

Farmer's Handbook on Food Processing Technologies



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National Institute of Agricultural Extension Management (MANAGE)
(An Autonomous Organization of Ministry of Agriculture and Farmers Welfare, Government of India)
Rajendranagar, Hyderabad - 500 030, Telangana State, India
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Compilation

Mr. Fasludeen N.S
Ms. Sujayasree O.J

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P. Vinay Kumar and P. Chandra Shekara

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Printed at:
Vamsi Printers Pvt. Ltd.,Hyderabad

ISBN No.
ISBN: 978-93-5281-407-7

Published by

National Institute of Agricultural Extension Management (MANAGE), An autonomous
Organization of Ministry of Agriculture and Farmer's Welfare, Government of India,
Rajendranagar, Hyderabad - 500 030, Telangana State, India.



Message from the Director General, MANAGE

A strong and dynamic food processing sector plays a vital role in reduction in the wastage of perishable agricultural produce, enhancing shelf life of food products, ensuring value addition to agricultural produce, diversification & commercialization of agriculture, generation of employment, enhancing income of farmers and creating surplus for the export of agro & processed foods. Authenticated information regarding efficient adoptable technologies on food processing will ensure better utilization and value addition of agricultural produce for enhancement of income of farmers. Technologies suitable for small holder farmers will certainly help them to increase their income other than from fresh produce selling. Focus has been given to the primary processing hand equipment's or machinery, processing and preservation of major crops, product development of commercial importance which has been developed from various national research institutes. The available information has been compiled in a simple format in farmer friendly manner aiming at its wide application nationwide.

Creating credible source of food processing technologies and network of institutions for the benefit of smallholder farmer is the primary objective of this publication. I hope this publication will be of immense use to all the Stakeholders in Agriculture when the Nation is talking about Doubling Farmers Income.

Smt. V. Usha Rani, IAS
Director General, MANAGE

PREFACE

Farmers produce grains, fruits, vegetables and Livestock's whereas farm produces are consumed after processing. Therefore, food processing is an important intervention in the agriculture value chain. It is very critical intervention as it reduces post-harvest losses at farmer's level and links the farm gate to consumer plate. Food processing add significantly to income of the farmers.

Majority of the agriculture produce are perishable. Production is seasonal whereas consumption is perineal. Hence, it is important to add value to raw agriculture produce so that, perishable produce are processed, preserved and consumed over a period of time. Processing also reduces post-harvest losses.

Food processing requires technologies, investment, infrastructure and skill. Hence, the sector is dominated by entrepreneurs and Agribusiness companies. However, awareness about food processing sector is almost absent among the farming community and inadequate among extension workers.

When the nation is talking about Doubling Farmers Income, interventions such as, food processing at farmers level play important role in enhancement of farmers income. It also creates jobs in rural areas. It increases profitability of agriculture and better utilization of resources including leisure time at the disposal of farmers.

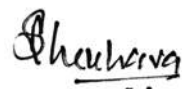
An attempt is made in this publication to gather food processing technologies which are useful to farmers. Also contact details of technology provider is indicated along with each technology so that, it becomes easy for every farmer to approach right source to adopt the technology. This is an important mandate of MANAGE and responsibility of extension worker.

Besides, the publication also provides contact details of institutions supporting food processing sector. This would help farmers to obtain relevant technologies from right source and benefit of developmental programmes.

The content of the publication has been collected from authentic sources such as websites of institutions and cross checking of information from sources.

This publication is expected to benefit extension workers and farmers directly. We hope that, these technologies spread quickly through extension workers and innovative farmers to farmers in every corner and contribute significantly to the income and happiness of the farmers.

The contribution of Mr. Fasludeen N.S and Ms. Sujayasree O.J in compilation of information and Mr. B. Chinna Rao in preparation of document is heartfully acknowledged.



(Dr. P. Chandra Shekara)
Director (Agril.Extn.)

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1. Coconut De-Husker

Name of the Technology: Pedal Operated Coconut De-husker

Application/ Use: For de-husking coconut with ease and minimal effort; can be conveniently used both by men and women

Description of Technology: The de-husking assembly consists of two sharp edged blades, one being stationary and the other movable - operated by a foot pedal through linkage mechanism. The twin-blades are mounted on a tubular stand. The unhusked coconut is pierced on the wedge like blade and then the foot pedal is pressed to split open and separate a portion of the husk. The operation is repeated 3-4 times until complete de-husking is done.



Size & Capacity

- ◆ Overall Dimension: 45 x 15 x 85 cm
- ◆ Weight : 6 kg
- ◆ Investment(Unit cost per machine):Rs. 600/-
- ◆ Output capacity: De-hulling - 600 kg/h or Deseeding - 45 kg/h

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences,
J- Block, GKVK Campus, Bangalore - 560 065, Karnataka

2. Tender Coconut Punch And Cutter

Name of the Technology: Tender Coconut Punch and Cutter

Application/ Use: For making a hole in tender coconut and for cutting it in to two halves



Description of Technology: A simple tender nut punch has been developed. It mainly consists of a square base made of MS angle of 40 cm length. The tender nut is placed on the nut holder which is a circular and hollow in shape with a diameter of 10 cm. The tender nut can be placed on the nut holder and by operating the lever mechanism a hole of 12 mm diameter is made in just 4-5 seconds a straw is put in the hole and one can drink the nut water. A simple Tender Coconut Cutter is also developed. It mainly consists of a wooden base of 50 cm length, a stand, a knife and a hand lever. The stand is mounted on the base. The cutting blade is mounted concentric to the stand and retained at a height of 15-20 cm.

Size & Capacity

- ◆ Overall Dimension: 1040 x 380 x 1240 mm.
- ◆ Weight: 105 kg.
- ◆ Land: 12 x 10 ft.
- ◆ Investment (Unit cost per machine): Rs. 15,000.00 + Operational Expenditure.
- ◆ Output capacity: 60 kg Per hour.

Contact Address: ICAR-Central Plantation Crops Research Institute (CP-CRI), Kudlu.P.O, Kasaragod- 671124, Kerala, Contact Number: 04994-232894, Email: director.cpcri@icar.gov.in, directorcpcri@gmail.com, cpcri@gov.in, Website: <http://www.cpcri.gov.in>

3. Coconut De-Shelling Machine

Name of the Technology: Coconut De-Shelling Machine

Application/ Use: For separating coconut shell and kernel after partial drying

Description of Technology: Traditionally after partial drying of split coconut, the kernel and copra is separated using a traditional wooden mallet by taking the individual cups in hand. To overcome this problem, a power operated coconut de-shelling machine was designed and developed. The capacity of the machine is 400 half cups per batch. The optimum average moisture content for maximum de-shelling efficiency (92.16 %) is 35 % d.b. The optimum speed of the de-shelling machine is 10 RPM and the time taken for de-shelling is 4 minutes per batch.



Size & Capacity

- ◆ Overall Dimension: 5000x1500x1500 mm
- ◆ Weight: 15 kg.
- ◆ Land: 9 sq m
- ◆ Investment(Unit cost per machine): Rs 50,000/-
- ◆ Output capacity: 20 nuts/ h

Contact Address: Research Engineer, AICRP on PHT Central Plantation Crop Research Institute (CPCRI), Kasaragod - 671124, Kerala.

4. Virgin coconut oil

Name of the Technology: Virgin Coconut Oil (VCO)

Application or use: In order to protect the farmer from the losses from the falling price of coconut, there is a need to look for diversified coconut products and large scale integrated processing. The development of this product is an effort in the direction to develop virgin coconut oil, so that better quality of the oil can be provided to customers and consumption of coconut oil can be increased, while increasing the profit margin to producers in terms of value addition. The technology for the manufacture of VCO is available from CFTRI.



Description of Technology: Virgin coconut oil (VCO) is prepared from fresh mature Coconuts. VCO is colorless and having an intense coconut scent, it is rich in lauric fatty acid, which is a proven antiviral and anti-bacterial agent. The high-grade VCO has a long shelf life due to presence of natural anti-oxidants in coconut oil. Coconut oil is in great demand in the cosmetic industry and international culinary. It is valued mainly for its characteristic nutty flavor and also for its nutritional values.

Coconut milk is extracted from deshelled, pared and disintegrated coconuts. Further, coconut cream is separated, which is subjected to tempering, conditioning and separation techniques to separate VCO. The novelty of the invention is that the VCO is obtained without heat treatment of coconut milk or fermentation of coconut cream, thereby keeping its characteristic flavor and nutrients intact.

Process Economics:

- ◆ Economic capacity : 5000 coconuts/day/shift
- ◆ Production / Day : 300 L
- ◆ No. of working days : 300 days / Year
- ◆ Project cost : Rs. 3.3 lakh

Contact Address: ICAR-Central Plantation Crops Research Institute (CPCRI), Kudlu.P.O, Kasaragod- 671124, Kerala, Contact Number: 04994-232894, Email: director.cpcri@icar.gov.in, directorcpcri@gmail.com,cpcri@gov.in, Website: <http://www.cpcri.gov.in>

5. Arecanut Dehusker

Name of the Technology: Manual Arecanut Dehusker

Application/Use: Suitable for de-husking freshly harvested mature green Areca nut. Developed to replace the traditional de-husking tool which involves drudgery.

Description of Technology: It is a manually operated unit where four persons can de-husk Areca nuts simultaneously. The unit is made of mild steel body mounted on angle iron stand. The de-husking assembly consists of two sharp edged blades, one being stationary and the other movable, operated by a pedal through a linkage mechanism. The unit has a hopper to hold 20kg raw nuts and the raw nut freely flows to the de-husking tray by gravity. The outer shell of freshly harvested nut is pierced by pressing the nut against the sharp edge of the blade and the leg pedal is operated to split the husk. About 2-3 strokes are required to completely de-husk a nut.



Size & Capacity:

- ◆ Overall Dimension: 68 x 68 x137 cm
- ◆ Weight : 40 kg
- ◆ Investment(Unit cost per machine): Rs.4500/-
- ◆ Output capacity: 160 kg raw nut per day / person

Contact Address: Research Engineer, AICRP on PHT, and University of Agricultural Sciences, J- Block, GKVK Campus, and Bangalore - 560 065, Karnataka

6. Tamarind Dehuller - Cum - Deseeder

Name of the Technology: Tamarind Dehuller-Cum-Deseeder

Application/ Use: De-hulling of freshly harvested matured dry tamarind fruits and then expelling seeds from de-hulled fruits



Description of Technology: This is a composite unit consisting of a tamarind de-hulling unit and a deseeding unit. The de-hulling unit consists of serrated mild steel rings mounted on two parallel shafts which rotate in opposite directions. Small pins welded on to the surface of the rings act as beaters to break and separate the brittle tamarind shell. The de-seeder consists of a rotating fluted stainless steel roller and a stationary rasp bar. When the de-hulled dry tamarind fruits pass between the fluted roller and the rasp bar, the seeds are squeezed out of the tamarind pulp. The expelled seeds are then separated manually.

Size & Capacity:

- ◆ Overall Dimension: 68 x 68 x137 cm
- ◆ Weight : 40 kg
- ◆ Investment(Unit cost per machine): Rs. 30,000/- (without motor)
- ◆ Output capacity: De-hulling - 600 kg/h or Deseeding - 45 kg/h

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore - 560 065, Karnataka

7. Cashew Apple Beverages

Name of the Technology: Cashew Apple Beverages

Application/ Use: Ready to serve beverage, Squash

Description of Technology: After removal of astringency i.e., tannin the decanted juice was used to prepare different beverages.

Size & Capacity:

- ◆ Investment (Unit cost per machine: Rs. 37,000/-
- ◆ Output capacity: 100 kg of cashew apple and 30 kg sugar gives 400 bottle of 200 ml capacity RTS. 100 kg. Cashew apple and 26 kg. Sugar gives 75 bottles of 750 ml capacity squash.
- ◆ Unit cost of operation: Cashew apple RTS: Rs. 4.90/- per 200 ml glass bottle
Cashew apple Squash: Rs. 16.75/- per 750 ml glass bottle

Contact Address: Research Engineer, AICRP on Post-harvest Technology College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar- 751 003, Odisha.



8. Mango Harvester

Type of Technology: Post-Harvest Gadget (Mango harvester)

Application/Use: To pluck mango fruits from the tree without fruit damage

Description of Technology: The gadget is a simple and maintenance free unit comprising of a metal ring with a fixed knife edge at one end for cutting the petiole of the fruit. Nylon net is fixed to the metal ring to hold the plucked fruits. The unit needs to be fixed to a long pole of suitable length to reach the fruits on the tree.



