

POST HARVEST TECHNOLOGY & AGRICULTURAL ENGINEERING



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ICAR-INDIAN INSTITUTE OF HORTICULTURAL RESEARCH

(DARE, Ministry of Agriculture & Farmers Welfare, Govt. of India)

Hesaraghatta Lake Post, Bengaluru-560089.



Current Thrust Areas

- Post harvest loss reduction in fruits, vegetables and flowers, through extension of shelf/ storage life by adopting suitable handling, packaging and storage methods
- Development of technologies for production of novel, nutritious, wholesome processed and value-added products with extended shelf life
- Development of Probiotic fruit beverages
- Minimal processing of fruits and vegetables with special emphasis on food safety and quality
- Waste and by-product valorization for development of value-added products
- Mechanization of production and processing operations of important horticultural crops

Future Thrust Areas

- IoT based tracking and tracing system for fresh horticultural produce
- Cost effective and energy efficient storage and transportation systems for fresh horticultural produce
- Biodegradable packaging material for fresh, minimally processed and processed fruits and vegetables
- Vitamin and micronutrient fortified processed fruit and vegetable products
- Preservative free Health foods and cold pressed beverages
- Functional foods from the by-products of processing industry and horticultural residues
- Crop wise end to end mechanization in production and post harvest operations using sensors, autonomous vehicles, robotics and Artificial Intelligence
- Adoption of alternative energy in production and processing technologies
- Incubation of entrepreneurs in Post Harvest processing of horticultural crops

Institute Research Projects

- Development of sustainable technologies for Post Harvest Management, Processing and Waste Utilization – 7 sub projects
- Development of machinery for production and processing of selected horticultural crops – 2 sub-projects.

Externally funded projects (Completed and on going)

- Projects in production and post harvest processing of horticultural crops funded by
- PL-480, ICAR-NATP, DST, DBT, AICRP –PHT & Floriculture, AICRP-EAAI, ICAR-Adhoc Scheme, ICAR-Extramural ICAR-CRP on FMPF

International Projects : INDO-USAID ; UNU Kirin Fellowship (Japan)

Recognition

- Centre of Team of Excellence under the NATP-World Bank Project for “Post Harvest Management of Fruits and Vegetables”
- PG teachers/ research guides for MSc and PhD programme from ICAR-IARI, New Delhi; UAS, Bangalore; UHS, Bagalkot; Dr. YSR Univ. of Horticulture, Andhra Pradesh; GRI, Dindigul and IGNOU, New Delhi, IGKV, Raipur, ANGRAU, Bapatla, TNAU, Coimbatore
- Scientists are involved as experts in horticulture related activities of BIS, FSSAI, MoFPI, State Departments of Horticulture, NHB, etc.
- Scientists are members of ISAE, IEI, IAT, HSI, SPH, AFSTI, NABS, AIPUB, AMI etc.

Services offered

- Technology licensing
- Contract research
- Consultancy
- Training and Entrepreneur Development Programs
- Transfer of design of machinery
- Guidance to farmers and industry
- Production and sale of fruit harvesters and processed products

We are growing in strength in terms of the technologies and facilities we offer. A symbiotic relationship between science and stakeholders, i.e., farmers, entrepreneurs, small and medium enterprises, food processing industry, supply chain management companies, service industry and machinery manufacturers for field and Post Harvest operations would foster a healthy future for innovation in production and Post Harvest Technologies. Our goal is to see a happy farmer and a healthy consumer.

MACHINERY FOR SEED AND PLANTING MATERIAL PRODUCTION



**NURSERY BAG FILLING MACHINE –
MODEL – I**



**NURSERY BAG FILLING MACHINE
– MODEL - II**

Sieves, mixes and fills the growing media into the nursery poly bags
Capacity: 1000 bags/h



PROTRAY DIBBLER CUM SEEDER
Dibbles and sows vegetable seeds in the
growing media filled protrays
Capacity: 60 trays/h



**AUTOMATIC PROTRAY DIBBLER CUM
SEEDER FOR VEGETABLE NURSERY**
Dibbles and sows seeds automatically
in the growing media filled protrays
Capacity: 150 trays/h



GRAFTING MACHINE
Useful to do grafting of
Vegetable Seedlings



WATER MELON SEED EXTRACTOR
Watermelon seeds and pulp gets separated.
Capacity : 2kg/h (seeds)~ 80 fruits/h

MACHINERY FOR MUSHROOM SPAWN PRODUCTION AND CULTIVATION



GRAIN CLEANER

Used to clean the grain from dust, sticks etc.
Capacity: 200 kg/h



GRAIN BOILER

Boils grain in hot water using 9 kW electric heaters
Capacity : 100 kg/batch



BOILED GRAIN AND CHALK POWDER MIXER CUM BAG FILLER

Mixes boiled grain with chalk powder and fills the mixed product into PP bags.
Capacity: 100 kg/batch (45 min.)



