

COMMERCIALIZATION OF HYBRID VARIETIES/TECHNOLOGIES

1. MAIZE HYBRIDS

PMH 1

Recommended ecology

Suitable for high fertility irrigated conditions for *Kharif* & spring seasons in Punjab and *Kharif* season in Zone II (Punjab, Haryana, Delhi and western UP)

Characteristics

- 95 days to mature
- Yellow orange flint grains
- Plants stay green at maturity
- Seed production is very good

Performance result

Average grain yield: 52.5 qha⁻¹ in Punjab
67.4 qha⁻¹ in Zone II*



PMH 1

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Head, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004 (Punjab) (0161-2401960, Ext. 224)

* Yield data from research trials only

PMH 2

Recommended ecology

Suitable for medium fertility, limited irrigation and rainfed conditions for *Kharif* & irrigated conditions of spring seasons in Punjab

Characteristics

- Yellow orange flint grains with yellow caps
- Short duration- Irrigated: 83 days
Rainfed: 82 days
- Drought tolerant
- Tolerant to lodging and bacterial stalk rot

Performance result

Average grain yield: 45 qha⁻¹ in Irrigated,
41.3 qha⁻¹ in Rainfed conditions



PMH 2

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Head, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004 (Punjab) (0161-2401960, Ext. 224)

PMH 3

Recommended ecology

Suitable for high fertility irrigated conditions for *Kharif* season in Zone II (Punjab, Haryana, Delhi and western UP)

Characteristics

- Long duration: 90 days
- Attractive orange flint grains
- Plants stay green at maturity

Performance result

Average grain yield*: 75 qha⁻¹

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

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PMH 3

* Yield data from research trials only

PMH 4

Recommended ecology

Suitable for irrigated conditions of *Kharif* seasons in Zone II (Punjab, Haryana, Delhi and western UP)

Characteristics

- Medium duration: 88 days
- Yellow orange flint grains with yellow caps on dorsal side
- Tolerant to major diseases like Maydis Leaf Blight, Erwinia Stalk Rot and Brown Stripe Downy Mildew
- Resistant to lodging

Performance result

Average grain yield: 83 qha⁻¹ in Zone II*

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Head, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004 (Punjab) (0161-2401960, Ext. 224)



PMH 4

* Yield data from research trials only

PMH 5

Recommended ecology

Suitable for rainfed conditions of *Kharif* (rainfed) season in Zone V (Rajasthan, Madhya Pradesh, Gujarat and Chhattisgarh)

Characteristics

- Short duration: 84 days
- Orange red flint grains with caps on dorsal side
- Tolerant to major diseases like Maydis Leaf Blight, Erwinia Stalk Rot and Brown Stripe Downy Mildew
- Moderately tolerant to drought stress

Performance result

Average grain yield: 58.9 qha⁻¹ in Zone V*

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
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Source of availability of material

Head, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004 (Punjab) (0161-2401960, Ext. 224)



PMH 5

* Yield data from research trials only

PMH 7

Recommended ecology

Suitable for irrigated conditions of spring season in Punjab

Characteristics

- Short duration: 115 days
- Attractive shinning deep orange flint grains
- Moderately tolerant to high temperature stress
- Moderately tolerant to post flowering stalk rots
- Moderately tolerant to shoot fly

Performance result

Average grain yield: 75 qha⁻¹

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Head, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004 (Punjab) (0161-2401960, Ext. 224)



PMH 7

2. SUNFLOWER HYBRID

PSH 996

Characteristics

- Suitable for growing in spring season
- Recommended for high fertility irrigated conditions
- Medium duration, medium tall hybrid having high seed and oil yield potential
- Leaves are many, simple, medium green, large and cordate



PSH 996

Performance result

Seed yield: 1951 kg ha^{-1}

Oil yield: 899 kg ha^{-1}

Other information

- Early maturing, less plant height than the private sector hybrids grown currently in the spring season
- Farmers can get more profit by sowing this hybrid
- Highly responsive to high fertility irrigated conditions