Size & Capacity:

- ◆ Overall Dimension: 37 x 24 x 2 cm
- ◆ Weight : 0.40 kg
- ◆ Investment(Unit cost per machine): Rs. 90/-
- ◆ Output capacity: 750 fruits / h

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore - 560 065, Karnataka

9. Mango Leather (Aam Papad), Mango powder and Mango Toffee

Name of Technology: Process for Mango Leather (Aam Papad), Mango powder and Mango Toffee

Application/ Use: The local varieties of Mango in Chhattisgarh are screened for processed products like mango leather, mango powder (Amchur), etc. The farmer may prevent distress sale.



Description of Technology: Mango toffee is made by boiling (at 150-160°C) mango pulp and other ingredients like glucose/sugar, milk powder and edible fat. The fruit pulp is first concentrated to half of its volume. For one kilogram of concentrated pulp, 160 g of glucose, 320 g of milk powder and 200 g of ghee is added. This mixture is further heated to a thick consistency (75-800 Brix) followed by spreading (one cm thickness on a smeared flat tray) and allowed to cool. Then, these are cut into pieces (called as toffee) of desired size, wrap and store it in cool dry place. The mango leather required about 100 to 110 hr to dry from the initial moisture content of around 76 -86% (wb). The ideal moisture of mango leather to have storage stability is 15% or a little more with a relative humidity between 63-70%. It was found that mangoes at an optimum stage of maturity (9-10 weeks after fruit-set) are good for preparation of mango powder. Bisulphate treatment given to the slices to improve retention of colour and vitamin-C. A drying period of 8-10 hr in tray dried and 15-18 hr in sun is necessary to reduce moisture content to 2-3% when the tray load is 0.6 kg ft² with a drying temperature of 55-60°C.

Size & Capacity:

- ◆ Investment (Unit cost per machine: Rs. 55,000/- (decorticator), Rs. 60,000/- (table oil expeller) and Rs. 30,000/- (oil filter press)
- ◆ Output capacity: Mango Toffee- 300 no (8 g), Mango leather -50 kg/day, Mango powder -10 kg/day
- ◆ Unit cost of operation: Mango Toffee- Rs. 0.5/toffee (8 g), Mango leather – Rs 75/kg, Mango powder – Rs. 10/pouch of 50 g

Contact Address: Dr. S. Patel, Professor & Head, Department of APFE, FAE, IGKV, Raipur, Chhattisgarh, 0771-2444254 (O), Mobile – 098265-65675, E-mail: patels47@rediffmail.com

10. Pineapple Harvester

Name of Technology: Pineapple Harvester

Application / Use: Harvesting pineapple in hilly slope areas of NEH



Description of Technology: A manually operated pineapple harvester is fabricated with mild steel rod of 30 mm diameter and 1500 mm length. A sharp cutting blade of 125 mm diameter made of mild steel is attached at the end of the mainframe which is used to cut the stalk of the pineapple. Rotation of the cutting blade (125mm) is obtained through a transmission from a 1.5 hp petrol engine through a spiral rotating shaft. When the operator pulls the lever of the cranking wheel of engine mounted at the back of the operator which is connected to the cutting blade, the blade starts rotating and cuts the stalk just beneath the pineapple. The cut pineapple is held with the finger provide just above the cutting blade. The detached/cut pineapple will be shifted to a basket kept on the ground. A single operator is required for cutting the pineapple and putting it in the basket as well. The total weight of the machine is 9 kgs. The cutting blade can be sharpened or replaced when damaged.

Size & Capacity:

- ◆ Overall Dimension: 1500(L) x 130 (B)
- ◆ Weight: 9 kgs.
- ◆ Space required : Hilly terrains/terrace land of NEH
- ◆ Investment(Unit cost per machine): Rs.10,000/-
- ◆ Output capacity: Field capacity is in the range of 250 to 280 harvested fruits per hour

Contact Address: P.I., AICRP on PHET, Directorate of Research, Central Agricultural University, Imphal-795004, Manipur.

11. Zero Waste Technology Of Pineapple

Name of the Technology: Zero Waste Technology for Osmo Dehydrated Pineapple Products

Application/ Use: Osmo dehydrated pineapple rings, tidbits, RTS, Squash

Description of Technology: After thorough cleaning of pineapples, they are sliced into 6-8 circular pieces. Skin is removed with the help of S. Punches. Hard core is removed with S.S. corer. The circular pieces are kept in sugar syrup of 57-600B for 8 hours. Then pieces are removed and adhering syrup wiped up. Then the pieces are dried at 70°C for 24 hours in a tray dryer. The broken pieces are dried in the same manner and tidbits are made. RTS and Squash are prepared from juice extracted out of thick skin/peel and leftover sugar syrup. The leftover of pineapple skin/peel with meat after juice extraction is called pineapple meal. This by product is used as an ingredient for cattle feed after drying and pulverization.



Size & Capacity:

- ◆ Investment (Unit cost per machine: Osmo dehydrated pineapple ring: Rs.10/- per 5pcs.(100gm.)
- ◆ Pineapple tidbits: Rs. 9/- per 100gm.

Contact Address: Research Engineer, AICRP on Post-harvest Technology College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar- 751003, Odisha.

12. Sapota Harvester

Name of Technology: Post-Harvest Gadget (Sapota Harvester)

Application/Use: To pluck Sapota fruits from the tree without fruit damage

Description of Technology: The gadget is simple and maintenance free unit comprising of a metal ring with a fixed knife edge at one end for cutting the petiole of the fruit. Nylon net is fixed to the metal ring to hold the plucked fruits. The unit needs to be fixed to a long pole of suitable length to reach the fruits on the tree.



Size & Capacity

- ◆ Overall Dimension: 35 x 17 x 3 cm
- ◆ Weight : 0.35 kg
- ◆ Investment(Unit cost per machine): Rs. 90/-
- ◆ Output capacity: 750 fruits / h

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore - 560 065, Karnataka.

13. Ready-To-Serve Jackfruit Beverage

Name of the Technology: Technology for Ready-to-Serve beverage from Jackfruit

Application/ Use: Production of Ready-to-Serve jackfruit beverage, a new product to the market; New avenue for food processing industry; contributes towards enhancing the farm income of rural people.

Description of Technology: Well matured and ripe deseeded minimally processed jackfruit bulbs are mashed in a blender-mixer grinder to get pulp. Required quantity of pulp (12%), sugar (13%), citric acid (0.2%) are blended with boiling water (75–80 %) in a container and boiled for 15 minutes at 80-85°C. The contents are cooled and filtered through muslin cloth or filters. Potassium Meta bi sulphate, the chemical preservative 100 mg per liter is added to the cooled, filtered juice. The juice is then filled into clean heat-sterilized glass bottles and sealed with cork using cork sealing machine. Cork sealed bottles are pasteurized in a water bath at 85–90°C for 20 minutes. The developed RTS beverage (13° Brix and 0.2% acidity) is ready to be served. The RTS beverage can be stored for 2 months under room temperature and 4 months under low temperature.

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore - 560 065, Karnataka.



14. Osmo Air-Dried Jackfruit

Name of the Technology: Osmo air-dried jackfruit

About the product: Jackfruit bulbs are a rich source of vitamins and mineral constituents especially calcium. Much of the raw jackfruit is consumed locally for curry preparation and after ripening the bulbs are relished as such. It is considered to be a good appetizer. Products such as fruit bars, jam, candy, etc., can be prepared from this fruit. However, it has not so far been fully exploited by the fruit preservation industry. The osmo-air dried product prepared from jack fruit bulbs may be consumed as snack. It can also be used in military rations in suitable packing. The osmo-air dried fruit products can be used in ready-to-eat type of foods, ice-creams, fruit salad, kheer, cakes and bakery products.



Process Economics

- ◆ Capacity : 200 kg / shift
- ◆ Working days : 150
- ◆ Installed capacity per annum : 30 tones
- ◆ Total fixed capital : Rs. 22.00 lakh
- ◆ Working capital margin : Rs. 2.70 lakh

Contact Address: CSIR-CFTRI, Cheluvamba Mansion Opp. Railway Museum, Mysuru, Karnataka Pincode: 570020, Contact Number(s): 0821 2514760, Email: director@cftri.res.in ram@cftri.res.in, Website: <http://www.cftri.com>



15. Bottling of Sugarcane Juice

Name of the Technology: Bottling of Sugarcane Juice

Application/ Use: Ready to consume sugarcane juice in bottles



Description of Technology: This technology has been developed for preserving the sugarcane juice in bottles for a period up to six months. The process of preserving the sugarcane juice involves peeling, crushing, filtration, pasteurization and bottling. Sodium Benzoate @ 125 ppm is added as preservative. The bottled juice can be stored without any loss in the quality and flavor for six months at room temperature. The cost involved for the production of one bottle (200 ml) of juice is Rs.3/-. Consumer acceptability of the preserved juice was evaluated and found to be 98 per cent.

Size & Capacity:

- ◆ Investment (Unit cost per machine): Minimum Rs.5,00,000 depending on the capacity
- ◆ Output Capacity: Depending on the production capacity
- ◆ Unit cost of operation: Rs.3/- per bottle of 200 ml. (excluding bottle)

Contact Address: Professor and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore – 641003, Tamil Nadu, Phone: 0422- 6611272; Fax: 0422-6611455; Email: processing@tnau.ac.in

16. Nutrition Rich Jaggery

Name of the Technology: Nutritionally Rich Jaggery

Application/ Use: Promotion of Nutritionally Rich Jaggery

Description of Technology: For the preparation of Nutrition rich jaggery, Aonla as a natural source of vitamin C has been added to jaggery in suitable form and quantity and at a proper stage of jaggery preparation. This results in preparation of Value-added jaggery cubes and bars. Such kind of jaggery, if included in the menu of mid-day meal of rural children schools will be beneficial in fighting malnutrition.



Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs.6000/-
- ◆ Output capacity: 7 kg/batch
- ◆ Unit cost of operation: Rs.6,000/-

Contact Address: Director or Research Engineer, Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh, Phone: 0522-2480726 Fax: 0522-2480748
Email: iisrko@sancharnet.in

17. Rectangular Shaped Jaggery

Name of the Technology: Rectangular Shaped Jaggery

Application/ Use: Production of rectangular shaped jaggery



Description of Technology: For the production of rectangular jaggery, Sugarcane juice is boiled and concentrated in an open pan on two / three pan furnace up to the striking point. The concentrated juice is then transferred from boiling pan on to a wooden cooling pan. It is allowed to get cooled for about 10 minutes which is followed by a manual pudding for about 10 minutes and is left for cooling in continuation for about 08-10 minutes. Then the concentrated juice starts solidifying in the form of slurry which will be poured into the rectangular moulding frame. It is then left for setting/ solidification. After 25 minutes, the rectangular frames are dismantled and rectangular shaped jaggery weighing about 10-12gm each is taken out and is put for shade or solar drying prior to packaging.

Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs 4000/-
- ◆ Output capacity: 3.5 kg/batch
- ◆ Unit cost of operation: Rs. 35 /kg

Contact Address: Director or Research Engineer, Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh, Phone: 0522-2480726 Fax: 0522-2480748
Email: iisrlko@sancharnet.in

18. Value-added Jaggery Cubes and Bars

Name of the Technology: Process Technology for Production of Value-added Jaggery Cubes and Bars

Application/ Use: Fights malnutrition, increased income to the farmers and improved socio-economic status of the farmers



Description of Technology: A process technology for production of value-added jaggery using aonla as a natural source of vitamin C has been developed. Using this technology nutritionally rich jaggery having vitamin C can be prepared in cubes and bars. Dried aonla shreds @ 75g/kg of jaggery is added in cooling pan in the process of jaggery making. Value-added jaggery produced using aonla as a natural source of vitamin C has a good palatability besides being rich in vitamin C.

Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs.4,000/-
- ◆ Output capacity: 30 kg of value-added jaggery per batch
- ◆ Unit cost of operation: Rs.70/- per kg

Contact Address: Director, Indian Institute of Sugarcane Research, Raebareli Road, Lucknow, Uttar Pradesh, Phone: 0522-2480726, Fax: 0522-2480748, Email: iisrlko@sancharnet.in

19. Liquid Jaggery

Name of the Technology: Liquid Jaggery

Application/ Use: Storage is better. It can be used as a substitute for honey and can give better profitability

Description of Technology: Sugarcane juice is extracted, filtered and heated over Jaggery furnace. On heating, lime (100g lime in 5 lts of water/100 kg juice) is added to raise the pH from 5.2-5.4 to 6.5-7.0 for coagulation of impurities. After removal of impurities, mucilaginous extract of vegetative clarificant is added for further clarification. Now juice is made acidic by adding phosphoric acid and is vigorously boiled. As soon as the temperature reaches 105-106°C, it is removed from pan, cooled and packed in glass or PET bottles. Addition of citric acid @ 0.04% and 0.1% potassium metabisulphite or 0.5% benzoic acid help in preventing crystallization and increasing shelf life respectively.



