

Research Highlights

2016-17



ICAR-AICRP on Post Harvest Engineering & Technology
ICAR-CIPHET, Ludhiana-141004. Punjab.

<http://aicrp.icar.gov.in/phet/>

ICAR-AICRP on Post Harvest Engineering & Technology

ICAR-CIPHET, Ludhiana-141004. Punjab.

MAJOR ACCOMPLISHMENTS DURING 2016-17

(i) TECHNOLOGIES IMPROVED/DEVELOPED

(a) Post-harvest tool/equipment/structures

1. PKV mini dal mill (3 hp & 5 hp) (Akola)
2. Semi-automatic jaggery making unit for the preparation of solid jaggery (Anakapalle)
3. Modified starch based edible films making machine (Anakapalle)
4. Modified Multipurpose ANGRAU Polyhouse Solar dryer (Bapatla)
5. Microprocessor controlled On-farm aeration bin (Bapatla)
6. Improved tamarind dehuller (1 ton/h) (Bangalore)
7. Pongamia decorticator (250 kg/h) (Bangalore)
8. Turmeric washer (Coimbatore)
9. Mechanical turmeric dryer (Coimbatore)
10. Mobile flaying cradle for flaying of food animals (Chennai)
11. Carrot washing-cum-dehairing machine and Grader (Hissar & Ludhiana)
12. Low cost pack house structure (Hisar)
13. Pedal operated maize shelling machine(Hisar)
14. Bamboo shoot peeling machine (Imphal)
15. Dehusker for minor millet (kodo) (Jabalpur)
16. Storage structure for green gram in high moisture environment (Jorhat)
17. Solar dryer for groundnut pod (Junagadh)
18. Coconut shell removing machine (Kasargod)
19. Improved coconut dehusker (Kasargod)
20. Arecanut deshelling machine (Kasargod)
21. Solar dryer for meat and meat products (Khanapara)
22. Semi-continuous mango pulper (Kharagpur)

23. Prototype of potato pre-conditioner – for accelerated conditioning of potatoes taken out from cold storage (Kharagpur)
24. Waffle shaped potato slicer (Kharagpur)
25. Low cost frequency based sensor for non-destructive inspection of food adulterants (Kharagpur)
26. Coating application machine for minimally processed agricultural produce (carrots) (Ludhiana)
27. Percussion based gadget for quality management of stored grains and their milled products (Ludhiana)
28. Gender friendly refrigerated fish vending and display unit using solar energy (Mangalore)
29. Continuous type ohmic heating unit for liquid foods (Pusa)
30. Solar dryer for drying of meat and offals (Raichur)
31. Chironji decorticator (Raipur)
32. Hydraulic tamarind briquetting machine (Raipur)
33. Mechanical apple seed corer (Solan)
34. Mechanical apple seed extractor (Solan)
35. Hand held mechanical apple seed peeler, corer and slicer (Solan)
36. Walnut cracker (hand and power operated) (Srinagar)
37. Improved water chestnut decorticator (Srinagar)
38. Women friendly multipurpose seed extractor for ash gourd, cucumber and pumpkin (Tavanur)
39. A jackfruit corer cum peeler (Tavanur)
40. Continuous cocoa pod breaker (Tavanur)
41. Electronic starch indicator (Under DST project) (Thiruvananthapuram)
42. Improved motorised chipping machine (Thiruvananthapuram)
43. Fruit ripening prototype using organic sources (Udaipur)

(b) Process protocol and products

1. Process for making compressed jaggery cubes to use in beverages (Anakapalle)
2. Process for preparation of jaggery chocolates, jaggery cookies, jaggery cakes and jaggery coated saunf, dried amla and ginger (Anakapalle)
3. Foxtail millet based One-Dish-Meal instant mix (Bangalore)