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004(Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Oilseed section, Department of Plant Breeding and Genetics, PAU, Ludhiana-141004 (Punjab)
(0161-240196, Ext. 224)

3. BAJRA HYBRID

PHB2168

Characteristics

- Recommended at State and National level
- Plant Height: 210 cm
- 2-3 productive tillers
- Long ears having average length 26 cm and girth 9 cm
- Matures in 83 days



PHB 2168

Performance result

Average grain yield: 41 q ha^{-1}

Other information

- Good quality grains (10.3% protein and 5.2 % fat)
- Grains are medium bold and slate in colour
- Resistant to downy mildew

Status of commercialization

Potential hybrid for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Head, Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004 (Punjab) (0161-2401960, Ext. 224)

4. BRINJAL HYBRID

PBH 3

Characteristics

- F₁ hybrid of small-round group
- Gives high yield in early pickings
- Fruit size small-oblong
- Fruit shining purple
- Fruits borne in clusters

Performance result

Average fruit yield: 257 qacre⁻¹

Other information

- Wider adaptability
- Identified under All India Coordinated Research Project Trials for zone IV (Bihar, UP, Trai Area of UK, Punjab) and Zone VI (Delhi, Haryana, Rajasthan, Gujarat)

Status of commercialization

Commercialized

Contact details

Director of Research, Punjab Agricultural University, Ludhiana- 141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material

Head, Dept. of Vegetable Science, PAU, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 370)



PBH 3

5. CHILLI HYBRID

Chilli Hybrid 27

Characteristics

- Plants light green, spreading and tall
- Fruits medium long (6 cm), pendent, light green when immature and deep red when mature
- Fruits rich in colouring matter and pungent
- Suitable for processing/ powder making

Performance result

Red ripe fruit yield potential: 90 qacre⁻¹

Other information

- Resistant to leaf curl virus
- Moderately resistant to dieback and root knot nematodes
- Tolerant to aphids, thrips and yellow mites

Status of commercialization

Trials over, recommended for commercialization

Contact details

Director of Research, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 216)

Source of availability of material


Head, Dept. of Vegetable Science, Punjab Agricultural University, Ludhiana-141004 (Punjab)
(0161-2401960, Ext. 370)



Chilli Hybrid 27

6. BIOFERTILIZERS FOR LEGUMINOUS CROPS AND SUGARCANE

- ❖ Bio fertilizers: *Azotobacter*/Consortium (for sugarcane) and *Rhizobium* (for berseem, lucerne, pea, lentil, moong, gram, soybean and pigeon pea)



PAU
***Rhizobium* bioinoculant**
(For One Acre)

Nitrogen fixation by *Rhizobium* in leguminous crops

Crop Date of expiry

Method of Application

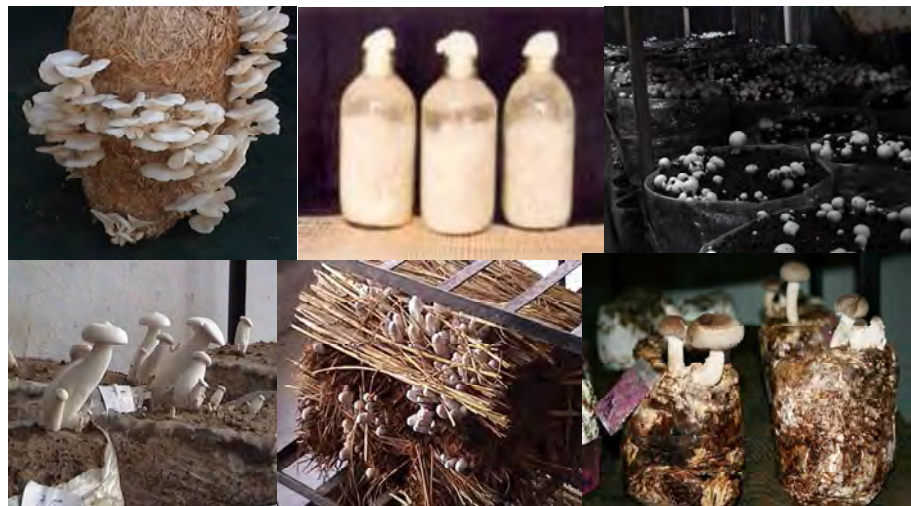
1. Dissolve the contents of biofertilizer packet (250 gm) in half litre of water to make a slurry.
2. The seeds required for an acre are mixed in the slurry so as to have uniform coating of the inoculant over the seeds.
3. The seeds are then dried in shade for 30 minutes.
4. Treated seeds should be sown within 24 hours.
5. Biofertilizer packet should be opened at the time of seed treatment.
6. Biofertilizer packet should be protected from direct sunlight and heat.