Size & Capacity:

- ◆ Unit cost of operation: Rs. 20/- per 300 ml

Contact Address: Director, Indian Institute of Sugarcane Research, Raebareli Road, Lucknow, Uttar Pradesh, Phone: 0522-2480726, Fax: 0522-2480748

20. Powder/Granular Jaggery

Name of the Technology: Powder/Granular Jaggery

Application/ Use: It can easily be packed and stored.

Description of Technology: Sugarcane juice is extracted, filtered and heated over jaggery furnace. On heating, mucilaginous extract of vegetative clarificant is added and the scum is removed. Now the juice is vigorously boiled till the temperature reaches to 120-122°C. Then it is transferred to wooden tray and cooled by continuous pudding. When it starts solidifying, it is rubbed using ladle and between palms/wooden plates and made into powder/granular form. It is then dried under sun, sieved/graded and packed in polythene packets.



Size & Capacity:

- ◆ Output capacity: 70/kg per hour

Contact Address: Director, Indian Institute of Sugarcane Research, Raebareli Road, Lucknow, Uttar Pradesh, Phone: 0522-2480726, Fax: 0522-2480748
Email: iisrko@sancharnet.in

21. Jaggery Chocolate

Name of the Technology: Jaggery Chocolate

Application/ Use: A novel confectionary product

Description of Technology: The nature of jaggery in terms of its color, texture and sweetness, would make it very suitable for a chocolate like product. Therefore, jaggery would be a healthier alternative due to its low fat and higher mineral content. It is much commonly used by rural people as a rich source of energy and minerals and has been a part of their traditional affairs as 'Desi Sweet'.



Size & Capacity:

- ◆ Unit cost of operation: Rs. 14/- per piece (50g)

Contact Address: Head, Department of Process and Food Engineering, College of Technology, G.B. Pant University of Agriculture & Technology, Pantnagar-263145, Uttarakhand.

22. Quick Cooking Maize Rab Powder

Name of the Technology: Process for Quick Cooking Maize Rab Powder

Application/ Use: The simple process technology developed has application for popularizing rab as quick cooking product.

Description of Technology : Rab is an ethnic product made by cooking maize grits in sour butter milk and used as a soup/appetizer and even as meal in hot and cold form by all class of people. A process has been developed and standardized for making instant rab powder. Traditionally rab is prepared in 2-3 h, but with the use of instant powder it can be prepared in 10-12 minutes, facilitating in adoption of product in fast moving urban and city conglomerates with ethnic taste. The process consists of pearling, soaking, boiling, drying and size reduction unit operations. The product has been found acceptable and generated a lot of interest among individuals/caterers/hoteliers.



Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs 2,00,000/-
- ◆ Output capacity: Rs 7-8/ kg
- ◆ Unit cost of operation: Rs. 14/- per piece (50g)

Contact Address: Research Engineer, AICRP on PHT, College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur– 313 001, Rajasthan.

23. PKV Mini Dal Mill

Name of Technology: PKV Mini Dal Mill

Application/ Use: Pulse milling (pigeon pea, green gram, black gram, chickpea)

Description of Technology: In the need of finished product, pulses produced in rural areas, are transported to urban areas, where commercial dal mills are situated. If the pulses are processed at rural level, this unnecessary taxation of transportation cost on producer can be reduced. In order to have solution to these problems a small enterprise at rural level is necessary for which the PKV Mini dal mill is developed and further refined for its multipurpose use (cleaning, grading of grains and polishing of split dal). It operates using two horse power single phase electric motor. Almost all pulses can be dehulled with this machine and the products are quite comparable with that of the available commercial dal mills. This plant is commercially manufactured and available in the market. The processing capacity of this dal mill is 100-125 kg/h for pigeon pea and 125-150 kg/h for green and black gram. The respective recoveries are 72-75% and 82-85%, which is higher to the tune of existing burr mill. It avoids dusty atmosphere and provides easy operation. The technology offers rural employment through micro enterprise. The present cost of PKV mini dal mill is Rs.55000 and 538 units of PKV mini dal mill have been sold to various entrepreneurs so far.



Size & capacity:

- ◆ Overall dimension: 1.5 x 1.3 x 1.8 m
- ◆ Weight: 170 kg
- ◆ Land: 200 m²
- ◆ Investment: Rs. 55,000/-
- ◆ Output capacity: 125 kg/h
- ◆ Unit cost (per machine): Rs. 50,000/- (including prime mover)
- ◆ Unit cost of operation: Rs 100-120 /q

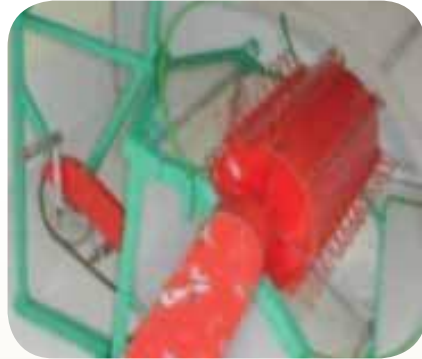
Contact Address: Research Engineer, AICRP on PHT, College of Agricultural Engineering, Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola - 444 104, Maharashtra.

24. VL Paddy Thresher

Name of the Technology: VL Paddy Thresher

Application/ Use: Threshing of paddy

Description of Technology: VL Paddy Thresher was designed, fabricated and developed for the purpose of threshing paddy grain. This is a manual-cum-power operated paddy threshing machine. It works on the principle of impact on the grain for the purpose of threshing. The threshing drum is fitted with a wire loop as a beating device, which provides impact on the grain.



In this thresher, sitting arrangement has been made for the easy operation. Chain-sprocket power transmission system with 1:7 speed ratio has been applied for providing rotational speed to the thresher. Threshing capacity and efficiency are largely affected by stem height, panicle height and grain weight of paddy crop

Size & capacity:

- ◆ Overall dimension: 1030×630×975 mm
- ◆ Weight: 42 kg
- ◆ Investment: 1.5 Lakh
- ◆ Output capacity: 60-100 kg/hr
- ◆ Unit cost (per machine): Rs.3700/-
- ◆ Unit cost of operation: Rs.0.10 per kg paddy grain

Contact Address: Research Engineer, AICRP on PHT, Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora - 263 601, Uttarakhand.

25. Pedal operated winnower-cleaner-grader for Millets

Name of the Technology: Pedal operated winnower-cleaner-grader for millets

Application/ Use: Winnowing of millets, pulses and other cereals such as wheat and paddy.

Description of Technology: A winnower-cleaner-grader suitable for winnowing, cleaning and grading of millet, cereal and pulses crops in single pass has been designed and developed at Vivekananda Institute of Hill Agriculture, Almora, Uttarakhand. The major components of the machine were fabricated using fiber reinforced plastic material. It consists of a winnower, cleaning sieve and grading assembly. The total weight of the winnower cum cleaner cum grader is 60 kg. It can be operated by one person. The cleaning capacity of the machine is 250-300 kg/h for finger millet and 275-300 kg/h for barnyard millet. The average cleaning capacity of the machine for different crop is found to be 200-250 kg/h. The winnowing capacity of the machine is found to be 300-350 kg/h for finger millet and 350-400 kg/h for barnyard millet. The average winnowing capacity of the machine for different crop is found to be 300-350 kg/h. The cleaning efficiency of the machine for finger and barnyard millet is found to be 96 and 97%, respectively. The average cleaning efficiency of the machine for different crops is 97%. The winnowing efficiency of the machine for finger and barnyard millet is found to be 97 and 98%, respectively. The overall efficiency of the machine is found to be 97.5%.



Size & capacity:

- ◆ Overall dimension: 1450 × 1450 × 1210 mm
- ◆ Weight: 60 kg
- ◆ Output capacity: 250 - 300 kg/h
- ◆ Unit cost (per machine): Rs. 8,000/-
- ◆ Unit cost of operation: Rs. 0.04/kg grain

Contact Address: Research Engineer, AICRP on PHT, Vivekananda Parvatiyaj Krishi Anusandhan Sansthan, Almora - 263 601, Uttarakhand.

26. 3-in-1 Mini Groundnut Decorticator-cum-Sunflower Thresher and Maize Sheller

Name of the Technology: 3-in-1 Mini Groundnut Decorticator-cum-Sunflower Thresher and Maize Sheller

Application/ Use: Suitable particularly for small farmers for decortication of groundnut seed pods and threshing of sunflower and maize seeds required during sowing season.



Description of Technology: It is a small hand-operated device with a mild steel body.

The ribbed threshing cylinder consists of rubber cushions to facilitate smooth shelling of the pods inside the shelling chamber. The pods are fed through a 500 g capacity hopper. When the handle is rotated, the pods get shelled inside the shelling chamber and both the shell and kernel fall through the sieve at the bottom of the shelling chamber to be separated manually. The equipment is provided with two separate interchangeable attachments for maize shelling and sunflower threshing which can be fitted to the shaft at the far end of the shaft.

Size & capacity:

- ◆ Overall dimension: 58 x 30 x 45 cm
- ◆ Weight: 8 kg
- ◆ Investment: Rs.850
- ◆ Output capacity: 15 kg groundnut pods / hour; 12-15 kg shelled maize or sunflower seeds
- ◆ Unit cost (per machine): Rs 850/-

Contact Address: Research Engineer, AICRP on PHT, University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore - 560 065, Karnataka.

27. 2-in-1 Maize Sheller-cum-Sunflower Thresher

Name of the Technology: 2-in-1 Maize Sheller-cum-Sunflower Thresher

Application/ Use: This gadget can be used for shelling maize cobs or for threshing sunflower ear heads. It has been designed to cater to the threshing needs of small and marginal maize growers especially for seed production.



Description of Technology: It is motor driven equipment with separate inter-changeable attachments for shelling maize cob / threshing sunflower ear-heads. A shaft driven by an electric motor rotates at about 200 rpm. On both ends of the shaft, either the maize shelling (tubular sheller) or sunflower threshing attachments (disc with pins) are fixed. Individual cob / ear-head is shelled / threshed manually and the seed damage is bare minimum making it suitable for seed production.

Size & capacity:

- ◆ Overall dimension: 40 x38 x105 cm
- ◆ Weight: 32 kg
- ◆ Investment: Rs. 4000/- (without motor)
- ◆ Output capacity: 1 quintal of threshed maize grains per hour by 2 persons
- ◆ Unit cost (per machine): Rs. 4000/- (without motor)

Contact Address: Research Engineer, AICRP on PHT, University of Agricultural Sciences, J-Block, GKVK Campus, Bangalore - 560 065, Karnataka.

28. Green Bengal Gram Pod Stripping Machine

Name of the Technology: Power Operated Green Bengal Gram Pod Stripping Machine

Application/ Use: Stripping of Green Bengal Gram

Description of Technology: Fresh Bengal gram is an intermediate product and is consumed as a vegetable in the northern states of the country. A Bengal gram stripper was developed at Jabalpur centre of AICRP on Post-Harvest Technology by using spike tooth type stripping roller. The length of the roller was 300mm and height of the spikes was kept as 50mm. The spikes were fastened on mild steel flat of 25 mm x 4mm at a distance of 15mm. Each such flat was mounted on two plates of 110mm diameter. A bunch of green Bengal gram plants is held in front of the stripping machine in such a way that pods and leaves are projected towards the stripping loop and on rotation of the stripping cylinder, the pods are detached from the plants. In this way pods from entire plants can be stripped in two or three bunches. The detached pods along with broken twigs and leaves while falling pass through a separating trough fitted on the lower part of the machine. Here the leaves and twigs are separated from the pods and pods can be collected separately. To calculate the stripping efficiency, weight of unstrapped pods, weight of stripped pods, weight of stem, and weight of leaves were recorded. Considering the effect of plant's moisture content and speed of machine, the best efficiency of the machine was obtained as 98.82% at 350 rpm of the machine and 61.41% moisture content (wb). At this point the capacity of the machine was computed as 100 kg/hr. The cost of machine is calculated as Rs.25,000/-.



Size & Capacity:

- ◆ Overall Dimension: 1040 x 380 x 1240 mm
- ◆ Weight: 105 kg.
- ◆ Land: 12 x 10 ft.
- ◆ Investment (Unit cost per machine): Rs.25,000.00
- ◆ Output capacity: 60 kg. per hour.

Contact Address: Research Engineer, AICRP on PHT College of Agricultural Engineering, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur - 482 004, Madhya Pradesh.

29. Millet - Roti-Making Machines

Name of the Technology: Millet Roti-Making Machines

Application/ Use: Used to make gluten-free roti conveniently with higher capacity and Removal of inconveniences in preparation of sorghum/millet based rotis.

Description of Technology: The Technology is jointly developed by Indian Institute of Millet Research (IIMR) in association with private entrepreneur. The prototype is hand operated machine and electricity operated. The mixed dough will be pressed and spread by the machine making dough to panful roti.

