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F.No. 1(58)/2015/PHT/30-W

Coordinator's Report
2013 - 2015

XXX WORKSHOP of
AICRP on POST-HARVEST TECHNOLOGY
(06 - 09 January 2015)

held at

University of Agricultural Sciences
Bangalore (Karnataka)

AICRP on PHT
ICAR-CENTRAL INSTITUTE OF POST-HARVEST ENGINEERING AND TECHNOLOGY
LUDHIANA - 141 004

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डा. एस. अय्यप्पन
सचिव एवं महानिदेशक
Dr. S. AYYAPPAN
SECRETARY & DIRECTOR GENERAL

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद
कृषि मंत्रालय, कृषि भवन, नई दिल्ली 110 001

GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH & EDUCATION
AND
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
MINISTRY OF AGRICULTURE, KRISHI BHAVAN, NEW DELHI 110 001
Tel.: 23382629; 23386711 Fax: 91-11-23384773
E-mail: dg.icar@nic.in

MESSAGE

It is a pleasure to know that the 30th Workshop of All India Coordinated Research Project on Post-Harvest Technology is being held at UAS, Bengaluru during 6-9 January, 2015.

Post-harvest technology acclaimed for its significant contributions towards enhancing availability of agricultural produce and products, by way of reducing post-harvest losses at one hand and value addition on the other. The location and crop specific post-harvest technologies are lifting up the growth of agricultural sector by establishing linkages of farmers with processors, industries/entrepreneurs, and consumers.

We need to focus our R&D towards development of major research programme to reduce the post-harvest losses in order to make a balanced condition between demand and supply of food grains and improve the nutritional security. It is expected that the deliberations on progress of projects and technical programme for the future coming years will be fruitful.

I wish the AICRP on PHT Workshop all success.

(S. Ayyappan)

क. अलगुसुन्दरम
उप महानिदेशक (अभियांत्रिकी)
K. Alagusundaram
eputy Director General (Engineering)

भारतीय कृषि अनुसंधान परिषद
कृषि अनुसंधान भवन–II,
पूसा, नई दिल्ली 110 012
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
KRISHI ANUSANDHAN BHAVAN-II,
PUSA, NEW DELHI-110 012

MESSAGE

India is a superlative producer of most food commodities and the third largest producer of all food commodities (next only to China and USA). We must profoundly thank Dr. M.S. Swaminathan, the legendary and the all time great agricultural scientist, who steered the Green Revolution. Our thanks must also be extended to those numerous scientists in the Indian Council of Agricultural Research whose decades of invaluable and timely research efforts offered the sustained food security to all of us.

We are, on the other hand, a great looser of food commodities in the post production systems. The losses, which have been phenomenal, about 3 decades ago, have dramatically been brought down to about 4 to 18%. This realization is due only to the contributions towards the advancement of technology and the science of post-harvest processing by those numerous scientists working in the All India Coordinated Research Projects on Post-harvest Technology. The efforts made by the post-harvest engineers and scientists spread across 34 centers: from north to south; from east to west; across varied agro-climatic zones; across numerous production catchments; from agricultural crops based foods to animal and marine based foods; in most agricultural universities and ICAR institutes; have helped us achieve this.

We need to, however, put greater efforts and more vigorously than in the past to further reduce the food wastages and making them nearly to zero losses. Appropriately value adding, packing and suitably marketing, both in the domestic and international markets, will bring in greater income for the producers, traders and the nation. Our research focuses must be sharp and should be need and problem based. Our scientist must interact closely with the farmers and the industry to identify problems and must work on offering solutions to them.

Collaborations between various AICRP centers and multidisciplinary research efforts will bring in meaningful results in solving the post production problems. On behalf of ICAR, I extend unconditional supports for forming such collaborative and multidisciplinary teams. Post-harvest engineers, food scientists, entomologists, microbiologists and scientists of other allied fields must come together for making our dreams realizable. **Our dream is: "Make India the Food Factory for the World"**

I am sure, in the 30th Biennial Workshop of All India Coordinated Research Project on Post Harvest Technology we will truthfully review our capabilities and potentials and will have meaningful dialogues leading to the formulation of strategies for our future research services to those producers, industry, the stake holders and the nation.

I must thank Dr. D.P. Kumar, In-charge Vice Chancellor and Director of Education; Dr. M.A. Shankar, Director of Research; Dr.B. Ranganna, Professor Emeritus for readily accepting to host the workshop and the team of scientists in UAS, Bangalore for hosting it in style.

Together we are stronger than in isolation and together we can offer greater services than alone. So, my dear colleagues let us come together for **Making India the Food Factory for the World.**

19/12/14

K. Alagusundaram

Ph: 91-11-2584 3415 Fax: 91-11-2584 2660 E-mail: ddgengg@icar.org.in

ACKNOWLEDGEMENT

AICRP on PHT family is grateful to Dr. S. Ayyappan, Hon'ble Secretary, DARE, and Director General, ICAR for his dynamic leadership, increased financial support and wholehearted encouragement to during the period of this report.

We are very lucky in getting Dr. K. Alagusundaram as DDG (Engineering). His dynamic leadership, deep knowledge of the subject and active interest in AICRP on PHT has made possible to organize this workshop and achieving the targets on accelerated pace. We all are indebted sir for your keen interest, guidance and motivation and inspiring support to strengthen the Project. Thanks are due to Dr. Kanchan K. Singh, ADG (Engg) for his persistent support and guidance to strengthen the project and organizing this workshop. Contributions and helps rendered by the previous DDG (Engg), Dr. D. Rama Rao and ADG (PE) Dr. K. K. Singh during the period are also acknowledged. Thanks are also due to all officials of the Agril Engg Division, ICAR for helping the Project.

Sincere gratitude and thanks are also due to Dr. D.P. Kumar, In-charge Vice Chancellor and Director of Education, University of Agricultural Sciences Bangalore, Dr. M.A. Shankar, Director of Research, other officials of the University and Dr. S. Subramanya, PI and staff of the Bangalore Centres for hosting this workshop and providing full support and cooperation.

Our expert-invitees Dr. P. Chandra, Dr. B. Rangana, Dr. V. K. Seghal, and Dr. S. Ganapathy have always been a guiding force and staunch supporters of this AICRP in their various capacities. We are highly thankful to them and hope to receive their continued patronage.

Sincere thanks are also due to Dr. R. K. Gupta, Director, CIPHET, Dr. S. K. Nanda, I/C TOT, and Dr. P. C. Sharma, HoD, HCP division, for their support and for improvement of this project. Dr. Anil K. Dixit, Dr. S. K. Aleksha Kudos, Dr. R. K. Vishwakarma worked hard over the past months in synthesizing the PC (PHT) and progress of externally funded projects of MoFPI and FCI and hence their contribution is warmly appreciated. Dr. Taqueer Ahmed, Dr. Anil Rai, Dr. Prachi Mishra Sh. G. M. Pathak, and Sh. Man Singh from IASRI, New Delhi deserves special thanks for their suggestions and valuable inputs in MoFPI project.

Sectoral PIs Prof. R. Viswanathan, Dr. P.A. Borkar, Dr. V. Palanimathu and Dr. Robinson J. J. Abraham deserve special thanks for their assistance, cooperation and their invaluable contributions in giving shape to the future research projects in consortia mode.

Our sincere appreciations are due to scientific, financial, administrative and other officials of CIPHET. Ms. Tanu Malhotra, Ms. Amanpreet Kaur, Ms. Sheetal Banga, Mrs. Sunita Rana and Shri Tarsem Singh Purba also deserve notice for their kind help.

Thanks are due to all the Vice-Chancellors of SAUs, Directors of ICAR institutes, PI / Research Engineers and staff of the Cooperating Centres for the achievements of the Project. We also thank all those who have helped directly or indirectly in smooth functioning of the Project and for the success of this workshop.

January, 2015
ICAR-CIPHET Ludhiana

(S. N. Jha)
I/C PC, AICRP on PHT

CONTENTS

AICRP ON POST-HARVEST TECHNOLOGY

Background

The All India Coordinated Research Project on Post-Harvest Technology was launched by the Indian Council of Agricultural Research, Department of Agricultural Research & Education, Ministry of Agriculture, Government of India, in September 1972 with R&D Centres at 10 locations. Coordinating Cell of the Project was established in the Division of Agricultural Engineering at Indian Agricultural Research Institute, New Delhi, which latter was shifted to CIAE Bhopal in February 1976. With the establishment of the Central Institute of Post Harvest Engineering & Technology at Ludhiana, the Coordinating Cell was further shifted from CIAE Bhopal to CIPHET Ludhiana in December 1990. The Project is currently operating from 34 centres (out of these, 3 centres are likely to be closed and one merged with other centre, as per EFC XII Plan) covering almost all states and agro-climatic zones in India.

Objectives of the Project

The Project aims to develop location and crop specific post-harvest technologies and equipment to minimize quantitative and qualitative post-harvest losses and to produce value added products from food grains and other crops. It is also to develop technologies for making available primary processed materials in the rural areas at cheaper rates and assure better economic returns to the farmers from their marketable surpluses and by-products and generate employment in the rural areas for overall economic development and improvements in quality of life.

The specific objectives of the Project are:

- To study the prevailing post-harvests practices and identify unit operations, equipment and their components that need improvement or substitution, adequacy and inadequacy of the prevailing practices.
- To develop and adopt farm level cleaners, graders and dryers for cereals, pulses, oilseeds, plantation crops, tubers, other field crops, livestock produce and fish.
- To develop simple processes, low cost equipment and pilot plants for farm/village level processing of food grains, oilseeds and other crops for rural consumption, as well as selling value added products to semi-urban and urban areas for better economic returns.
- To develop simple processes and equipment farm/village level for better economic utilization of bio-wastes and by-products as food/feed/fuel etc. for increasing profitability of the commodity and income of the farmer.
- To undertake studies on techno-economic feasibility and economical viability of on farm/village level processing industries and other enterprises.

- To field evaluate laboratory proven technologies and carry out operational research trials on the developed technologies for villages to identify technical, managerial and social constraints and take remedial measures before releasing for popularization.
- To facilitate creating of post-harvest technology consciousness and transfer of proven technologies in selected villages and monitoring its effects on economics and social development.
- To generate income and employment in rural areas through adoption of proven technologies and equipment through establishing agro-processing centres.

Mandate of the Project:

- To develop location and crop/commodity specific post-harvest technologies for minimization of quantitative and qualitative losses to produce in agriculture and allied sectors.
- To adapt and develop improved post-harvest processes and equipments for value addition to food grains and other produce at rural threshold for higher income and generation of rural employment.
- To develop processes and equipment for economic utilization on bio-wastes and byproducts.
- To conduct operational research and multi-location trials on developed technologies to identify technical, financial, managerial and social constraints for better market acceptability to technologies.
- To establish need based agro-processing centres to assure better economic returns to the farmers from their marketable surpluses.
- To assess, refine and transfer proven technologies.

List of the Cooperating Centres of AICRP on PHT
State and Central Agricultural Universities

1. College of Agricultural Engineering
   Dr. Punjabrao Deshmukh Krishi Vidyapeeth,
   Akola (Maharashtra)
2. Faculty of Agricultural Sciences
   Aligarh Muslim University
   Aligarh (Uttar Pradesh)
   (To be closed w.e.f. 01 April 2015 as per XII Plan EFC proposal)
3. Regional Agricultural Research Station, **Anakapalle**
   Acharya N.G. Ranga Agri. University Andhra Pradesh)
4. University of Agricultural Sciences,
   Bangalore (Karnataka)
5. College of Agriculture,
   Acharya N.G. Ranga Agri. University,
   Bapatla (Andhra Pradesh)

6. College of Agricultural Engineering,
Orissa University of Agri. & Technology,
Bhubaneshwar (Orissa)

7. Sugarcane Research Station: Assam Agricultural University,
Buralikson (Assam)
(Mearged with AAU Jorhat, as per XII Plan EFC proposal)

8. Tamil Nadu Veterinary and Animal Sciences University,
Chennai (Tamil Nadu)

9. College of Agricultural Engineering,
Tamil Nadu Agricultural University,
Coimbatore (Tamil Nadu)

10. College of Agricultural Engineering
CCS Haryana Agricultural University
Hisar (Haryana)

11. Central Agricultural University
Imphal (Sikkim)

12. College of Agricultural Engineering,
Jawaharlal Nehru Krishi Viswa Vidyalaya,
Jabalpur (Madhya Pradesh)

13. Rajasthan Agricultural University
Agricultural Research Station
Durgapura, **Jaipur** (Rajasthan)
(To be closed w.e.f. 1 April 2015 as per XII Plan EFC proposal)

14. College of Agriculture,
Assam Agricultural University,
Jorhat (Assam)

15. College of Agricultural Engineering,
Junagadh Agricultural University,
Junagadh (Gujarat)

16. Assam Agricultural University
Khanapara (Assam)

17. Indian Institute of Technology,
Kharagpur (West Bengal)

18. Regional Sugarcane & Jaggery Research Station,
Kolhapur (Maharashtra)

19. West Bengal University of Animal and Fishery Sciences,
Kolkata (West Bengal)
(To be closed w.e.f. 01 April 2015 as per XII Plan EFC proposal)

20. College of Agricultural Engineering,
Punjab Agricultural University,
Ludhiana (Punjab)

21. Karnataka Veterinary, AH & Fishery Science University
Mangalore (Karnataka)

22. Maharashtra Animal and Fisheries Science University
Mumbai (UP)

23. College of Agricultural Engineering,
Rajendra Agricultural University,
Pusa (Bihar)

24. College of Agricultural Engineering and Technology
University of Agricultural Sciences
Raichur (Karnataka)

25. Indira Gandhi Krishi Vishwa Vidyalaya,
Raipur (Chhattisgarh)

26. Birsa Agricultural University,
Ranchi (Jharkhand)

27. College of Horticulture
Dr. Y.S. Parmar University of Horticulture and Forestry,
Nauni, **Solan** (Himanchal Pradesh)

28. Sher-e-Kashmir University of Agri. Sciences and Technology,
Srinagar (Jammu & Kashmir)
Kerala Agricultural University
KCAET, **Tavanur** (Kerala)

29. College of Technology & Agri. Engg.,
Maharana Pratap Agricultural University,
Udaipur (Rajasthan)

ICAR Institutes

1. Vivekanand Parvartiya Krishi Anusandhanshala,
Almora (Uttaranchal)

2. Central Plantation Crops Research Institute,
Kasargod (Kerala)

3. Indian Institute of Sugarcane Research
Lucknow – 226 002 (U.P.)

4. Central Tuber Crops Research Institute (ICAR),
Thiruvananthapuram (Kerala)

MAJOR ACCOMPLISHMENTS DURING 2013-15

Post-harvest tools/equipment developed

1. Power operated turmeric slices (Akola)
2. Hand operated Winnower-cum-cleaner (Almora)
3. Mahua Stamen removal machine (Bhubaneswar)
4. Manual and Motorised Sausage Stuffer (Chennai)
5. Cocoa pod breaker- Modified (Coimbatore)
6. Solar dryer for cocoa bean with biomass backup heater (Coimbatore)
7. Mango destoner cum pulper (Coimbatore)
8. Designed Pilot Plant for extraction of pectin from mango peel (Coimbatore)
9. Semi-automatic Jaggery moulding machine (Lucknow)
10. Fish Vending cum Display Unit- Modified with Composite Material (Mangalore)
11. Animal Skin Holder (Mumbai)
12. Multimode dryer designed for drying of grapes, fig and chilli (Raichur)
13. Apple seed corer (hand operated and paddle operated), Solan centre
14. Modified Apricot stone decorticator attached with dust separator (Solan centre)
15. Walnut dehuller machine (Srinagar centre)
16. Power operated pepper decorticator (Tavanur centre)
17. Banana peeler (Tavanur)
18. Green gram depoder cum sheller (Udaipur centre)

Agricultural structures

- Established Model retail outlet for chicken (Mumbai)
- Small poultry processing plant (Mumbai)

Process protocol and products

i. Extruded products from small millets (Bangalore)
ii. Probiotic Low-fat Dahi from Small Millets (Bangalore)
iii. Fermented alcoholic & Non-alcoholic Beverages from Kokum/Tomato (Bangalore)
iv. Jackfruit Ice cream and Jackfruit Peda (Bangalore)
v. Ready To Eat mushroom curry in retortable pouches (Coimbatore)
vi. Dried fermented bamboo shoots (Jorhat)
vii. Extrudates from VCO cake, broken rice, maize and pearl millet (Kasargod)
viii. Low cost good quality gum from tapioca starch (Jorhat)
ix. Probiotic guava, kinnow and mango juice (Ludhiana)

x. Coco based mulhati guava products (bar & nuggets) (Hisar)
xi. Cassava starch-nano clay composite based biodegradable film (Trivandrum)
xii. Jaggery with carotenes, beta carotene and vitamin C (Anakapalle)
xiii. Process protocol for Jaggary cubes (Anakapalle)
xiv. Dietary fibre enriched pork nuggets and sausage (Khanapara centre)
xv. Value addition to pork sausage with banana pseudostem flour (Khanapara)
xvi. Ready to eat and ready to cook fishery products (Mangalore)
xvii. Ready-to-eat fish ham with shrimp chunks (Mangalore)

Adoptive trails, popularization and transfer of technology/process equipment developed

- Adoptive trails on various post-harvest machinery/plant (Dehydration of fruits and vegetables, PKV Mini dal mill, Millet thresher, CIAE cleaner-cum-grader, garlic peeler, garlic grader, continuous washing machine, fish deboner) were undertaken by the designated.
- Model retail outlet for production of hygiene chicken meet (Mumbai Centre)
- Performance evaluation and popularization of the tamarind dehuller cum de-stoner machine (Bangalore centre)
- Technology for making Jaggery chocolates (Buralikson centre)

Establishment of Agro processing centres (listed as annexure I)

- APC established :30
- APC under establishment: 04

Patient Filed: 05

1. "Mechanized Jaggery Granulator for producing jaggery granules" application No. 1265/CHE/2013 filled on 19-03-2014 (Anakapalle)
2. "Production of probiotic fruit juices". Application No. 614/DEL/2013); Filed on 4th March, 2013 (Ludhiana)
3. "Development of Women friendly fish vending and display unit" Ref.#IPR/FA/13013, applied on 08/06/2013 through National Research Development Corporation (NRDC), New Delhi
4. "Retail Chicken Slaughter Unit" Application No. 1842/MUM/2014, dated 01/04/2014 (Mumbai)
5. "Carrot washer" Patient filed and obtained with Sh. Krishan Jangra, manufacturer

Awards

Our Entrepreneur Sh. Krishan Jangra, village Behbalpur, Hisar, received 'Innovator-Farmer award' by ICAR-IARI, Pusa, New Delhi on 28 February, 2014.

In addition, following works have been undertaken by AICRP on PHT

(i) Around 26 trainings and 31demonstrations were conducted under TSP and 1005 individuals from 133 villages were benefitted.

(ii) Data collection, scrutiny, analysis and draft report preparations for ICAR-MoFPI project on 'Assessment of Harvest and Post-Harvest Losses of Major Crops and Commodities in India'.

(iii) Selection and staking of chambers under ICAR-FCI project on "Study on determining storage losses in food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management". The progress of the project has also been discussed during two review meetings with FCI official during the period under report.