Address for enquiry: Department of Microbiology,
Phone: 0161-2453867, 0161-2401960-65/330)

PUNJAB AGRICULTURAL UNIVERSITY
(LUDHIANA- 141004 (PUNJAB))

7. LICENSING OF MUSHROOM VARIETIES/STRAINS FOR YEAR AROUND CULTIVATION

Low cost technology for round the year cultivation of recommended varieties of mushrooms



8. TECHNOLOGY FOR THE PRODUCTION OF NATURAL VINEGAR

Vinegar (Sugarcane and Grapes)



1. Specifications and salient technical features
A two-step fermentation process for production of natural vinegar from sugarcane and grape juices, which involves controlled batch scale 28 days fermentation by specific inoculant microbial cultures (available with the department). It requires 25-28 days to produce vinegar.
2. Performance results
Natural vinegar (at least 4% volatile acidity) is produced in 28 days under the batch fermentation conditions.
3. Cost
A 750 ml of bottle costs ₹50-55/- (sugarcane juice @ ₹13-15/L) for sugarcane vinegar.
A 750 ml of bottle costs about ₹100/- (grape juice @ ₹30/L) for Grape vinegar.
4. How the new technology will impact the income of the farmers and its benefits over conventional system in terms of savings in cost of operation, inputs, timeliness and other pertinent information
 1. The technology provides a culture specific fermentation process for natural vinegar production as the vinegar prepared by rural masses is a ruggid, unhygienic let alone process which takes about 4-6 months to complete and many a times suffers from contamination by unwanted microflora.
 2. Perlette grapes are available in plenty in Punjab but due to their low shelf life, get spoiled easily and thus don't fetch good market price. The fermentation of perlette grapes for vinegar production will help in natural preservation of their nutraceutical constituents thus making their use in household throughout the year.
5. Social/environmental/other benefits
The scaled up technology developed will help consumers (farmers and entrepreneurs) in harnessing benefits of useful components of natural juice as well as those accruing from fermenting organisms besides providing a cost effective means for natural vinegar production from sugarcane and grapes.
6. Contact details of person to whom technology and further details can be held
Head, Dept of Microbiology, Punjab Agricultural University, Ludhiana-141004 (Punjab)
7. Sources of availability
Sugarcane and grape vinegars and inoculant cultures are sold by the Department of Microbiology, Punjab Agricultural University, Ludhiana @ Rs. 20 and Rs 30/200 ml bottles and Rs 200/set of inoculant culture, respectively.

