

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-560 089.



Thrust Areas of Research

- ▶ 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
- ▶ Minimal processing of fruits and vegetables with special emphasis on food safety and quality
- ▶ Nutritional profiling of underutilized crops and development of nutraceuticals and value added products from such underutilized crops
- ▶ Waste and by-product valorization for development of value-added products
- ▶ Mechanization of production and processing operations of economically important horticultural crops

Future Thrust Areas

- ▶ Tracking and tracing systems for fresh horticultural produce from production to consumer
- ▶ Cost effective and energy efficient storage and transportation systems for fresh horticultural produce
- ▶ Vitamin and micronutrient fortified processed fruit and vegetable products
- ▶ Preservative free Health foods and cold pressed beverages
- ▶ Probiotic processed fruit products
- ▶ Functional foods from the by-products of processing industry and horticultural residue
- ▶ Crop wise end to end mechanization in production and post harvest operations
- ▶ Adoption of alternative energies in production and processing technologies

Institute Research Projects

- ▶ Development, refinement and demonstration of post harvest handling, storage and processing technologies for minimization of post harvest losses and production of value added products.
- ▶ Mechanization of production and processing of horticultural crops.

Externally funded projects

- ▶ Handled projects in production and post harvest processing of horticultural crops funded by PL-480, ICAR-NATP, DST, DBT, AICRP-PHT & Floriculture, ICAR-Adhoc Scheme, ICAR Extra mural fund

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.
- ▶ 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, etc.

Services offered

- ▶ Technology licensing
- ▶ Consultancy
- ▶ Supply of machinery drawings
- ▶ Production and sale of fruit harvesters and processed products through ATIC
- ▶ Contract research
- ▶ Training and Entrepreneur Development Programs
- ▶ Guidance to farmers and industry

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 for handling fresh horticultural crops, 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



GROWING MEDIA SIEVER

Sieves growing media: soil, cocopeat, vermicompost etc. & to fill in bags
Capacity: 1 tonne/h



GROWING MEDIA MIXER

Mixes different growing media for use in nursery protrays/ polybags.
Capacity: 0.5 tonne/h



NURSERY BAG FILLING MACHINE

Sieves growing media: soil, cocopeat, vermicompost etc. and to fill in bags
Capacity: 1 tonne/h



ROTARY DIBBLER CUM VACUUM SEEDER

Sieves growing media: soil, cocopeat, vermicompost etc. and to fill in bags
Capacity: 1 tonne/h



MANUALLY OPERATED GARLIC BULB BREAKER

Whole garlic bulb gets separated into cloves for planting. Capacity: 120 kg/h



WATER MELON SEED EXTRACTOR

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

MACHINERY FOR MUSHROOM SPAWN PRODUCTION



GRAIN CLEANER

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



GRAIN BOILER

Boils grain in hot water with 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

Whole garlic bulb gets separated into cloves for planting. Capacity: 120 kg/h



SOLAR AND ELECTRICAL ENERGY BASED AUTOCLAVE

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

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



TRACTOR OPERATED BED FORMER CUM TRANSPLANTER

Useful for transplanting vegetable seedlings

Field capacity: 0.5 ha/h



TRACTOR OPERATED WEEDER

Removes weeds between rows in vegetable fields

Field capacity: 0.2 ha/h



TRACTOR HYDRAULIC OPERATED PLATFORM WITH SPRAYING SYSTEM

Useful for spraying in orchards.

Field capacity: 120 – 150 kg/h



TRACTOR HYDRAULIC OPERATED PLATFORM PRUNING

Useful for pruning in orchards

Field capacity: 4-5 trees/h



TRACTOR HYDRAULIC OPERATED PLATFORM FOR HARVESTING

Useful for harvesting fruits in orchards/ suitable for trees

Field capacity : 1 ha/h/person



MANGO HARVESTER

Useful for harvesting mango fruits with pedicel (1-2 cm)

Field capacity: 100 kg/h



SAPOTA HARVESTER

Useful for harvesting sapota guava, pomegranate fruits.