****

GLIMPSES OF TECHNOLOOGIES from AICRP on PHT

Turmeric Slicer (Akola)

Winnower-cum-Cleaner (Almora)

Mahua Stamen Remover (Bhubaneswar)

Sausage Stuffer (Chennai)

Chennapoda in Vacuum Packed and Sterilized Packet
(Bhubaneswar)

Solar Tunnel Dryer with Biomass backup Heater for Cocoa Beans Drying
(Coimbatore)

GLIMPSES OF TECHNOLOGIES from AICRP on PHT

Fermented alcoholic and Non-alcoholic Beverages from Kokum and Tomato (Bangalore)

Stream Boiler (Installed at Anakapalle)

Jackfruit Ice cream (Bangalore)

Compressed Jaggery cubes (Anakapalle)

Extrudates from VCO cake, broken rice, maize and pearl millet (Kasaragod)

Dried fermented bamboo shoot (Jorhat)

Pork Sausage with Banana Pseudostem flour (Khanapara)

Ready-to-eat fish ham with shrimp chunks (Mangalore)

GLIMPSES OF TECHNOLOOGIES from AICRP on PHT

Fish Vending cum Display Unit with Composite Material (Mangalore)

Animal Skin Holder (Mumbai)

Demonstration of Sunflower Dewaxing unit (Bhubaneswar)

MOU with M/s Vowel Technologies, Pune Granular jaggery (Anakapalle)

Demonstration of PHT Equipment under TSP (Junagadh)

Inauguration of Model Retail Chicken Outlet (Mumbai)

PROGRESS REPORT OF THE CENTRES OF AICRP ON PHT
(2013 – 2015)

AKOLA CENTRE			
S. No.	Research Project Title/ period	Objectives	Specific Output
1	Development of turmeric slicer (May 2013 to April 2015)	1. To develop turmeric cutting cum slicing machine 2. To study the performance evaluation of developed machine 3. To assess the techno-economic feasibility 4. Popularization and transfer of technology	• Power operated turmeric slicer (Capacity - 250 kg/h) developed. The machine cuts the turmeric rhizomes into slices of desired thickness from (2 to 5 mm) • At optimum condition of rotor speed 400 rpm, slice thickness 2.5 mm and duration after harvest zero days i.e. fresh turmeric rhizomes, the slicing/cutting efficiency, percent damage and capacity were found to be 74.74%, 24.95% and 385 kg/h, respectively • Cost of processing was assessed to be Rs. 350/- per ton of turmeric
2	Pod shelling and minimal processing of green pigeon pea (March 2014 to April 2016)	1. Development of green pigeon pea pod shelling machine 2. Performance evaluation of the machine 3. Minimal processing and packaging of green pigeon pea kernels 4. Popularization and transfer of technology	• A prototype 'Shelling green pigeon pea pods' (capacity 25 kg/h) developed • Maximum shelling efficiency was 70.81% for the speed of 900 rpm of fast roller, 150 rpm of slow roller i.e. with the speed ratio 1:6. • The coefficient of wholeness and coefficient of shelling at these input parameters were 0.9709, respectively • Project is on going
3	Adoptive trials of management of pulse beetle	1. To find out the efficacy of Black Pepper powder and sand layer method against pulse beetle. 2. To recommend effective, safer alternative to insecticides for storing pulse grain in Vidarbha region 3. To popularize the method recommended for pulse beetle management	• Black pepper seed (Piper spp) powder (dried) mixed with the produce was found effective in management of pulse beetle in stored chickpea and mungben (90 DAS) • Sieved coarse sand mixed with the pulse grain also inhibited the infestation of bruchid upto 90 DAS • Project is on going
4	Establishment of Agro	1. To undertake case study of a village with	• A survey was undertaken of village Kanzara and nearby

	Processing Centre	respect to processing 2. To suggest suitable gadgets based on survey 3. To establish agro processing centre 4. To monitor performance of agro processing centre and and techno-economic feasibility	villages with respect to agriculture production, population and existing processing machines available in Kanzara • Two APCs were established (i.e., (i) Smt. Sarita Shyamsundar, Secretary of Renuka Mahila Bachat Gat and Processing Center, in village Kanzara, Dist. Akola (ii) Shri Nivrutti Barabde,Kokarda, Dist. Amravati) These APC inugratued by Hon'ble Vice-Chancellor on 5 May and 13 Aug 2014, respectively. • Equipments consist of PKV Mini dal mill, pulverizer and shewai machine. • The entrepreneur (APC Kanzara), processed 120 q wheat, 240 q pigeonpea, 120 q shewai (noodles) and 80 q spices (chili and turmeric)
ALMORA CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Adaptive trial on improved post-harvest equipment suitable for N-W Himalayan region (March 2005 to march 2014)	1. Feasibility testing of identified post-harvest technologies/equipments and need based modification for suitability in N-W Himalayan region. 2. To demonstrate these technologies on large scale and assessing their impact on local population.	• Various processes, technologies and equipment of AICRP on PHT (mini *Dal* mill of PKV Akola; Vivek millet thresher-cum-pearler of ICAR-VPKAS, Almora; CIAE hand maize sheller) as well as commercial units such as soybean processing unit were evaluated & demonstrated to the farmers. • During testing of the PKV *Dal* mill, the recovery percent of *Arhar*, *Moong*, *Urd*, *Massor* and Soybean was 80, 80, 87, 85 and 89%, respectively. • Soy Cow Machine (SC20) installed at the institute, demonstrated to the farmers/entrepreneurs. • The machine/plant is suitable for the small scale production system of hills and about 12 kg of *Tofu* can be made in 6 hours with 12 kg soybean per day & requires about 2 mandays. • Demonstrations were given to more than 9781 farmers/extension personnel/officials in different Kisan Mela/Divas/trainings/visits/field days, etc.

2	Establishment of Agro Processing Center, training and demonstration of technologies (March 2011 to Continue)	1. Establishment and Techno economic evaluation of APC in N-W Himalayan region for generating income and employment. 2. Demonstration and adaptive trial of improved post-harvest technologies at farmer's field and assessing their impact. 3. Training of farmers/ officials/ manufacturers in processing of primary agricultural products and its marketing policy.	• Two Agro processing centres (1) .Sh. Shyam Singh Bisht, village Raulshera, District - Almora and Takula villages (2) Sh. Chandershaker, village- Ganaie Gangoli, District-Pithoragarh) were evaluated for economic performance. • The net reruns were Rs. 193374 and 168220 per annum while B:C ratio were 2.16 and 2.10, respectively during 2013-14.
3	Post-harvest management and value addition of barnyard millet (April 2011 to March 2014)	1. Standardization of value added products of barnyard millets such as composite flour for making bread, biscuits & cake etc. 2. Making of Pillow using barnyard husk.	• Barnyard millet cake was prepared using the ingredients: Wheat flour-600 g, Barnyard millet flour-400 g, Baking power-1tsp, Egg-2, Oil-125 ml (1 Cup), Vanilla essence-2 tsp, Sugar- 1 cup (powdered) • Barnyard millet husk was utilized for making of pillow (size: 500 x 250 x 110 mm, weight: 2 kg).
4	Development and evaluation of pedal operated low cost light weight winnower-cum-cleaner for millets (April 2011 to March 2014)	1. Development of new prototype of winnower cum cleaner by reducing overall size & weight. 2. Testing of machine for millets and other crops.	• The VL winnower-cum-cleaner was tested in different crop including cereals, pulses and oilseed crops and efficiency ranged from 96 to 98%.
5	Development of a medium capacity millet dehuller (April 2012 to March 2014)	1. To design & develop the prototype of the millet dehuller 2. To test its performance in all minor millets and comparison with the traditional system. 3. To commercialize the technology.	• The dehusking capacity of 20 kg/h and efficiency of 99% is observed at 1100 rpm at 10% mc in two passes.
6	Development of an amaranth thresher (April 2012 to March 2014)	1. Design & Development of light weight amaranth thresher. 2. To test the performance of this developed machine. 3. Adaptive trials at farmers' fields. 4. To commercialize the machine.	• A light weight single phase 1 hp motor operated prototype amaranth thresher has been developed for threshing of Amaranth crop. • Capacity 20 kg/h and efficiency 99%. • Demonstrated in Kisan mela for popularization

BANGALORE CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Development of Value Added Formulations from Underutilized Pulses (Horsegram and Cowpea)	1. Ready to eat and ready-to-cook meal solutions such as pulse-based composite mixes, health drink mixes, high fibre bakery products and snacks incorporating cowpea and horsegram will be developed. 2. To assess the nutritional composition and consumer acceptability of the developed products. 3. Storage, packaging and market feasibility studies of developed products. 4. To work-out cost-economics	• Process protocols for two value added products namely, *Baked Nipattu* and *Bread* from horsegram were developed • The best accepted baked *nippattu* samples were analyzed for their physico-chemical properties, textural profiles, sensory qualities and microbial populations during storage period with different packaging materials like LDPE and PP covers. • Horsegram bread samples were evaluated for their sensory attributes •
2	Management of storage insects in small millets and their milled rice grains	1. To identify infestation pattern in different small millets and milled rice. 2. To devise suitable management strategies for controlling insect infestation in small millets and their milled rice grains	• Preliminary observations indicated that Kodo Millet was relatively free from insect damage as compared to other millets (Foxtail millet and little millet)
3	Microbial Processing of Fruit Waste for the product development of animal feed (March 2014 to March 2016)	1. Evaluation of different Yeast and Lactic Acid Bacteria strains for the fermentation efficiency of the selected fruits and vegetable wastes 2. Solid state fermentation of selected fruit and vegetable wastes blended with different organic and inorganic sources of nitrogen to develop enriched animal feed 3. Standardization of protocol for the development of enriched animal feed using fruit and vegetable wastes 4. Evaluation of the developed enriched animal feed for its performance as feed supplement	• Mango peel fermented by dual inoculation with *L. plantarum* and *S. boulardi* significantly enhanced the protein (7.88%), fat (4.18) and ash (5.74 %) content over an uninoculated control (4.89%, 1.78% and 3.34% protein, fat and ash, respectively). • Mango peel fermented with *S. boulardii* alone and *with L. plantarum* was more efficient in fermenting mango peel waste. • Mango seed meal supplemented with 1 % ammonium sulphate and fermented by yeast (*S. boulardii)* significantly enhanced protein (14.17%), fat (5.39%) and ash (5.90%) over an un-inoculated control (5.17%, 1.81% and 3.92%, respectively). • Mango peel supplemented with 1 % ammonium sulphate,

			10 % soyabean and 10 % maize grits fermented by single inoculation with yeast (*S. boulardii*) enhanced highest protein (18.98%) followed by fermentation by dual inoculation with lactic acid bacteria and yeast (18.70%) over un-inoculated control (6.65%). • Developed feed based on mango waste will be studied for its performance by feeding it to poultry chicks / fish/ rabbit
4	Value chain on Tamarind (Jan 2014 to Dec 2015)	1. Design modification / development of improved high capacity (1 t/h) Tamarind Fruit Dehuller 2. Development of new tamarind fruit deseeder suitable for commercial pulp production (100 kg/h) 3. Optimization of operational parameters for efficient hull and seed removal 4. Workout cost-economics of developed machines	• The tamarind pods small, medium and large in size with locules containing seeds ranging from 1 to 14 were used. The length, width and thickness of the tamarind pods ranged from 3.6-15.5, 1.2-5.4 and 0.62-1.34 cm. • The fabrication of dehusker with multi dehusking roles and the deseeding unit with impact mechanism has been planned • Status report 'Value chain on Tamarind' is in progress
4	Adoptive trials, establishment and testing of low cost edible oil refining unit (Bhubaneswar Centre) and fruit grader (Junagadh Centre) (April 2014 to Dec. 2015)	1. Testing and Evaluation of On-farm Fruit Grader developed by JAU, Junagadh Centre for Grading of Onions 2. Installation and Testing of Small Scale Oil Refining Unit for Sunflower (developed by OUAT, Bhubaneswar Centre)	• Fruit grader is suitable for spherical products and small onions varieties. However, for large onions, orientations of the onions needs to be controlled for proper grading as large onions are elliptical in shape. • The fruit grader requires little modifications to avoid spillage. Further trials on the modified grader and trials at different flapper spacing of the grader are required. • The grading efficiency was about 41.41% (at 25 rpm) and 36.79% (at 20rpm) with 0.64% mechanical damage. About 6.23% (at 25 rpm) and 36.89% (at 20 rpm) spillage of onions (weight basis) were observed during the trials. • Capacity of the grader was found to be more than 600 kg/h. • Installation and Testing of Small Scale Oil Refining Unit for Sunflower is in progress

BAPATLA CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Accelerated Ageing of Rice and Value Addition in Discoloured and and Cyclone Damaged Paddy	1. To study the ageing in different varieties before and during storage 2. To study the effect of physical, thermal treatments on ageing of rice during storage. 3. To study the effect of various chemical treatments to avoid discolouration of lodged paddy crop 4. To study the feasibility and development of various value added products from discoloured and cyclone damaged paddy	• Thermal treatments were given for artificially age the Swarna (MTU 7029), that are (i) Incubation of freshly milled rice below gelatinization temperature of 50^{o}C at 2,4,6,8 h (ii) Open Steam treatment of paddy for 10 min at 100^{o}C (iii) heat treatment of freshly milled rice above gelatinization temperature at three different temperatures 80^{o}C, 90^{o}C and 100^{o}C incubated for four different times 2,4,6 and 8 hours. • No inference was drawn as none of the treatments have given amylose content of 12 months naturally aged paddy. Hence treatment needs to re-conduct to achieve concurrent results
2	Feasibility Testing and Evaluation of Proto Type Mobile Paddy Drier and its Adaptive Trials in Rural Areas of A.P.	1. To survey the Machine harvested areas in different districts of AP. 2. To fabricate mobile paddy drier of high capacity (1 T) by adopting the design of CIPHET, Ludhiana. 3. Testing and Evaluation of mobile paddy drier. 4. To study the unit cost of operation of drier. 5. To popularize the mobile paddy drier among farming community i.e. in rural areas of A.P.	• Manufacturer has been identified for fabricator: M/s Kardi Dryer, Chennai • Design and drawing of PAU trolley dryer has been received • Waiting for EFC approval and release of NRC funds.
BHUBANESWAR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Establishment of Agro Processing Centre, Training and Demonstration of Technologies	1. Installation of need based processing equipments at the agro-processing center 2. To run agro-processing complex for commercial production & evaluate its feasibility 3. To provide technical guidance to the rural	• APCs established at villages Rajkanika, Kendrapada have been operated successfully for dal processing. The APC has processed 485 q of green gram and 240 q of black gram during 2011-12 and 366 q of green gram during 2012-13 with direct employment for 2 persons.

		entrepreneurs interested in setting up agro processing industries.	• An agro processing centre has been established at Salepur for fruit juice processing. The unit is processing pine apple and aloevera Ready-to-Serve beverages and generating employment for 5 persons
2	Feasibility testing, performance evaluation and popularisation of the prototypes developed at other centers in the state of Odisha	Feasibility testing, performance evaluation and popularisation of selected prototypes	• Tamarind dehuller-cum-deseeder machine (developed by UAS Bangalore center) has been tested for dehulling and deseeding of tamarind. Necessary modifications were made by attaching an extra pulley for providing direct drive to the two cylinders. • The initial moisture content of the tamarind sample was 16.3%. Capacity of the dehulling unit was 500 kg/h. • Dehulling efficiency was found out to be 91.7% and defibring efficiency was 82.3 % after second pass • Capacity of the deseeding unit was found out to be 110 kg/h and deseeding efficiency was 78.8 % after third pass. • The broken seed percentage was around 10% seed weight. • PKV mini dal mill has been demonstrated to farmers and entrepreneurs for milling of green gram and blackgram
3	Processing and value addition to grain amaranth (Amaranthus hypochondriacus) – an underutilized food grain	1. Standardization of process technology for preparation of value added products from grain amaranth 2. To study the shelf life of the prepared products	• Best quality Puffing of grain amarantus was found at 120°C for 45s. • Malt preparation with amaranthus supplement has been standardized. A nutrition reach formulated food using roasted flour of Wheat, Bengal gram and grain amaranthus is under progress.
4	A value chain on Mahua	1. Development of a hygienic flower collection system of mahua 2. Adoption of a suitable on-farm dryer 3. Development of a manual and power operated stamen remover 4. Storage studies of mahua flower and value added products 5. Study of mahua oil filtration/refining for edible purpose	• The physical properties of mahua flower and stamen at different moisture content has been determined. • The geometric mean diameter of mahua flowers increased from 10.83 mm to 11.62 mm and arithmetic mean diameter from 11.80 mm to 12.54 mm as moisture content increases. • The bulk density for different moisture levels varied from 491.8 to 553.63 kg/m^3.

		6. Utilisation of by-products 7. Demonstration of developed value added products and equipments 8. Entrepreneurship development and market linkage	• Power operated Mahua stamen removal machine has been developed. It consists of a rasp bar mounted cylinder (150 mm dia, 250 mm length), oscillating sieve, 0.5 hp motor and 20 mm dia shaft, hood and frame. • Stamen removal efficiency and whole flower recovery were found to be i.e. 97.1 and 88.47 % respectively at 11% (w.b) moisture content with 900 rpm and 9.5 mm concave clearance which was the optimum condition. • Mahua flower were dried to a final moisture content of 15-17% (wb) and storage study is under process.
5	Development of low cost retortable pouch technology for preservation of traditional *Chhena poda* (cheese based baked sweet product)	1. Standardization of the process technology for preparation of *chhena poda* suitable for retortable pouch packaging 2. Selection of suitable packaging material for low cost retortable pouch 3. Storage studies of chhena poda in retortable pouch	• Standardised ingredient for preparation of *Chenna poda* • Higher proportion of sugar content in chhenapoda leads to oozing of sugar syrup from the product during retort processing and less quantity sugar affected the texture and sensory attributes. • Retort processing time for 200 g chhenapoda in laminated retortable pouch was found to be 30 min after the retort attained 121^{0}C. • It took 15 min to achieve 120 ^{0}C at the thermal centre of chhenapoda during retort processing. • Retort packaged chhenapoda could be stored for 28 days under ambient condition with acceptable microbial and sensory quality.
6	Development of process technology for preparation and storage of beverages from watermelon	1. Development of process technology for preparation of different beverages like juice, RTS, nectar and syrup from watermelon 2. Standardisation of physical and chemical methods of preservation for extension of shelf life of the developed products 3. Study of the storage stability of developed products with different packaging materials.	• Stabilizer like pectin and carboxy methyl cellulose (CMC) helpful to overcome the problem of cloudiness of the beverages during storage • RTS with 15:1 brix to acid ratio, 20 % juice and 1 % pectin as stabilizer gave optimum result based on sensory attributes

7	Modified Atmosphere Packaging of Jamun fruit (*Syzygium Cumini*)	1. Study on the optimum harvest condition of Jamun with respect to nutritional and sensory quality. 2. Study of modified atmospheric packaging (MAP) for shelf life extension of whole Jamum using different packaging material and storage condition.	• MAP enhanced the shelf life of fresh jamun. It could be stored for up to 30 days in case of cold storage (1 to 3^0 C), up to 27 days in case of refrigerator storage (8 to 10 ^{0} C) and upto 2 days under ambient storage (28 to 30 ^{0} C). • The O_2 content of the packets increased and CO_2 composition decreased with no of days up to 3-5 days and then equilibriuate up to 28 days of storage. • Microbial load was less (i.e. within 1-3 cfu/g) in case of MAP sample for cold storage and refrigerated sample., whereas it was in the range of 114-117 cfu/g under control.
COIMBATORE CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Establishment of Agro Processing Centre, training and demonstration of Technologies	1. To promote the improved processing equipment and technologies among the farmers through demonstrations, exhibition, etc. 2. To establish agro processing centres at village level and backward areas 3. To run the agro processing complex for commercial production and to evaluate its economic feasibility	• Agro Processing Complex at Kanur Pudur and Therampalayam village, Karamadai block located about 40 kms from TNAU campus have been established. • Existing APCs were monitored and found an earning of net profit to the tune of Rs. 1.47 lakh and Rs. 32000 per annum from Kanurpudur and Therampalayam, respectively • Few Women Self Help Groups and Farmers Association were motivated for establishment of APC
2	Development of fermented millet based probiotics	1. Isolation and identification of native probiotic bacteria from various millets 2. Screening of isolates for pH tolerance and antimicrobial activity against food spoilage organisms 3. Preparation of porridge mix using superior probiotic isolates 4. Shelf life and other quality parameters of millet based porridge	• Potential lactic acid bacterial cultures from pearl millet with probiotic attributes has been identified and used for the preparation of porridge with improved nutritional properties and shelf life. • Organoleptic properties studied with 11 testers showed that the overall acceptance of porridge was better compared to un-inoculated (control) • The native ragi isolates were isolated from soaked seeds, slurry and fermented porridge.