9. DRINKING WATER TESTING KIT.



1. Specification and Salient technical features	A defined substrate method in bacteriological water testing kit (BWTK) has been developed to recover and detect the presence/absence of total coliforms and emerging pathogens from drinking water without the need for the confirmatory or complete tests. This method is based on technology that uses a hydrolysable substrate as a specific indicator- nutrient for the target microbes.
2. Performance results	To perform the test, one has to add water to the ingredients in the BWTK and incubate at room temperature for 48hrs. Specific color changes denote the presence of the target microbe (s).
3. Cost	₹40 per kit
4. How the technology will impact the income of the farmers and its benefits over conventional system in terms of saving in cost of operation, inputs, timeliness and other pertinent information	There are number of advantages of BWTK over conventional method like to perform the test, one need only to add water to the kit and incubate. No other equipment is required than incubator if faecal coliform at 44.4°C are to be detected. Specific color changes denote the presence of the target microbe(s). Only the target microbes (Emerging pathogens), Total coliforms and <i>Escherichia coli</i> , produce color changes during the incubation period. In conventional methodology (MPN and MF), transfers from the original positive tube or plate must be made into lactose broth for confirmatory testing and a second transfer must be made to solid or liquid medium for a completed test. Where as in BWTK, <i>E.coli</i> can be detected by adding few drops of Kovac's reagent directly into the positive kit, pink coloration shows the presence of <i>E.coli</i> and other emerging pathogens can be detected by pellicle, turbidity ,color and by directly streaking on selective media and faecal coliforms can be detected by incubating kit at 44.4°C
5. Social/environmental/ other benefits	BWTK is cost effective and economical than other <i>Standard Methods</i> . The participants felt that the major cost saving associated with the test lies in decreased labor and better quality control. So the advantages of BWTK over conventional method are- it does not require confirmatory tests, promotes growth of injured coliforms and emerging pathogens, easy to inoculate, and to interpret. Color production is directly related to the growth of the target bacteria.
6. Status of commercialization/ IPO rights	Bacteriological assessment of the quality of drinking water by presence/absence test of total coliforms by BWTK has been recommended by REC,PAU (209 th Meeting).
7. Special features required	Autoclave, developed media, glass kits, sealer, labour

10. HONEY HEATING-CUM-FILTRATION PROCESS TECHNOLOGY

Type of Technology	:	Equipment
Technology developed	:	Honey Heating-cum Filtration System
Application/ Use	:	This heating-cum-filtration system saves time and ease the cumbersome process under hygienic conditions as both the processes are achieved simultaneously in one unit. This unit will be helpful for both the entrepreneurs as well as bee keepers.

Description of Technology

This is a fully mechanized Honey Filtration Unit with separate heating and filtration arrangements having two separate sensors for sensing and controlling the temperature of heating water as well as honey in the main chamber. It consists of two sections; the top heating section and the lower filtering section. The heating section consists of a double walled cylinder and two electric heating elements, each of 2 KW fixed in the space in between the outer and inner cylinder filled with water which is heated by heating element provided. In addition a separate pipe is provided for filling/ un-filling of water in/from the system which is attached with a tullu pump for re-circulating the water causing turbulence, thus maintaining uniform temperature of water used for indirect heating of honey. In order to have uniform temperature profile throughout the heated honey an electrically operated six fins stirrer was attached which is operated by 0.25 hp motor, stirring the sample at optimum speed as and when required. 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 section consists of the stainless steel cylinder having lid of four layered muslin cloth.

Input/raw material	:	Honey
a) Overall dimension	:	686×686×1524 mm
b) Weight	:	110 kg
c) Prime mover	:	Electric Power
d) Power	:	4 kW
e) Man power	:	1
f) Land	:	1x1m
g) Investment	:	₹35,000
Output capacity	:	50 Kg batch ⁻¹
Unit cost (per machine)	:	₹35,000
Suitability for crops/commodity	:	Honey
Efficiency	:	N.A
Unit cost of operation	:	₹0.50 kg ⁻¹
Patent obtained/applied	:	Nil
Commercialization status	:	In process of commercialization
(a) No. of Licensees to whom the technology has been transferred	:	Nil
(b) Selected Addresses of Licensee / Manufacturer and contact person	:	Head, Department of Processing and Food Engineering, College of Agricultural Engineering, Punjab Agricultural University Ludhiana-141004

11. FARM LEVEL FRUIT AND VEGETABLE WASHING MACHINE

Type of Technology	:	Equipment
Technology developed	:	Farm level fruit and vegetable washing machine
Application/ Use	:	A wide range of fruits (kinnow and pears) and vegetables (carrot, potato, reddish, turnip, ginger, okra, tomato, spinach and turnip) can be mechanically washed and can replace the prevalent practice of washing which involves drudgery and unhygienic conditions. This machine can be used both by the producer as well as by a processor.