Output & Investments:

- ◆ Output capacity: 80 – 100 Rotis / hour
- ◆ Speed: 250 rpm
- ◆ Investment(Unit cost per machine): Rs.8,000/-
- ◆ Space requirement: Less

Contact Address: Center of Excellence on Sorghum ICAR - Indian Institute of Millets (IIMR) Research, Hyderabad - 500 030, Telangana, India. Website: www.millets.res.in



30. Post-Harvest Gadget (Portable Winnower)

Name of the Technology: Post-Harvest Gadget (Portable Winnower)

Application/ Use: For winnowing of agricultural produce after threshing

Description of Technology: The winnower consists of an axial flow fan operated by a 1 hp motor enclosed in a casing with adjustable shutter. The shutter can be tilted up or down to adjust the direction of the air-flow. The winnowing fan assembly is mounted on a tall frame with caster wheels to facilitate easy mobility of the unit especially in rural environment.



Size & capacity:

- ◆ Overall dimension: 68 x 68 x137 cm
- ◆ Weight:40 kg
- ◆ Investment: Rs.13,500/-
- ◆ Output capacity: 5 quintals of grain / h
- ◆ Unit cost (per machine): Rs.13,500/-

Contact Address: Research Engineer, AICRP on PHT, University of Agricultural Sciences, J-Block, GKVK Campus, Bangalore - 560 065, (Karnataka).

31. Multipurpose grain mill

Name of the Technology: Multipurpose grain mill

Application/ Use: Grinding cereals, pulses, and spices

Description of the Technology: It is 1.0 HP single phase, electric motor operated equipment for grinding of cereals, coriander and pulses to produce flour/ grits, powder, and split, respectively. The grains with 8-10% moisture content (wet basis) with low oil contents are most suitable. The mill consists of hopper, feed adjuster, vertical grinding wheels, etc.



Size & capacity

- ◆ Overall dimension: 840x580x670 mm
- ◆ Weight: 69 kg
- ◆ Land: 2x2 m area
- ◆ Output capacity: Cereal/Pulses flour 11-20 kg/h, Coriander 10 kg/h, Split pulses 50-70 kg/h
- ◆ Unit cost (per machine): Rs. 9,500/-

Contact details: Research Engineer, AICRP on PHT, Agro-Produce Processing Division, Central Institute of Agricultural Engineering, Nabibagh, Berasia Road, Bhopal - 462 038, Madhya Pradesh.

32. Groundnut cum castor decorticator

Name of the Technology: Groundnut cum castor decorticator

Application/ Use: For shelling of groundnut or castor

Description of Technology: It is manually operated equipment to separate kernels from groundnut and castor pods. The unit consists of frame, handle, oscillating arm and separate sieve for groundnut and castor. The pods are fed in batches of 5 kg and crushed in between concave and oscillating arm having cast iron/ nylon shoes to achieve shelling.



Size & capacity

- ◆ Weight: 15 kg
- ◆ Output capacity: 60-68 kg/h
- ◆ Unit cost (per machine): Rs.2,200/-

Contact person: Research Engineer, AICRP on PHT, Central Institute of Agricultural Engineering, Nabibagh, Berasia Road Bhopal- 462038, Madhya Pradesh

33. Household Paddy Parboiling Unit

Name of the Technology: Household Paddy Parboiling Unit

Application/ Use: To parboil paddy uniformly at house hold/farm level

Description of Technology: The parboiling drum is made of galvanized iron sheet of 20 gauge thickness with a lid. The drum is divided into three equal portions. The top two-third portion retains paddy for parboiling and bottom one-third portion holds water to produce steam for parboiling. A perforated slanting sheet with perforated pipes separates the steam chamber from parboiling chamber. The lateral perforated pipes attached to the main steam pipe divides the entire parboiling chamber into a number of small compartments and helps for uniform and simultaneous parboiling of paddy. Perforated sloping floor helps for natural unloading of parboiled paddy. The water in the drum can be heated by burning firewood or any agricultural waste. After the completion of parboiling, the remaining hot water can be used for next batch.



Size & capacity

- ◆ Output capacity: 125 kg/ batch
- ◆ Unit cost (per machine): Rs.10, 000/-

Contact Address: Professor and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore-641003, Tamil Nadu, Phone: 0422- 6611272; Fax: 0422-6611455; e-mail: processing@tnau.ac.in

34. Tungabhadra Winnower

Name of the Technology: Tungabhadra Winnower for grains

Application/ Use: This is basically a winnowing fan for generating wind for cleaning of grains from chaff that can be operated using manual/electric/I.C. engine power depending upon available power source. This avoids the need for keeping the labour idle when no wind is blowing if winnowing is carried out manually on natural wind. Only a few demonstrations by the university have convinced farmers about the utility and hundreds of such machines in different versions are being manufactured in local workshops and sold in Tungabhadra command area. Now it is spreading to other areas also.



Description of Technology: This is a mechanical device consisting of a frame, 3-4 fan blades (1000-1250mm) fixed on the hub, an axle, bicycle pedal drive arrangement with seat, pulley belt transmission system and a grill partition. A pedal and chain transmission assembly for manual power and a pulley and belt arrangement for electric motor / IC engine power are provided to transmit the rotary motion to the fan blade assembly. An operator can easily generate the air flow with a velocity to clean the grains from chaff.

Size & capacity:

- ◆ Output capacity: 125 kg/ batch
- ◆ Unit cost (per machine): Rs.10, 000/-

Contact Address: Sr.Scientist & PI, AICRP on Post-Harvest Technology, Dept. of Processing and Food Engineering, College of Agricultural Engineering, UAS, Raichur, Karnataka.



35. White Pepper Machine

Name of the Technology: White Pepper Machine

Application/ Use: Production of white pepper corns from freshly harvested mature green pepper berries; can also be used for black pepper with additional microbial retting technique.



Description of Technology: The machine removes outer pericarp from steeped fresh mature pepper berries (also from black pepper) to get white pepper kernels. It consists of a rotor shaft attached with 4 nylon brushes that rub the steeped pepper berries against the perforated metallic concave cylinder. During the operation continuous water supply is provided to the pulping chamber so that the loosened pulp (pericarp) is washed away by water through the sieve and the natural white pepper kernels are collected at the far end. The product should be further dried to the storable moisture content. All the contact parts of the machine where the pepper move are made up of food grade materials.

Size & Capacity

- ◆ Overall Dimension: 83x74x105 cm
- ◆ Weight: 45 kg
- ◆ Space required: Building (100 sft)
- ◆ Investment (Unit cost per machine): Rs 25,000 (without motor)
- ◆ Output capacity: 125-150 kg/h

Contact Address: Research Engineer, AICRP on PHT, University of Agricultural Sciences -J Block, GKVK Campus, Bangalore - 560 065, (Karnataka)

36. Cardamom Dryer

Name of the Technology: Cardamom Dryer

Application/ Use: To dry freshly harvested cardamom capsules in cardamom plantations

Description of Technology: It is basically a convective dryer. The vertical drying chamber is made-up of wood with wooden drying trays / racks. Hot air generated with electrical heaters is pushed through the trays containing freshly harvested cardamom capsules from bottom of the dryer using an electrical blower. The exhaust is at the top for the moisture laden air. With this drier, it is possible to reduce the moisture content of fresh cardamom capsules from 90% to 12% in about 10 hours.



Size & Capacity:

- ◆ Overall Dimension: 165 x 105 x 225 cm (including heat bank, air blower with motor)
- ◆ Investment (Unit cost per machine): Rs. 30,000/-
- ◆ Output capacity: Dries 10 kg of fresh cardamom capsules

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences, J-Block, GKVK Campus, Bangalore – 560065, (Karnataka).

37. Turmeric/Ginger Washer

Name of the Technology: Turmeric/Ginger Washer

Application/ Use: Washing of Turmeric / Ginger

Description of Technology: Vertical cylindrical chamber having rotating base and provision of water spray through a perforated pipe fitted at the inside of the chamber.



Size & Capacity:

- ◆ Overall Dimension: 1 h.p. Single Phase A.C.Motor
- ◆ Investment(Unit cost per machine): Rs. 20,000/-
- ◆ Output capacity: 3 q/h

Contact Address: Research Engineer, AICRP on Post-harvest Technology College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar- 751 003, Odisha.

38. Turmeric Boiler

Name of the Technology: Improved Farm Level Turmeric Boiler

Application/ Use: To boil the turmeric rhizomes under hygienic condition

Description of Technology: It consists of one rectangular, larger size, solid outer container, made out of 20 SWG thick galvanized iron sheet to hold water and two to three inner containers to hold rhizomes. Washed rhizomes are loaded in the inner cylinder and required quantity of water is added in the outer cylinder. Rhizomes are boiled by the steam liberated from the boiling water. Sodium bicarbonate is added in the boiling water to add colour. The inside containers which hold turmeric can easily be taken out without wasting boiling water, which can be reused and thereby fuel requirement can be considerably reduced.



Size & Capacity:

- ◆ Investment(Unit cost per machine): Rs.14,000/-
- ◆ Output capacity: 225 kg per batch

Contact Address: Professor and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore - 641 003, Tamil Nadu. Phone: 0422-6611272; Fax: 0422-6611455; Email: processing@tnau.ac.in

39. Peeler Cum Polisher For Ginger And Turmeric

Name of the Technology: Peeler cum Polisher for Ginger and Turmeric

Application/ Use: The machine has application for peeling of fresh ginger rhizomes and smoothening/ value addition of dried rhizomes of ginger and turmeric. It has utility for processors

Description of Technology: A simple machine was developed to peel the outer skin from fresh ginger rhizomes and abrade off outer shriveled skin of dried rhizomes of ginger and turmeric. The peeling operation helps in faster drying and polishing facilitates in value addition & quality improvement of dried rhizomes. The machine works on the principle of friction and abrasion. It consists of a perforated drum with a common opening for feeding and discharge of rhizomes. The machine has a perforated drum coated with emery strips at inner surface. The drum is rotated at 40 rpm. Water supply through hollow shaft helps in removal of peel/skin through the drum perforation. In case of polishing dehydrated rhizomes, water supply is disconnected. Effective output of machine has been worked out as 40-50 kg/h vis a vis 30 and 50 kg/day through manual and gunny bag peeling.



Size & Capacity:

- ◆ Overall Dimension: 900 mm x 700 mm x 1070 mm
- ◆ Weight : 57 kg
- ◆ Investment (Unit cost per machine): Rs 20,000/-
- ◆ Output capacity: 8 kg batch in 8 to 10 min i.e. 40-50 kg / hr for peeling & 50-60 kg/ hr for polishing

Contact address: Research Engineer, AICRP on PHT College of Technology & Agricultural Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur– 313 001, Rajasthan.

40. Storage Of Ginger Rhizomes in Fresh Form

Name of the Technology: Storage of Ginger Rhizomes in Fresh Form

Application/ Use: Increase shelf life up to 6 months after harvest.

Description of Technology: Fresh rhizomes can be stored safely in a bamboo rack placed in a covered and aerated space. The breadth of each shelf of the rack should be such that, it is easier to inspect the material. If it is made near the wall, it should be not more than 50 cm. The vertical distance between two shelves should be at least 25 cm so that it is easy to inspect the rhizomes. When the numbers of shelves increase, the numbers of posts should also be adjusted to bear the load of rhizomes and sand. The shelves should be made with the bamboo mat, below which support should be given with un-split bamboo. The Bamboo mat is covered with gunny/ polythene bags. In one meter square area of each shelf, about 7.5 to 10 kg fresh rhizomes can be stored. For 1m² area, 10 kg sand is required to form a 1” layer of sand. Rhizomes to be stored are cleaned with water to remove the adhered soil. Only matured and healthy rhizomes are selected for storage. The rhizomes are placed near to each other over the sand layer. Again a 1” layer of sand is made to cover the rhizomes. Water should be sprinkled uniformly over the dry sand @ 3-4lit/m² area so that the moisture content of the sand becomes about 30% on dry wt. basis. There is no problem from January to the middle of April. However, April onward, sprouting starts which need to be broken manually, when these are 1”-2” in length. Rotten rhizomes should be discarded. Water should not be sprinkled up to one week after nipping the sprouts. By this method, rhizomes can be stored well up to 6 months retaining the quality of fresh ginger. During these 6 months, though 40-50 percent weight is lost, it is not visible in the appearance of the rhizomes, as water is absorbed during storage. The weight is lost due to respiration, and it is mainly the carbohydrate, which is broken down as CO₂ and water during storage. However, the volatile oils and oleoresins imparting flavour and pungency, respectively to the rhizomes are retained by this method of storage. Though 40-50% fresh weight is reduced, during the said period, the price of raw ginger is increased by 100-300%, and as such, there is no chance of loss of profit, if rhizomes are stored. The structure made with the help of above-mentioned materials can be used for storage of rhizomes for 5 years.



Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs.1500/-
- ◆ Output capacity: 100 kg per batch
- ◆ The unit cost of operation: Rs. 300/- per quinta

Contact Address: PI, AICRP on PHT, Department of Agricultural Engineering, Assam Agricultural University, Jorhat-13, Assam.