SPAWN INOCULATOR

To inoculate mother spawn to sterilized grain bags
Capacity: 100 bags/h



SOLAR AND ELECTRICAL ENERGY BASED AUTOCLAVE

Uses solar hot water, steam & electrical energy in separate boiler, to sterilize spawn/paddy straw filled PP bags
Capacity: 100-140 kg/batch - Spawn



MULTIFUEL AUTOCLAVE FOR PADDY STRAW STERILIZATION

Useful for sterilizing the paddy straw.



Solar powered outdoor mushroom growing unit

Useful for growing mushroom at home.

MACHINERY/TOOLS FOR TRANSPLANTING, FERTILIZING, SPRAYING, PRUNING AND HARVESTING



TRACTOR OPERATED BED FORMER CUM TRANSPLANTER

Useful for transplanting vegetable seedlings

Field capacity: 0.2 ha/h



FERTREE DRILL

Useful for fertilizer application in Orchards

Field capacity : 250-600 kg/h



TRACTOR HYDRAULIC OPERATED PLATFORM WITH SPRAYING SYSTEM

Useful for spraying in orchards.

Field capacity: 120 – 150 kg/h



TRACTOR HYDRAULIC OPERATED PLATFORM FOR PRUNING

Useful for pruning in orchards

Field capacity: 4-5 trees/h



TRACTOR HYDRAULIC OPERATED PLATFORM FOR HARVESTING

Useful for harvesting fruits in orchards

Field capacity : 1 ha/h/person



MANGO HARVESTER

Harvests mango with pedicel (1-2 cm)

Capacity: 100 kg/h



SAPOTA HARVESTER

Harvests sapota, guava, pomegranate

Capacity: 50 kg/h



LIME HARVESTER

Harvests lime/ lemon

Capacity: 20 kg/h

MACHINERY FOR ONION CULTIVATION AND ON-FARM PROCESSING



ONION SEED EXTRACTOR

Separates seeds from umbels
Capacity: 30 kg/h



MANUALLY DRAWN ONION SEEDER

Useful for sowing onion seeds in flat bed.
Reduces seed rate by 40 % and maintains uniform crop stand.
Field capacity: 0.06 ha/h



ANIMAL DRAWN ONION SEEDER

Useful for sowing onion seeds in flat bed. Saves seed rate, time and labour by 40 – 50% and maintains uniform crop stand.
Capacity: 0.4 ha/h



TRACTOR DRAWN ONION SEEDER

Makes raised beds and sows onion seeds.
Field capacity: 0.2 ha/h



TRACTOR OPERATED ONION DIGGER CUM WINDROWER

Useful to dig onion bulbs.
Separates the dug out onion bulbs from soil and windrows at the rear side of the machine.
Field capacity : 0.3 ha/h



POWER OPERATED ONION DE-TOPPER

Cuts the leaf of harvested onion bulbs.
Capacity 1500 kg/h



MANUALLY OPERATED ROSE ONION GRADER

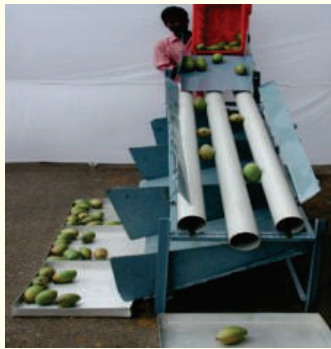
Useful to size grade rose onion into three grades.
Capacity – 1 tonne/h.



