarcane juice product is also useful as flavour enhancer of food, beverages, sweets, confectioneries, bakery items, dairy products, weaning food, novel value added foods and medicinal / pharmaceutical preparations.



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Technology : 10

Name of technology	QUATRO sugarcane single bud cutter machine
Year of release	2019
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

Planting of sugarcane crop with pre germinated settling plants is the best solution for improving seed health, seed multiplication ratio and uniformity in plant population, which ultimately assures higher sustainable crop yield. The foremost requirement of settling raising and transplanting work is the availability of cost effective cutting tool for detaching uniform size mini single bud setts. Many sugar mills and farmers of southern states, had successfully adopted this method, but in north India the unavailability of motorized single sett cutters was one of the biggest bottleneck towards adoption of settling transplanting techniques. The cutters were manufactured in southern states, viz., Maharashtra, Tamilnadu etc but due to their higher price and huge transportation cost there was least interest in adoption of setting transplanting method by the sugar mills of the region. To address this issue, ICAR-SBIRC, Karnal have designed and developed, a cost effective single budded sett cutting tool namely "Quatro Sugarcane Single Bud Cutter" which begged design patent in the country "Design No. 297432". Nearly 7-8 thousands single bud setts, adequate to grow settlings for transplantation in an acre area, can effectively be detached in one hour by this machine, when it runs at full capacity i.e. four persons operating on each cutting slot of the machine.

Features of technology with their benefits

From the last three crop seasons nearly 272 lakhs single bud setts were detached and utilized either in raising settlings for transplanting or direct planting of treated single budded setts in around 2899 acres of area.



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Technology : 11

Name of technology	ICAR-CIAE-SBI sugarcane rind removing equipment
Year of release	2021
Source of technology	National Bureau of Agricultural Insect Resources, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

The developed sugarcane rind remover consists of four metallic brushes attached to the rotating shaft. When the sugarcane is inserted between the four metallic brushes, the upper, lower and two sides skin of the sugarcane is removed due to the rotation of the brushes (because of the abrasion action between the brushes and the sugarcane fed). The feeding arrangement is made of two nylon roller rotating at about 270 rpm, which enables retention of the canes to be peeled for sufficient time in the peeling zone. The equipment is mounted on the wheel enabling easy transportation from one place to another. Capacity of the power operated sugarcane rind removing equipment is 240 canes/h and 175-200 kg/h. The potential stake holders are sugarcane juice vendors and Sugarcane juice bottling plants.

Features of technology with their benefits

Traditional manual method by using knife is time consuming, unsafe and unhygienic. In view of this, development of a power operated sugarcane rind removing equipment has been developed.


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Technology : 12

Name of technology	ICAR-CIAE-SBI Motorised double headed sugarcane single bud cutting machine
Year of release	2021
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

The number of single buds required per hectare is 24,700 (at a spacing of 90 x 45 cm) mini chips. This process is time consuming and cumbersome. Thus there is an urgent need for the mechanization of this operation and the double headed single bud cutting machine (motorized) was developed. Double of head sugarcane single bud sett cutting machine has two pairs of two circular blades high carbon steel, which rotates at a speed of 2800 rpm. A spacer is provided between the two blades, which facilitate variation in the size of single bud sett as per requirement' the in an hour with Two persons can operate simultaneously and can cut about 3000 single buds in an hour with the help of the developed unit. The machine can be operated by 0.75 kw (1 hp) electric motor which powers both the sets of cutting blades. The cost of the equipment is Rs.25,000 cost economics of adoption of single bud cutting machine gave savings in time and cost of 89 and 64 per cent.

Features of technology with their benefits

In this technique of raising of settling in the portray, the single bud along with a portion of the nodal region is cut off and planted in raised bed nurseries/polybags/portrays filled with FYM or press mud' soil and sand at 1:1:1 proportion. Seed material required under this technique is only 2 to 3 tons per hectare and the cane after taking single buds can be sent for milling/ jaggery making. Nursery raised from sugarcane mini chips and transplanting them in main field was found to be more economical than traditional methods for seed increase.