Description of Technology

A stainless steel, portable, electric power (1 hp) operated vegetables washing machine has been designed, developed and evaluated. The inner rotary drum of the washer is made of stainless steel with 1.5 mm thickness, 760 mm length and 620 mm diameter. The periphery of the drum is provided with perforations of 6 mm diameter each @ 20 per 100 cm. The drum is mounted between two bearings through a hollow shaft and stainless steel pipe carrying water is placed inside the shaft. Pressurized sprays of water with a water injection pump through the central, perforated inner shaft is provided for extensive washing. The machine is provided with a timer and an electronic device to regulate precisely the rotational speed of the drum upto 60 rpm. Proper arrangement for feeding water into machine and draining out dirty water and silt is provided. Rotating parts and moving belts are covered with guard for operational safety.

Input/raw material	:	Carrot, potato, radish, turnip, ginger, okra, tomato, spinach, turnip, kinnow and pears.
Overall dimension	:	860 × 760 × 1140 mm
Weight	:	200 kg
Prime mover	:	Electric motor
Power	:	1 hp
Man power	:	one
Land	:	4 m × 4 m
Investment	:	₹50,000-₹70,000 (for different capacity model)
Output capacity	:	1-6 qph
Unit cost (per machine)	:	₹50,000-₹70,000 (for different capacity model)
Suitability for crops/commodity	:	Carrot, potato, radish, turnip, ginger, okra, tomato, spinach, turnip, kinnow and pears.
Efficiency	:	90.2-95.5% (Washing efficiency)
Unit cost of operation	:	₹1-₹10 q ⁻¹
Patent obtained/applied	:	Nil
Commercialization status	:	Commercialized
a) No. of Licensees to whom the technology has been transferred	:	This machine has been approved by the Research Evaluation Committee, PAU.
b) Selected Addresses of Licensee/Manufacturer and contact person	:	Head, Department of Processing and Food Engineering, College of Agricultural Engineering, Punjab Agricultural University Ludhiana-141004 (Punjab)

12. TECHNOLOGY FOR MASS PRODUCTION OF TRICHO-CARDS FOR BIO-CONTROL OF SUGARCANE AND MAIZE BORER

The success of Integrated Pest Management (IPM) programs is strengthened by the compatibility of chemical and biological control methods used in the system. Trichogrammatid egg parasitoids are the key mortality factors of tissue borers. Two species, *Trichogramma chilonis* and *T. japonicum* are widely distributed and attack sugarcane borers viz. early shoot borer(*Chilo infuscatellus*), top borer(*Scirpophaga excerptalis*), stalk borer(*Chilo auricilius*) and maize borer (*Chilo partellus*) throughout the country. Inundative release of these parasitoids has been attempted in many parts of the country including Punjab and the demand for these parasitoids has increased.

Commercialization of Biological Control agents

To overcome resistance problem and also to meet the demand of international market, for producing good quality agro products, now more stress is on pesticide-free produce. The release of mass-produced egg parasites of the genus *Trichogramma* to control lepidopterous pests has gained increasing attention in the last few years. In recent years, PAU has identified and recommended the use of *Trichogramma*, an egg parasitoid for its potential use in biological control programme in sugarcane and maize crops and these practices can fit in an IPM programme.

Mass production of natural enemies has seen fast development during the past three decades: the numbers produced have greatly increased, the spectrum of species available has widened and mass production methods have clearly evolved. Developments in the area of mass production, quality control, storage and release of natural enemies have decreased production costs and led to better product quality, but much more can be done. If this technology is commercialized, trichocards can be produced on larger scale to cater to the needs of farmers involved in sugarcane and maize farming.