4. Fermented beverages from banana pseudo-stem (Bangalore)
5. Process for extraction of collagen from chicken skin (Chennai)
6. Process for extraction of chondroitin sulphate from trachea and ear of beef carcasses (Chennai)
7. Technology for extraction of food enzyme from selected oil cakes (Coimbatore)
8. Technology for the production of ready to eat milky mushroom curry (Coimbatore)
9. Soybean-okra enriched peda sweet (Hisar)
10. Carrot greens enriched pearl millet based product (Hisar)
11. Spray drying of soya milk (Hisar)
12. Pineapple RTS, Jam, squash and osmo-dehydrated rings (Imphal)
13. Extruded products of maize, dhal mill by product (Jabalpur)
14. Extrudates and pasta from coconut milk residue and virgin coconut oil cake (Kasargod)
15. Novel Technology for production of restructured pork ham (Khanapara)
16. Solar dried meat balls and meat cubes (Khanapara)
17. Innovative meat snack '*Meat Jalebi*' (Khanapara)
18. Pork nuggets with natural humectants and antioxidant for extended shelf life (Khanapara)
19. Protein iron enriched goat meat powder with indigenous herbs of Assam (Khanapara)
20. Technology of conversion of Silica to silicon (Kharagpur)
21. Technology for production of mango/jackfruit leather by Refractance Window drying (Kharagpur)
22. Protocol for Organic Jaggery Production (Kolhapur)
23. An algorithm for feature extraction from acquired images of different grades of kinnow captured by CCD camera (Ludhiana)
24. Shelf life enhancement of minimally processed black carrot using diffusion barriers. (Ludhiana)
25. Production of silage using seafood industry waste for poultry feed (Mangalore)
26. Production of fish oil concentrate rich in Omega 3 fatty acids (Mangalore)
27. Preservation and handling techniques for porcine skin for production of biological bandages (Mumbai)
28. Protocol for extraction of Chondroitin Sulphate from cartilage of buffaloes (Mumbai)
29. Process protocol for Extraction of Collagen from animal and poultry (Mumbai)

30. Drying and milling processes for *Asthama* plant (Raichur)
31. Supercritical fluid extraction of phyto-chemicals from *Asthama* plant (Raichur)
32. Packaging technology for the split pulses to protect from insect infestation (Raichur)
33. Technology for starch production from tikhur rhizomes (Raipur)
34. Modified atmosphere storage of important fruits and vegetables of Jharkhand State. (Ranchi)
35. Osmo-dried plum, kiwi and apricot (Solan)
36. Beverages from the hypertonic solution (Solan)
37. Protocol for storage of fresh ginger rhizomes under low cost storage structures (Solan)
38. Process for isolation of kiwi fruit enzyme (Solan)
39. Analog of petha from sand pear (Solan)
40. Ginger based sweet and snack foods (Solan)
41. Thiamine rich brown rice based extrudates (Srinagar)
42. Retort pouch packaging of tender jackfruit (Tavanur)
43. Vacuum drying of ripened deseeded jackfruit bulbs. (Tavanur)
44. Microencapsulation of papaya leaf extract (Tavanur)
45. Health mix from banana, rice, ragi flour and sugar(Tavanur)
46. Green particle board using cassava starch (Thiruvananthapuram)
47. Moisture resistant adhesive from cassava starch (Thiruvananthapuram)
48. Cassava starch based thermoplastic sheet (Thiruvananthapuram)
49. Alkali free corrugating adhesive mix (Thiruvananthapuram)

(c) Pilot Plants

1. Pilot plant for extraction of pectin from kinnow peel (Ludhiana)
2. Pilot plant for production of probiotic fruit juices (Ludhiana)
3. Pilot plant for osmotic dehydration (Solan)
4. Pilot plant and value chain for virgin coconut oil and coconut chips (Kasargod; likely to be completed by March 2017)