41. Curing of Vanilla beans

Name of the Technology: Curing of Vanilla beans

Application/ Use: For curing the vanilla beans for the development of flavour

Description of Technology: The existing method of curing vanilla beans is by Bourbon method. The improved method developed by this centre is faster, less energy-intensive and produces quality output in terms of vanillin content. In this, vanilla beans are killed using hot water at 630°C for 3 minutes. Instead of sun drying, they are subjected to mechanical drying at 550°C for 90 minutes/day for nearly 12 days so that the initial weight of vanilla beans reduced to half. It is then slow dried at 70% relative humidity for nearly 7 days to reduce the initial weight to one-third. At this time the moisture content of vanilla beans is 25%. The slowly dried beans are kept for conditioning for three months in suitable packaging material.



Contact Address: Research Engineer, AICRP on PHT, Kerala Agricultural University, Kelappaji College of Agricultural Engineering and Technology, Tavanur - 679573, Kerala.

VI VEGETABLES

42. Bulk Onion Curing Unit

Name of the Technology: Bulk Onion Curing Unit

Application / Use: Curing freshly harvested onions in bulk

Description of Technology:

The onion curing unit is a forced hot air dryer modified to cure freshly harvested onions in bulk. The unit consists of a curing chamber with a perforated vertical hot air distribution duct and laterals. The walls of the chamber are actually fabricated with a perforated sheet so that moisture-laden air escape at all sides. An electrical heat bank and a blower supply of hot air at about 45°C for curing onions. The curing chamber is provided with two doors: one at the top for loading onion bulbs and the other in the front for unloading onions after the curing process. The electric heat bank consists of four 600 W finned heaters to obtain an inlet curing air temperature ranging from 30 to 80°C.



Size & Capacity:

- ◆ Overall Dimension: 100 x 100 x100 cm + heat bank & motorized air blower
- ◆ Weight : 6 kg
- ◆ Investment(Unit cost per machine): Rs. 4500/-
- ◆ Output capacity: Cures 500 kg of freshly harvested onions

Contact Address: Research Engineer, AICRP on PHT University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore - 560 065, Karnataka

43. Barn Drying of Chili

Name of the Technology: Barn Drying of Chili

Application/ Use: Drying of quality chilli, free from external contamination, protection from unforeseen rains



Description of Technology: Ten to twelve quintals of ripened chilli can be loaded in the existing tobacco barns to dry chilli. The barn can be converted to dry chilli by small modifications such as providing GI trays on the existing tiers of the barn. Galvanized iron wire mesh trays of size 105x75x7.5 cm (LBH) are suitable to hold chilli on the existing tiers of the barn. About 100 to 120 trays are required to load chilli depending upon the size of the barn, initial moisture content and type of chilli. The output of the dried product is about 3 quintals per batch. Drying time required to reduce moisture from 75 to 9% (w.b) varied depending upon whether the chilli is hybrid or variety. Hybrid chilli require about 50 hours to dry whereas the other varieties require about 40 hours. The temperature and ventilator operation regimes are important to get good quality uniform dried produce. The operating regimes are optimized to dry both hybrid and varieties of chilli.

Size & Capacity:

- ◆ Overall Dimension: 6000x6000x7500 mm
- ◆ Investment(Unit cost per machine): Rs.14,000/-
- ◆ Output capacity: 300 kg of dried chilli / batch

Contact details: Research Engineer, AICRP on PHT Acharya N.G. Ranga Agricultural University, Bapatla-522101, Andhra Pradesh

44. Potato Tubular Aeration System

Name of the Technology: Tubular aeration system for improved on-farm storage of potato

Application/ Use: The Tubular Aeration System is useful in the reduction of storage losses during Kharif potato in Southern Karnataka (Mean temperature: max. 32°C & min. 15°C; Mean RH: Max. 89% & min. 42%; Average annual rainfall: 893 mm). The physiological and rotting losses were reduced by 2.1% and 2.8% respectively when compared to traditional pit storage system over 2-3 months of storage.



Description of Technology: The tubular aeration system consists of a horizontal perforated duct with vertical tubular risers. The main duct is made up of 100 mm diameter PVC pipe with 13 mm diameter perforations at a pitch distance of 50 mm along the axial direction. The length of the pipe will be equal to the length of the potato heap. The hole-to-hole distance in the lateral direction (along with the circumference) is 50 mm. There are air vents (risers) at a distance of 1 m between them. The vents are 60 mm in diameter and 1.2 m long PVC pipes whose bottom ends are connected to the main horizontal aeration duct, and the top ends emerge out of the potato heap to the atmosphere. The vents basically help the warm air gets collected inside the main duct to go up to the atmosphere. The main duct is placed horizontally along the length of potato heap at the centre, 0.30 m above the bottom surface and the ends of the duct protrude slightly outside the heap by about 50 mm. A gentle slope of about 2° to the horizontal is kept for the duct so that moisture if any, that may condense, run down the slope of the duct and go out of the potato heap. The aeration system is designed in such a way that the main duct filled with warm air in the vicinity inside the potato heap goes out through air vents (risers) due to natural convection. The entire aeration system is placed inside the traditional potato heap or pit as explained earlier to reduce tuber losses during storage.

Size & Capacity:

- ◆ Overall Dimension: 35 x 17 x 3 cm
- ◆ Weight : 0.35 kg
- ◆ Output capacity: 750 fruits / h

Contact address: Research Engineer, AICRP (PHT), University of Agricultural Sciences, GKVK, Bangalore – 560065, Karnataka.

45. Green Pea Shelling Machine

Name of the Technology: Power Operated Pea Shelling Machine

Application/ Use: Shelling of Green Peas.



Description of Technology: Manual removal of kernels from green pea pods take a lot of time (3-3.5 kg of green peas in one hour), and it is a laborious and tiring job. Therefore, it was felt necessary to develop a suitable power operated green pea pod sheller to meet the requirement of the pea growers. The sheller consisted of feeding hopper, roller, concave, frame and a 0.25 hp electric motor. The roller is fixed on a central shaft supported on two bearings. The roller rotates in the concave. The roller and concave assembly are mounted on a frame. The concave consists of galvanized iron sheet punched with holes of 16mm dia. at a centre to centre distance of 26 mm.

The pods were fed through the hopper from shelling operation. Green pea pods were shelled by uniform feeding at a constant speed. The feed rate was controlled by the delivery lever and clearance was adjusted slightly less than the pod size. Pods with higher moisture content were shelled prior to the pods having a lower moisture content. The pea pods get shelled due to friction between the roller, whose surface is abrasive made of punched sheet and concave and also due to impact developed during the rotation of the roller. After completion of peeling operation, the different fractions of the shelled sample like whole kernels, damaged kernels and unshelled pods were collected cautiously. The capacity of the power operated pea shelling machine is 60 kg/hr with about 98% efficiency. The cost of the machine is computed as Rs. 20,000/-

Size & Capacity

- ◆ Overall Dimension: 1040 x 380 x 1240 mm
- ◆ Weight: 105 kg
- ◆ Land: 12 x 10 ft
- ◆ Investment (Unit cost per machine): Rs. 15,000.00 + Operational Expenditure
- ◆ Output capacity: 60 kg. per hour

Contact Address: Research Engineer, AICRP on PHT College of Agricultural Engineering, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur - 482 004, Madhya Pradesh

46. Instant Mushroom Noodles

Name of the Technology: Technology for Preparation of Instant Mushroom Noodles.

Application/ Use: Instant Mushroom Noodles are a very good alternative to commercially available noodles because of high carbohydrate and protein contents and thus possess a very good scope for its adoption by the industry.



Description of Technology: The following steps are used for the preparation of instant mushroom noodles. Take Mushroom Powder. Add potato flour, wheat flour, rice flour, baking powder and edible oil. Knead with water (78%) to form a dough. Pass through the manual extruder. Steaming (3-4 Minutes). Air Drying (24 hours). Packaging and Storage.

Process Economics:

- ◆ Investment (Unit cost per machine): Rs. 5,500/- home scale level
- ◆ The unit cost of operation: Rs. 12.70 per 100 g pack

Contact Address: Research Engineer/ PI, AICRP on PHT, Department of Food Science & Technology, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan -173 230, Himachal Pradesh

47. Dehydrated Vegetable Curry Mixes

Name of the Technology: Dehydrated Vegetable Curry mixes



Description about the Technology: Cauliflower, cabbage, beans and carrot are some of the most popular but seasonal vegetables which are used to make curry, as such or in combination with other vegetables. An attempt has been made to dehydrate these vegetables and prepares instant curry mixes with spices such that the curry would be ready in 10 min. time by emptying a packet of curry mix into a required quantity of boiling water. All the above curries go well with chapati, puri or can be adjuncts for rice.

Process Economics:

- ◆ Capacity of Production : 1000 kg/day
- ◆ Cost of Plant/Equipment : Rs 8.0 lakh
- ◆ Total project cost : Rs. 25.0 Lakh

Contact Address: Horticulture officer of your area

48. Tomato Juice

Name of the Technology: Tomato Products

Application/use: Tomato is one of the most versatile fruit. The surplus production during seasons could be suitably processed and preserved in bottles and cans in the form of tomato juice, paste or puree, ketchup/sauce, tomato chutney and tomato pickles which are popular ready-to-serve products relished very much in local as well as export markets. The products are mostly utilized in the domestic market. With fast-food sector expanding, the demand for tomato ketchup and sauces is estimated to have expanded as indicated by the trend. Service sectors like flight catering and hospital catering, armed rations etc. are the potential markets for tomato products.



Description of the Technology: The main raw material is tomato and only sound fully ripe tomatoes, Pusa ruby or similar variety is to be used. Tomato concentrate can also be converted as juice, Ketchup/sauce, chutney etc. Other raw materials needed are sugar, salt, acetic acid (glacial), onion, garlic, sodium benzoate and spice powder – the spice powder mix consists of clove, cinnamon, black pepper, cardamom, cumin, mace, red chilli powder, etc. Except for tomato juice, all the other products are packed and marketed in bottles. Tomato juice can also be bottled and marketed as RTS juice (spiced/salted & plain/salted). Tomato juice is packed in OTS cans (425 and 800 ml)

Process Economics:

- ◆ No. of working days : 300 days/annum
- ◆ Installed capacity : 750 kg/day
- ◆ Total Fixed Capital : Rs. 16.6 lakh
- ◆ Total working capital : 15.0 lakh

Contact Address: Horticulture officer of your area

49. Instant Pickles

Name of the Technology: Instant pickles

Application & Use: Fruits and vegetables are available during different seasons, which varies from product to product, in abundance. The raw materials are to be processed during the season, prepared, cured, dehydrated and stored for the ready use all-round the year. Powdered spices are the other raw materials of importance in instant pickle preparation. Dry powdered salt is to be used. All the materials can be locally procured. Packaging materials also form an important input.



Description of Technology: Pickles are adequately spiced unfermented preparations of fruits and vegetables. Preservation of fruits and vegetables in the form of pickles is an old art. The process of making instant pickle mix, which can be converted to a palatable pickle at home without any difficulty by the simple addition of water and oil has been standardized. The dry mix is a convenient product to pack, transport and handle in the trade channel. A variety of dry pickle mix can be developed by using dehydrated mango, lime (lemon), Green chilli, tomatoes, carrots, a different type of leaves such as gongura, coriander, etc. However, the instant pickle (dry) mix is a new concept, yet to become popular. By virtue of its quality, convenience to handle this product may become popular and acceptable.

Process Economics:

- ◆ For 250 kg of Instant Pickles/day: 8 hr shift
- ◆ Total fixed capital : Rs.13.75 lakh
- ◆ Working capital margin : Rs 2.70 lakh
- ◆ No. of working days/annum : 300
- ◆ Capacity utilization : 70%

Contact Address: Horticulture officer of your area

50. Water Chest Nut Decorticator

Name of the Technology: Water Chest Nut Decorticator (Manual)

Application/ Use: The kernel of water chestnut contains 60-68% carbohydrates, 8-12% proteins, 2 - 6% sugar, 3 - 4% minerals and less than 1% fat. In Indian villages, it is generally used in breakfast. It has significant importance in the manufacturing of starch and alcohol, and therefore, this valuable crop has potential and needs to be exploited.