MANUALLY OPERATED COMMON ONION GRADER

Useful to size grade common onion into four grades.
Capacity – 2 tons/h

MACHINERY FOR RAW MANGO PROCESSING



RAW MANGO GRADER

Useful to grade raw mangoes into four grades based on size.
Capacity – 500 kg/h



RAW MANGO PEELER

Useful to remove skin of raw mangoes
Capacity – 500 kg/h



RAW MANGO SLICER

Useful to slice the raw mangoes
Capacity – 800 kg/h



RAW MANGO CUBE CUTTER

Useful for dicing the raw mango slices.
Capacity – 1 tonne/h

MACHINERY FOR POST HARVEST OPERATIONS



HOT WATER TREATMENT UNIT FOR MANGO

Useful to treat the freshly harvested mangoes in hot water to control anthracnose and fruit fly at pre fixed temperature and time.
Capacity- 500 kg/ batch



SOLAR POWER INTEGRATED FRUITS AND VEGETABLE VENDING VAN

Maintains freshness of the fruits and vegetable, useful for vending
Capacity – 400 kg

MACHINERY FOR POST HARVEST OPERATIONS



SOLAR POWERED TRICYCLE FOR FRUITS AND VEGETABLE VENDING

Maintains freshness of the fruits and vegetable, useful for vending
Capacity: 80 - 100 kg



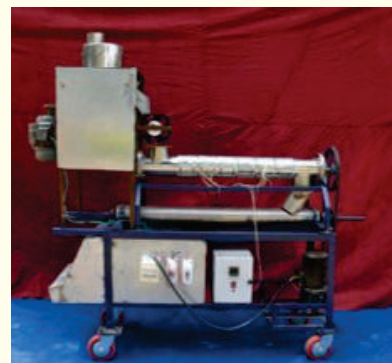
SOLAR POWERED TRICYCLE FOR MUSHROOM VENDING

Maintains humidity for mushroom growing bags
Useful for vending fresh mushroom
Capacity: 36 bags



POWER OPERATED GARLIC BULB BREAKER

Whole garlic bulbs are separated into cloves for further processing.
Capacity: 200 kg/h



GARLIC BULB BREAKER CUM PEELER

Breaks the whole garlic and peels the garlic cloves.
Capacity – 20 kg/h



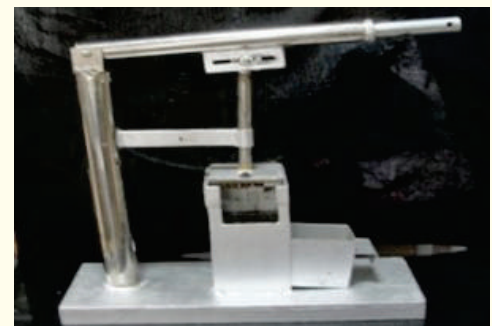
POMEGRANATE ARIL EXTRACTOR

Separates pomegranate arils from fruits
Capacity – 100 kg/h



RAW JACK FRUIT PEELER

Useful to peel the raw jack fruit
Capacity – 30 fruits/h



PORTABLE VEGETABLE DICING TOOL

Useful for dicing of vegetables in bulk
Capacity – 60 kg/h

POST HARVEST MANAGEMENT

Protocols have been standardized for

Delaying ripening using ethylene action inhibitors (1-MCP)

- ❖ Delays ripening of climacteric fruits & extends their shelf life
- ❖ Maintains firmness & quality



Individual and box shrink wrapping of fruits and vegetables

- ❖ Prevents weight loss and extends storage life
- ❖ Helps in retaining freshness and quality



Modified atmosphere packaging

- ❖ Extension of storage life
- ❖ Helps in retaining freshness and quality of fruits and vegetables

POST HARVEST HANDLING AND STORAGE



Integrated storage protocols for fruits

- Integration of post harvest operations with cold storage
- Possibility of export through sea shipment using refrigerated containers.

Low cost ripening of fruits

- Hastens uniform ripening
- Safe, cheap, approved and easy method
- Suitable for ripening of fruits in wholesale markets/ mandis



Arka High Humidity Storage Box retains freshness and increases the shelf life of green leafy vegetables up to 48h under ambient conditions. No refrigeration or electricity is needed for storage purpose. Hygienic way of storage of fresh green leafy vegetables. Suitable for vegetable retail shops, super markets and vegetable vendors

MINIMALLY PROCESSED VEGETABLES

Integrating pretreatment with packaging helped in increasing the shelf life of nine fresh-cut vegetables, viz., beans, capsicum, carrot, cucumber, coriander, cabbage, onion, garlic and radish from 6 - 21 days during their storage at 8 °C.