(ii) TECHNOLOGY TRANSFERRED/ADOPTED

<i>Centre</i>	<i>Name of the technology</i>	<i>No. of licenses</i>	<i>No. of units sold</i>
Almora	Vivek millet thresher-cum-pearler	9	55
	VL paddy thresher	1	50
Anakapalle	Mechanized jaggery granulator	1	-
	Process for making Jaggery Coated Saunf	1	-
Bangalore	Jackfruit Value Added Product Technologies	1	-
	Manual Arecanut Dehusker	-	5
	Coconut Dehusker (Foot Operated)	-	11
	Mango Harvester	-	46
	Sapota Harvester	-	7
Bapatla	Dhal mill	-	4
	Turmeric steam boiler	-	5
Coimbatore	Improved mini dhal mill	-	13
Hisar	Jaggery unit	1	-
	Honey filtration	1	-
Jabalpur	Water chestnut decorticator	1	2
Junagadh	Extraction of pectin from mango peel	1	-
Kasargod	Virgin coconut oil (VCO) by hot process	15	-
	Coconut chips	12	-
	CPCRI developed machineries	1	-
	Shell fired copra dryer	-	1
	Coconut deshelling machine	-	1
	Coconut grating machine	-	1

Kolhapur	Liquid Jaggery Production Technology	5	-
	Boiling pan and Pre Heating Pan (SS)	1	2
	Collection and storage tanks, with accessories	1	2
	Organic Jaggery Production Technology	1	-
	Powder Jaggery Production Technology	1	-
	Juice clarification technique	1	-
Ludhiana	Honey-heating-cum-filtration system	-	5
Mangalore	Dried Masala coated Anchovies using Solar Drier	3	-
	Fish vending and Display Unit	1	-
Mumbai	Model Retail Outlet for Hygienic Chicken Meat Production	1	-
Raichur	Solar Tunnel Dryer	-	4
Raipur	Mechanization of <i>tikhur</i> starch extraction	12	-
Solan	Osmodried destoned plum fruits	3	-
	Osmodried destoned apricot fruits	3	-
	Analog of petha from sand pear	3	-
	Value added chain of mushroom	2	-
Tavanur	Women friendly multipurpose seed extractor	4	-
	Process protocol for canning of tender jackfruit	1	-
	Banana Flour Based Ethnic Health Mix	1	-
Thiruvananthapuram	Production of fried snack foods	2	-
	Cassava chipping machine	3	8
	Cassava harvester	2	14
Total		96	236

(iii)PATENTS

Patents Granted

1. Coconut Testa Removing Machine. No. 278013 dated 08.12.2016 (Kasargod)
2. Pedal operated machine for pricking fruits and vegetables. No.3381/DEL/2014 A (Hisar)

Patents Filed

1. Design of starch based edible films making machine. Application no. 3815/CHE/2016 (Anakapalle)

(iv)AWARDS

1. Dr. Mahindra Pal award conferred to Dr. D.P. Kshirsagar for Best Research in Zoonoses at XIV Annual Conference of Indian Association of Veterinary Public Health Specialists (IAVPHS) & National Symposium on “Innovative approaches to promote food safety and reduce the Risk of zoonotic diseases in changes” (21-22 November 2016) at Udaipur Rajasthan
2. Young Scientist Award conferred to Dr. Darshan, M. B., Assistant Research Engineer, Bangalore Centre for his contribution in the field of Post-Harvest Engg. & Tech. by SSDAT, Meerut.
3. Young Scientist Award conferred to Dr. K. B. Suresha., Assistant Research Engineer, Bangalore Centre for his contribution in the field of Dairy Tech. by SSDAT, Meerut.
4. Young Scientist Award -2016 conferred to Dr. K. B. Suresha., Assistant Research Engineer, Bangalore Centre in IJTA 3rd International Conference on Agriculture, Horticulture and Plant Sciences held at New Delhi
5. Meritorious Research Scientist Award conferred to Er. S. Vishnu Vardhan, Scientist (AP & FE), Bapatla Centre during 48th Annual Convocation of ANGRAU.
6. Best Teacher award of Tamil Nadu Agricultural University (2015) conferred to Dr. C. Indurani, Coimbatore Centre.
7. Best Researcher award of Tamil Nadu Agricultural University (2015) conferred to Dr. S. Balakrishnan, Coimbatore Centre.