Description of Technology: At present water chestnut decortication is done manually by the growers which are slow, laborious and tiring one. Keeping in view the problems of the water chestnut growers, a manually operated water chestnut decorticator was developed. Hand operated water chestnut decorticator consists of a hopper and an oscillating shoe. Hopper is made from MS angle iron (25mm x 25mm x 3mm) having a sieve (slot of 44mm x 15mm size) in the bottom and two MS sheets on the sides. The oscillating sector consists of MS flat having three wooden rollers on the top which acts as a handle and three cast iron shoes mounted at the bottom. The decortication of water chestnuts involves cracking and rubbing under pressure in between the screen and the shoe. The screen is stationary whereas the shoe rotates. While rotating the shoe, the water chestnuts get cracked due to the frictional and rubbing action between the oscillating sector and the perforated concave sieve. Decorticated kernels along with husk pass through the screen and collect at the bottom of the unit for this study, looking at the size of water chestnuts, the screen was developed so that only de-husked kernels along with husk may pass through the screen. To avoid kernel damage, developed decorticator was operated at about 35 OPM. The capacity of water chestnut decorticator is determined as 60 kg/hr with about 99% efficiency. The cost of the machines computed as Rs. 2500/-.

Size & Capacity:

- ◆ Overall Dimension: 250 x 500 x 1100 mm
- ◆ Weight: 26 kgs
- ◆ Land: 250 x 500 x 1100 mm
- ◆ Investment (Unit cost per machine): Rs. 5000.00 + Operational Expenditure
- ◆ Output capacity: 60 kg. Per hour

Contact Address: Research Engineer, AICRP on PHT College of Agricultural Engineering, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur - 482 004 Madhya Pradesh.

51. Walnut De-Huller

Name of the Technology: Walnut de-huller

Application/ Use: Walnut de-huller was developed to suit the hilly regions of J&K state.

Description of Technology: After harvesting green walnuts are heaped under the tree for 10-15 days to get the hulls loosen due to heat generation. The heaped green walnuts are then subjected to manual de-hulling by either rubbing the green walnuts with one other or by beating them by wooden logs. The juglone dye (5-hydroxy-1, 4-naphthalenedione) present in the hull gets permanently stained on the hands of workers, which takes not less than two months to go off. In order to overcome the above-mentioned problems the Srinagar Center AICRP on PHET has developed a walnut de-huller and also standardized the pre-chemical treatment. The walnut de-huller was found to be most effective when green walnuts were sprayed with ethephon (0.3%) as a pretreatment for hull dehiscence and were subjected to de-hulling 4 days after spraying.



Size & Capacity:

- ◆ Overall Dimension: Front View: 1375 mm x 880 mm
- ◆ Side view: 1375 mm x 480 mm
- ◆ Weight: 65 kgs.
- ◆ Land: Can be operated with a space of 3.4×2 feet
- ◆ Investment (Unit cost per machine): Rs. 35000
- ◆ Output capacity: 250 kg/hour

Contact Address: PI, AICRP on PHET Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, Srinagar – 191 121 (J&K)

52. Extraction of Kernel Oil from Apricot / Wild Apricot Seed

Name of the Technology: Extraction of Kernel Oil from Apricot / Wild Apricot Seed

Application/ Use: Apricot stones are used for kernel oil extraction and oil is rich in polyunsaturated fatty acids and vitamin E is used as edible oil and for many medicinal and cosmetic purposes. It is used for body massage, baby massage, relieving joint pain, as face oil for dry skin and in preparation of facial creams, body lotion etc.



Description of Technology : The technology for extraction of apricot kernel oil consist of mechanical decortications, kernel separation with gravity method, extraction of kernel oil with table oil expeller, filtration and then packing of oil in bottles. The stone breaking efficiency of mechanical decorticator varies from 80 - 100kg/hr. against manual crushing of 3.2 - 4.6 kg stones per hour. The decorticated stones are immersed in 20% salt solution (1.888 specific gravity) and floated kernels are separated immediately from the crushed apricot stones. The separated kernels after immediate washing under tap water and drying under the sun or in the mechanical drier to remove surface moisture are passed through Table oil expeller for 3 - 4 times for extraction of oil from apricot kernels with an oil yield of 42 - 45%. The extracted oil is filtered through filter press prior to its packing in glass or plastic bottles. Add 0.02% TBHQ (tertiary butyl hydroquinone) for better storage quality of the oil.

Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs.55,000/- (decorticator), Rs.60000/- (table oil expeller) and Rs. 30000/- oil filter press
- ◆ Output capacity: 80 - 100 kg stone/h, 5 kg kernel/ h and 2 kg oil/h
- ◆ Unit cost of operation: Rs. 1.55 lakh

Contact Address: PI, AICRP on PHT, Department of Agricultural Engineering, Assam Agricultural University, Jorhat-13, Assam.

53. Cassava Rasper

Name of the Technology: Cassava Rasper

Application/ Use: The cassava rasper is efficient and an economical equipment for small-scale processing of cassava roots.

Description of Technology: The rasper consists of a crushing cylinder made up of a mild steel pipe with blades sets fixed on the circumference. The crushing cylinder is fixed on a shaft which rotates inside bearing, which is fixed on a trapezoidal angle iron frame, fixed to the floor by foundation bolts. The power is provided by 3 hp (3 phase electric motor) with belt and pulley.

The drum is rotated inside the crushing chamber which is made up of two halves, the upper being rectangular shape and the bottom half portion acts as an outlet for the crushed mash. The gap between the blade set and crushing chamber is adjusted by providing wooden planks fixed to it. A changeable sieve plate is provided in the bottom half to filter the starch pulp without any bigger pieces. While feeding the tubers, the tubers are expelled from the feed inlet and to avoid that a slanting projection was given at inlet point of the hopper.



Size & Capacity:

- ◆ Overall Dimension: 800 mm x 800 mm x 1000 mm
- ◆ Weight : 135 kg
- ◆ Land: Can be operated with a space of 3.4×2 feet
- ◆ Investment(Unit cost per machine): Rs.45,000/-
- ◆ Output capacity: 800 -1000 kg/h

Contact Address: Research Engineer, AICRP on PHT Central Tuber Crops Research Institute, Thiruvananthapuram – 695 017, Kerala.

54. Cassava Peeling Knife

Name of the Technology: Cassava Peeling Knife

Application/Use: Used for peeling (removal of the corky skin alone or along with the fibrous rind) of cassava tubers



Description of the Technology: On-site evaluation of the improved prototype showed that the average output of the peeling knife is 132 kg/h, comparable to that of the traditional knife used by professional workers. Additional labour cost per ton of tubers peeled by the improved knife (@ Rs.3/- per basket of 55 - 60 kg unpeeled tubers) is about Rs.12/- only; Flesh loss with the improved knife is only 1.38% compared to the 5.70% flesh loss by the traditional knife. The cost of the additional tuber loss by the traditional knife, or in other words the saving of tuber flesh by the improved knife, is nearly Rs 106/- at the factory rate of Rs 145/- per bag 70 kg of tubers. The traditional knife costs Rs 5/- each, and two to three knives are disposed of by a labourer each week, with the minimum cost of operation being Rs 10/-. The cost of the improved knife is estimated at Rs 40/-

Size & Capacity:

- ◆ Overall Dimension: 230 mm
- ◆ Weight : 0.075 kg
- ◆ Investment (Unit cost per machine): Rs 40/-
- ◆ Output capacity: 132 kg/h

Contact Address: Research Engineer, AICRP on PHT Central Tuber Crops Research Institute, Thiruvananthapuram – 695 017, Kerala.

55. Cassava Chips Cutter

Name of the Technology: Cassava Chips cutter

Application/ Use: The Cassava Chips cutter is another efficient and an economical equipment for small-scale processing of cassava roots from Tamil Nadu.

Description of Technology: The machine is built to less than 1 HP power specifications. In the fabrication of the Cassava Cutting machine, Local lathe works are enough to make the machine. It works with a motor fixed in bottom rolling the flat blade fixed horizontally above the tray. A pipe is inserted from up to down dropping the Cassava, which passes towards the blade cutting into chip pieces. The cut pieces are placed in the tray of the machine for easy hand picking. Later, the chips shall be uniformly dried and hence, degradation of starch is reduced this is the main advantage in this value addition. The size of the chips ranges from 2mm to 25 mm thickness.



Process Economics:

- ◆ Output capacity: Single pipe – 200 kg per hour
- ◆ Double pipe – 400 kg per hour
- ◆ Investment(Unit cost per machine): Rs. 10,000

Contact Address: TNAU, Coimbatore, KVK, Namakkal , Seva NGO, Madurai NABARD, Namakkal & National Innovation Foundation, New Delhi Processing (Ghani) and Flour Mill (as cottage industry)

IX OTHER TECHNOLOGIES

56. Solar Dryer

Name of the Technology: Natural Convection Solar drier for fruits, Vegetables & Cereals.



Application/Use: Over the last few decades, open-air drying has gradually become more and more limited because of the requirements for a large area, the possibilities of quality degradation, pollution from the air, infestation caused by birds and insects, and inherent difficulties in controlling the drying process. In many rural locations of India, the electricity is either not available or too expensive for drying purpose. Alternatively, the fossil powered dryer can be used, but it poses financial barriers due to large initial and running cost making them beyond the reach of small and marginal farmers. In the present day crisis, it is desirable to apply a little solar technology for dehydration of fruits and vegetables, so the gas, oil and electricity can be saved. Because this system overcomes all those problems and ensures a better quality of dried products, there by fetching a higher price for the dried products for the sustenance of a small holder farmer.

Description of Technology: The mini-multi rack solar dryer consists of a transparent glass cover for transmitting solar radiation, Aluminium trays (five numbers) for loading the produce, GI sheet coated with dull black paint to absorb maximum solar radiation, a wooden cover with saw dust as insulating material to minimize the thermal losses and a main cabinet made out of wood for housing different parts of the dryer. The fresh air enters the cabinet through the holes made in the bottom of the dryer. The solar radiation falling on the dryer is transmitted by the transparent glass, which is absorbed by the absorber plate. Then the air gets heated and rises upwards as it becomes less dense. The hot air while moving upward removes the moisture from the product kept on the trays and exits through the holes made at the top of the dryer. This dryer saves 40 percent of drying time with superior quality dried products over open sun drying.

Size & capacity of the unit

- ◆ Overall Dimension: 1360 x 600 x1455 mm
- ◆ Weight: 65 kg
- ◆ Space required: 3 square meter
- ◆ Investment (Unit cost per machine): Rs.4500/-
- ◆ Output capacity: 15 kg of horticulture produce dried per batch

Contact Address: Sr. Scientist & PI, AICRP on Post-Harvest Technology Dept. of Processing and Food Engineering, College of Agricultural Engineering, UAS, Raichur, Karnataka

57. Honey Processing Unit

Name of the Technology: Honey processing unit

Application/ Use: Integrated honey heating cum filtration system is used for processing of raw honey without deteriorating its quality. The machine cost is low as compared to commercially available, and easy to handle.

Description of Technology: The commercially available heating cum filtration units are very costly, and small entrepreneurs could not buy. The small entrepreneur can process honey in production catchment itself with a heating cum filtration unit designed by Ludhiana centre. The heating section consists of a double-walled cylinder and two electric heating elements filled with water and attached to a pump for recirculating the water for maintaining uniform temperature profile throughout the heated honey. The heated honey is passed to the filtration unit through the hole provided at the bottom of the inner cylinder and extended through a pipe having gate valve. The filtration cylinder consists of the lid of four layered muslin cloth. The operator was comfortable while working with the machine.



Size & Capacity:

- ◆ Overall Dimension: 686x686x524 mm
- ◆ Weight: 80 kg (approximately).
- ◆ Investment (Unit cost per machine): Rs. 35000
- ◆ Output capacity: 50 kg/ batch

Contact Address: Research Engineer, AICRP on PHT Department of Processing and Food Engineering, College of Agricultural Engineering and Technology PAU Ludhiana- 141 004, Punjab.

58. Value Addition of Roselle Calyces

Name of Technology: Value addition of Roselle calyces

Application/ Use: Value-added products (Sharbat, Jam, syrup, sweet pickle)



Description of Technology: Hibiscus sabdariffa L., member of the family Malvaceae (also known as Roselle calyces) is a tropical plant of considerable economic potential. Different value-added products from Roselle calyces, e.g. sharbat, Jam, syrup, pickle, Roselle supari etc. were prepared. Roselle sharbat was prepared with the proportion of sugar syrup in extract equivalent to 1:0.22. To prepare sharbat from 100 g extract, nearly 4 to 5 table spoon of sugar syrup is sufficient. For the preparation of roselle concentrated syrup, calyces extract to sugar ratio was taken 1:0.75. The supari powder was obtained from retained calyces, after their drying. The dried supari powder prepared by adding 0.30 g cumin powder, 0.40 g black salt, 5 g common salt in 10 g retained calyces. The Roselle jam prepared from calyces obtained from 1 kg fresh Roselle fruit, 1 kg sugar and 1 litre of water was required. Roselle sweet pickles were prepared from the retained calyces obtained during concentrated syrup. 50 g of retained calyces were mixed with 50 g of sugars and heated till stickiness is lost.