PROCESSING AND VALUE ADDITION

Osmotically dried products



- Osmotic drying/dehydration of fresh fruits / vegetables is carried out by removal of water using osmotic agent, followed by drying/dehydration of osmosed slices in cabinet driers, solar tunnel driers or vacuum driers.
- Osmotically dried products are free from any added colour, flavour or essence and retain the colour and taste of the fresh fruits/vegetables. Products are dense, nutritious and wholesome and have a shelf life of six months or more under ambient conditions.

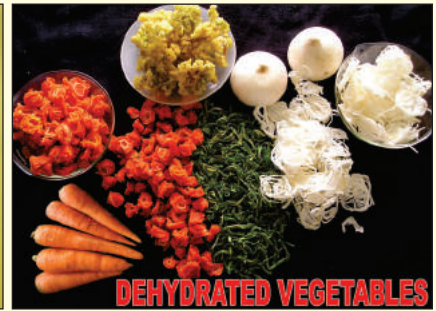
DEHYDRATED PRODUCTS



**DEHYDRATED ONION
FLAKES & POWDER**



FRENCH BEANS



DEHYDRATED VEGETABLES



Dehydration protocols have been developed for French beans, okra, carrot, cauliflower, pumpkin and mushrooms.

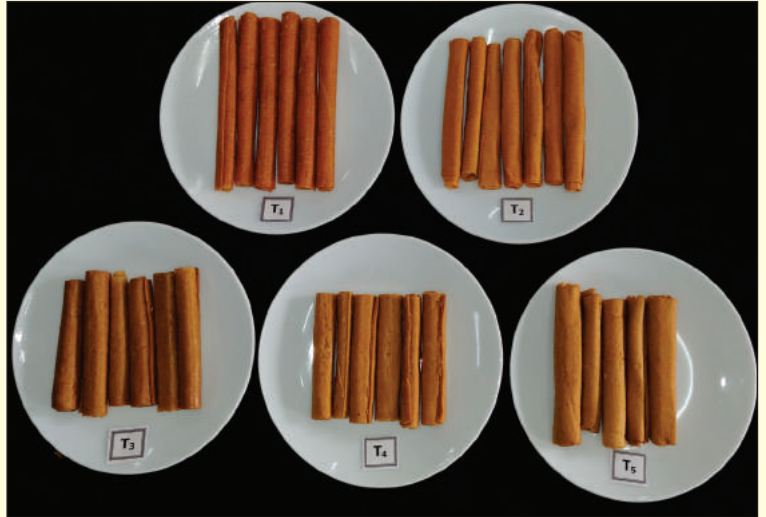
CRUSHED TOMATOES



CRUSHED TOMATO

- ◆ Crushed tomatoes are tomatoes which have been processed in a way that the final product retains peel and seeds in the processed product.
- ◆ The product has a good colour and consistency.
- ◆ Ready-to-use crushed tomato is acidic, rich in ascorbic acid and lycopene, a well known potent antioxidant.

FRUIT BAR OR FRUIT LEATHER



- ◆ Fruit bar is a concentrated and dense product prepared from fruit puree or pulp. Fruit bars retain the original colour and taste of the fresh fruit and can be prepared using simple drying techniques, such as solar drying, solar tunnel drying as well as cabinet drying. The product does not contain any added colour, flavour or essence and has a shelf life of six months or more under ambient conditions.
- ◆ Nutritional composition of Fruit bars can be improved through incorporation of protein and millet rich sources.

BEVERAGES & READY-TO-SERVE JUICES



MANGO BEVERAGE



PINEAPPLE BEVERAGE



PASSION FRUIT BEVERAGE

- Fruit beverages, such as squashes and concentrates are rich in fruit content and are prepared without the addition of any added colour, flavor or essence and with minimum level of preservatives.
- Blended beverages using different fruits, such as amla and bottlegourd, passion fruit with guava, banana, bael, pineapple; banana blended with lime, pineapple and grapes have shown good consumer acceptance.
- Ready to serve (RTS) juices or beverages are prepared without the addition of any preservative, colour, flavor or essence.
- Bittergourd RTS juice has been prepared without the addition of any chemical preservative or additive. Fruit juices and beverages have shelf life of about six months under ambient conditions.



GUAVA RTS BEVERAGE



FRUIT SQUASHES

READY TO DRINK JACKFRUIT BEVERAGE



- Prepared through enzymatic liquefaction without addition of water, sugar or any preservatives. Contains no added colour, flavour or essence. Product has a shelf life of six months under ambient conditions.