8. Best Research Paper award conferred to Dr. Udaykumar Nidoni (2016). Effect of active packaging materials on microbial characteristics of wheat flour bread during storage. 2nd International Conference on Food Properties-2016 at Bangkok, Thailand.
9. Best original paper award conferred to Dr. Shameena Beegum, Dr. M.R. Manikantan, Dr. Monika Sharma, Mr. M. Arivalagan, Dr. K.B. Hebbar and Dr. R.K. Gupta (2016). Optimization and evaluation of ready to eat extruded snack from virgin coconut oil cake. 3rd International Symposium on Coconut Research and Development held at ICAR-CPCRI, Kasaragod during 10-12 December, 2016
10. Best Poster Award was secured for the work published by Mangalore centre at International conference on emerging issues in quality and safety of fish and shellfish organised by TNAU, Chennai.
11. Best poster award conferred to Kalne, A., S. Patel, A.K. Geda, and P.K. Joshi (2016). Aloe vera processing an approach towards aloin removal and dehydration of gel. 50th Annual convention of Indian Society of Agricultural Engineers (ISAE) and Symposium on Agricultural Engineering in National Building: Contributions and Challenges held during 19-21, January 2016 at OUAT, Bhubaneswar, Orissa
12. Best poster award conferred to Mishra, N.K., S. Patel, R.K.S. Tiwari, D. Khokhar and P.S. Pisalkar (2016). Traditional method of bixin production from annatto fruit (*Bixaorellana*L.). National Seminar on “Emerging Technologies for Enhancing Water Productivity, ETEWP-2016” held during 17-18 November, 2016 at IGKV, Raipur.

(v) AGRO PROCESSING CENTRES ESTABLISHED

State	Name of the Centre	Address of APC	Total APC established
Assam	AAU Jorhat	Prerona Self Help Group, Jamuguri Gaon, Jorhat	1
Andhra Pradesh	ANGRAU Bapatla	Post Harvest Technology Centre, Bapatla	1
Jammu & Kashmir	SKUAST Srinagar	Mr. Hilal Ahmad M/S Gulmarg, Honey Sheikhpora Tangmarg, Baramulla.	1

West bengal	IIT Kharagpur	SRP Nutriments Private Limited, 3B, Science and Technology, Entrepreneurs Park, IIT Kharagpur	1
Madhya Pradesh	JNKVV Jabalpur	Pariyat, Panagar, Jabalpur	1
Haryana	CCS HAU Hisar	a) Pavitra Honey; Manjeet Sharma, ward no. 12, Pasa Colony, Barwala b) Pure Honey producer company limited; Suresh & Sanjeev, 481, Sector 14, Hisar c) Shakti vardhak milk producer company limited, Jyoti Kaushik and Radha Sehgal, 196, Prem Nagar, Hisar d) Paushtik Aahar producer company limited, Prashant, 170, Red Square Market, Hisar	4
Karnataka	UAS Raichur	a) M.T. Agro Processing Centre, Prop. Mr. Hussainappa, Kudlur, Raichur b) MailarLinga Roti Kendra, Prop. Mr. Shivakumar, Thinthani, Surapur, Yadagir.	2
Kerala	KCAET Tavanur	Snehima Kudumbasree Unit	1
Gujarat	JAU Junagadh	Agro Processing Centre, Chotila Plot No. 18, GIDC, Chotila, Rajkot	1
Punjab	PAU Ludhiana	a) S Veer Singh s/o S. Suba Singh, Punjabi Food Processing Mill, Khosa Kotla, Moga b) S. Avtar Singh, Sarabha, Ludhiana c) S. Dhanwant Singh, Kehar/ Kundan Flour mill, Threke, Ludhiana d) Kulwinder Singh Sidhu, Smallsar Road, Sekhan Kalan, Moga e) S. Gurtej Singh s/o S. Gurmail	7