Size & Capacity:

- ◆ Investment (Unit cost per machine: Rs. 37,000/-)
- ◆ Output capacity: 25 kg Roselle fruit/day
- ◆ Unit cost of operation: Rs 32/kg for Jam, Rs.33/- litre for syrup (sweet pickle is by-product of syrup)

Contact Address: Research Engineer, AICRP on PHT College of Agricultural Engineering Dr Punjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola - 444 104, Maharashtra.

59. Agarbatti

Name of the Technology: Utilization of 'patchouli spent charge' after distillation of essential oil for the manufacture of agarbatti

Application/ Use: Wood powder, one of the raw materials used in the manufacture of agarbatti @15% level, can be replaced advantageously up to 10% with the powdered by-product namely, 'patchouli spent charge' with improved quality characteristics

Description of Technology: Patchouli spent charge, the by-product (waste) obtained after extracting essential oil from patchouli herbage was sun-dried and ground to 20-40 mesh powder using a shredder and a grinder. This powder can be substituted (up to 10%) for the wood powder normally used at about 15% level in the manufacture of agarbatti base sticks which are subsequently dipped in fragrance solutions to get commercial agarbattis. Since, the 'spent charge' powder also contains about 0.1 - 0.5% aromatic essential oil, the agarbattis can have added patchouli smell. Wherever patchouli oil is used in the agarbatti dip (fragrance) solution, in such cases, the costly essential oil usage is either reduced / replaced by using the above agarbatti base sticks prepared using the 'spent charge' powder



Size & Capacity:

- ◆ Investment (Unit cost per machine): Rs. 37,000/-
- ◆ Output capacity: About 4000 agarbatti base sticks per person

Contact address: Research Engineer, AICRP (PHT), University of Agricultural Sciences, GKVK, Bangalore – 560065, Karnataka.

60. Ready to Eat Meat Wafers

Name of the Technology: Ready to eat meat wafers

Application/use: This product has the edge over other ready-to-eat snacks and will have a potential market as its nutritive value is higher. The wafers can be made available either in ready-to-eat (fried) or ready-to-use (without frying) forms. Products with a different flavour and reasonably high shelf-life (up to 6 months) could boost its market potential.



Description of the Technology: Wafers are the convenience snack food liked by people of all age groups. Varieties of potato wafers are available in the market. Chicken wafers or egg wafers or wafers from any source of meat including fish or prawn will be a delicacy. The ready-to-eat wafers can also be produced without deep fat frying using the latest technique. The ready-to-eat meat wafers are not just the convenience snack, but also could be popularized as a nutritious product, as it is rich in quality protein. It can be made available in different seasoning flavours e.g. garlic, ginger, tomato, pepper, mint, or spicy traditional masala etc., to meet customers' needs. The product has high sensory acceptance and good shelf-life when packed in flexible laminated pouches.

Process Economics:

- ◆ Economic capacity : 500 kg /day/shift
- ◆ No. of working days : 300 days/year
- ◆ Cost of machinery : Rs. 10 -11 lakh
- ◆ Payback period : 2.3 years

Contact Address: CSIR-CFTRI, Cheluvamba Mansion Opp. Railway Museum, Mysuru - 570020, Karnataka, Contact Number: 0821 2514760, Email: director@cftri.res.in ram@cftri.res.in, Website: <http://www.cftri.com>

61. Pulse Papad

Name of the Technology: Pulse Papad

Application/use: The demand for papad exists throughout the year and is increasing steadily. It peaks during festival season and in the marriage season, and a number of players spring up during this period. The total market is about four tones per day. With the increasing awareness about quality, the demand for hygienically prepared, appropriately packed papad is on the rise. This provides a good demand for papad prepared using processes like the one developed by CFTRI.



This provides a good demand for papad prepared using processes like the one developed by CFTRI.

Description of the Technology: The present process focuses on using gadgets/machinery that are semi-automatic to increase production besides overcoming drudgery of manual operation. CFTRI has standardized the technology and general methods of processing pulse based papad. This processing technology provides information about quality control, packaging and packaging material specifications and equipment details. This process involves grinding of black gram, mixing with ingredients, kneading the dough in a kneader, shaping in pedal/hand-operated presses, drying at room temperature and packing in suitable packaging material.

Process Economics:

- ◆ Economic capacity : 30 tons of papad per year
- ◆ Production / Day : 100 kg of papad
- ◆ No. of working days : 300 days/Year
- ◆ Project cost : Rs. 7.50 lakh

Contact Address: CSIR-CFTRI, Cheluvamba Mansion Opp. Railway Museum, Mysuru, Karnataka Pincode: 570020, Contact Number: 0821 2514760, Email: director@cftri.res.in ram@cftri.res.in, Website: <http://www.cftri.com>

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**INDIAN INSTITUTIONS FOR
DEVELOPMENT OF FOOD
PROCESSING**

ANDHRA PRADESH

SI No	Institution	Technologies/ Services Available	Contact Address
1	College Of Agricultural Engineering and Technology	<ul style="list-style-type: none"> • Chilli drier, Groundnut decorticator, husk fired paddy drier. • Technology for preparation of Jaggery powder. • Standardized package for commercial packing and transport of mango for export. 	College of Agricultural Engineering and Technology Bapatla, Acharya NG Ranga Agricultural University, Bapatla, Andhra Pradesh Pincode: 522 101 Contact Number(s): 9989625205,08643-225180 Email: caebpt@gmail.com
2	CSIR - Central Food Technological Research Institute-Resource Centre	<ul style="list-style-type: none"> • Papain from papaya latex • Dehydration of grapes for production of raisins • Annatto dye preparation annatto seed separator. 	CFTRI Resource Centre, Near NGRU Campus, Habshiguda, Uppal Road, Hyderabad Pincode: 500 007 Contact Number(s): +91-40-27151157, +91-40-27171128 Email: rchyderabad@Cftri.Res.In
3	ICAR- Central Tobacco Research Institute	<ul style="list-style-type: none"> • Use of Tobacco as food and medicine 	Central Tobacco Research Institute Bhaskarnagar Rajahmundry Andhra Pradesh Pincode: 533105 Website: http://www.ctri.org.in Contact Number(s): 0883-2448995, 2449871 E-mail: ddreddy132@yahoo.com , ctri-ap@nic.in
4	ICAR- National Research Centre on Meat	<ul style="list-style-type: none"> • Emulsion preparation with the use of ordinary stone grinder • Chicken deboning table • Small animal carcass holding stand • Incorporation of vegetables and condiments for improving nutritional value of meat 	ICAR- National Research Centre On Meat, Chengicherla, P.B.No – 19, Boduppal Post,Hyderabad, Pincode: 500 092. Website: http://www.nrcmeat.org.in Contact Number(S): 040 29801672/73/74,29804541 Email: nrcmeat_director@yahoo.co.in
5	ICAR- Directorate of Rice Research	<ul style="list-style-type: none"> • Nutrient enriched rice varieties 	Directorate of Rice Research, Rajendra Nagar, Hyderabad, Pincode: 500030 Website: http://www.drricar.org Contact Number(s): +91-40-24591241 Email: director.iirr@icar.gov.in

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6	ICAR-Indian Institute of Millets Research	<ul style="list-style-type: none"> • Sorghum Biscuits • Shelf life Practices 	Indian Institute of Millets Research Rajendranagar, Hyderabad, Telangana. India, Pincode: 500 030 Website: http://millets.res.in Contact Number(s): +91 - 040 - 2459 9301,; +91 - 040 - 2459 9300 E-mail: millets.icar@nic.in , director.millets@icar.gov.in
7	ICAR - Indian Institute of Oil Palm Research	<ul style="list-style-type: none"> • High yielding varieties of oil palm • Value addition techniques in oil palm 	ICAR-Indian Institute of Oil Palm Research Pedavegi, West Godavari District, Andhra Pradesh, Pin code - 534 450 Website: http://dopr.gov.in Contact Number(s): 91-8812-259532, 259524 Email: director.iopr@icar.gov.in
8	ICMR - National Institute Of Nutrition	<ul style="list-style-type: none"> • Food analysis • Food fortification • Genetically modified foods • Food safety • Nutritional monitoring 	National Institute Of Nutrition (Indian Council Of Medical Research) Near Tarnaka Flyover. Jamai-Osmania PO, Hyderabad, Pin code: 500 007 Website: http://www.ninindia.org Contact Number(s): +914027197200 Email: nin@ninindia.org , nin@ap.nic.in , dirnin_hyd@yahoo.Co.In
9	International Crop Research Institute for the Semi-Arid Tropics (ICRISAT)	<ul style="list-style-type: none"> • Mobile low cost aflatoxin Detection Kit • Ground nut sheller • A frame ground nut stripper • Mobile Choppers for crop residue 	ICRISAT, Patancheru Hyderabad, Telangana Pincode: 502324 Website: http://www.icrisat.org Contact Number(s): +91 40 30713071 Email: icrisat@cgiar.org
10	National Institute Of Plant Health Management (NIPHM)	<ul style="list-style-type: none"> • NIPHM Paddy Dryer 	NIPHM, Rajendranagar, Hyderabad, Andhra Pradesh - 500 030 Contact Number(s): 040-24013346 Email: infoniphm@nic.in , niphm@nic.in
11	Post-Harvest Engineering and Technology Centre	<ul style="list-style-type: none"> • Processing, Handling and Storage of Jaggery & Khandasari 	Regional Agricultural Research Station, Anakapalle, Pincode: 531 001 Website: http://www.angrau.ac.in/ResAnakapalli.php Contact Number(s): 93940 43908 Email: phtc_bapatla@rediffmail.com

ASSAM

1	Post-Harvest Engineering and Technology Centre	<ul style="list-style-type: none"> • Long-distance transportation of pineapple, orange etc., • Extending shelf-life of perishable vegetables and also for commercial floriculture. 	Dept. of Agricultural Engineering, Assam Agricultural University, Jorhat-785 013 Contact Number(s) : 0376-2340001 Email: webadmin@aau.ac.in
2	Regional Centre Indian Institute of Food Processing Technology (IIFPT)	<ul style="list-style-type: none"> • Food Processing Incubation Cum Training Centre • Ready to serve (RTS), Ready to Drink (RTD), Ready to Cook (RTC) foods and beverages 	Regional Centre IIFPT, #55, Srimantapur Near DGP (Border) Office, Bhangagrah, Guwahati, Pin code: 781032 Website: http://www.iifpt.edu.in/regional-centres/guwahati.html Contact Number(s): 0361-2529929, 07373068429, 09750968402 E-mail: iicptghy@gmail.com ,
3	Department of Food Engineering & Technology	<ul style="list-style-type: none"> • Functional food • Food Engineering 	Department of Food Engineering & Technology, School of Engineering, Tezpur University, Napaam, Sonitpur, Assam, India, Pin code: 784028 Website: http://www.tezu.ernet.in/dfpt/ Contact Number(s): +91-3712-267007/8/9, Extn:5701 E-Mail: mkhararika@tezu.ernet.in
4	Indian Institute of Entrepreneurship (IIE)	<ul style="list-style-type: none"> • Training program for • Food Processing and Spice Grinding 	Indian Institute of Entrepreneurship (IIE), 37, N.H. Bypass, Lalmati, Near Games Village, Guwahati, Pin code: 781029 Contact Number(s): 0361-2300840 / 2302646, 7086051330 E-mail: director@iie.gov.in
5	North Eastern Regional Agricultural Marketing Corporation Ltd. (NERAMAC)	<ul style="list-style-type: none"> • Fruit Juice Concentration Plant (FJCP) • Cashew Processing Unit (CPU) • Integrated Ginger Processing Plant (GPP) 	North Eastern Regional Agricultural Marketing Corporation Ltd. 9 Rajbari Path, Ganeshguri Guwahati-781005, Assam Website: http://neramac.com Contact Number(s): +91 361 2341427 Email: neramac@gmail.com
6	M/s North East Mega Food Park Ltd.	<ul style="list-style-type: none"> • Processing and storage facility for industries 	M/s North East Mega Food Park Ltd. Hotel Brahma Putra Ashok M.G. Road, Guwahati - 781001 Website: http://nefoodpark.com Contact Number(s): 08811096878 Email id.: ronn.pakrashi@nefoodpark.com