3	Development of ozone based storage structure for managing insects in grains	1. To develop ozone based storage bin suitable for paddy, rice and green gram. 2. To study the effects of ozone concentration and exposure time on mortality rate of insects in stored grains. 3. To analyze the biochemical quality characteristics and germination characteristic of ozone treated paddy, rice and green gram during storage. 4. To analyze the cost economics of ozone treated grains.	• Engineering properties of grains were studied • The design for ozone based storage bin suitable for paddy, rice and green gram is in progress.
4	Exploring the production of food enzyme from edible	1. Collection, screening, characterization and selection of microbial cultures for food enzymes production 2. Optimization of growth and nutritional parameters for higher enzyme production by solid and submerged fermentation techniques using deoiled cakes 3. Development of low cost microbial medium for large scale multiplication and enzyme recovery 4. Development of pilot scale production technology for enzymes with selected strains 5. Downstream processing and recovery systems for enzyme recovery and purification 6. Biochemical characterization of enzymes for commercial utilization 7. Technology refinement, cost economics , appraisal and establishment of techno economic feasibility for scaling up of the technology	• α-amylase activity of 15600 Uml^{-1} was attained when deoiled rice bran was used as a substrate at a concentration of 2 per cent and when supplemented with dextrose. • α-amylase activity of 5400 Uml^{-1} was attained when deoiled rice bran was used as a substrate at a concentration of 2 per cent and when supplemented with ammonium chloride. • α-amylase activity of 11500 Uml^{-1} was attained when sunflower oil cake was used as a substrate at a concentration of 2 per cent and when supplemented with ammonium chloride. • α-amylase activity of 6080 Uml^{-1} was attained when sunflower oil cake was used as a substrate at a concentration of 2 per cent and when supplemented with sodium nitrate.
5	Studies on storage parameters of onion	1. To study the physical, thermal and biochemical characteristics of onion.	• The time taken for curing of fresh onion bulb was 17, 14, 11 and 8 hours for sun curing, and cabinet curing at 35,

		2. To conduct studies on curing of onion 3. To conduct storage studies of cured onion in the modified ventilated storage structure and to optimize the storage parameters based on the quality parameters. 4. To conduct storage studies of onion in cold storage and to optimize the storage parameters based on the quality parameters. 5. To study the effect of composition of gases in modified/controlled atmospheric storage on quality parameters of onion. 6. To work out the cost economics of different storage methods	40 and 45^{o}C respectively. • Three modified onion storage structures with varying spacing between compartments were installed at the farmer's field at Vanjipalayam, Tirupur district, Tamilnadu • The maximum pyruvic acid content 5.51 µmol/g was observed at 20 cm depth of storage in the 10 cm air spacing storage structure after 13 weeks of storage. • • Under low temperature storage conditions, cured onion bulbs were found to be good than uncured onion bulbs till 90 days of storage
6	Development of on-line grading system based on internal and external qualities of mango using machine vision technology	1. To explore and study the possible internal and external quality parameters of mango which suits for machine vision technique evaluation 2. To acquire and analyze images of mango fruits at different stages of maturity using smart camera 3. To develop an algorithm between acquired images and internal, external quality parameters of mango using various image processing methods 4. To develop an on-line machine vision system using the developed algorithm 5. To evaluate the performance of the developed machine.	• Shade free imaging chamber was developed with the dimension of 20"x17"x20" • Mathematical modelling study was carried out with the measured physical properties of two varieties of Indian mangoes as a function of projected area (Pip) calculated using image processing technique • Quadratic model was found to be best suitable to predict weight, volume, surface area, geometric and arithmetic mean diameter with higher accuracy (R2>0.95) • Fabrication of online grading machine is going on (The main frame (size 12'x1'x3'), and hollow conveyor roller of 4" dia with 13" length were fabricated)
7	Production of Ready To Eat mushroom curry in retortable pouches	1. To optimize the size of slices of the mushroom suitable for the preparation of RTE mushroom curry. 2. To optimize process parameters for the production of RTE mushroom curry in retortable pouches.	• Ready to Eat Mushroom curry was prepared using balanced mushroom slices and packaged in retort pouches and processed at 121.1° C for 18min in the retort processing unit. The processed retort pouches are cooled to room temperature and stored in a dry place for further storage studies.

		3. To conduct shelf life studies on RTE mushroom curry stored under NTP conditions. 4. To work out the cost economics of the newly proposed RTE mushroom curry packaged in retortable pouches.	• Storage studies are being conducted at ambient conditions, which ranged between 28±2 °C and a relative humidity of 55±10 %.
8	Studies on the nutraceutical properties of selected underutilized green leafy vegetables and their value addition	1. To find the phyto chemical and nutraceutical properties of fresh selected green leafs (1. *Mukia maderaspatana* (Tamil: Musumusukkai 2. *Celosia argentea* (Tamil: Pannai Keerai) 2. To design and optimize the dehydration treatments for the selected leafy vegetables. 3. To analyze and compare the phyto chemical and nutraceutical properties of dehydrated green leafy vegetables with fresh leafy vegetables. 4. To prepare a value added products with selected dehydrated green leafy vegetables - ready to use herbal nutra-mix powder, instant dosa mix powder, green noodles etc . 5. To test the shelf life and organoleptic properties of selected green based value added products and workout the cost economics	• Preliminary phytochemical screening of the different fractions of fresh leaf extracts of *Mukia maderaspatana* revealed the presence of alkaloids, carbohydrates, phytosterols, tannins, flavonoids and proteins • Similar results were obtained with dried (sun dried) leaf powder and it confirms that there was no loss in the phyto nutrients on dehydration • Maximum extractive value for dried leaf was obtained with ethanol. • Studies are initiated on the screening of antidiabetic and antioxidant properties of dehydrated and fresh *Mukia* leaves
9	Mango Destoner cum pulper	Refinement and Adoptive trails	• Suitable for removal of stone from mango fruits and pulping • Capacity of the unit is 1000 kg/h • Pulping efficiency is 94.6% • Pulp recovery is 20 % more than manual method • More hygienic and less time consuming

10	Pilot Plant for extraction of pectin from mango peel	Refinement and Adoptive trails	• A pilot scale pectin extraction unit (batch type) was designed for production of pectin from fruit waste. The plant can produce 1 kg of pectin from 25 kg of fresh peel per day (8 h). • Cost of production for one kg of mango peel pectin was estimated as Rs 2600/- while the commercial pectin is available for Rs.2750-5500
11	Cocoa Pod breaker	Refinement and Adoptive trails	• Capacity of the unit is 250 kg per hour • Efficiency of the unit is 91 % • Labour requirement is 40 % less than manual method • Cost of operation is Rs. 46 per hour • The cost of the unit is Rs.5,000/- (app.)
12	Solar Tunnel dryer with biomass backup heater for Cocoa beans drying	Refinement and Adoptive trails	• Dries cocoa beans from 50% to 7- 8 % w.b. within 48 hours, where as sun drying takes 80 hours • Fuel requirement for the biomass burner is 10 kg / h (or) 80 kg / batch of 45 kg. • Cost of the tunnel dryer with furnace is Rs. 50,000 for a holding capacity of 100 kg • Quality of the dry beans in terms of market value is not affected. • Thermal efficiency of the unit is 20.4 % • Cost of operation is Rs. 7.47 per kg
HISAR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Establishment of agro processing centre, training and demonstration of technologies	1. To train manufacturers to produce improved machines 2. To demonstrate improved machines	• One APC on aonla preserve was established and monitored in village Bhatrai (Bhiwani district, Haryana). • A patent was filed and obtained along with entrepreneur Sh. Krishan Jangra on carrot washer • Technical advice given to rice processing at Meham and Mr. Subash village Palwan, P.O. Uchana, Distt. Jind

2	Field evaluation and testing of equipments developed at other centres	1. Field testing of TNAU pearler, carrot washing machine (continuous type), and Garlic Peeler and Garlic grader from Udaipur centre	• Field evaluation of continuous carrot washing machine, Garlic Peeler and Garlic grader has been undertaken. • Potato peeler and potato slicer were purchased from CIAE, Bhopal. • Carrot washer (continuous) type was tested in Rohtak, Faridabad and Hisar fields.
3	Establishment of pack house for carrots, aonla and ber	To conduct adoptive trials with pack house for ber, aonla and carrots in farmers' fields	• Low cost technologies/innovations were identified • A case was identified in Karnal for improvements and field adoptions
4	Modification of pedal operated cleaner-cum-grader for CIAE, Bhopal based model for pearl millet and nustard	To modify and evaluate pedal operated cleaner-cum-grader for pearl millets and mustard	• The unit is being tested in Hisar
5	Design and development of carrot twigs plucker and utilization of carrot twigs for food, feed and fuel	Utilization of carrot twigs as Novel food, feed and fuel	• Samples of carrot twigs collected and experiment laid down
IMPHAL CENTRE			
1	Development of ginger processing unit	1. To develop a suitable dryer for drying of spices such as ginger, turmeric 2. To study the drying characteristics of the spices to optimize the drying parameters	• A prototype biomass based dryer developed • Better conversion (solid biomass to flue gas) efficiency (above 80%) • Better control on burning of biomass (handling gaseous fuel) • Recirculation of hot flue gas/air for increasing the heat utilization efficiency
2	Production of improved fermented soybean product	**1.** Documentation and collection of traditional fermented soybeans from different states of Northeast India. **2.** Isolation and characterisation of the fermenting microorganism.	• Isolates as potential starter culture for soybean fermentation have been identified • Two low cost fermentors, i.e. Prototype I (electric Power operated) and prototype II (Pipe line conventional without Power) developed

		3. Screening for starter cultures on the basis of fermentation properties and potential. **4.** Optimisation of conditions for fermentation of whole soybean by the selected cultures. **5.** Development of a low cost incubator for fermentation of soybean for rural households.	
JABALPUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Operational Research Project in Agro Processing Centre with Techno-Economic Feasibility	1. To impart training to the villagers and women of the area. 2. To provide technical guidance to the rural entrepreneurs interested in starting post-harvest industries 3. To develop Agro Processing complex at adopted site	• The centre conducted demonstrations and trainings for creating awareness and delivered lectures in the trainings conducted by the department of agriculture, MP Government.
2	Design, Development of Testing of Groundnut Testa Remover	1. To design and develop a power operated machine for remove testa from groundnut Kernel. 2. To test this machine in a commercial scale snacks manufacturing unit	• The prototype developed was found to be 40 kg/h. • Processing cost is Rs 0.80 per kg. • For flash heat treated (1 min) groundnut kernels best shelling efficiency (87 %)
3	Field evaluation and testing of equipment developed at other centres	To evaluate the performance of a commercial dalia mill.	• Highest percent recovery of fine dalia (1-2.5 mm) was observed 56.5% at a feed rate of 180 kg/h. • With 7 mm sieve opening of the dalia mill, maximum percent recovery of fine dalia (1-2.5 mm) was 58.2% at a feed rate of 270 kg/h.
4	Value addition and quality enhancement of by products of pulse milling industry by extrusion cooking technology	CCM Suggested to include maize, sorghum and minor millets in the experiments	• Experiments have been designed. The extruder available in the lab was breakdown and recently got repaired.

JAIPUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1.	Post-Harvest Management of Aonla and Aloe vera (Old project)	1. Self life improvement of aonla for off season use. 2. To develop alove vera juice extractor to obtain peel free clear juice from aloe vera leaves and standardisation of juice preparation technique. 3. Value addition of aonla and Aloe vera products/ by products.	• Process technologies were standardized for different products of aonla, viz. Aonla candy and Aonla syrup and juice. • The effect of different treatments on the shelf life Aloe vera juice, its colour flavor, taste and consistency was studied under laboratory condition for two months. Sodium benzoate 0.05 % + citric acid 0.05 % found better than other treatments in maintaining the quality parameter.
2.	Post-Harvest Management of Henna (Old project)	1. Standardization of henna leaves drying and separation process. 2. Development and testing of a mechanical henna harvester.	• Shade dried leaves at 45 cm bed thickness for 5 days with atmospheric RH 48 -21% and temperature 33 – 20^{o} C retained 8.86 % (wet basis) moisture content which was safe for storage, trading and grinding and found superior over sun drying method in maintaining its quality and having higher Lawson pigment. • The fabrication of modified henna harvester is in progress • Designed and developed henna leaves separator. The separation effectiveness and output capacity of the machine was 0.764 and 347.2 kg /h respectively.
3.	Adaptive trails on improved and developed post-harvest technology at different centres of AICRP on PHT/ other organization	Adaptive trials on Aloevera processing machinery	• The machine can extract gel from with capacity of 40.8 kg per hour. The percentage of gel from gel outlet was 42.2 per cent. • It was noted that the gel obtained at gel outlet was not peel free
4.	Establishment an Agro Processing centre	**1.** To establish an Agro-processing centre. **2.** To introduce improved processing equipment and technology for proceeding of Aloevera 3. To establish linkage between Agro-processing centre and farmers.	• APC on Aonla and Aloe vera processing has been established in Village Jatwara, Distict Jaipur. • This APC was earning an amount of Rs. 35000 – 40,000 per month

JORHAT CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Establishment of Agro Processing centre, training and demonstration	1. To select suitable site, in co-operation with local farmers and voluntary agencies. 2. To undertake study of a cluster of villages with respect to processing of farm produce, demand for processed food and their supply. 3. To identify suitable equipment and technologies based on the types of farm produce and processed products demand and to examine their techno-economic feasibility. 4. Installation of processing equipment and machines in a selected rural area to develop an agro-processing complex. 5. Testing of equipment and machines in the complex for optimizing their performance	• The first APC established at Allengmora, Jorhat has repaid nine yearly instalments so far. After one more repayment the APC would become property of the SHG. • The total annual turnover of APC at Roha was monitored and found net profit of Rs.58,935.00 during 2011. • *APC Bihaguri Seuji Krishok Sammittee* was monitored • *Gopal Krishna Self Help Group* established APC in Merapani, Golaghat district in August 2013 with capital investment on machinery of Rs.4.19 lakh.
2	Adaptive trials and feasibility testing of technologies developed at other centers of AICRP on PHT and commercially available technologies for Assam conditions	1. Testing and evaluation of technologies/equipment namely : Ginger washing machine and Ginger peeling machine 2. On farm demonstration under PRA mode of adaptable and economically feasible technologies/ equipment for Assam conditions	• The capacity for ginger washer cum cleaner evaluated was found to be 75 kg/h, including time taken for loading, cleaning, and unloading • Most efficient working was found at10 kg per batch
3	Bio-control of storage insect-pests of rice, green gram and black gram	1. Testing the efficacy of different formulations of orange peel and black pepper and botanical 'C' against stored grain insect-pests of rice, green gram and black gram. 2. Preparation of desirable and effective formulations 3. Proximate analysis of treated rice, green gram and black gram	• Botanical 'C' (at 50ppm or 0.005% concentration) was tested against four storage insect-pests • Rice kept half filled in containers with application of botanical 'C' @ 50 ppm showed the best results with only 1.11 damaged grain even after 9 months of storage • Botanical 'C' was found to be effective against *Callosobruchus chinensis* in green gram & against *Sitophilus oryzae* in wheat however it was not found to

		4. Effect of treatments on grain quality in terms of texture, colour, viscosity and organoleptic aspects	work against paddy • Two natural enemies of storage insect-pests of paddy were recorded for the first time from the North Eastern Region. The parasitic wasp, *Anisopteromalus calandrae* was found to parasitize on larvae of *Rhyzopertha dominica*, *Sitophilus oryzae*, *Sitophilius zeamais* and *Cryptolestes pusillus*. The warehouse pirate bug, *Xylocoris flavipes* was found to predate on larvae of *Tribolium castaneum* and *Tribolium confusum*
4	Evaluation and demonstration of extraction of starch from tapioca varieties of N.E India	1. To evaluate the extraction potential and quality of starch from tapioca varieties grown in the North Eastern region of India. 2. To conduct training on extraction and utility of starch to prospective entrepreneurs.	• Development of low cost good quality gum using tapioca starch. • Pilot plant study on production of safe and low cost holi powder from tapioca flour completed. • Starch based film and physico-chemical parameters studied • Storage of low moisture content food materials such as Elaichi, dalcini, mustard, tea, pepper, mixed spices in starch films revealed that the samples kept well in comparison to control(polypropylene) at room temperature(30-33^{0}c) and RH(95%).
5	Development of combination drying system (solar and biomass furnace) for drying of ginger and black pepper	1. Conduct experiments to study the drying kinetics. 2. Design and Development of the drying system. 3. Optimize the energy efficiency of the drying method under various operating conditions	• A solar biomass fired integrated drying system (IDS) was developed • Drying air temperature could be raised to 50 - 55 deg C prior using husk as fuel and to 65 deg C by using woody biomass • Specific energy consumption of husk fired dryer, fluidized dryer and electrical tray dryer were 28.43, 19.84 and 25.25 kWh/kg of moisture evaporated. • Overall efficiency of the IDS was found to be 36.33%.
6	Value addition of locally available vegetables through minimal processing (leafy vegetables: spinach, *khutora*,	1. Standardization of minimal processing sequences 2. Shelf life evaluation of cut vegetables in different packaging systems under ambient	• Sequences for minimal processing of Dhekia (*Diplazium esculentum*) have been standardized • Loss of moisture content was found to be more in case of

	lai, morisa, vedailota; vegetables: beans, cauliflower, carrot, cabbage)	and refrigerated condition 3. Evaluation of market acceptability of the products	sample stored in brown paper bag.
7	Value addition to indigenous citrus (khashi mandarin, pummelo and citron) peel waste by candy making	1. To standardize the method of candy making from citrus peel. 2. Storage studies of different candies.	• Methods have been standardize for candy making from different citrus peel. • The mean score for colour and appearance of the treatments irrespective of storage period varied between 7.33 and 8.25 • Score for texture at different storage periods irrespective of treatments showed decreasing trend. • At initial stage the mean score for overall acceptability was found maximum (7.92) which decreased gradually to 6.92 at three MAS
8	Development of a storage regimen for a standardized biopesticide for the control of *Callosobruchus chinensis* in pulse storage and a small scale production unit	1. Standardization of storage regimen for developed formulation in scaled up bins vis-à-vis traditional structures with improvisations, if necessary. 2. Process standardization of drying – grinding – packaging line, ready for commercialization 3. Popularization of the technology through participatory appraisal mode and other popular audio-visual aids.	• Three gram of Black pepper seed powder per kg of green gram can effectively control the infestation of *Callosobruchus chinensis* during storage when green gram seed is kept in scaled up metallic bins of 25-50 kg capacity , polythene lined bamboo structure '*Duli'* and traditional seed storage structures. • Popularization of the technology through PRA is on progress.
9	Value addition to bamboo shoot through an improved fermentation process.	1. To develop an improved bamboo shoot fermentation method. 2. To improve the drying process of fermented bamboo shoot	• Fermentation process for bamboo shoot has been standardized • Fermentation of bamboo shoots with garlic extract is found to be better in comparison to ginger, common salt and control (Sensory score 8 on 9 point scale).