Contact for further details

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Technology : 13

Name of technology	Sugarcane detrashing tool
Year of release	2020
Source of technology	National Bureau of Agricultural Insect Resources, Bengaluru
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

This ergonomically improved sugarcane detrashing tool was designed for 280 g weight using the design software as against the existing model of 430 g and developed. This tool has two stainless steel (SS) knives fitted in a 'U' shaped stainless steel flat with tension. These knives are 8 inches in length with varying width of 2.5 inches to 1 inch from top to bottom. The knives are welded with 4 inch length stemmed 18 x 3mm stainless steel flat, which gives tension by which the knives are stiff enough to detach the leaves. At the bottom of the 'U' shaped steel flat a stainless steel pipe of 25 mm diameter with 30 mm length is attached. It is provided with a wooden handle (1 inch diameter and 5 inches length) for convenience. An adjustable oval shaped loop of 3 mm thickness made up of SS rod was provided which can be moved to and fro to adjust the gap between two knives depending upon the diameter of the sugarcane stalk. The knives are inserted between the internodes at the top and pulled vertically down for removing the dry and unwanted leaves. Detrashing angle of 5 degree and varying approaching/ cutting width ranging from 25 to 50 mm were provided in the tool to ease the detrashing process.

Features of technology with their benefits

Though detrashing has several advantages, physical labor for doing this operation is hard to obtain because of the drudgery. In view of avoiding the direct contact with hands and sugarcane leaves and also to reduce the drudgery involved in detrashing, an ergonomically improved sugarcane detrashing tool was designed and developed with a substantially reduced weight.


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Technology : 14

Name of technology	Powder jaggery processing from sugarcane juice
Year of release	2021
Source of technology	ICAR-Sugarcane Breeding Institute, Coimbatore
Suitable for which crops/ animals/enterprises etc.	Sugarcane
Recommended for region (Names of districts/states)	Not region specific

Details of technology

The powder jaggery is produced from sugarcane juice by concentrating and allowing crystallization with continuous aeration to form powder or granular form. Traditional method of solid jaggery or jaggery powder making is the closest method. In conventional method of jaggery powder preparation, various chemicals, clarificants and emulsifiers are being used indiscriminately. “Powder jaggery” has advantages over the block jaggery as the powder gets equilibrated at lower moisture compared to solid jaggery blocks. Extra stirring involved in making jaggery increase the crystallinity of jaggery powder compared to corresponding solid blocks which make the product more user friendly. Jaggery powder is more stable even under severe storage conditions and hence has more shelf life.

Features of technology with their benefits

In an attempt to improve the business potential of jaggery, the manufactures are adding chemical clarificants at undefined rate during clarification. The chemical clarificants such as Hydros, sodium carbonate, sodium bicarbonate, super phosphate alum, sodium formaldehyde sulfoxylate, Tri sodium phosphate and magna floc are used in the jaggery preparation. Hence, there is a necessity to improve methods for the production of quality of the jaggery to tap better indigenous and export market and thus powder jaggery process is beneficial and economical.



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EPILOGUE

- ❖ Agriculture in India is largely dependent on nature with different agro-climatic regions and predominantly small farmers with diversifying risk prone agriculture. The need of the hour is to educate farmers in the use of new technologies and innovative approaches for enhancing productivity and production thereby raise profitability and net income.
- ❖ Innovation in agriculture is leading an evolution in agricultural practices thereby that reduce losses and increase efficiency. It is generally recognized that agricultural research is a creative activity. In this regard, the Indian National Agricultural Research System (NARS), in a broad sense, includes all those institutions like ICAR, SAUs etc., involved in promoting quality agricultural education, research and extension in the country.
- ❖ The ICAR is driving continuous improvement in developing agricultural technologies, and the trend is here to stay, resulting in improving crop yields and helping to increase the income of the farming community which is positively impacting farmers and other stakeholders.
- ❖ Dissemination of latest and right technologies at right quantity in right time with right approach to intended farmers with less time gap from the research system has a major role in agriculture and allied sectors, and with the advent of Krishi Vigyan Kendras (KVKs), the scope has widened.
- ❖ In simple terms, technology backstopping for KVKs is the process of making available ready to use agricultural technologies for farm families and other stakeholders through technology assessment, technology demonstration and capacity development in order to combat the existing/forecasted technology fatigue. In this regard, a total of 377 latest technologies are from 24 ICAR institutes readily available by way of this publication for dissemination through KVK system across the country.
- ❖ The technology inventory presented in this publication may act as reference for Heads and Scientists (Subject Matter Specialists) of KVKs for opting as technology solution through appropriate extension approaches for addressing the identified and prioritized problems faced by the farmers in their adopted cluster villages.



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