Field capacity: 50 kg/h



LIME HARVESTER

Useful for harvesting lime/ lemon

Field 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. Field capacity: 0.4 ha/h



TRACTOR DRAWN ONION SEEDER

Makes raised beds and sows onion seeds.
Field capacity: 0.5 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



MOTORISED ONION DE-TOPPER

Cuts the leaf of harvested onion bulbs.
Capacity : 200 kg/h



MOTORIZED ONION DE-TOPPER CUM GRADER

Cuts leaves of harvested onion bulbs and size grades the de-topped onions into four grades.
Capacity: 300 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 three grades.
Capacity: 1 tonne/h.



MOTORIZED COMMON ONION GRADER

Useful to size grade common onion into four grades.
Capacity: 2 tonnes/h

MACHINERY FOR RAW MANGO PROCESSING



RAW MANGO GRADER

To grade raw mangoes into four grades based on size.
Capacity: 500 kg/h



RAW MANGO PEELER

To remove the peel of raw mangoes.
Capacity: 200 kg/h



RAW MANGO SLICER

To slice raw mangoes.
Capacity: 800 kg/h



RAW MANGO CUBE CUTTER

To dice raw mango slices.
Capacity: 1 tonne/h



HOT WATER TREATMENT UNIT FOR MANGO

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

MACHINERY FOR POST HARVEST OPERATIONS



MANUAL POMEGRANATE ARIL REMOVER

Separates pomegranate arils from the fruit.
Capacity: 20 kg/h



MOTORISED GARLIC BULB BREAKER

Whole garlic bulbs are separated into cloves for further processing.
Capacity: 400 kg/h



MANUALLY OPERATED GARLIC PEELER

Peels dried garlic cloves.
Capacity: 12 kg/h

POST HARVEST MANAGEMENT

Extended storage life of fruits and vegetables has been achieved by Modified Atmosphere Packaging (MAP) at optimum temperature and alleviation of chilling injury at lower temperatures.



Pretreatments using growth regulators, waxes, SO₂ releasing pads, ethylene absorbents and 1-MCP have been standardized.

Individual shrink wrapping helped in extending the storage life of non-climacteric and climacteric fruits and vegetables.



Controlled atmosphere storage for alleviation of chilling injury of mango and banana for long term storage/ transport.

Integrating pre- & post harvest management practices to extend the storage life of Alphonso and Banganapalli mangoes to 4-5 weeks.



Artificial ripening using ethylene gas standardized for uniform ripening of mango, banana, papaya and sapota, offers a good substitute to the banned hazardous calcium carbide.

Zero energy, high humidity storage box for freshness retention and storage life extension of green leafy vegetables.



MINIMALLY PROCESSED VEGETABLES



Integrating pretreatment with packaging helped in increasing the shelf life of fresh-cut vegetables from 6 - 21 days during their storage at 8 °C.

FERMENTATION

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



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

Good quality vinegar has been produced from mango processing wastes.