JUNAGADH CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1.	Adoptive trials, establishment and testing of low cost edible oil refining unit (Bhubaneswar Centre) and fruit grader	1. Testing and Evaluation of On-farm Fruit Grader developed by JAU, Junagadh Centre for Grading of Onions 2. Installation and Testing of Small Scale Oil Refining Unit for Sunflower (developed by OUAT, Bhubaneswar Centre)	• Fruit grader is suitable for spherical products and small onions varieties. Capacity of the grader was found to be more than 600 kg/h. • The grading efficiency was about 41.41% (at 25 rpm) and 36.79% (at 20rpm) with 0.64% mechanical damage. About 6.23% (at 25 rpm) and 36.89% (at 20 rpm) spillage of onions (weight basis) were observed during the trials. • No progress as far as Installation and Testing of Small Scale Oil Refining Unit for Sunflower is concerned.
2.	Assessment of microbial flora strength during postharvest handling of custard apple and lemon	1. To isolate and find out the microorganisms present on the fruits surface. 2. To find out the strength of microorganisms at each of the post harvesting handling stage.	• Human pathogenic organisms such as *E. coli* and *Salmonella* were found on the surface of fruits at very high level (>100), not suitable for consumption. • Soil microbial flora also to be found on the surface of fruits. i.e. spp. of *Aspergillus, mucor* etc. • The intensity of microorganisms increases at transportation stage because it might be due to improper handling of fruits as well as some Agricultural and Non-Agricultural products were also transported along with fruits.
KASARAGOD CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1.	Design and fabrication of a coconut shell removing machine	1. To design and fabricate coconut shell removing machine. 2. To study the technical viability and economic feasibility of coconut shell removing machine.	• Conceptual design and drawing for the proposed machine has been made. Two concentrically rotating circular blade and a stationary shaft on which coconut is placed firmly are the major components of the de-shelling machine • The fabrication of the machine is in progress.
2.	Development of pilot level process and technology for the production of health foods	1. To investigate the effect of pre-treatments on the recovery and quality of milk residue and cake	• Moisture dependent flow specific physical properties of coconut milk residue and virgin coconut oil cake were

	from coconut milk residue and Virgin coconut oil cake	2. To optimize the process parameters for the production of protein and dietary fibre rich flour from milk residue and cake 3. To upscale the optimized process for the production of protein and dietary fibre rich flour at pilot level. 4. To utilize the protein rich flour in the production of food formulations such as bakery and extrudates.	determined. • The effect of incorporation of coconut flours in changing the softening and flow point temperature of cereal flours was investigated using phase transition analyzer. • In order to improve the recovery, effect of milk expelling methods (manual and mechanical) and pre-treatments (slicing, pulverizing and blanching) on milk and hot process VCO recovery with respect to fresh coconut kernel weight was studied. • Preliminary investigation on the utilization of two important co-products of hot process VCO such as coconut milk residue and VCO cake in the development of ready-to-eat extrudate was conducted.
3.	Design and development of self loading arecanut dehusker	1. To design and fabricate the arecanut dehusker with self loading and dust collection system 2. To study the technical viability and economic feasibility of the developed prototype	• Designed arecanut dehusker • Fabrication of roller grader is completed. • Fabrication of self loading system and dust collection system are in progress
KHARAGPUR CENTRE		Not applicable	The centre was closed
LUDHIANA CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1.	Establishment of Agro Processing centre, training and demonstration of technologies.	1. To study the machinery management in different Agro-processing complexes 2. To study the economic management in these agro-processing complexes 3. To popularize the concept of APC	• Seven agro-processing complexes were established in 2013 and four APCs in 2014. All these complexes were found to be economically viable units, providing employment to 2-5 persons. • Installation of exhaust fans, dust collectors, air purifiers, use of face mask, safe practices of agro-processing, HACCP concept, with maintenance of sanitary conditions in the premises were suggested to the owners. • APC concept was popularized through TV talks, training programs, various extension lectures and popular articles

2.	Demonstration and commercialization of developed equipments and technologies for honey extraction	1. Dissemination of equipment/ prototype/ technologies i.e PAU electric-cum-battery heated uncapping knife and PAU honey heating -cum- filtration system developed under AICRP on PHT	• Twenty prototypes of honey uncapping knife were fabricated, and tested for their performance in the laboratory and at different locations of Punjab at Beekeepers Apiaries for its performance. • An automated unit for processing of raw honey, an inbuilt filtration system in the existing honey heating-cum-filtration system was designed and developed. The cost of the developed processing unit is Rs 75,000/. • The beekeeper showed high satisfaction with the performance of the machine in terms of its ease in operation, cost, timeliness, hygiene and quality of honey. • The developed honey-heating-cum filtration system has been licensed for Rs 50,000/- • The licensee has supplied to 17 KVK's of PAU. Trainings were imparted to KVK's officials for its working know-how.
3.	Development and evaluation of percussion based gadget for quality management of stored grains and their milled products	1. A preliminary study on storage of wheat flour from different sources to ascertain the necessity of the project. (Project was not approved in CCM)	• The infestation increased gradually in all the samples with increase in storage period with the simultaneous increase in uric acid, alcoholic acidity and microbial load in the infested samples. • However, no infestation was observed in the samples collected from Modern Flour Mill collected before and after entoleter treatment. • No infestation was detected in the samples where wheat grains were properly fumigated prior to milling.
4.	Utilization of de-oiled rice bran for food purpose	1. To study the effect of physical processing on biochemical and bio functional compounds of deoiled rice bran. 2. To select the best method of protein extraction from deoiled rice bran for its better utilization in food. 3. To optimize the percent utilization of physically, chemically (extracted protein	• Protein was extracted by using alkali extraction method at three different levels of pHs i.e 7.0, 9.0, 11.0 with extraction time of 30 min and 60 min respectively • Utilization of DRBPC at different levels in cookies and chapattis are under progress.

		concentrate) and enzymatically processed deoiled rice bran in wheat based food products.	
5.	Protocol and pilot plant for extraction of pectin from kinnow peel/waste	1. To compare the different methods for extraction of pectin in order to identify the most effective method for extraction of pectin from kinnow waste 2. To characterize the pectin extracted by different methods. 3. To optimize the process parameters of selected methods under lab conditions. 4. To develop the pilot plant for extraction of pectin	• Pectin extraction process from kinnow peel was standarized. The yield of pectin obtained by enzyme polygalacturonase was 15.1% (dry weight basis) with a degree of esterification of 49%. • Optimized conditions for extraction of pectin from pomace using HNO_3 were 69.34°C extraction temperature, 60.54 min extraction time and pH 2.0 of extraction solution which gave 6.0% yield of pectin, 90% DE, 0.03023 poise viscosity and 90342.2 MW. • Optimized conditions for extraction of pectin using HCl were 73.0°C temperature, 61.28 min and pH 2.0 of extraction solution which gave 6.1% yield, 90% DE, 0.02924 poise viscosity and 77915.4 MW. • Designed pilot plant for pectin extraction by HNO_3 method and awaited for NRC funds for fabrication and installation.
6.	Technology for production of probiotic and synbiotic juice from guava, kinnow and mango	1. Microencapsulation of the probiotic strains. 2. Production of novel probiotic and synbiotic juices 3. Microbiological, physiochemical and sensory analysis of the developed products. 4. Development of a Pilot plant to produce probiotic and synbiotic fruit juices.	• The probiotic guava, kinnow and mango juices were successfully formulated, with stable and viable beneficial bacteria content in the recommended dose (106 cfu/ml) with a shelf life of one month. • The sensory evaluation of the developed juices indicated that the consumer preference was more for the juices with free probiotic cells as compared to the ones with microencapsulated cells owing to the mouthfeel of the probiotic beads. • Undesirable organisms like Coliforms and E. coli were not found in these probiotic juices. • A Patent on 'Production of Probiotic fruit juices using free probiotic cells from guava, kinnow and mango", was filed on 4th March, 2013.

			• A process flow diagram (equipments) for pilot plant to produce probiotic fruit juices was prepared
PUSA CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1.	Procurement and evaluation of Litchi peeling machine	1. Survey of existing machines/technology for Litchi Processing particularly for peeling & destoning of Litchi 2. Preparation of status report on post-harvest management of litchi fruit 3. Procurement and evaluation of Litchi peeling machine	• Supply of CIPHET Litchi Peeling Machine is awaited • Technical bulletin on Post-harvest Management of Litchi has been published.
2.	Adaptive trials of Jackfruit Processing Technology developed by UAS, Bangalore center of PHTS	1. Survey of existing practices for post-harvest processing & management of Jackfruit in local areas. 2. Training and acquiring jackfruit processing technology from UAS, Bangalore centre. 3. Adaptive trials of the technology at Pusa centre. 4. Transfer of technology to farmers/ entrepreneurs	• Survey of existing practices for jackfruit processing has been conducted. • Scientific personnel of Pusa centre have been trained at UAS, Bangalore on products development from ripened jackfruit. • Five value added products (*halwa*, RTS beverage, seed flakes, squash and jam) from fully ripe jackfruit have been successfully made and organoleptically evaluated. All the products were liked by judges.
3.	Studies on byproduct utilization of Litchi peels and Litchi stones/seeds	1. Survey of existing practices for post-harvest management & utilization of Litchi peels and stones/seeds. 2. Preparation of status report on post-harvest management & utilization of Litchi peels and stones/seeds. 3. Development of new technology / product to utilize Litchi waste / byproducts.	• Survey of existing practices for post-harvest management & utilization of Litchi peels and stones/seeds was carried out. • Engineering properties of litchi peels and stones/seeds were determined. • The fractional analysis (on weight basis) was performed on 50 randomly selected litchi fruits of two different varieties (*Shahi & China*). • The weight of whole litchi fruit, its peels and its stone was measured alongwith the T.S.S. content of the pulp. The bulk density of litchi fruits, peels and stones was also determined for both the varieties. Project closed

RAICHUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Development of Process Technology for accelerated ageing of major rice variety of North Karnataka	1. To optimize the parameters involved in accelerated aging of rice 2. To evaluate the effect of accelerated aging on engineering properties of local varieties **3.** To evaluate the effect of accelerated aging on proximate composition and cooking quality of local varieties	• Rice varieties namely BPT-5204, Gangavati sona and Kaveri Sona were selected for accelerated ageing of rice. The proximate composition and rheological properties of stored rice samples (six months, one year and two year), were determined. The results revealed that amylose content increased with storage period • Freshly harvested rice samples of selected varieties were procured in the first week of December, 2014 and the analysis is under progress
2	Adaptive Trials on Processing and Value Addition Technologies of Turmeric developed under PHTS	1. To select the proven turmeric processing and value addition technologies developed at different PHT centers 2. To conduct the adoptive trials at the turmeric production catchments of North Karnataka 3. Demonstration and popularization of processing and value addition technologies among the stakeholders	• The scientist of Raichur center visited the turmeric grower fields near Coimbatore and had discussion about the adoption of the technology • A training cum demonstration on turmeric processing technology involving boiling, drying and polishing of turmeric rhizome was conducted to the farmers of North Karnataka region
3	Standardization of Process Technology for Honey Powder	1. To standardize process technology for production of honey powder 2. To characterize the developed honey powder	• Initial trial experiments were conducted to produce honey powder with malto-dextrin and corn starch as a coating materials using pilot scale spray dryer • The optimization of spray drying process parameters (like drying temperature, feed rate, blower rpm) and characterization of honey powder in terms of its physical, bio-chemical and textural properties is under progress.
4	Development of Packaging Technology for Fresh Figs to Enhance their Shelf life	1. To study the effect of new honey comb structured packaging material on shelf life/qualities of selected fruits 2. To study the economics of the packaging technology	• Honey comb structured packaging material with inscribing circle diameter of 50 mm and 50 mm height was designed as per the physical dimensions of the fresh fig fruits. • The craft paper of 90 and 120 GSM was selected and

			fabricated the honey comb structured packaging material • The estimation of transportation losses in terms of PLW, bruising (%), decay loss and shelf life of the fresh fig fruit is under progress.
5	Development of Large Capacity Multimode Solar Dryer for Drying of Food Crops/ Commodities	1. To evaluate the performance of developed dryer for selected crops/commodities 2. To study the economics of the packaging technology 3. To conduct the demonstrations for promotion of developed technology among the stake holders	• Drying experiments were conducted to produce raisins from the Thomson seed less grapes in the developed dryer covered with 75 per cent shade net for maintaining the desired temperature • Saving in drying time by 49.5 % and labour cost 54.5 %. • The dryer is economically viable and benefit cost ratio was 1.7
6	Development of poultry feed supplemented with methionine producing probiotic to improve quality of eggs	1. To optimize media for mass production of methionine producing pro-biotic 2. To screen efficient carrier material for developed pro-biotic poultry feed 3. To evaluate the effect of poultry feed supplemented with methionine producing pro-biotic on bird health and quality of egg production in larger scale	• Methionine producing probiotic microorganisms isolated from milk samples were found to be efficient compared to that of from soil and poultry waste • Poultry feed supplemented with methionine producing probiotic was prepared with mixing proportions of 10:1 • Proboitic poulty feed resulted in improved egg quality in layers interms of High values of egg weight shell thickness and yolk colour.
7.	Standardization of protocol for extraction of phycocyanin from algae to replace synthetic in Food Industry	1. To standardize protocol for phycocyanin extraction from Algae 2. To evaluate the phycocyanin stability under various storage conditions	• Natural colouring pigment phycocyanin was extracted from dried algal biomass and the powder was obtained from spray drying technique • Phycocyanin extract was also tested for its antibacterial activity against food pathogens namely E.coli, Streptococcus and pseudomonas species • Thermal stability of the phycocyanin in milk was studied using different colour stabilizers for a range of temperature from 30 to 80^{o}C
8.	Establishment of Agro Processing Centre, Training and Demonstration of	1. To promote the improved processing equipment and technologies among the farmers	• Six numbers of APCs already established were monitored • Different models of agro processing equipment were demonstrated to the farmers, entrepreneurs, SHGs and

	Technologies	2. To establish agro-processing complex at production catchments 3. To run the agro-processing complex for commercial production and evaluate its feasibility and adoption	rural unemployed youths • Motivated the aspirant entrepreneurs and resulted in establishment of their own APC (2 No.); one at Raichur city and other at Kuradi village of Raichur district
RAIPUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Development of process technology for starch production from *tikhur* rhizomes (*Curcuma angustifolia* L.)	1. To study and document the traditional/conventional method of c*hironji* processing in the area. 2. To study physico-chemical properties of c*hironji* seed (nut) and kernel. 3. To develop a decorticator for processing of c*hironji* seed/nut. 4. To study the storability of c*hironji* kernel over a period of time on different packaging modes/material. 5. To study possible reason(s) for development of bitterness in the product.	• Improved process technology for starch extraction from *tikhur* rhizomes developed. Partial mechanization of the traditional technology of the tikhur starch extraction by tribal families resulted in increased yield of 3-4 % of starch, with reduction in processing time. • About 1.5 to 1.75 quintals of rhizomes can be handled by two persons in a day. • One extraction unit has been procured from CTCRI for testing. • Enhanced production of *tikhur* starch and availability in the market and increased the income the groups involved in the business.
2	Densification, packaging and storability of deseeded tamarind pulp	1. To evolve densification technique/mechanism for the de-seeded tamarind pulp. 2. To study the effect of different packaging material on quality of tamarind pulp over a period of storage vis-à-vis loose pulp. 3. To study the cost economics of densified tamarind pulp blocks (bricks).	• A low cost device/gadget for tamarind block (briquette) has been developed for densification of dehulled and de-seeded tamarind pulp into densified blocks of two standard sizes, viz. 500 g and 1 kg weight. • Unit Cost of machine is Rs 14,000 and the cost of briquetting : Rs 1.42 per unit for 500 g and Rs 0.95 per unit for 1 kg • The machine is found suitable for both male and female workers without significant difference in output/capacity and enhanced income of the benificiary.
3	Design and Development of *Chironji (Buchanania lanzan)* decorticator and study the	1. To study and document the traditional/conventional method of c*hironji* processing in the area.	• Collection of *chironji* nuts samples from different forest areas of Chhattisgarh is done. • Survey and documented traditional method of Chironji

	shelf life of *Chironji* on various modes	2. To study physico-chemical properties of c*hironji* seed (nut) and kernel. 3. To develop a decorticator for processing of c*hironji* seed/nut. 4. To study the storability of c*hironji* kernel over a period of time on different packaging modes/material.	processing • Physico-chemical properties of c*hironji* seed (nut) and kernel has been studied
4	Development of process technology for optimum recovery of essential oil from Patchouli (*Pogostemon cablin Benth*.)	1. To study the effect of pectinase producing microbial incubation on oil recovery. 2. To study the dehydrogenase producing microbial incubation on active ingredients of patchouli oil. 3. Analysis of physico-chemical properties along with active ingredients using gas chromatograph.	• Important and promising microbial cultures from *Aspergillus, Penicillium, Trichosporon* and *Bacillus* groups have been screened on the basis of pactinase activity. • Cultures having potential activity (as per literature) were selected (*Penicillium citrinum*, *Aspergillus foetidus* and *Tricosporon asteriodes*) and procured from the repository (Institute of Microbial Technology, Chandigarh). • Patchouli herbage collected from the fields was subjected to drying process (shade drying and oven drying) followed by oil extraction. • Moisture content of the herbage was varied for the extraction of oil and at different moisture content the oil recovery was studied. • Quality of oil was assessed using physical parameter along with TLC
5	Establishment of Agro Processing Centre, training and demonstration of technologies	1. To create facilities for processing of locally produced commodities. 2. To create opportunities for employment generation. 3. To enhance the income of cultivators. 4. To promote the small/rural entrepreneurs	• One new APC was established in Patari village, about 25-30 km from IGKV Raipur Campus, This APC is equipped to process wheat and paddy along with turmeric, coriander and chili powder. The entrepreneur has also initiated the processing and marketing of branded Organic Turmeric Powder. • The turmeric powder processed by the centre is being marketed directly to the consumers. • Around 16.5 tonnes of turmeric powder were handled by the processor, and earned profit of Rs. 2,43,000.00 during 2013-14

6	Performance evaluation and popularization of prototype developed at other PHT Centers and other R&D institutions	1. To identify the equipment and processes suitable for post-harvest loss reduction and value addition in the selected crops of the region. 2. To make available suitable equipment/ machine for processing and value addition of agricultural commodities. 3. To procure the selected equipment, their installation, testing and adoptive modifications (if any). 4. To assess financial viability of these in comparison to the existing practices.	• Testing, evaluation of following machines/protype have been done. i. Seed grader (AGROSAW - commercial model). ii. Cashew nut processing unit. iii. Maize sheller-manual. iv. *Kodo*-sheller v. *Tikhur* processing machine. • Sun flower thresher and maize sheller found to be reduced the time and processing cost • Cost of maize shelling was Rs. 1.02 per kg of maize • Hand operated maize has become very popular and by now more than 13500 units is sold • Installed 12 numbers of wet grinders for *tikhur* processing for SHGs in Jagdalpur District with the support from TSP and District authorities
RANCHI CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Adoptive Trails and feasibility testing of Equipments developed by AICRP on PHT centres	1. Performance evaluation of selected equipments suitable for processing of selected crops of the Jharkhand state. 2. To assess financial viability of selected equipments.	• Equipment Tamarind decorticator-cum-deseeder was obtained and evaluated. The decortications efficiency (75.67 %) and deseeding efficiency (45.6 %).
2	Development of Agro-Processing Centre for Training and Demonstration	1. To establish agro processing centre at BAU, Ranchi. 2. Performance evaluation of selected machines (baby oil expeller with filtration unit, flour mill and pulverizer). 3. Demonstration of technologies among potential users. 4. To impart training to farmers, rural youth, personnel of NGOs and SHGs.	• Baby oil expeller and pulverizer have been installed. • Training and hands on practices imparted to the rural youth.