		Singh, Dashmesh Flour mill, Mahimuana, Faridkot f) S. Harmel Singh s/o S Hoshiar Singh, Sehaj Flour Mill, Near Bada Gurudwara, VPO Baddowal, Ludhiana g) S Harbhajan Singh, Ravneet flour mill, Kotmanna Budhree, Ludhiana	
Himachal Pradesh	Solan	Mrs. Anuradha, APC for ginger and garlic processing unit, Poorva Food Industry, Joul, PO-Jubbar, Kasauli (HP)	1
Tamil Nadu	TNAU, Coimbatore	Farmer producer organization, Pudukottai	1
Manipur	ICAR-CTCRI Thiruvananthapuram	Village Incubation Centre, Riha, Ukhrul, Manipur	1
Total			23

(vi) ADAPTIVE TRIALS, POPULARIZATION AND TRANSFER OF TECHNOLOGY/ PROCESS

- Adaptive trials on various post-harvest technologies (machinery/ plant/ process/ storage etc.) were conducted. For instance, Soy processing plant, CIAE hand maize sheller, PKV mini Dal mill, Vivek millet thresher-cum-pearler (Almora); PAU Trolley dryer for chillies (Bapatla); dehulling of minor millets. (Jabalpur); Solar-Biomass Integrated Drying System, Bio-rational insecticide for safe storage of green gram. Response of *Rhynchostylis retusa* L. to mineral nutrients in different growing supports. *Reaserch on Crops*, tapioca starch films for biodegradability and food storing. (Jorhat); Up-scaling of traditional meat products of North East region (Khanapara); Dried Masala coated Anchovies using Solar Drier, Fish vending and Display Unit (Mangalore); Production of Hygienic Chicken Meat (Mumbai); starch production from *tikhur* rhizomes, technology for optimum recovery of essential oil from patchouli, technology for the production of Bixin (*sindoor* powder) from annatto *sindori* fruit (*Bixaorellana*) (Raipur); storage of fresh ginger rhizomes (Solan).

- Centres organized/conducted various trainings/demonstrations for farmers and entrepreneurs on various post harvest technologies. 50 (Almora); 10 (Anakpalle); 4 (Bapatla); 3 (Coimbatore); 2 trainings on Soya milk making & Pearl millet processing (Hisar); 7 (Jabalpur); 3 (Jorhat); 3 (Junagadh); 1 training on Processing and value addition technologies of coconut (Kasargod); 2 (Khanapara); one on Fruit processing (Kharagpur); training on 4 different technologies (Ludhiana); training on 3 different technologies (Mumbai); training on 2 different technologies (Pusa); 4 (Raichur); 2 (Raipur); one training on Pulse and Spice Processing (Ranchi); 4 (Solan); training on 18 different technologies (Tavanur); training on three different technologies (Trivandrum).
- Mangalore centre organized two day workshop on “Fish Processing” in collaboration with Karnataka Science and Technology Academy.

(vii) PROGRESS OF VALUE CHAIN PROJECT

The following Projects on Value Chain were initiated during 2015-16 and 2016-17. Brief progress of each project is described as below.