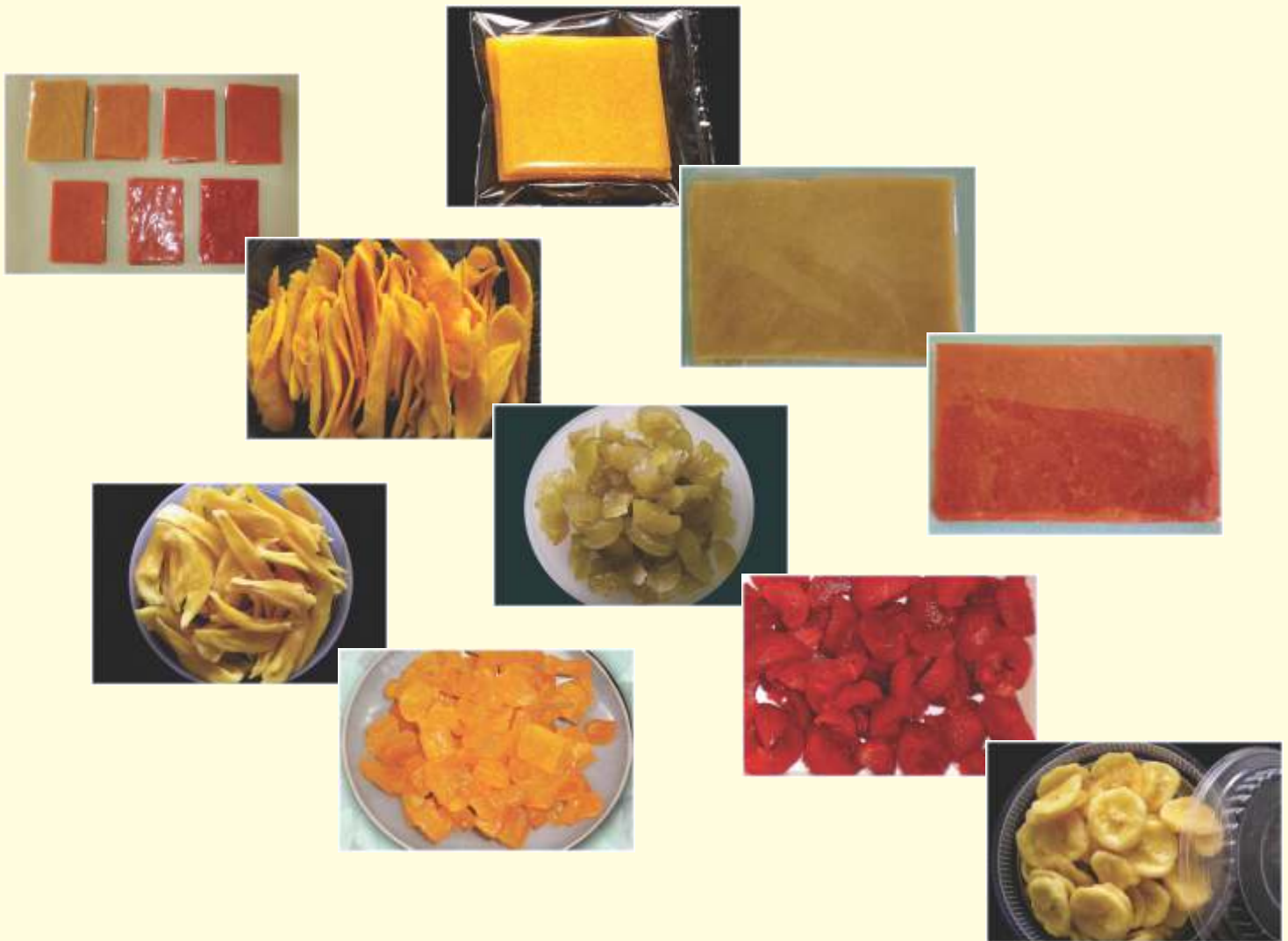
ENOLOGY



- 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.
- Technology for quality wines from mango, banana, pineapple, guava, jack fruit, pomegranate, sapota and passion fruit has been developed.
- Process for flavored wine.

PROCESSING AND VALUE ADDITION

OSMOTIC DEHYDRATION AND FRUIT BARS



- Osmotic dehydration of fresh fruits/ vegetables is by removal of water using osmotic agent, followed by dehydration of osmosed slices in cabinet dryers, solar tunnel dryers or vacuum dryers.
- Osmotic dehydration preserves the wholesomeness of food. The major benefits of the osmotic dehydration technology are quality improvement, colour and flavour retention, energy saving. The product is nutritious, less bulky has better shelf life and can be used as healthy snacks or as an adjuvant with other dried fruits and nuts, suitable for all the sections of society, especially, children, women, mountaineers and defense forces.
- Osmotically dehydrated aonla segments are less acidic and astringent than fresh aonla and therefore are largely accepted by the consumers
- Mango fruit bar is a concentrated, dehydrated fruit product with good nutritive value,

PROCESSING AND VALUE ADDITION

BEVERAGES & READY-TO-SERVE JUICES



- Beverages and RTS juices having more fruit and no artificial flavour or colour, minimal chemical preservatives, are economical and suitable for cottage level industry.
- Beverages of mango, grapes, pineapple, banana, papaya, custard apple and passion fruit.
- Blended beverages using different fruits, such as amla and bottlegourd, passion fruit with guava, banana, bael, pineapple; banana blended with lime, pineapple and grapes.
- Nutritional enrichment of beverages of cherry and kokum with mango, grapes, jack fruit and banana; and banana with noni.
- Screening of varieties of fruits and vegetables suitable for preparation of beverages, juices, dehydrated or frozen products.