3	Modified atmosphere storage of important fruits and vegetables of Jharkhand State	1. To determine respiration rate of guava in fruits and in case of vegetables cauliflower and bitter guard respiration will be ascertained at the different temperatures. 2. Development of low cost modified storage structure for bulk storage of guava, okra, tomato, cauliflower, bitter and pointed gourd storage. 3. Quality evaluation under developed perforated nonflexible modified atmosphere storage system. 4. To promote the developed technology among farmers.	• Size of box has been finalised theoretically based on the density • Experiments on MAP were laid out and further study is under progress.
SOLAN CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Development of protocol and pilot plant for extraction of pectin from apple pomace	1. To adopt and evaluate solar cum electric drier for drying of apple pomace. 2. To optimize parameters for continuous acid digestion of pomace, filtration, concentration and alcoholic precipitation for extraction of pectin. 3. To standardize parameters for drying of extracted pectin. 4. To upscale the process for mass production of pectin from apple pomace	• Pilot plant for pectin from apple pomace has been designed and testing is under progress. • Autoclaving at 121^{o}C for 15 minutes was found to be the best method for production of pectin on the basis of quality of pectin i.e. anhydrogalactronic acid and methoxyl content. • The feasibility of apple pomace as animal feed was tested on calf and found successful results.
2	Development of apple seed extractor for separation of apple seeds	1. To standardize optimum dimensions of the apple fruit and cores of different varieties prior to development of the apple seed extraction machine. 2. Design and development of apple seed extraction machine (Apple corer and seed extractor) 3. Evaluation of germination quality of apple	• Apple corer and seed separator was designed and fabricated with three core tubes of different sizes (16mm, 18mm and 22mm) provided with fruit holding cups (60mm, 65mm and 75mm) respectively. The efficiency of paddle operated machine is 100kg fruits/h. • Apple seed extractor (operated with 1hp motor) having two chambers one for milling of cores provided with 4 knives, 4 shafts and flow of water jets. The milled mass is then

		seed extracted by using mechanical seed extractor Pilot scale testing of mechanical seed extractor in apple orchards /apple processing plant	shifted to seed extraction chamber provided with 6 knives and 5 shafts and with flow of water jets. • Separator took 2.58 minutes for separation of one kg of seeds against 1 h by conventional method, without compromising germination (89.9%). • The technology is disseminated through several on campus trainings and sold to 2-3 orchardists.
3	Utilization of kiwi fruit enzyme (actinidin) for value addition	1. To extract actinidin enzyme from kiwifruit. 2. To use actinidin for the production of novel dairy products, alternative to cheese and yoghurt type products.	• The juice from kiwi fruit was extracted and centrifuged. The juice was treated with ammonium sulphate and standard method for enzyme extraction. • Efficiency of 0.1mg/l of extracted crude enzyme is studied under different temperature conditions i.e., ranging from 25-70^{o}C for retention of coagulation temperature. • On the basis of minimum maillard browning and yield, 40^{o}C was selected as optimum coagulation temperature.
4	Extraction and evaluation of bio-colour from plum fruits	1. Optimization of the suitable method for extraction of the bio-colour from the plum and its waste on pilot scale. 2. Utilization of the extracted plum bio-colour in value addition 3. To study the storage stability of the colour after addition in different food products.	• The spray drying process was performed in lab scale spray drier with 1.5mm diameter nozzle. The feed flow rate used was 15ml/minute and inlet and outlet temperature were 140±2^{o}C and 78±2^{o}C respectively. From the varying concentrations, 6% (w/w) of maltodextrin was found optimium on the basis of yield and ease of operation. • The extracted powder is encapsulated and is studied for its storage behavior. • Further the plum pulp was also clarified by using standardized dose of pectinase enzyme. Out of the different concentrations of pectinase enzyme, pectinase @1 percent at 40^{o}C for 5 hrs was standardized for clarification of plum pulp on the basis of the yield.
5	Value Chain on Postharvest Practices, Processing and Utilization of Ginger	1. Complete value chain for utilization of ginger	• The best method of peeling has been standardized on the basis of yield, time taken, peeling losses and cost of production.

			• The structure designed by Johrat centre (Assam) for storage has been constructed at Dr Y S Parmar UHF, Nauni as an adaptability trial. • It shall further be compared with pit storage of ginger (designed by UHF)
6	Technology for Value addition of Mushroom	1. To develop method for drying of mushroom and conversion into powder for extension of shelf life 2. To standardize the process for value added products from Mushroom 3. To optimize the packaging system and to evaluate the suitability of using moisture absorbers for extension of shelf-life for distant marketing and storage of fresh mushrooms.	• The mushrooms were blanched with KMS (0.5%) + Citric acid (1%) and dried into cabinet dryer at 60^{o}C at 10-11 percent moisture level and was grinded into powder. • *Pleurotus* powder is added in different concentrations to the wheat flour for value addition and the products were screened on the basis of physico-chemical and sensory characteristics. • On the basis of sensory analysis sensory analysis combination of 90: 10 was found to be the best among all the treatments for the preparation of bread. In T_0 (control) the energy value was 271.081 and on addition of mushroom the maximum energy value achieved was 277.134. 10 per cent fortification was found optimum for the preparation of mushroom fortified chapatti.
7	Adaptive trial on dehydration of fruits and vegetables using continuous type of drier developed at aicrp on pht centre kasargod; preparation of sand pear candy	1. To evaluate the suitability of continuous type solar cum electricity/biofuel drier developed at AICRP on PHT centre Kasargod for drying of the fruit and vegetable in HP 2. To upscale the process of sand pear candy making at pilot plant 3. To train the rural youth for dehydration of fruits and vegetable and manufacture of sand pear candy for development of entrepreneurship.	• The osmotic drying of apricot, plum and sand pear has been pilot tested and products prepared were sold in the campus. • The revenue generated deposit in a revolving fund scheme HPL-038-05
8	Operational research project on Agro-Processing Centres	1. Establishment of Agro-Processing Centre in the main campus of the university with the aim for total utilization of all the fresh	• Four Agro-Processing Centres on Fruit Processing and Apricot Kernel Oil Extraction already established in Solan, Shimla, Kinnaur and Kullu Nauni were monitored.

		produces of the university into different value added products. 2. To evaluate and demonstrate the oil extraction technologies at existing APC at Solan, Kinnaur, Kullu and Rohru 3. Establishment of Agro-Processing Centres in the fruit growing areas.	• Technical consultancy given to: (i) Golden crystals, Kotla Nala, Solan (technology for RTS, squash and other beverages developed by the centre has been transferred). (ii) Vikas mushrooms, Samlech, Solan (post-harvest dips to extend shelf-life and drying of mushrooms). (iii) Bhuira Jams, District Sirmour, Himachal Pradesh (adopted different processing technologies) (iv) Preparation of honey enriched mango nectar (Technology given in Package of Practices). (v) Method for extraction, blending and concentration of kiwi apple juice (Technology given in Package of Practices).
SRINAGAR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Mechanization of value chain of walnut	1. Development of walnut dehuller 2. Technology, promotion, entrepreneurship development by monitoring. 3. Commercialization of equipment.	• Portable walnut dehuller developed • Walnut dehuller was evaluated. The capacity was recorded 188.38 kg/h, dehulling efficiency (95.97%) and fully dehulled walnut percentage (98.84%) and breakage of nuts (1.18%) • Walnut dehuller 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 dehulling 4 days after spraying.
2	Value addition and shelf -life improvement of pear by osmotic dehydration	1. Survey to document existing drying practices 2. Standardized drying practices of pear using osmotic dehydration	• In case of traditionally drying of pear, the product was unacceptable for human for all quality attributes after 15 days of storage • The two methods of drying were adopted viz. sun drying and cabinet drying. The determination of observations like moisture content, solute gain, weight reduction, weight loss and other quality attributes is under progress.
3	Exploitation of Underutilized	1. To study proximate composition and	• Extruded product prepared from lotus stem and broken

	Crops of J&K for Development of Extruded Snacks	functional properties of the crops. 2. To study the milling and cooking characteristics of the crop (broken rice of J&K varieties, water chestnut and lotus stem). 3. To optimize extrusion parameters to get quality product. 4. To study the storage stability of the extruded products. **CCM suggestions** (i) A high pressure washing system should be developed for cleaning lotus stem	rice • With the increase in lotus stem incorporation bulk density, WSI, hardness, a* and b* values increased, while as SME, WAI, expansion ratio and L* value decreased • The difference in pasting temperature of flours (rice and lotus stem) implies that increasing level of lotus stem flour has a tendency to increase the gelatinisation temperature in rice and lotus stem blended extrudates
4	Adoptive trial on water chestnut decorticator developed by Jabalpur centre	Modification and evaluation of waterchestnut decorticator developed by Jabalpur centre to suit the the waterchestnut of Kashmir region	• Preliminary trails on Waterchestnut decorticators (hand and power operated) of Jabalpur centre were conducted at Jabalpur. • Some modifications in this waterchestnut for adoption in Kashmir region as the size and hardness of waterchestnut of Kashmir is different than that of Jabalpur. • The Srinagar centre therefore shall procure the decorticators of Jabalpur and modify them accordingly. The process of procurement of waterchestnut developed by Jabalpur is under progress. • Work on Modification and evaluation will be initiated during 2015-16
5	Establishment of Agro-Processing Centres, trainings and demonstrations.	1. To develop appropriate processing technologies for value addition of horticultural produce. 2. To provide technical assistance to interested persons for entrepreneurship in agro-processing. 3. To organize seminars, workshops and symposiums for creation of awareness in adoption of Scientific Post-harvest	• The following units were guided and established • M/s Pakeeza Food Products, Industrial Area, Lassipora, Pulwama (Processing of Fruit and vegetable) • M/s Food processing unit, Kargil (processing sea buckthorn and apricot • M/s Dara Enterprises Pvt. Ltd. Srinagar (Packaging of walnut and canning of cherry) • M/s Rather juice plant, Shopian (Fruits baverages) • M/s Shah foods, Food Park, Khunmoh, Srinagar (fruits,

		Technologies. 4. To provide guidance to entrepreneurs in selection, procurement and installation of post-harvest machinery.	vegetables and honey) • M/s Ladakhi Foods, Ladakh (fruits and vegetables processing) • M/s Khanday agro-mills, Pattan Baramulla (Milling of pulse, wheat, rice and oil extraction) • In addition, four trainings on processing and value addition of horticultural crops and milling of rice were conducted and around 125 persons were benefited during this period.
TAVANUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Establishment of Agro Processing Centre, training and demonstration of technologies	1. Installation of need based processing equipments at the Agro Processing Centre in view of reducing post-harvest losses in the catchment area 2. To organize trainings on the equipments/technology for farming community 3. Run the agro processing centre for commercial production and evaluate its feasibility and adoption 4. To monitor the progress of the centre	• The Agro Processing Centre at Naduvattom is functioning satisfactorily but the unavailability of areca leaf sheath and lower market value of the plate upsetting the progress of APC • Model Agro Processing Centre at KCAET campus and Food Safety and Standards Authority of India registration of the centre has been done on 24/01/2014 for one year • The centre has provided technical guidance to a new agro processing centre at kulukkallur, Palakkad district for the production of Banana flour
2	Development of pilot plant for osmotic dehydration of green pepper	1. Development of a steam blancher and a hot water blancher for the production of dehydrated green pepper 2. To compare the performance of both the blanchers in terms of quality of dehydrated green pepper	• A steam blancher was fabricated and tested with green pepper • The samples blanched in steam blancher for 3 minutes showed a better color when compared to all other samples obtained in steam blanching and hot water blanching
3	Development of banana (CV Nendran) peeler for making chips	1. Development of a banana peeler for the production of chips 2. Evaluation of the developed banana peeler	• A new prototype motorized banana peeler was developed, which could peel 3 grades (small, medium and large) of Nendran banana (Capacity: 35 kg/h, Peeling efficiency: 88%, Material loss: 9%).

			• Pre-treatment (drying of banana peel in a tray drier at 50^0C for 10, 12 and 15 minutes and heating in hot water at 100^0C for 30 seconds, 1 minute and 1.5 minute respectively) was given for easy removal of banana peel.
4	MAP of edible wax coated passion fruit (Project not listed)	1. To standardize edible wax formulation based on bee wax, rice bran oil 2. To standardize a Modified Atmosphere Packaging (MAP) by understanding the gas kinetics and physiology of passion fruit. 3. To evaluate the post-harvest behavior of Passion Fruit during storage and handling by measuring the quality parameters.	• The capacity of wax applicator was found to be 250 kg/hr., initial testing of wax applicator was conducted with passion fruit to evaluate its performance. On testing, the coating efficiency was less due to the insufficient conveying length to uniformly smear/coat the wax over the fruits. • Hence to improve the efficiency, this length was increased and the number of rollers was also increased from six to nine. Fabrication work of the modified wax applicator completed and testing will be done in this season.
5	Fibre fortification of pasta using banana peel powder and evaluation of nutritional and physicochemical properties	1. Standardization of the effect of drying in the dietary fiber content of banana peel. Standardization of addition of banana peel powder to make fiber fortified pasta. 2. Evaluation of nutritional and physico-chemical properties of fiber fortified pasta.	• Initial trials conducted with combinations of wheat: banana peel powder, Maida: banana peel powder and wheat: Maida: banana peels powder as ingredients in various proportions for making pasta. • The samples were dried, powdered and packed (LDPE) • The quality of pasta was assessed in terms of crude fibre content and studied the textural behavior of the product.
6	Development of protocol for extruded RTE snack food from rice and banana	1. To standardize the extrusion process parameters. 2. To standardize the composition of RTE food from rice and banana. 3. To study the shelf life of extruded RTE snack food under Modified Atmospheric Package	• Extrusion (broken rice and banna) was carried out for these four different blends under different die zone temperatures of 170, 180, 190, 200^{o}C with an extruder screw speeds of 80, 100 and 120 rpm. • Quality of the extrudates assessed in terms of bulk density, expansion ratio, water activity, water absorption index, water solubility index and textural property (crispness) and browning index • Extruded samples were packed in laminated aluminum pouches with nitrogen flushing and kept it for storage studies for 3 months.

7	Processing and value addition of jackfruit (*Artocarpus heterophyllus* L.)	1. To standardize the blanching process for tender jack fruit. 2. To standardize the thermal processing of tender jack fruit. 3. Storage studies and quality evaluation of thermally processed tender jack fruit 4. Development of a multipurpose fruit cutter	• Standardized blanching of tender jackfruit (Varikka variety). • Suitable thermal processes (pasteurization (T_p) and sterilization (T_s) time- temperature combinations) were optimized based on the results of textural, colour and microbial analysis. • Storage studies of the thermally processed canned tender jackfruit were conducted and different quality parameters like TSS, Titrable acidity, pH, Firmness, Toughness were analyzed.
8	Development of technology for alternative material to areca leaf plates	1. Identification of suitable alternative leaves to the areca leaf sheath. 2. Studies on effect of moisture content on quality of plates 3. Standardization of die temperature and retention time. 4. Development of eco plates from the alternative leaves. 5. Storage studies of plates from the alternative leaves. 6. To conduct entrepreneurship programmes and transfer of technology. 7. Standardization of suitable adhesives for good binding property and to get desired shape.	• Process parameters were optimized for production of eco-friendly leaf plate from '"vattayila" (*Macaranga peltala*). • Treated leaves were sandwiched with 1 mm thick card board using natural and edible pasting material, for better leak proof quality. • The plates made of vattayila leaves dried at 50 ^{0}C for 20 minutes having moisture content of 41 % wb and packed in LDPE of 400 gauges or PP of 200 gauges, could be stored for 21 days without any change in quality.
TRIVANDUM CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Development of Thermoplastic Cassava Starch Composites based Biodegradable Films and Foam type Packaging	1. To develop biodegradable films from cassava starch-protein/wax composites and their characterization 2. To develop thermoplastic cassava starch composites by thermo-pressing methods and	• Biodegradable films were prepared by using (i) native starches added with various waxes viz., paraffin wax,, microcrystalline wax,, bees wax, • (ii) modified starches viz., using propylene oxide and octenyl succinic anhydride with waxes viz., carnauba,

	Products	analysis of their physico-mechanical, structural and functional properties. 3. To develop expanded foam type single use disposable articles and loose fill packaging materials from thermoplastic starch composites and their characterization 4. To study the biodegradability of the developed packaging product	microcrystalline and candelila (iii) modified starches viz., using propylene oxide and octenyl succinic anhydride with proteins viz., whey protein concentrate and casein; and their properties were evaluated. • It was difficult to extrude PLA with 10 and 20% native starch, but could be extruded successfully by adding 5% glycerol based on starch content. • Modified starch could be added upto 40% for better processability and 20% modified starch was found to be optimum for injection moulded products. • Ten percent starch and glycerol each was found to be optimum for blown film extrusion.
2	Development of functional pasta and spaghetti from yams and aroids based composite flours	1. Developing two types of functional products from amorphophallus and yams viz., pasta and spaghetti (noodles) incorporating the native functional attributes of Dioscorea and elephant foot yam flours as well as through fortification with functional additives.	• Protein and fibre fortified pasta from amorphophallus and yams were developed. • by incorporating maida (21,31,41%), amorphophallus /yam flour (40,50 and 60%) and by fortifying with protein sources (whey protein concentrate and casein, 10% each) and fibre sources (wheat fibre and rice fibre, 10% each) . • Cooking characteristics, biochemical properties, in-vitro starch digestibility, colour properties and the textural properties of the pasta have been studied.
3	Development of cassava starch based adhesive formulations for corrugating and paper industries	1. To modify cassava starch using suitable techniques (chemical, physical and enzymatic) to impart specific functional properties to adhesive formulations for corrugating applications. 2. Preparation of adhesive formulations based on various modified starches and their evaluation and optimization of formulations. 3. To develop adhesive formulations from second grade starch (Azhukkumavu), which is a secondary product from cassava starch	• Adhesive pastes based on native as well as modified cassava starch, as multipurpose adhesive have been developed and tested for tack. • The paste is moisture resistant and does not undergo syneresis and microbial contamination. • It can be used for book binding, sticking labels on bottles, making envelops and paper pouches, sticking labels on fabrics, paper boxes etc. • A Ready- to- Mix two- part moisture resistant adhesive consisting of two components, which can be mixed together at the time of use has been developed. It is

		industries as well as broken sago, this is a by-product from sago polishing process. 4. Large scale preparation of optimized formulations and their testing.	suitable for binding hard materials.
4	Development of particle board from cassava stem and starch factory waste by utilising cassava starch as binder	1. To study the physico-mechanical, drying and briquetting characteristics of cassava stem and other residues 2. To develop particle boards from cassava stem alone or by incorporating starch factory by product or other fibrous by products 3. To find the possibilities of native or modified starches as a binder in particle board making	• Drying studies were conducted for cassava stems of different lengths (2, 3, 4, 5, and 6") , thippy and peels of tuber under oven and tray drying conditions at 50,60 and 70°C • Particle boards were prepared by varying the proportions of resins and waxes in cassava stem and their properties viz.. density, moisture content,, modulus of rupture, water absorption after 2hrs, water absorption after 24 hrs and thickness of swelling after 2 hrs were measured.
UDAIPUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Establishment of Agro Processing Centre, training and demonstration of Technologies	1. Establishment of location specific unit technologies at the rural site. 2. Study of techno-economic feasibility of APC model at village level. 3. To conduct trainings and demonstration of field worthy technologies.	• Around 33 demonstrations were carried out on machines (dhal mill, garlic grader, garlic bulb breaker, garlic flaker, ginger peeler cum polisher and aloe vera gel extractor) in Sirohi, Udaipur, Ajmer, Bhilwara, Chittore, Baran, Kota and Jhalawar districts • 3 trainings (2 for farmers and 1 for officers) on Post-harvest Technology and Management • Establishment of APC in Rajsamand and Bhilwara
2	Adoptive trials on Post-harvest Equipment developed at other centres of AICRP on PHT	1. To evaluate the performance of selected improved post-harvest technologies/equipment developed at other centres of AICRP on PHT. 2. To modify/refine the same (if required) to suit the local need. 3. To conduct adoptive trials and	• Cumin grader (developed by Junagadh centre) performance was observed satisfactory at preliminary trials. The exhaustive trials and training to the farmers/ entrepreneurs will be conducted in the field during next cumin season. • TNAU insect trap was evaluated against pulse beetle in chick pea and found effective in trapping the beetles