Exposure to *Trichogramma*



Trichocard



Trichocards packages



Trichocard strips

Mass production of *Trichogramma*



Field release of Trichocards

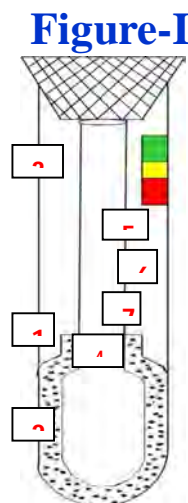
13. PAU TENSIO METER

Rice occupies a sizeable area (27 lakh ha) in Punjab thereby consuming about 65 per cent of total irrigation water. The continuous decline in water table in the state is mainly due to the pumping out of irrigation water for rice. Efforts are being made to make judicious use of irrigation water to different crops. The rice crop being a big water guzzler, it was felt to devise irrigation water saving soil-specific technique. The four year experimentation in a sandy loam soil showed that rice crop when irrigated at a soil matric potential of -200 cm, consumed about 30 per cent lesser irrigation water compared to the existing practice of irrigating 2 days after complete infiltration of water into the soil. At the same time the rice grain yield remained at par with that with existing practice of scheduling irrigation. The major advantage of this technique is that water requirement being a function of soil type, climate and stage of plant growth; it can be used in all types of soils. The soil matric potential is measured with an instrument called "Tensiometer". The gauge type tensiometer available in the market being costly and not-so-user friendly was replaced with a simple PAU tensiometer. This simple instrument developed by PAU is easy to use, inexpensive and useful tool for scheduling irrigation to rice.

The PAU tensiometer is a simple and innovative device which indicates the status of water in the soil. It has been developed at PAU in the Department of Soil Science. This is very simple, cheap, and sturdy and can withstand hot climatic conditions. It has been standardized and tested at different levels of water in the soil which may be sufficient for rice crop without affecting its yield. It can be used by the farmers for scheduling irrigation to rice. The water in the inner tube of the tensiometer equilibrates with the surrounding soil through porous ceramic cup and the level of the water in the inner tube indicates the water status of the soil. The colours designed on the outer tube of the tensiometer body guides the farmers for scheduling irrigation to crops. The irrigation to rice is recommended when the water level reaches the bottom of the green strip or just enters into the yellow zone. It is applicable under all soil textural and weather conditions and irrigation methods.

Figure-I: Schematic diagram of a simple, user-friendly field tensiometer for soil moisture studies

1. Inner smaller diameter polyacrylic tube
2. Ceramic porous cup
3. Silicon cork
4. Outer bigger diameter polyacrylic tube
5. Green strip (Low soil matric tension)
6. Yellow strip (Medium soil matric tension)
7. Red strip (High soil matric tension)



PAU Tensiometer

14. TECHNOLOGY FOR THE PRODUCTION OF 'ROYAL JELLY' FROM EUROPEAN HONEY

Royal jelly is a mixture of secretions from hypopharyngeal and mandibular glands of nurse bees mixed in a ratio of 1:1. It is very nutritious, milky white fluid with creamy consistency which is fed by nurse bees to all gyne larvae throughout this stage and for life long to adult queen bee. It is rich source of organic fatty acids, minerals, vitamins and amino acids.

Year round Royal Jelly production

Year round royal jelly production technique standardized at PAU, Ludhiana revealed that under the Punjab conditions, the annual royal jelly production potential is 823.80 g per colony.

During spring, summer and monsoon seasons, employ 20 bee-frame strength queen-right cell builder colonies and fed with vitamin B₆ supplemented PAU pollen substitute. Use 90 graftsin primed PVC cell cups for royal jelly production.

During winter, honey bee 20 bee-frame strength queen-right cell builder colonies under crowded conditions i.e. 20 bee-frames on 16 combs be used, while during autumn even 10 bee-frame strength colony can be used for the royal jelly production.

15. TECHNIQUES OF EXTRACTION OF NATURAL DYES FROM PLANT SOURCES

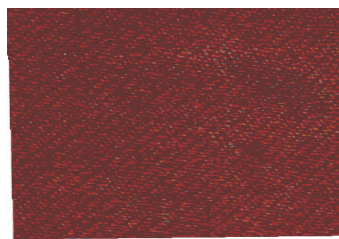
Potential Technology	Dyeing of different substrate (cotton, wool, silk) using natural plant sources.
Product	Natural dyes.