PROCESSING AND VALUE ADDITION

DEHYDRATED PRODUCTS



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

DEHYDRO-FROZEN PRODUCTS



Protocols for preservation of vegetables through freezing standardized for carrot, peas, beans and okra; and dehydro-freezing for fruits - mango slices, pineapple and papaya.

CULINARY PASTES



Culinary pastes from onion, garlic, ginger, green chillies, and sauces from tamarind and lime have been developed. Bread spreads from avocado paste prepared.

CULINARY PASTES



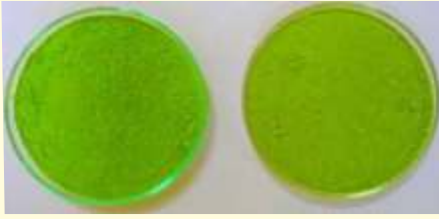
Crushed tomatoes retain peel and seeds in the processed product. The product has a good colour and consistency, is acidic, rich in ascorbic acid and lycopene, a well known potent antioxidant.

CULINARY PASTES



Using hurdle technology high moisture, intermediate, fresh like products with shelf life of 4-6 months have been developed in fruits - mango, sapota and Guava.

VALORIZATION OF HORTICULTURAL WASTE



- Crop residues of cabbage, cauliflower and chillies (47.35%, 31.48% and 42.65% of total biomass respectively), can be used to substitute 5-7% of refined wheat flour (maida) with clean and residue free cabbage or cauliflower leaf powder.
- Supplementation with these crop residues enhanced carotenoids, proteins and fibre in baked food products like bread, biscuit and rusk by 2-5 folds.

Paddy straw waste after harvesting mushrooms when used for briquetting, yielded 2.5 kcal/g energy - a good fuel source.



CARROT POWDER



FORTIFIED PASTA



BANANA STEM POWDER

- Carrot powder had total carbohydrate - 42.33%, protein - 5.29%, crude fibre - 8.61%, vitamin C - 25.96 mg%, total carotenoids - 46.94 mg% and antioxidants - 228.75 mg%.
- Banana stem powder had total carbohydrate - 47.75%, protein 3.43%, crude fibre - 16.65%, vitamin C - 178.20mg% and antioxidants 878.35 mg%.
- Pasta prepared from 10% carrot + banana stem powder mix (1:1) and 90% semolina showed good sensory attributes, and had 71.7% carbohydrates, 1.5% protein, 9.25% fat, 1.15% crude fibre, 7.52 mg% Vitamin C, 1.28 mg% total carotenoids and 28.9 mg% antioxidants.

• Cold break method of tomato processing yielded 8.31% peels, hot break method yielded 9.44%. Enzymatic pre-treatment followed by incubation yielded 56.72 mg to 43.98 mg of lycopene/ 100g wet peel.

• Fruit/ vegetable beverages, tomato soup & juice were fortified with lycopene extracted from tomato peels; fortification with 15-30 mg/kg significantly increased the nutritive value and antioxidant capacity of the final product.



WATERMELON RIND CANDY

By products of water melon rind, normally discarded, have been used to produce candy and pickles.

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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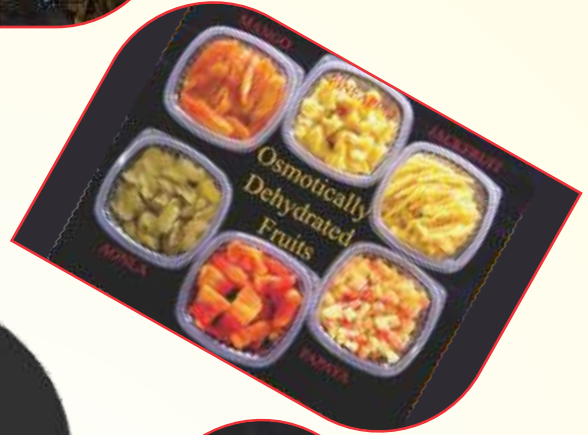
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