		demonstrations for popularization of same in production catchment. 4. To impart training to farmers/ entrepreneurs for effective management of improved technology/equipments.	(males and females). • The TNAU traps also have been demonstrated in the trainings and to the farmers visiting the centre.
3	Development of maize based extrusion cooked ready to use products	1. Evaluation, adoption and refinement of existing extruders 2. Development and standardization of maize based ready to use products 3. Nutritional, Shelf life and packaging studies on the products. 4. Cost economics of the process & technology	• Maize based extruded products were developed in different proportions with black gram to improve the nutritional quality (protein content)*i.e.* 60:40; 70:30; 80:20 and 90:10. The samples were evaluated on the basis of expansion ratio, cutting force, colour value and organoleptic score. All the products were found acceptable in terms of color and taste.
4	Development and evaluation of fly ash based organic pesticides for the management of pulse beetle	1. To develop fly ash based organic pesticides. 2. To test the efficacy of developed organic pesticides against stored pulse beetle. 3. To study the effect of fly ash based organic pesticides on the germination of seeds. 4. To study the effect of insecticidal properties of developed pesticides with ageing.	• Fly ash based insecticides (Fly ash + neem seed kernel powder) showed the maximum of 95.33 per cent mortality after 72h time intervals. The minimum of 55.00 per cent mortality was observed in cowpea grains treated with fly ash + curry leaf powder. • The lowest number of eggs (0.40 eggs/seed, minimum adults (1.10) emergence), minimum weight loss of 1.4 per cent was recorded in fly ash + neem seed kernel powder. • The minimum of 62.40 per cent adult inhibitions were exhibited by fly ash alone at 10 g/kg seeds.
5	Development of pilot plant for processing and value addition of bottle gourd for retention of bioactive components	1. To develop pilot plant for processing and value addition of bottle gourd 2. To study the effect of storage on physico-chemical, microbiological and sensory quality of value added products	• Bottle gourd (*Langenariasiceraria),* Lemon (*Citrus x limon*) and Mint (*Mentha*longifolia) juice was blended in the proportion of 90:5:5. Prepared blend juice was hot filled at 85°C in sterilized glass bottles and thermally treated at 85°C for 5 min. The pH and TSS in lauki juice prepared was observed to be 4.52 and 6.7 °Brix. • The processed blend juice was found stable and microbiologically safe and having acceptable sensory score of 8.5.
6	Protocol and equipment for	1. To adopt/develop a green Bengal gram	• Trials have been conducted with different configuration

	depodding, shelling and minimal processing of green Bengal gram	depoder cum sheller 2. To study the effect of various pre-treatments and MAP on shelf life, antioxidant status of minimally processed green bengal gram kernels. 3. To record various sensory/quality parameters during storage and standardize the protocol.	of impeller of shelling section and speed of operations to increase the shelling recovery. The testing results indicates that even after refinements/ modification the maximum shelling efficiency of the machine was found to be 75 % in five passes.
7	Post-harvest management of fenugreek (*Trigonella foenumgraecum* L.) leaves	1. To study the shelf life of green fenugreek leaves 2. To standardize the process parameters for dehydration of fenugreek leaves 3. To study the shelf life of dehydrated fenugreek leaves	• Good qualityfenugreek leaves plucked from plants were used for dehydration experiments in shade, solar and convective tray dryer (40, 50 and 60 ^{o}C). • The quality of dried fenugreek leaves was evaluated on the basis of colour(L*) value, rehydration ratio. • The drying method was optimized on the basis of quality parameters. The sample dried at 50 ^{o}C was observed the best among all samplesdried at 40, 50 and 60 ^{o}C.

Jaggery & Khandsari Sector

ANAKAPALLE CENTRE

S. No.	Research Project Title	Objectives	Specific Output
1	Development of Protocol for organic jaggery (Old project)	1. To study the effect of organic manures on yield and quality of jaggery in relation to those affected by inorganic fertilizers in sugarcane	• Process protocols for organic jaggery (from planting to processing) were developed. • Superior colour readings (higher L^* values) for organically processed jaggery were obtained in comparison to inorganic treatments. • Better hardness (as from depth of penetration of needle in cm) was observed for organically processed jaggery with lemon juice as clarificants. • No significant changes were observed in percent sucrose and reducing sugars in jaggery prepared using different clarificants
2	Studies on Quantification and effect of Phenolic compounds of sugarcane juice on colour of jaggery. (Old project)	1. To study the effect of phenols and phenol related compounds on the colour of jaggery.	• Higher concentration of phenolic compounds recorded in jaggery prepared using lime alone compared to other clarificant. • No correlation was found in between phenolic compounds of sugarcane juice and colour of the jaggery
3	Enrichment of granular jaggery with carotenes & beta carotene for dietary allowances	1. Cost effective enrichment of the granular jaggery with precursors of vitamin A.	• Addition of 100g of carrot paste increased total carotenes of jaggery from 26.6 (control) to 94.9µg /100g. • Addition of 100 g moringa leaf increases total carotenes of jaggery from 26.6 to 167.2 µg / 100g in jaggery.
4	Evaluation of vacuum and modified atmosphere packaging for storage of granular jaggery.	1. Identification of suitable packaging material for vacuum and MAP packing. 2. Identification and standardisation of suitable gaseous mixture for MAP packing. 3. Effect of packing methods and materials on quality characteristics and shelf life of the product.	• It was observed that, the shelf life of granular jaggery packed with aluminium foil was found to be good for the period of 270 days in MAP packaging system followed by Vacuum packing compared to control sample. • After 180 days of storage, the moisture gain was found to be low in multilayer (kurkure) packaging material with 100% nitrogen in MAP packaging method.

			• The moisture gain was found to be increased with decrease in nitrogen content in MAP packing system
5	Steam boiling system using bagasse for manufacturing of jiggery	1. Design and Development of steam boiling system of (0.3 ton / hr boiler steam capacity) for juice boiling. 2. Testing and evaluation of steam boiling system. 3. Techno economic analysis of the system.	• Fabrication of steam jacket pan is completed. • Installed steam boiler on the concrete base and fabrication of pan of 500 kg capacity with tilt mechanism was completed • Construction of fire brick furnace for steam generation is under progress
6	Adaptive trial on (a) Sugarcane juice filtration system developed by Kolhapur for quality jaggery and (b) Pasteurization technology developed by TNAU Coimbatore for storage of sugarcane juice as a beverage	1. To evaluate the performance of filtration unit developed by Kolhapur Centre 2. To adopt pasteurization technology for bottling of sugarcane juice developed by TNAU, Coimbatore 3. To test the keeping quality of juice during its storage.	• Evaluation of the sugarcane juice filtration system could not be carried out due to non availability of funds under NRC. • The juice in bottles maintained acceptable quality up to 7 days and upto 4 weeks under refrigerated conditions. • No microbial growth was observed in the samples till today after 120 days. • It was observed that, % sucrose and TSS^{o}brix was reduced from 17.98 to 15.56 and 19.7 to 18.5 respectively from initial to period of 120 days
7	Compression of powder jaggery in the form of cubes using edible binders to use as sweetener in beverage	1. To identify the suitable tablet making machine for compressing powder jaggery into cubes. 2. Selection of suitable edible binders for making compressing cubes. 3. Evaluation of tablet making machine. 4. To study the physical properties of cubes. 5. Storage and sensory studies.	• The cubes from granular jaggery have been prepared with different concentrations of binders with the tablet making machine and the physical properties of the samples are being measured. • The hardness of the cubes was measured using Textural Analyzer available at Gitam University, Visakhapatnam. Dispersibility of the compressed cubes in hot water was measured. • The value of water activity ranges from 0.316 to 0.363 for different treatments. • The samples were kept under ambient conditions to study the shelflife.
8	Design and development of vacuum pan for solid and	1. Design and development of two stage vacuum pan for sugarcane juice boiling.	• Designing of vacuum pan for a capacity of 400 lt of sugarcane juice per boiling was completed.

	granular jaggery	2. To evaluate the performance in terms of heat utilization efficiency, time and fuel savings. 3. Cost economics. 4. Transfer of technology	• Clarifier for effective removal of soluble impurities for production of good jaggery was designed. • Awaiting for release of NRC during this year
9	Design and development of mechanized process for production of jaggery fortified Paper Sweet	1. To study the existing traditional process for the production of paper sweet. 2. To study the parameters which effect the formation of rice starch based edible films. 3. To design and development of mechanized system for production of rice starch based edible films. 4. To study the performance evaluation of the mechanized system. 5. To evaluate the cost economics	• Survey was carried out to study the paper sweet making and process parameters in Vastrapuri village, Rajam mandal, Vizianagaram district and Atreyapuram village of East Godavari district of Andhra Pradesh, a famous place for production of Pootharekulu was collected as follows. a) Temperature before and after placing slurry on earthen pot. b) Production capacity / day. c) Slurry preparation. d) Earthen pot preparation for placing films. e) Cost –economics. f) Value addition to paper sweet. • Schematic diagram of the machine for the production of paper sweet was prepared. The design of individual components is being under progress.
BURALIKSON CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Testing, evaluation and transfer of proven technology and equipment to end users	1. To study the suitability and adoptability of the technology developed at other centers in the local condition. 2. To transfer the technology to the end users.	• Four varieties are Kapilipar, Nambor, Doiyang and Kakodonga are to be tested for bottling of sugarcane juice. The crops are in the field and in maturity stage • The method for making jaggery chocolate has been refined
2	Evaluation of low cost storage system for long term storage of jaggery in the humid regions of the NE states (old project)	1. To improve the storage system of jaggery for long term storability. 2. To minimize the cost involvement suiting to the need of small scale jaggery manufacturer.	• Jaggery storage chamber is made of clay and enclosed in poly jacket and compared with other systems. The chamber made of clay is to be wrapped on all sides with 400 μ poly sheet so as to prevent entry of moisture during humid period • The cost is Rs 500.00 per chamber

3	Establishment of pilot plant for making liquid jaggery (Operational research project on Agro Processing centre)	1. To process in the catchments area and value addition to the product.	• The work of jaggery pilot plant is in the final stage. • One APC at vill. Mahanial, P.O. Missamora, Dist. Golaghat has been established. The unit is engaged in production of jaggey and providing service of cane processing and juice extraction. The unit earned about Rs 30,000/- during 2012-13.
4	Storage of harvested sugarcane for a limited period before crushing (old project)	1. To develop package of treatments and suitable system for storing the harvested cane for a limited period to check the deterioration of quality of sugarcane as well as jaggery.	• The treatments finalised i.e., (1) Control and stored in shade (2) Pre-harvest spray of $ZnSO_4$ @ 100 mg/l and sodium metasilicate (2%) (3 days prior to harvest), soil application of $ZnSO_4$ @ 25 kg/ha and post-harvest spray of lauryl sulphate @ 12 mM (3.5 g/l), Na-metasilicate (1%) and formaldehyde (100 ppm) + harvested cane staked in shed and covered with tarpaulin (3) Spraying of Benzalkonium chloride @2000 ppm and covered with tarpaulin.
LUCKNOW CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Evaluation of shrink wrap, stretch wrap and modified atmosphere packaging for storage jaggery cubes and blocks	1. Evaluation of shrink-wrap, stretch wrap and modified atmosphere packaging for storage jaggery cubes and blocks	• Jaggery was prepared CoPant 84212 variety of sugarcane. Initial values of the jaggery quality parameters were determined as brix,(13.5), pol%(77.1), reducing sugar (5.6), moisture content(7.1), pH (6.4) and colour(193) in the normal room conditions. • The initial readings corresponding to different environments viz. nitrogen, stretch wrap and shrink wrap were also determined, which were almost similar. Jaggery samples were packed in shrink wrap and stretch wrap and kept for storage for six months
2	Evaluation of jaggery furnaces (single, double and triple pan) for emission of green house gases and level of bagasse combustion	1. To evaluate jaggery furnaces for emission of greenhouse gases 2. To evaluate level of bagasse combustion 3. To incorporate related parameters to improve existing design	• Emissions of CO @ 900-2000 ppm, CO2 @ 10-15%) and O2 @ 6-20% were recorded using Flue Gas Analyzer during operation of three-pan furnace. • Flue gas temperature reached to a maximum value of 294^{o}C and hence, increasing the efficiency of the system

3	Refinement of juice extraction process with special reference to sugarcane cleaning and juice filtration for 100 kg jaggery/8 h	1. Development of a refined juice extraction process including cleaning of cane and selective filtration of juice	• A power operated cleaning cum washing machine has been developed. The unit consisted of mechanisms for sugarcane feeding through a chute, scraping, scrubbing, washing with re-circulatory forced water spray system, GI water tank and a compact power transmission system consisting of 1.0 hp motor, speed reduction unit and chain- sprocket arrangement. • The machine successfully scraped the left out trashes, roots, and soil clods etc., and also washes the cane and delivers well cleaned sugarcane smoothly as a raw material for juice extraction purpose. Thus cleaned sugarcane stalks are fed into the crushing unit directly for crushing and juice extraction.
4	Development/Adoption of evaporator for sugarcane juice	1. To design a closed system of evaporation for sugarcane juice 2. To develop the closed evaporator 3. To test and evaluate the developed evaporator	• A counter current type of evaporator for concentration of juice has been designed. • The proposed unit of evaporator is made of a steel cylindercal body having 2.50 m height and 1.00 m diameter. It has a liquid distributor and film guides. The bottom has an opening for taking out the condensate. •
5	Development of power operated jaggery moulding machine	1. Design and develop a prototype of power operated jaggery moulding machine 2. To test and evaluate the developed prototype	• A batch type mechanical screw press rectangular system for jaggery moulding was redesigned to save time and smooth vertical movement of the rotor piston in alignment of the static cubical mould system and also in pressing out the jaggery moulds after setting. • Two vertical shafts for smooth vertical movement of the rotor pistons into the static moulding frame and third vertical shaft (rectangular) was also provided with spring loaded lever system from back side of rotor system for pressing out the jaggery moulds. A sliding plate, which works as platform for setting of jaggery, has been provided at bottom of these base moulds.

6	Development/Adoption of suitable mixer for production of value-added jaggery using aonla as natural source of vitamin C (old project)	1. Developement of mixer for value-added jaggery with aonla	• An auger kind of mixer having arrangement on the main vertical shaft,has been designed. • Unit has been designed for 13 kg jaggery and can be further increased after finalizing blade profile for proper mixing
7	Value addition of jaggery with Indian spices and herbs for increased palatability and market value	New project approved in CCM 2014	• Indian spices and herbs for increased palatability have been identified and ratio/ various combinations have also been finalized. Work recently initiated in Nov 2014 and is under progress
8	Development of an semi automatic jaggery manufacturing plant	New Project approved in CCM 2014 Collaborate with Anakapalle centre for mechanical moulding unit and Kolhapur centre for mixing and cooling.	• Various processes where automation can be done has been identified and indent has been given for procurement of the equipments. Waiting for NRC funds
KOLHAPUR CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Identification and utilization of non-conventional organic clarificants (Soyabean-DOC, Isabgol seed husk, Aloe vera pulp) for jaggery (old project)	1. To test the clarification efficiency of various organic base juice clarificants for quality jaggery manufacturing 2. To standardize application of efficient clarificant and its commercialization	• Sole application of soybean DOC @ 1 kg per 1000 liters of sugarcane juice found superior non organic clarificant for jaggery processing • Significantly highest scum recovery (7.28 %) was recorded by the conjunction use of soybean DOC @ 0.500 kg + isabgol seed husk @ 0.110 kg per 1000 liters of sugarcane juice. • Sole application soybean DOC @ 1.250 kg /1000 litre juice showed maximum gross monetary returns (32,401), net monetary returns (9,224) with higher B:C ratio (**1.39).**
2	Development of protocol for production of organic jaggery from Sugarcane	1. Identification of concentrated and bulky organic sources and their quantification for sugarcane production. 2. Biological control for disease and pest of sugarcane.	• The protocol for production of organic jaggery from sugarcane has been developed • Compiled extensive information on National Standards of Organic Farming with regard to (1) permissible and restricted products/ inputs/ additives for organic

		3. Weed management through green manuring, mulching etc. 4. Standardization of organic jaggery processing by using organic clarification of juice. 5. Standardization of physico-chemical parameters of organic jaggery. 6. Incorporation of National Standards for Organic Production (NSOP) 7. Inclusion of Organic Certification procedure and Certification Authorities 8. Develop complete protocol by compiling set of rules, regulations, standards and procedures for production of organic jaggery from sugarcane	cultivation as well as organic processing and (2) Organic Certification procedure.
3	Development of HACCP Protocol for jaggery manufacturing	1. To conduct hazard analysis for identification of Critical Control Points in jaggery processing 2. To recommend controls, critical limits and procedure for monitoring and verification 3. To develop HACCP protocol for jaggery processing	• Significant hazards associated with each specific step of the manufacturing process were identified and preventive measures to control hazards are specified. • Identified Critical Control Points at liquid jaggery manufacturing process by using CCP decision tree. • By applying CCP design tree technique important steps of jaggery manufaturing • Liquid jaggery sample will be collected from identified unit operation of liquid jaggery (based on survey) • Accordingly HACCP protocol will be finalized upto March 2015.
4	Reduction of sugarcane staling losses through post-harvest physico-chemical practices	1. To test efficacy of post-harvest physico-chemical practices against staling losses of sugarcane	• **S**praying of electrolyzed water and heaping found superior for minimizing the post-harvest deterioration of sugarcane even after 120 hours of harvest at high ambient temperature • Spraying of Sodium hypochlorite (electrolyzed water) and heaping found superior for minimizing the post-harvest deterioration of sugarcane even after 120 hours of harvest at high ambient temperature.

5	Evaluation of packaging material for keeping the quality of jaggery under cold storage conditions	1. To study the performance of different packaging material on keeping quality of jaggery under cold conditions 2. To study the quality of jaggery during post cold storage period	• Identified the cold storage at Kawathe Ekand in Sangli district. • Jaggery samples (chemical,without chemical and organic type) were wrapped in different packaging material viz; Hessian cloth packing, LDPE-50 micron, Poly Propylene-50 micron, Laminates : one side and both side. • Jaggery sample were kept under cold storage conditions from July to November 2014.