PROBIOTICATED POMEGRANATE JUICE



- 100% Pomegranate juice prepared from Pomegranate arils.
- Product contains no added water, sugars or preservatives
- Shelf life of more than three months under refrigerated conditions with cell population of more than one billion cells/ml
- Acceptable taste and flavour throughout the storage period
- Product is rich in free phenolic acids, anthocyanins with added vitamins through probiotication

PROBIOTICATED RTS MANGO BEVERAGE

Prepared using 20% Mango pulp. Product contains added water and sugars but no preservatives. Shelf life of more than four months under refrigerated conditions with cell population of more than one billion cells/ml. Acceptable taste, flavour and aroma throughout the storage period. Product is rich in free phenolic acids, carotenoids with added vitamin through probiotication.



CULINARY PASTES



ONION PASTE



AVOCADO PASTE

- Culinary pastes from onion, garlic, ginger, green chillies, and tamarind have been developed.
- Two variants of butter fruit spreads have been developed; one for regular consumers and second one for children with chocolate flavor for better acceptability.
- Butter fruit chutney: A spicy chutney has been developed from butter fruit
- Culinary pastes and products prepared from butter fruit have a shelf life of six months under ambient conditions

FERMENTATION



Process protocols for lactic acid fermentation for preservation of carrot, capsicum, cucumber, cabbage, coccinea, radish, cauliflower, pea, tomato and gherkins have been standardized.

Technology for long term preservation of unpeeled raw mango slices for hot and sweet pickles has been extremely useful for preparing pickle or other processed products from mangoes during off-season.

- ♦ Process for good quality vinegar from mango processing residues has been standardized.

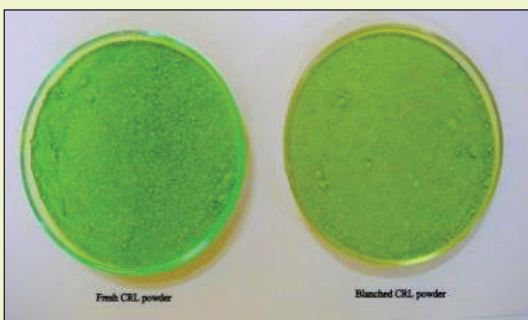


ENOLOGY



- ➔ Indigenous and exotic grape varieties/ new hybrids have been evaluated for wine quality.
- ➔ Thermovinification, chemical deacidification, skin-juice contact techniques helped in enhancing the quality of wines.
- ➔ Technologies for quality wines from mango, banana, pineapple, guava, jack fruit, pomegranate, sapota and passion fruit and flavoured wines have been developed.

VALORIZATION OF HORTICULTURAL WASTE



- ➔ Crop residues of cabbage, cauliflower and chillies could be used to substitute 5-7% of refined wheat flour (maida). Supplementation with these crop residues enhanced carotenoids, proteins and fibre in baked food products like bread, biscuit and rusk by 2-5 folds.



CARROT POWDER CARROT POWDER

- ➔ Pasta prepared from 10% carrot + banana stem powder mix (1:1) and 90% semolina showed good sensory attributes, and had good nutritional values.



FORTIFIED PASTA

VALORIZATION OF HORTICULTURAL WASTE

Fortification of fruit/ vegetable beverages, tomato soup & juice with 15-30 mg/kg of lycopene significantly increased the nutritive value and antioxidant capacity of the final product



WATERMELON RIND CANDY

Water melon rind, normally discarded has been used to produce candies and pickles.

JACKFRUIT CHOCOLATE

Chocolate is used as a coating on a ball of jackfruit seed powder enriched with mushroom and sesame.

The product has 30% less calorific value, 7% less carbohydrates, 14.5% less fats and 50% less chocolate compared to commercial brands.

Product has shelf life of six months under ambient conditions with good palatability



JACKFRUIT COOKIES



Jackfruit cookies are prepared with replacement up to 40% of refined wheat flour through addition of blanched jackfruit seed powder, fruit powder and mushroom powder

Product is rich in fibre and has a shelf life of four weeks under ambient conditions with a good palatability

DRY FLOWER TECHNOLOGY



- Low cost, energy efficient technology has been developed for drying natural flowers.
- Dried flowers using the standardized technology retain their colour and appearance for an year or more.
- Dried flowers can be used in preparation of mementoes, book marks, table mats, sceneries, other decoration material.



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