HARYANA

1	Dept. of Agricultural Processing & Energy	<ul style="list-style-type: none"> • Aonla (Indian gooseberry) Pricking machine • Solar Hara (Chullah) • Solar Dryer 	<p>Dean, College of Agricultural Engineering. & Technology , CCS Haryana Agricultural University, Hisar, Pincode: 125 004 Contact Number(s): +91-1662-284313,255206 E-mail: deancoaet@rediffmail.com</p>
2	ICAR- National Dairy Research Institute (NDRI)	<ul style="list-style-type: none"> • Kheer Mohan Production from Buffalo Milk • BajraLassi • Whey Jaljeera Drink 	<p>ICAR-NDRI, Karnal Near Jewels Hotel, GT Rd, Karnal, Haryana Pincode: 132001 Website: http://www.ndri.res.in Contact Number(s): 0184 225 9023/ 2259002 (O) E-mail: dir.ndri@gmail.com</p>
3	MOFPI-National Institute of Food Technology Entrepreneurship and Management (NIFTEM)	<ul style="list-style-type: none"> • Novel food processing technologies • Nutraceutical and health foods. • Nano-Science in food preservation and food quality. • Development of value added food products 	<p>NIFTEM Plot No. 97, Sector 56, HSIIDC Industrial Estate, Kundli, Sonipat, Haryana Pincode: 131028 Website: http://www.niftem.ac.in Contact Number(s): +91-130-2281000,2219759-64 E-mail: vc@niftem.ac.in</p>
4	FCI-Institute of Food Security	<ul style="list-style-type: none"> • Training program on food security 	<p>Institute of Food Security, Food Corporation of India, Plot No 87, Sector 18, Gurgaon, Haryana Pincode: 122015 Website: www.ifswb.nic.in Contact Number(s): 0124-4820403-04,4820414-15, Email: ifs.fci@nic.in</p>
5	ICAR- Indian Institute of Wheat & Barley Research	<ul style="list-style-type: none"> • High yielding varieties of barley and wheat and its processing. 	<p>Indian Institute of Wheat & Barley Research, GahoonVihar, Karnal, Haryana Pincode: 132001 Website: http://www.dwr.res.in/ Contact Number(s): +91-184-2267390 E-mail: wheatpd@gmail.com</p>
6	Horticulture Training Institute	<ul style="list-style-type: none"> • Training on Processing, Preservation and Value Addition 	<p>Horticulture Training Institute, Uchani (Karnal), Haryana, Pin code: 132001 Contact Number(s): +911842265484 E-mail: htiharyana@gmail.com</p>
7	National Horticulture Board, ,Ministry of Agriculture and Farmers Welfare	<ul style="list-style-type: none"> • Popularization of identified new technologies • Promotion and market development of processed 	<p>National Horticulture Board, 85, Institutional Area, Sector – 18 Gurgaon - 122015 (Haryana) Website: http://www.nhb.gov.in Contact Number(s): 0124-2342992, 2347441, 2342989-90, Email: info@nhb.gov.in</p>

HIMACHAL PRADESH			
1	Department of Food Science & Technology, Dr. Y. S. Parmar University of Horticulture and Forestry	<ul style="list-style-type: none"> Value Addition of Food Industries Waste Maturity indices for harvesting of mangoes 	Department of Food Science & Technology, College of Horticulture, Post-Harvest Technology, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan-173 230 Website: http://www.yspuniversity.ac.in Contact Number(s): 01792-252410, +91-94180-23770 E mail: hodfstuhf@gmail.com
2	CSIR - Institute of Himalayan Bioresource Technology	<ul style="list-style-type: none"> Catechin Tea Concentrates Tea Wine Nutribar Bamboo products 	CSIR-Institute of Himalayan Bioresource Technology, Post Box No. 6 Palampur (H.P.), Pin Code: 176061 Website: http://www.ihbt.res.in Contact Number(s): +91-1894-230411 E-mail : director@ihbt.res.in
JAMMU & KASHMIR			
1	CSIR-Indian Institute of Integrative Medicine	<ul style="list-style-type: none"> Herbal formulation as drug dietary / food supplement 	Indian Institute Of Integrative Medicine, Post Bag No. 3, Canal Road, Jammu-Pincode: 180001 Website : http://www.iiim.res.in Contact Number(s): 0191-2584999, 2585222/ 201 Email: director@iiim.res.in
2	Division Of PHT/ Food Science And Technology, SKUAST of Jammu.	<ul style="list-style-type: none"> Colour extraction from different fruits Value addition of Harad 	Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Main Campus Chatha, Jammu, Jammu & Kashmir Pincode: 180009 Website: http://www.skuast.org/ Contact Number(s): 94191-12723 E mail: anjubhat.skuastj@gmail.com
3	ICAR-Central Institute of Temperate Horticulture	<ul style="list-style-type: none"> Osmo-dehydrated products of apricot and cherry Shelf life and retention of quality of peach, apple and cherry Value added products of cape gooseberry 	Central Institute of Temperate Horticulture, Old AirPort Road, Rangreth, Srinagar, Kashmir-190007 Website: http://www.cith.org.in/ Contact Number(s): 01942305044, 0985 8776364 Email : dircithsgr@icar.org.in

JHARKHAND			
1	Department of Agricultural Engineering	<ul style="list-style-type: none"> Testing of agricultural processing instruments 	Dept. of Agril Engg., Birsa Agricultural University, Kanke, Ranchi, Jharkhand Pincode: 834006 Website: www.bauranchi.org Contact Number(s): 9431543781 Email : dkrusia@gmail.com
2	M/s Jharkhand Mega Food Park Pvt. Ltd.	<ul style="list-style-type: none"> Primary Processing Centres (PPC) Mobile Collection Centres (MCC) 	M/s Jharkhand Mega Food Park Pvt. Ltd. Plot No. 1596, Road no.7, Hawainagar, Muazahinoo, Jagganathpur, Ranchi Pincode: 834003 Contact Number(s): 09930444534, 08796666666 Email: alireza.thaver@jmfppl.com
KARNATAKA			
1	Department of Agricultural Engineering	<ul style="list-style-type: none"> Value addition on Small millets Value addition on Jack fruits Harvesting tools for fruits Bakery training unit 	University of Agricultural Sciences, J-Block, GKVK Campus, Bangalore - Pincode: 560065 Website: http://www.uasbangalore.edu.in Contact Number(s): 080-23545640 Email: hod.agengg.uasb@gmail.com
2	College of Agricultural Engineering	<ul style="list-style-type: none"> Harvesting tools for fruits Rice processing machineries 	College of Agricultural Engineering, Raichur, Pincode: 584 102 Website: www.uasraichur.edu.in Contact Number(s): 08532-220079 E-mail: deancaer@uasraichur.edu.in
3	College of Fisheries	<ul style="list-style-type: none"> Processing of fishes Canning and value addition of fishes. 	KVA&FSU, Mangalore, College of Fisheries, Mathsyangar, Mangalore, Pincode: 575 002 Website: http://www.kvafsu.kar.nic.in Contact Number(s): +91-8482-245313, 245264;200223, 91-9341190975 Email : hsmurthy05@yahoo.com hsmurthy05@gmail.com
4	Department of Food Technology	<ul style="list-style-type: none"> Food technology Enrichment of nutrients in food grains 	University of Agricultural Sciences, Dharwad, Dharwad, Karnataka State, Pincode: 580 005 Website: http://www.uasd.edu Contact Number(s): 0091-836-2214420 E-mail: registrar@uasd.in
5	University of Horticultural Sciences	<ul style="list-style-type: none"> Fortification of Tomato Ketchup Homescale aloe vera jel extraction Jamun vine 	University of Horticultural Sciences, Udyanagiri, Bagalkot, Karnataka, India Pincode: 587104 Contact Number(s): 08354-230279, 08354-230278, 08354-230276 Email: registrar@uhsbagalkot.edu.in registrar_uhsb@rediffmail.com

6	CSIR – Central Food Technological Research Institute (CFTRI)	<ul style="list-style-type: none"> • 300 proven technologies • 1000 patents 	<p>CSIR-CFTRI, Cheluvamba Mansion Opp. Railway Museum, Mysuru, Karnataka Pincode: 570020 Website: http://www.cftri.com Contact Number(s): 0821 2514760 Email: director@cftri.res.in ram@cftri.res.in</p>
7	ICAR- Indian Institute of Horticultural Research	<ul style="list-style-type: none"> • Osmotic Dehydration Technology for Fruits • Ready to Serve Beverages • Fruit Bar Technology • Processing Machineries 	<p>ICAR-IIHR, Hessaraghatta lake post, Bengaluru- 560 089. Website: http://www.iihr.res.in Contact Number(s): 080-28466471 E-mail: director@iihr.res.in</p>
8	Defence Food Research Laboratory (DFRL)	<ul style="list-style-type: none"> • Ready to eat retort pouch processing technology • Ready to cook products • Ready to drink juices and Beverages 	<p>Defence Food Research Laboratory, Iddarth Nagar, Chamarajapuram Mohalla, Mysuru, Karnataka 570011, Website: https://www.drdo.gov.in/drdo Contact Number(s): 0821-2473783 E-mail: director@dfri.drdo.in</p>
9	Division of Post-Harvest Technology, Coffee Board	<ul style="list-style-type: none"> • Processing and Packaging of Coffee • Training on Post Harvest Management and Processing of coffee 	<p>Coffee Board, #1, Dr. B.R.Ambedkar Veedhi, Bangalore, Karnataka, India. Pin Code: 560001 Website: http://www.indiacoffee.org Contact Number(s): 080-22252917/ 22250250, +91-80- 22266991 - 994 Email: chairman.coffeeboard@gmail.com</p>
10	Southern Campus of NDRI Adugodi	<ul style="list-style-type: none"> • Gulab Jamoon Mix technology • Curd Rice technology 	<p>Southern Campus of NDRI Adugodi, Bangalore - 560030 Website: http://www.ndri.res.in/ndri/Design/southernregionalstationbangalor.html</p>

KERALA

1	ICAR-Central Plantation Crops Research Institute	<ul style="list-style-type: none"> • Coconut climbing machine • Coconut shell removing machine • Virgin Coconut Oil • Coconut chips 	<p>ICAR-Central Plantation Crops Research Institute, Kudlu.P.O, Kasaragod,Kerala, Pincode: 671124</p> <p>Website: http://www.cpcri.gov.in/</p> <p>Contact Number(s): 04994-232894</p> <p>E-Mail : director.cpcri@icar.gov.in directorcpcri@gmail.com cpcri@gov.in</p>
2	ICAR- Central Tuber Crops Research Institute	<ul style="list-style-type: none"> • Pasta from cassava • Fried snack from tuber flour • Cassava harvesting tools 	<p>ICAR-CTCRI Sreekariyam. P.O Thiruvananthapuram. Kerala Pincode: 695017</p> <p>Contact Number(s):(+91)(471) 2598551</p> <p>E-mail: ctcritvm@yahoo.com</p>
3	ICAR-Indian Institute of Spices Research, Kozhikode	<ul style="list-style-type: none"> • White pepper from green pepper • Salted ginger, • Packing system for spices 	<p>ICAR-Indian Institute of Spices Research Marikunnu P.O., Kozhikode (Calicut), Kerala, Pin Code: 673012</p> <p>Website: http://www.spices.res.in/</p> <p>Contact Number(s):0091- 0495-2730294</p> <p>Email: director@spices.res.in</p>
4	Kerala Agriculture University (KAU) Tavanur	<ul style="list-style-type: none"> • Pineapple Peeler, corer cum slicer • Ash gourd seed extractor • Pepper Thresher 	<p>KAU Tavanur RE/PI, AICRP on PHET, Kerala Agricultural University, Kelappaji College of Agricultural Engineering and Technology, Tavanur, Kerala -679573</p>
5	ICAR-Central Institute of Fisheries Technology (CIFT)	<ul style="list-style-type: none"> • Fish curry in retortable pouches, Fish kure, batteded and bredded products, fish pickle • CIFT Driers, smoked masmin flakes 	<p>ICAR-Central Institute of Fisheries Technology, CIFT Junction, Willingdon Island, Matsyapuri P.O., Cochin-682 029, Kerala</p> <p>Contact Number(s):0484-2412300; Fax: 091-484-2668212</p> <p>E-mail: aris.cift@gmail.com, cift@ciftmail.org</p> <p>Website: www.cift.res.in</p>
6	Central Marine Fisheries Research Institute	<ul style="list-style-type: none"> • Sustainable mariculture and strategic research into Muricidae for nutraceutical development 	<p>Central Marine Fisheries Research Institute, Post Box No. 1603, Ernakulam North P.O., Kochi-682 018.</p> <p>Contact Number(s):+91 484 2394357 /12, 2391407, 2394867, 2397569, 2394268 /96, 2394750</p> <p>Fax : +91 484 2394909</p> <p>E-mail : contact@cmfri.org.in</p>

MADHYA PRADESH

1	JNKVV Jabalpur	<ul style="list-style-type: none"> • Development of laboratory model fermented for production of Jamun vinegar • Drying characteristics of Jamun kern 	<p>JNKVV Jabalpur RE/PI, AICRP on PHET, College of Agricultural Engineering, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur-482 004 Contact Number(s):0761-2353314, 2353805(O), Fax: 0761-2353314(O) Mobile: 9407001170 E-mail: rajendragnema@rediffmail.com</p>
2	Central Institute of Agricultural Engineering	<ul style="list-style-type: none"> • Development of Agricultural implements • Small-holder Farmers technologies 	<p>Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal - 462038 (Madhya Pradesh) INDIA Phone Numbers: Director: 91-755-2737191 E-mail: director.ciae@icar.gov.in</p>



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