Livestock Produce Sector

ALIGARH CENTRE

S. No.	Research Project Title	Objectives	Specific Output
1.	Design, construction and performance evaluation of bulb crops (onion & garlic) storage structure in northern region of Utter Pradesh	1. To construct a prototype storage structure for bulb crops (onion and garlic). 2. To modify the available storage structure to prevent from rain, rodents and thieves. 3. To evaluate the various physico-chemical qualities of fresh and stored Onion and garlic for the period of at least 6 months. 4. To evaluate the onion loss during storage periods (at least 6 month) and compare this loss with that in the bulk or traditional storage method. 5. To analyze the economics of developed low cost improved structure. 6. To organize the training programme and transfer the technology	• In rural areas, the present storage capacities are quite inadequate and most of the available units are, traditional and unscientific. • The design for construction of proper storage structure for these crops, at farmer level as well as commercial level, equipped with facilities of proper ventilation and control of storage temperature and relative humidity for long duration, especially from May to October/November (for a period of 4-6 months) in northern region of U.P is under progress.
2.	Development of processing technologies for foxtail millet incorporated meat products	1. To standardize the processing techniques for foxtail millet incorporated buffalo meat products viz. sausages, nuggets, meat slices and kabab. 2. To evaluate the physical, biochemical, microbial, textural and organoleptic qualities of the developed products. 3. To study the shelf-life of developed products in various packaging materials. 4. To study the economics of developed products. 5. To organize the training programme and transfer the technology.	• Process protocols were standardized for buffalo meat emulsion sausage nuggets, meat slices and kabab • Slight increases in the quantity of meat resulted into significant change in the moisture content of the products • Foxtail millet is the deciding factor for the ash content of the developed product • The range of fat content was between 5.0 and 5.52% in developed samples and pH of sausages samples (freshly prepared) was near 6.5 • Fortification of sausages (meat 94.99 g, foxtail millet 6.48 g) was optimised with RSM; moisture 68.53%, fat 5.05%, Ash 2.0% and pH 6.34.

			• Yeast and mould count of sample was found to range between 3.75 and 4.02 for all the samples on 28th day of storage.
3.	Development of effective and efficient processing technology for securing and raising quality for sweet potato (*Ipomoea batatas* L.) consumption and its industrial uses	1. To evaluate physical and biochemical parameters of matured sweet potato 2. To standardize the processing techniques for sweet potato and develop jam, powder, chips, frozen sweet potato (steamed & fried) products and intermediate moisture products, etc. 3. To evaluate the physical, biochemical, microbial, textural and organoleptic qualities of the developed product. 4. To study the effects of different drying techniques on physico-chemical starch of sweet potato 5. To develop products using different type flour 6. To study the shelf-life of developed products in various packaging materials. 7. To study the economics of developed products. 8. To organize the training programme and transfer the technology.	• Snack food prepared by using different levels of sweet potato and composite flour (gram and corn flour) and fried in soybean oil • The Nine samples of snack food prepared, i.e., (i) three from gram flour only, three from gram flour and corn flour in 90:10 ratio, and (iii) three prepared from gram flour and corn flour in 80:20 ratio. • During the ambient temperature storage, the fat contents of all snack food samples were found to be decreased • On increasing the sweet potato level ash content increases. Similarly, the percentage of corn flour increases in composite flour ash content increase • Mineral content of sample increases with the increasing ratio of sweet potato. This was due to presence of high amount of minerals in the sweet potato about 7% and in gram 2.7%. • All the samples had Free Fatty Acid content well within the permissible limit up to 90 days of storage • TBA values of all nine-snack food samples were found to increase slightly during 90 days of ambient storage but were under safe limit. • During 90 days of storage “L” value continuously decreases that the snack food become darker. • Taste acceptability decrease if sweet potato incorporated beyond 50 percent. • The sensory scores of all attributes like color, taste, aroma and texture (crispness), in general, decreased during 90 days of ambient storage because of the absorption of moisture, increase in TBA number and FFA of snack food samples.

CHENNAI CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Development of low cost models of meat processing equipment	1. To study existing sausage stuffers 2. To prepare a model sausage stuffer 3. To work out the cost economics of the sausage stuffer	• A sausage stuffer (manual and mechanically operated) was developed • The sausages produced using the newly developed sausage stuffer was comparable to the sausages produced using an imported sausage stuffer but the product yield was low.
2	Utilisation of ruminal contents in formulation of Japanese quail feed	1. To develop protocol for drying of rumen contents without deterioration of its nutritive value 2. To formulate diet using rumen contents according to the requirements to effect enhancement of weight gain in quails. 3. To optimize enzyme treatment of the diet containing rumen contents in a cost effective manner 4. To study the effect of feeding rumen content incorporated feed to Japanese quails by studying the carcass traits on slaughter	• Suitable levels of fibrolytic enzymes were included in the formulation • Slaughter of the control and experimental birds was undertaken and Carcass characteristics were studied. • The physicochemical characteristics (pH, Colour), muscle architecture (Sarcomere length, Fibre Diameter,) of the meat samples were studied. • Japanese quails fed with feed containing rumen contents and blood meal has a higher body weight in comparison to that of meat obtained from Japanese quails consuming feed with soyabean alone as a protein source (Control diet) • Japanese quails renders their meat darker, less red and less yellow and higher shear force value in comparison to that of meat obtained from Japanese quails consuming feed with soyabean alone
3	Bio- Protection of meat using Pediocin	1. To select the suitable beneficial bacterial culture for fresh meat preservation and to standardise the quantity of innoculum 2. To study the shelf life and microbial stability of fresh meat inoculated with beneficial bacterial culture 3. To study the shelf life and microbial stability of the meat inoculated with beneficial bacterial culture	• Cell free extract of Lactobacillus bulgaricus was prepared and its antibacterial activity was evaluated against *Escherichia coli, Staphylococcus, and Lactobacillus bulgaricus.* • The cell free extract *Lactobacillus bulgaricus* exhibited antibacterial activity against *Escherichia coli*, *Staphylococcus*, and *Lactobacillus bulgaricus*, as evidenced by no growth of these organisms in their respective media.

		4. To study the economic viability of the technology	• Pure culture of Pediococcus was propogated in MRS broth. • Cell free supernatant of Pediococcus was prepared to assess the bio-preservation effect of Pediococcus on meat. • The antibacterial activity of the prepared cell free supernatant of Pediococcus against *Staphylococcus* was demonstrated by Agar well diffusion method. A clear zone of inhibition was appreciable. • The results of the study suggest that chicken carcasses sprayed with Pediocin alone or in combination with EDTA in comparison to that of control untreated chicken carcasses had higher pH throughout the study indicating a decline in autolysis and microbial load on the chicken carcasses, due to spraying of Pediocin alone or in combination with EDTA on chicken carcasses.
4	Effect of edible coating of hydrocolloids and cinnamon oil on meat	1. To develop a suitable edible coating of hydrocolloids with cinnamon oil for preserving meat. 2. To assess the shelf life of fresh and chilled coat meat 3. To develop and study the storage stability of chicken meat nuggets from the best combination of coated meat	• The effect of coating of cinnamon oil and chitosan by methods such as brushing, spraying and dipping on chicken carcass was studied and the concentration of the cinnamon oil used in coating was reduced (0.05%, 0.1% and 0.2%). • Physico-Chemical parameters such as pH, WHC, Thio barbituric acid No. (TBA No.) and Tyrosine value (TV) were estimated. • Chicken carcasses coated with cinnamon oil and chitosan by methods such as brushing, spraying and dipping on chicken carcass had a higher ERV than control chicken carcasses, suggesting that coating of cinnamon oil and chitosan increases the potential shelf life of chicken.
KHANAPARA CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Characterization of Different Biogenic Amines in Meat and Meat Products and Development of Mitigation	1. To characterize the different biogenic amines, if any, in the smoke treated traditional meat products of the North Eastern region of India. 2. To suggest suitable mitigation measures to	• A total of 12 smoke-dried meat products collected from the states of Mizoram and Arunachal Pradesh were analyzed for the presence of biogenic amines. • The smoked meat products obtained from the states of

	Measures (old project)	reduce the level of biogenic amines for public health welfare of the meat consumers.	Mizoram and Arunachal Pradesh were found to have biogenic amines beyond MRL. • Further progress little delayed due to disorder of cell of the UV-vis detector of the Ion Chromatography system. The system re-installed in 2nd week of Dec. 2014.
2	Development of Dietary Fibre Enriched Pork Nuggets and Sausage	1. To study the effect of incorporation of different levels of dietary fibre of cereal origin on physico-chemical, proximate, microbiological and sensory quality of pork nuggets and sausage. 2. To study the shelf-life of dietary fibre enriched pork nuggets and sausage under chilled/ frozen condition.	• Technology for production of dietary fibre enriched pork and chicken nuggets has been developed • Pork sausage with all four combinations - green pea flour, oat flour, rajma flour and corn flour at 5% and 10% were prepared. • Pork sausage prepared with 5% corn flour and 5% green pea flour were better in terms of physico-chemical properties and sensory quality attributes as compared to the other combinations although all combinations with 5% dietary fibre were found to be acceptable by the sensory panel. • Inclusion of dietary fibres at higher levels of 10% tended to affect the sensory attributes of the product.
3	Development of intermediate moisture pork	1. To study the effect of application of the paste of fenugreek and colocasia corm on physico-chemical, proximate, microbiological and sensory quality of pork. 2. To study the shelf-life of the intermediate moisture pork at room temperature.	• Microbiological and physico-chemical characteristics of the samples without curing and after curing were investigated on 1st and 15th day of room temperature storage. • IM Pork with paste of fenugreek appears to be better in terms of shelf- stability
4	Novel technology for restructured pork ham	To develop technology for production of restructured wet cured pork ham shortening the production process without compromising on the quality attributes.	• Three batches of restructured pork ham with three different muscles and replacement of water with liquid whey to the extent of 25, 50 and 75% were prepared. • Quality evaluation such as proximate analysis, microbiological quality, sensory and textural attributes of the freshly prepared samples were studied. • Storage behavior of the restructured pork ham samples were studied up to 15 days at refrigeration temperature.

			• Inclusion of up to 50% liquid whey to the brine formulation for wet cured ham as a substitute for water had no effect on juiciness, tenderness, flavor, and visual discoloration, as evaluated by the sensory panel • Liquid whey can be added successfully to restructured pork ham with a resultant product that is similar in appearance, taste, and storage stability to non whey added ham.
5	Value addition to pork sausage with banana pseudostem flour	To study the effect of incorporation of BP on the physico-chemical, textural and sensory attributes of cooked and smoked pork sausage to develop suitable technology for production of a functional pork sausage beneficial in urinary disorders, stones in kidney, gall bladder, and prostate and in reducing the body weight.	• Three batches of pork sausage with banana pseudostem flour were prepared. • Pork sausage prepared with the incorporation of 1.5% and 3% BPF were found to be highly accepatable to the sensory panel as the colour, appearance, juiciness, and flavor were similar to the control samples. • Storage behaviour of the sausage samples were investigated up to 3 months of storage at refrigeration temperature at regular time intervals.
6	Processing of emulsion based pork products with porcine globin and plasma as fat replacers	1. Production of emulsion based low fat healthy pork products. 2. Value addition to slaughterhouse by-product and hence better economic return to pork processors.	• Three batches of pork sausage with 5, 8 and 10% replacement of fat with porcine blood plasma were prepared. • Pork sausage with 10% replacement of fat with porcine blood plasma was found to be highly acceptable by the sensory panel. The product had superior microbiological quality with nil coliform and sulphide reducing clostridial count. Textural property, appearance and colour attributes were found to be good. • Pork sausage with porcine blood plasma significantly reduces the fat content of the sausage thereby making it more healthy product as compared to the sausage with 10% fat (control). • The storage behavior of the sausage with different levels of porcine blood plasma was not found to be significantly different from the control and the product could be safely stored up to a period of 60 days.

KOLKATA CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Pilot scale production of feed using Shrimp Processing waste	1. Optimization of fermentation period for shrimp waste in Biofermenter using three bacterial species. 2. Quantification of amino acid composition of fermented shrimp waste 3. Estimation of Drying rate of fermented fish product. 4. To establish a small scale production unit (as per availability of space and sustenance) unit for fish feed preparation	• Shrimp waste material was taken from local processing industry and the proximate compositions (protein 40.37%, fat 9.86%, moisture 9.74%, ash 19.82%, crude fibre 15.78% and nitrogen free extract 4.43%) were analysed on dry weight basis. • Research trials were conducted using three different bacteria namely, *Lactobacillus brevis, Bacillus amyloliquefaciens* and *B. subtilis* in conventional method and also in Biofermenter after two days onwards regularly up to 10 days duration for optimization of fermentation period. • Value of protein becomes fairly constant after 6^{th} day of fermentation (55.81% for *L. brevis*, 52.88% for *B. amyloliquefaciens*, 55.17% for *B. subtilis* respectively). • Quantification of amino acids of fermented shrimp head waste is in progress.
2	Efficacy of solar drier for salted dried fish products.	To evaluate the overall performance of Solar drier (developed by Raichur) in terms of nutritional parameters of dried fish products	• Solar drier for salted dried fish products is found superior compared to OSD drying in terms of reduction of drying time, higher ($p<0.05$) protein content, colour, flavor, texture, taste and overall acceptability. • The biochemical parameters like TMA, TVBN, PV and TBA were within the limit of acceptability after 180 days storage) but cross limit after 165 days in case of OSD. • The ash content was significantly higher ($p<0.05$) in OSD than STD samples. • The microbiological quality parameters viz; TPC, TFC of OSD were significantly higher ($p<0.05$) than STD in all the samples during storage period.
3	Development and demonstration of model retail	Establishment of a model retail outlet at AICRP on PHT Kolkata Centre for distribution of	• An outlay for model retail outlet has been laid down

	outlet for live fishes and seafood (Jan 2011 to Dec 2018)	hygienic and good quality raw and processed fish products to consumers	
4	Utilization of indigenous herbs for preservation and shelf life maintenance of processed fish products (April 2014 to Dec. 2018)	1. To develop techniques on how the antimicrobial properties of different traditional indigenous herbs can be out to use for fish preservation. 2. Extraction of antibacterial substance from indigenous herbal source. 3. Formulation of standard concentration of solvent plant extract for maximum antimicrobial effect 4. Characterization of antimicrobial and other active chemicals present in indigenous herbal source (*Centella asiatica*). 5. Assessment of preservation effect on fish using the extract of indigenous herbal source under refrigerated condition (4±1^{o}C). 6. To estimate the cost economics of the technology	• The extract of *C. asiatica* in boiled form for a period of 1 h and n-hexane at 25% and 75% conc. showed maximum zone of inhibition against *Staphylococcus aureus* (found at boiled water and 75% conc. of n-hexane) *and Enterococcus facelis* (at 25% conc. of n-hexane). • Chloroform at 0%, 25% and 50% concentration with the extract of *C. asiatica* were found more effective against *Bacillus sublitis*, *Staphylococcus aureus* and *Vibrio parahaemolyticus.* • Ethanol at 25% and 50% concentration with the extract were effective against *Staphylococcus aureus*, *Vibrio parahaemolyticus*
5	Extension of shelf-life of extruded fish products using multilayer packaging material under nitrogen flushing (Jan 2011-Dec 2013)	1. Selection and evaluation of multilayer packaging materials. 2. To study the physico-chemical, microbiological and sensory properties of extruded fish products.	• The multilayer packaging material consisting of LDPE, metalized polyester and Polyethylene was found suitable for nitrogen infused packaging system. • The shelf-life of the extruded fishery product was found to be 3 months. • Development of sustainable packaging methods for processed fishery extruded products is documented.
6	Development of bio-preservation strategies for seafood and safety (Jan 2011-Dec 2013)	1. Quality assessment of fermented fish products. 2. Microbiological and biochemical analyses of fermented fish products. 3. Proximate analysis of fermented fish products.	• In proximate composition, lower level of protein and fat content in the products obtained from retailers indicated the relative nutrient losses occurring at different stages of marketing chain. • High total volatile base nitrogen (TVB-N), peroxide values

			and moisture content along with promising microbial load in the retailer's samples reflected poor quality, whereas those obtained in producer's samples were within the acceptable limit. • *Lactobacillus plantarum* was isolated from *shidal*, a traditional fermented fish product of Assam. The isolate was found to be bacteriocin positive possessing promising antibacterial property. • *Bacillus* sp. was identified as one of the predominant microbiological populations present in *shidal* which has wide scope for exploration as potent biopreservative in preparation of fermented fish products. • The nucleotide sequences of isolated two *Bacillus* spp. were directly submitted to the GenBank and after analysis of the sequences the following accession numbers were generated respectively: • GenBank accession number: "KF319057" and "KF319058"
MANGALORE CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Utilization of natural antioxidants and antimicrobial compounds from horticulture waste on the quality stability of sea foods (April 2013 - May 2015)	To study their influence on oxidative and microbial stability of sea foods under different storage conditions	• The effective concentration of natural antioxidants and antimicrobial agents extracted from natural origin i.e., grape seed extract (GSE) and papaya seed extract (PSE) were determined as 500 mg/L and 1000 mg/L respectively in the seafood industry. • During chilled storage the shelf life of whole mackerel and steaks without any treatment was found to be 9 days whereas with GSE and PSE treatment it increased to 15 days and 12 days, respectively • Total plate counts of whole mackerel and steaks with or without antioxidant treatment increased during chilled and frozen storage period • Pathogens viz. *Staphylococcus aureus*, *Escherichia coli* and

			Salmonella were not detected throughout the storage period in any of chilled and frozen samples
2	Development of fish snacks using hybrid solar biomass powered dryer (April-2013 - May, 2015)	1. Preparation of snack product using low cost fish 2. To study the rate of drying and to estimate the shelf life of the product 3. To compare the quality of products between traditional drying with hybrid solar biomass powdered dryer 4. To find out suitable packaging material for dried fishery products.	• Technology on very hygienically processed salt-dried fishery products was developed. • The improved version of mechanical solar drier coupled with biomass heater not only helps to overcome the insect infestation but also avoided fungal and microbial problems. • The masala coated anchovies dried using solar hybrid biomass dryer was observed to have extended shelf life even after 2 months of storage than uncoated sample.
3	Technology for the production of silage using seafood industry waste for animal feed (April 2013 - May 2015)	1. To find out suitable technologies for the production of fish silage from seafood industry waste. 2. To conduct the palatability tests for domestic livestock animals 3. To study the nutritional quality, shelf life and suitable packaging material.	• A preliminary survey was conducted in the pre-processing and processing industries, which generates fish waste.
4	Development of women friendly fish vending and display unit	1. Improvement of cost effective, durable, contamination-less, women friendly, fish vending and display unit by using alternate materials such as plastic/stainless steel/fibre for fabricating and replacing the galvanized iron used earlier. 2. To make it more user friendly by fining wheels, covering display portion etc. 3. To test its suitability and ergonomics in market condition.	• A prototype of fish vending and display unit has been developed, evaluated and refined. • A modified steel display unit was exhibited in Global symposium on Aquatic Resources for Eradicating Hunger and Malnutrition – Opportunities and Challenges held during 4-6 December 2012 at Mangalore. • The unit has been demonstrated at Marine Fisheries Research and Information Centre, Ankola, Uttara Kannada, Fisheries Research and Information centre (Inland), Hebbal, Bangalore for marine and fresh water fish species respectively; at various places in Karnataka; in Directorate of Fisheries, Ranchi, Jharkhand and to the project team of SECURE FISH, United Kingdom who visited the Department. The patent application is in pipeline.