Kachnar



Kilmora



Madder

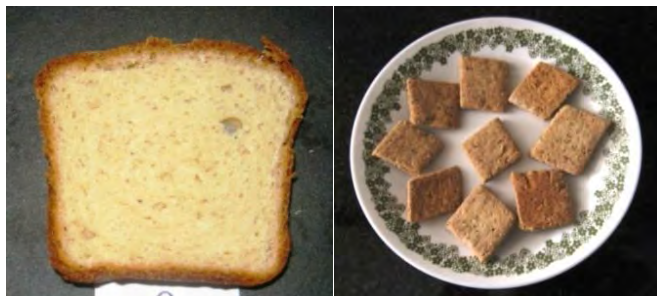


Red Silk cotton tree



Walnut

16. HIGH FIBRE BREAD AND BISCUITS



The low GI bread prepared from refined flour and soy flour has GI of 52 against the GI of 93.7 for refined flour bread. Similarly, the low GI salty biscuits made from refined flour, barley and soy flour in appropriate proportions have GI of 38.7 against the GI of 83.7 for biscuits prepared from only refined flour. The low GI bread and biscuits are designed especially for diabetic patients.

17. MULTI FRUIT JUICE PRODUCTION

Two or more juices were mixed to yield balanced flavoured, highly palatable and refreshing drinks. Juices were blended so as to utilize sweet fruits (grapes, pomegranate, mango, and beetroot), acidic fruits (lemon, plum, jammun, kinnow, tomato etc), bland fruits (papaya, pear, and apple) and strongly flavoured (guava) fruits. The standardized bottled multi-fruit juice blended juices packed in 200 ml/ 650 ml bottles, processed for 30 minutes can be stored for six months at ambient room temperature.

18. LINSEED/FLAX SEED BASED WHOLE GRAIN FOOD PRODUCTS

Linseed/Flaxseed has recently gained attention as a functional food ingredient because of its unique nutrient profile and potential to affect the risk and course of cardiovascular diseases and some cancers. The main components of flaxseed expressed on moisture free basis are 21% protein, 28% dietary fiber, 41% fat. Flaxseed has high poly unsaturated fatty acid (PUFA), moderate in mono unsaturated fatty acid (MUFA) (18%) and low in saturated fatty acid (9%). Flaxseed also contains lignin which is a good source of soluble fiber. Whole wheat meal cookies, muffins and bread could be prepared.

19. MULTI GRAIN INSTANT PORRIDGES

Multigrain blends of wheat, mung bean, sorghum, barley, corn and flaxseeds were processed by three independent instantization treatments i.e. cooking, roasting and extrusion treatment, to produce instant multigrain porridge. Multigrain blends can be instantized into an acceptable and nutritional, traditional breakfast food (porridge). During 5 months of storage period, instant multigrain porridge is acceptable range with respect to sensory attributes.

20. EXTRUDED SNACK FOODS

Extrusion is a versatile technology to produce shelf stable snack foods from various blends to have convenient as well as nutritious servings. It is a low cost processing and great number of attractive food products can be made using abundant available raw material of different grains in the State. A great number of products with added health benefits after incorporation of functional ingredients from fruits and vegetables could be prepared for school feeding programmes which have long shelf life, easy to carry, store, transport and consumption.

21. VEGETABLE PLUCKER (TESTED AND MODIFIED)

- i. Purpose: For Plucking Vegetables
 - Designed for plucking of vegetables especially *Ghia*, *Tori* and *Tar*.
- ii. Use:
 - Saves labor and time.
 - Reduces finger injury, as fingers do not come in direct contact with the vegetable.
 - It is easily available in market.
 - Less risk of injury.
 - Minimizes grip stress.
 - Low cost.
- iii. Specifications:
 - Highly efficient for sharp and smooth cutting.
 - Light in Weight and very convenient to use.
 - Blades are made of high carbon Steel.
 - Can be put to any finger making the hand free for holding more vegetables



22. OTHER COMMERCIALIZED TECHNOLOGIES/VARIETIES

- i. Micro-propagation Protocols for sugarcane, potato, mentha and banana
- ii. Poly net house design for protected cultivation
- iii. Mushroom spawn production
- iv. Solar power drip irrigation
- v. Tomato hybrid TH-1

For further details you may visit the web link: www.pau.edu. Interested parties may contact the undersigned.

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