Sr. No.	Crop	Lead Centre and Collaborating Centres	Progress
1.	Small millets	VPKAS, Almora	Machinery: Vivek thresher cum dehusker; winnower Process/product: (a) cake from barnyard millet (b) pillow from barnyard husk (c) barnyard millet based composite flour
2.	Tamarind	UAS, Bangalore	Machinery: Tamarind Dehuller (10 q/h), dehulling efficiency (>90%)
3.	Chilli Processing	ANGRAU, Bapatla	Value chain on chilli established at Venkatareddypalem: (i) modified polyhouse solar Dryer, (ii) designed and developed Chilly calyx removal machine (iii) Linkages with State Horticulture Department, Spices Boards, ITC Agri Business Division, Janani e serve for for enabling good market for dried chillies

4.	Mahua	OUAT, Bhubaneswar	Machinery: Pedal operated Mahua stamen remover, Mahua seed decorticator. Pilot plant (in progress) Process/products: Value added products from mahua flower
5.	Jackfruit	KAU Tavanur	Machinery: Tender Jackfruit peeling machine Process/products: Retrot pouch packed jackfruit var. <i>Halwa</i> and tender jackfruit
6.	Pineapple	CAU Imphal	Machinery/Tool: pineapple peeler cum slicer Process protocol: pineapple RTS, Jam, squash and osmo-dehydrated rings, extraction of bromelain enzyme from pineapple waste. Machinery purchased: Fruit pulper, LUG CAP Sealing Machine Skill development: Conducted four training programmes for rural women
7.	Pilot plant for value chain of guava	JNKVV, Jabalpur	Nil
8.	Pilot plants of value chain of small millets	JNKVV, Jabalpur	Machinery: Millet Dehusker Survey to identify processing method, machines used and status of processing units in Dindori district of M.P. Pilot plant: will be completed by March 2018
9.	Potato	IIT, Kharagpur	Tool/machinery: Manually operated small scale waffle shaped potato slicer Design machine for accelerated conditioning system of potatoes taken out from cold storage Process: Low cost ethanol from spoiled potatoes (in progress)
10.	Maize	RAU, Pusa	Process standardized: Dehusking and shelling, dried grain, cleaing and grading, pearling and products

			(brokens/dalia and powder/flour of <i>deoki</i> variety of maize)
11.	Litchi	RAU, Pusa	Tested litchi peeling machine (developed by ICAR-CIPHET)
12.	Kodo rice/ <i>Ragi</i>	IGAU, Raipur	Process developed: (i) <i>Ragi</i> malt and composite flour; Machinery identified: Dehusking and dehulling of kodo rice for the processing of <i>kodo</i> and <i>ragi</i> Trainings (02 nos) to sensitize farmers, small entrepreneurs and processors at Kanker and Gariyaband districts.
13.	Apple	YSPUH&F, Solan	Tool/machinery: apple grader, piller, corer, slicer and seed extractor Process protocols: Osmotic dehydration of apple slices and cubes, beverages from juice and pulp, and utilization of apple pomace Pilot plant: Extraction of pectin from apple pomace
14.	Ginger	Udaipur, Jungadh	Standardization of peeling and pulping method of ginger Process protocol: appetized ginger flakes, ginger apple and ginger plum leather, ginger biscuits, ginger apple butter and ginger apple peda. Storage structures: storage of fresh ginger rhizomes under low cost structures
15.	Walnut	SKUAST, Srinagar	Batch type value chain (Mechanical walnut dehulling bleacher-cum-washer, Walnut grader, Tunnel drier) for inshelled walnut processing
16.	Jackfruit with	KAU, Tavanur Bhubaneswar	Retort pouch packaging of tender jackfruit and jackfruit var. <i>Halwa</i>

(viii) PUBLICATIONS

Papers in referred Journals	:	60
Books/Book Chapters/Reports/Mannuals/Bulletins/Proceedings	:	25

In addition, AICRP on PHET centres have undertaken the following activities:

1. Monitoring of existing APCs and motivation for establishment of new APCs,
2. Data collection and data entry is in progress under ICAR-FCI project on “Determining storage losses in food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management”. Under this project a data entry software has been developed by ICAR-IASRI, New Delhi.
3. Two Technologies cum Demonstration Kisan Melas (March 2016 and February 2017) in association with other AICRPs.