5	Development of Fish Ham and Patty using Natural Antioxidant Extracts March, 2011 - Completed	1. To standardize recipe for the preparation of fish ham and patty using low value fishery resource 2. To study the physio-chemical, microbiological and sensory quality changes of the product stored at refrigerated (0-5 °C) and frozen conditions (-18±2°C).	• Fish ham has been developed using shrimp chunks in fibrous casing which is not only nutritious and healthy but also maintains the integrity of shape of the product even after slicing. • Fish patties have been prepared with 25% button mushrooms (optimized) which acts as preservative and enhancer of flavour and texture of the product. • The shelf life study on fish ham in fibrous and synthetic casing is being carried out by storing them at ambient condition; refrigerated condition (6 ± 2 °C); and in cold storage condition (sliced fish hams, sealed in polythene bags separately and packed in a carton boxes) (-18 ± 2 °C). • The physical, chemical, microbiological and sensory studies of fish patties stored in refrigerated condition showed a shelf life of 20 days. The storage study under cold storage condition is in progress. • The technology of fish patties has been transferred to a local female entrepreneur following a training programme.
6	Development of fish chikuwa from low cost marine and fresh water fish and their shelf life study March, 2011 - Completed	1. Process development for the preparation of marine and fresh water fish chikuwa 2. To pack the prepared products in Bio-active packaging material 3. To estimate the shelf life of the product 4. Development of electrical kiln to heat process the product. 5. To popularize and commercialize the product entrepreneur groups and industry	• Process for preparation of fish chikuwa (popular snack in Japan as a low-fat source of protein) was optimized using fish, starch (10 %) and other spices mixture microwave oven cooking time (20 min). • A training programme has been conducted on the technology and its transfer to one woman entrepreneur is in process.
MUMBAI CENTRE			
S. No.	Research Project Title	Objectives	Specific Output
1	Quality evaluation of shelf stable fermented pork sausages	1. To evaluate the sensory and keeping quality/shelf-life of fermented pork sausages. 2. To study the physico-chemical qualities of	• The process protocol was developed and standardized for preparation of raw fermented pork sausages which can be stored upto two months at ambient temperature.

	September, 2013 -December, 2014	these sausages. 3. To carry out the nutritional/proximate analysis of these fermented sausages. 4. To assess the microbiological qualities of these sausages	• *Pediococcus pentosaceus* @ 180mg/kg and Glucono delta Lactone @ 1% in meat emulsion are recommended as an acidulent during the preparation of fermented pork sausages having shelf-life of 60 days with acceptable microbial, physic-chemical, nutritional and sensory attributes of the products at ambient storage temperature. • The process protocol is being adopted by food industry on commercial scale.
2	Preservation and handling techniques for porcine skin for production of biological bandages August, 2011- December, 2014	1. To collect porcine skin from freshly slaughtered pigs at Deonar abattoir. 2. To standardize shape and size of porcine skin xenografts. 3. To standardize the preservation techniques for porcine skin xenografts.	• Designed and developed the skin holder for holding the skin firmly. • Process protocol was developed for the preparation of porcine skin xenografts as biological bandages for the treatment of burns or non-burn cases especially in the treatment of diabetic wound and skin-ulcers.
3	Adoptive trials and popularization/commercialization of model retail outlet for production of hygienic chicken meat (September, 2013 - June, 2015)	1. To undertake the adoptive trials and popularization/commercialization of model retail outlet for production of hygienic chicken meat developed by Mumbai Centre.	• The low cost model retail outlet for hygienic production of chicken meat has been developed and established. • For the popularization of the model, the Centre has communicated in written to all Municipal Corporation Commissioners for conducting a demonstration session for registered licensed butchers and poultry owners. • Training programmes for local butchers have been conducted. • Developed model retail outlet has been established at Babu Broiler, Mermaid-II, Shop No. 13, Sector 11(B), Belapur, Navi Mumbai. The shop was inaugurated on 21st August, 2014 by Mr. Sagar Naik, Hon'ble Mayor of Navi Mumbai.
4	Detection of food-borne pathogens by LAMP (Loop Mediated Isothermal Amplification) technology (March, 2014 - April, 2017)	**1.** To isolate *E. Coli*, *S. Aureus* and *Salmonella* spp. From foods of animal origin. **2.** To characterize *E. Coli*, *S. Aureus* and *Salmonella* spp. By morphological, cultural and biochemical tests. 3. To develop a rapid Loop Mediated Isothermal	• Meat samples collected from local markets of Mumbai were processed through different morphological, cultural and biochemical tests to isolate *E. Coli, S. Aureus* and *Salmonella* spp. • Presumptive 63 *E. Coli,* 29 *S. Aureus* and 37 *Salmonella*

		Amplification (LAMP) method for detection of *E. Coli*, *S. Aureus* and *Salmonella* spp. 4. To compare sensitivity and specificity of LAMP with conventional PCR.	isolates were recovered and preserved on Brain Heart Infusion Agar slants for further processing. • Target gene specific primers have been designed using LAMP primer design software.
5	Application of commercial enzymes viz. papain and bromelin for tenderization of meat from spent hen (March, 2014 - April, 2017)	1. To compare the tenderization effect of different enzymes on meat from spent hen. 2. To study different physico-chemical and organoleptic qualities of tenderized meat from spent hen.	• Trials using the enzymes Papain and Bromelin for treatment of spent hen meat procured from various farms located in and around the city are in progress.

In addition to above the progress made under TSP, projects of ICAR-MoFPI on "Assessment of Harvest and Post-Harvest losses of Major crops and Commodities in India" and ICAR-FCI project on "Study on determining storage losses in food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management" were also discussed. The Summary of progress made under these projects is presented below.

(I) **Progress under Tribal Sub-Plan (TSP)**

The basic objectives of the Tribal Sub Plan (TSP) is substantial reduction in poverty and unemployment, creation of productive assets in favour of Scheduled Tribes to sustain the growth likely to accrue through development efforts, human resource development of the Scheduled Tribes by providing adequate educational and health services, and provision of physical and financial security against all types of exploitation and oppression. And the major objective is to ensure the much needed flow of funds and benefits for the welfare and development of these two categories in proportion to their population

Programs namely training and demonstrations in this Plan is undertaken by 14 AICRP on PHT centres in 13 districts (Table 1).

Table 1: State-wise name of districts in which TSP is operational are given below

State	**District**	**AICRP on PHT Centre looking after**
Andhra Pradesh	Prakasam, Guntur, Krishna	Bapatla
Chhattisgarh	Bastar, Kanker, Gariaband	Raipur
Gujarat	Gir-somnath	Junagadh
Himachal Pradesh	Chamba, Kinnaur	Solan
Jharkhand	Ranchi, Giridih, East Singhbhum, Latehar	Ranchi
Karnataka	Chamarajanagar	Bangalore
	Raichur, Yadgir, Koppal, Bellary	Raichur
Madhya Pradesh	Satna	Jabalpur
Maharashtra	Akola, Washim, Buldhana	Akola
Odisha	Gajapati, Kandhamal, Koraput, Deogarh, Keonjhar, Mayurbhanj	Bhubaneswar
Rajasthan	Udaipur, Banswara, Chittoregarh	Udaipur
Tamil Nadu	Coimbatore	Coimbatore
Uttar Pradesh	Lakhimpur	Lucknow
West Bengal	West Medinipur	Kharagpur

Training and demonstrations have been given on various post-harvest technologies viz., processing and value addition of cereals, pulses, oilseeds, spices, horticultural crops and demonstration on various post-harvest machinery. Some topics covered so far are sand puffing and roasting of cereal grains like rice, maize and Bengal gram, safe storage of food grains, processing and value addition of mushroom, pineapple, mahua, root crops, tamarind, aonla, betel leaves, extraction of pulp and juice, preparation of jam and chutney from fruits, dehydration of fruits, development of beverages from fruits, extraction of oil from wild apricot, preparation of pickles from green mango, chilli, carrot, beans and mixed vegetables, preparation of tomato sauce and puree, preparation of grapes squash, preparation of mixed fruit jam, processing and value addition of non-timber forest produce (NTFP), demonstration of post-harvest machinery, e.g. banana fibre extractor, dhal mill and millet pearler, etc. Till December 2014, Around 26 trainings and 31demonstrations were conducted under TSP and 1005 individuals from 133 villages were benefitted.

(II) ICAR-MOFPI project (Period: Feb 2012 to Jan 2015; Budget: Rs. 539.91 lakh)

A survey project on harvest and postharvest losses of major agricultural crops/commodities funded by Ministry of Food Processing Industries was undertaken at National level by ICAR (AICRP on PHT, CIPHET and IASRI), with the objectives (i) to estimate the post-harvest losses for major crops and livestock produce; (ii) to identify those operations and commodities where the magnitude of post-harvest losses is high; (iii) to estimate the losses of various crops and commodities at Agro Climatic Zone Level. In this study 45 crops and commodities such as: (i) Cereals: Paddy, Wheat, Maize, Bajra, Sorghum, (ii) Pulses: Pigeon pea, Chick pea, Black gram, Green gram, (iii) Oilseeds: Mustard, Cottonseed, Soybean, Sunflower, Safflower, Soybean, Groundnut, (iv) Fruits: Apple, Banana, Citrus, Grapes, Guava, Mango, Papaya, Sapota, (v) Vegetables: Cabbage, Cauliflower, Green Pea, Mushroom, Onion, Potato, Tomato, Tapioca, (vi) Plantation Crops and Spices: Areca nut, Black Pepper, Cashew, Chilli, Coconut, Coriander, Sugarcane, Turmeric, (vii) Livestock Produce: Egg, Inland Fish, Marine Fish, Meat, Poultry Meat, Milk) were covered. Besides, eight farm operations (Harvesting/ Picking/ Slaughtering, Collection, Threshing/Dehusking, Sorting/ Grading, Winnowing/Cleaning, Drying, Packaging and Transportation) and five Storage channels (Farm Storage, Godown /cold storage, Wholesaler, Retailer and Processing unit) were studied.

The primary data collection for estimation of losses was started in Oct 2012 by 36 centers of AICRP-Post Harvest Technology. For digitization of collected data the software developed in previous study was updated and circulated to all centers in March 2013. The hands on practices were given to the concerned Research Engineer/ PI during training programmes. The progress of the project was discussed and reviewed in a meeting with MoFPI and ICAR officials organized on March 8, 2014 at CIPHET, Ludhiana. It was also decided to collect and report the data of 14 Agro Climatic Zone level exempting Island region. The various ACZ's under consideration are Western Himalayan Region, Eastern Himalayan Region, Lower Gangetic Plain Region, Middle Gangetic Plain Region, Upper Gangetic Plain Region, Trans Gangetic Plain Region, Eastern Plateau and Hills Region, Central Plateau and Hills Region, Western Plateau and Hills Region, Southern Plateau and Hills Region, East Coast Plains and Hills Region, West Coast Plains and Ghats Region,

Gujarat Plains and Hills Region and Western dry region. The entire team of AICRP on PHT was involved in monitoring and scrutiny of data collected. The data covering about 109 districts out of 120 districts for 45 selected commodities have been analysed and Agro-climatic zone-wise report were compiled and submitted separately.

(III) ICAR-FCI project (Period: July 2013 to June 2017; Budget: Rs.320.53 lakh)

The project entitled "Study on determining storage losses in food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management" was undertaken by 20 centres of AICRP on PHT. The aim of study is to identify the extent of storage losses in food grains (wheat, paddy, rice and maize) in FCI and CWC warehouses; to identify the factors responsible for losses in storage; arriving at storage loss norms in different agro-climatic regions/ State with respect to various factors and the factors responsible such losses, to suggest ways and means to reduce the extent of storage losses in different unit operations. The study covers 13 agro-climatic regions covering 21 states and one UT. The depots selected were 45 godown and 18 CAP storage. Commodities selected for storage study were wheat and rice in godown storage for 3 years and wheat and paddy under Cover and Plinth storage for one year. Maize was selected to be stored in godown for one year. Among these depots, rice is to be stored in 38 godowns; wheat in 33 godowns; maize in one godown; 17 depots for wheat under CAP and 4 depots for paddy under CAP. Stacking in almost all godowns and CAP has been completed and the data collection is in progress. The detailed progress report has been submitted separately.

Annexure- I

A. List of Papers Published in National and International Journals

1. Amit Pisal, V. D. Mudgal, P.S. Champawat and Santosh Gagare. Convective Drying of Ginger Rhizomes and Slices. J. of Agril. Engineering. (Under review processcation).
2. Anju, Meena, PravinJawake, S.K.Jain, V.D.Mudgal, M.A. Saloda and K.C. Sharma, 2014. Foam Mat Drying of Papaya. Journal of Agricultural Engineering, 51 (3): 9-18
3. Basamma, K, Mathad P F, Udaykumar Nidoni and Savitha R S, 2013. Fortification of Fish Sausage Developed Using low value Underutilized Fresh Water Fish (Tilapia). *National Level of Symposium on Sustainable Food Systems for Food Security & Nutrition, 2013* Food Explore, September- 2013
4. Dahiya, P., Singh, K.; Mehta, M. and Sharma, D.K. (2014). Work posture analysis of workers engaged in polyhouse farming. Chapter No. 55 in book Humanazing work and work envioronment, edited by V. Deepa, Astral Int. (P) Ltd., pp. 403- 407.
5. K. Mehta, S.K. Jain, V. D. Mudgal and K. Chatterjee, 2013. Osmotic Dehydration Characteristics of Button Mushroom Slices. Environment and Ecology, 31(1):148-153.
6. Kumar, N., Kumar, A.; Sharma, D.K. and Garg, M.K. (2014). Performance evaluation of power operated *aonla* pricking machine considering physical and nutritional properties of *aonla*. Environment & Ecology 32(3), July- Sept, 2014, pp. 816-820.
7. Mehta B.K., S.K. Jain,V. D. Mudgal and K. Chatterjee, 2013. Convective Drying Characteristics of Osmosed Button Mushroom Slices. Environment and Ecology, 31(1):154-159.
8. Mishra B.K., N.K. Jain, Sunil Kumar and K.C. Sharma, 2013. Storage stability of ready-to-serve beverage from mahua (*Madhucaindica*) flowers, *Indian Journal of Horticulture.* 70 (3), 459-462.
9. Paikra, C.K., Patel, S., Naik, R.K. and Ram, D.S. (2014). Performance evaluation of tikhur (Curcuma angustifolia) starch extraction machine. Indian Journal of Science and Research. 2(5): 34-38.
10. Pal , U. S., Patra, R.K., Sahoo N.R., Bakhara C. K., Panda M.K. 2014. Effect of refining on quality and composition of sunflower oil. J. Food Sci Technol
11. Panchal, I.; Sharma, D.K. and Nagajjanavar, K. (2014). Optimization of process parameters in soymilk for maximum production and quality by manufacturing unit. Annals of Agri-Bio Research 19(2): 304-307.
12. Panda, M K, Pal ,US, Bal, LM, Mohapatra, T (2014) Changes in tissue structure and textural characteristics of maize grain during cooking process. Journal of Food Measurement and Characterization
13. Pisalkar, P.S., Jain, N.K., Pathare, P.B., Murumkar, R. P. and Revaskar, V.A. (2014). Osmotic dehydration of aloe vera cubes and selection of suitable drying model. International Food Research Journal, 21(1): 373-378.
14. Revaskar, V.A., Pisalkar, P.S., Pathare, P.B. and Sharma, G.P. (2014). Dehydration kinetics of onion slices in osmotic and air convective drying process. Research in Agricultural Engineering : 60(3): 92–99.
15. S. Gagare, V.D. Mudgal, P.S. Champawat and Amit Pisal. Standardization of Curing and Microwave Drying of Turmeric (*Curcuma longa*) Rhizomes. *International J. of Food Engineering. (Accepted for publication).*
16. Sahoo, N R, Pal, U S, Dash, S K, Khan, Md. K. 2012 Drying kinetics and quality aspects during heat pump drying of onion (Allium cepa L.). International Journal of Food studies(2): 159-167.
17. Sahoo, N. R., Bal, L. M., Pal, U. S., Sahoo, D. (2014) A comparative study on the effect of packing material and storage environment on shelf life of fresh bell pepper. J. of Food Measurement and Characterisation.
18. Sahoo, N.R., Pal, U.S., Dash S.K.,Panda M.K., Sahoo D (2014) Effect of combined hot air heat pump and microwave assisted drying on quality characteristics of onion shreds. J of Agril. Engg, vol 51 (1).

19. Sahoo, N.R., Panda M.K., Bakhara C.K., Mohapatra, M. 2014 Process optimization for development of extruded product from rice flour-moringa leaf bland. Oryza (Accepted for publication)
20. Sharma, Vinita, P.S. Champawat and V. D. Mudgal, 2014. Process development for puffing of Sorghum. International J. of Current Research and Academic Review: 2 (1): 164-170.
21. Shoba S., P.S. Champawat, V.D.Mudgal and S.K.Jain 2012. Dehydration Kinetics of Garlic Slices in Fluidized Bed Dryer, J. of Agril. Engineering, 49(3): 25-31.
22. Shukla, S., Singhal, S. and Sharma, D.K. (2013). Emission of carbon dioxide by urban households. Eco. Env. & Cons. 19(4), pp. 1123-1125.
23. Shukla, S., Singhal, S. and Sharma, D.K. (2013). Harnessing fuel-energy from biomass for drudgery reduction in rural households. Asian Journal of Home Science. 8(2), pp. 754-758.
24. Singh, R., B. K. Mishra, K. B. Shukla, N. K. Jain, K. C. Sharma, Sunil Kumar, Krishna Kant and J. K. Ranjan, 2013. Fermentation process for alcoholic beverage production from mahua (*Madhucaindica*J. F. Mel.) flowers,*African Journal of Biotechnology*, 12 (39): 5771-5777.
25. Singh, V.K., Mandhyan, B.L., Pandey, S. and Singh, R. B. (2013) Process Development for Spray Drying of *Ber (Ziziphus jujube L.)* Juice. *American Journal of Food Technology*. Vol. 8(3): Page: 183-191.
26. Singh, V.K., Sharma, D.K.; Garg, M.K. and Pushkar (2014). Packaging and storage studies of *Satawar* and *Mulhatti* powder. Environment & Ecology 32(1A), Jan.- March, 2014, pp. 304-309.
27. Singh,V. K., Garg, M.K., Sharma, D. K. and Pushkar (2014) Packaging and Storage Studies of Satawar and Mulhatti Powder. *Environment & Ecology*. Vol. 32 (1A), Page: 304-309.
28. Singh,V. K., Garg, M.K., Sharma, S and Verma, D.K. (2013) Estimation Heat loss from Spray dryer: Study on Indian jujube *(Ziziphus jujuba)*. *Environment & Ecology*. Vol. 31 (2B), Page: 974-978.
29. Sinha, A.K., Patel, S. and Choudhary, P. L. (2012). Some studies on physical and chemical properties of tamarind at different moisture content. *Journal of Plant Development Sciences*. 4(1): 81-84.
30. Sinha, A.K., Patel, S. and Choudhary, P.L. (2012). Some studies on physical and chemical properties of tamarind at different moisture content. *Journal of Plant Development Sciences*. 4(1): 81-84.
31. Tirkey, B., Pal U.S., Sahoo N.R.,Bal L.M., BakharaC.K. and Panda M.K. (2014)Evaluation of physico chemical changes of fresh cut unripe papaya during storage, Journalof Food Packaging and Shelf Life,17
32. Tiwari, S. and Patel, S. (2013). A comparative study of tikhur traditional and partial mechanical processing and cost economics. International Journal of Agricultural Engineering. 6(1): 213-215.
33. Tiwari, S. and Patel, S. (2013). Physico-chemical variation on tikhur powder obtained from mother and finger rhizomes. Journal of Plant Development Sciences. 5(2):139-141.
34. Verma, V. and Patel, S. (2012). Nutritional security and value added products from Finger millers (ragi). *Journal of Applicable Chemistry.* 1(4): 485-489.
35. Verma, V. and Patel, S. (2013). Production enhancement, nutritional security and value added products of millets of Baster region of Chhattisgarh. *International Journal of Research in Chemistry and Environment.* (Accepted).
36. Verma, V. and Patel, S. (2013). Value added products from nutri-cereals: Finger millers (*Eleusine coracana*). *Emir. Journal of Food Agriculture.* 25(3): 169-176.

(B) Papers presented in Conference/ Seminar/ Symposia

1. Champawat, P.S, Priyanka, Chandaliya and K. C. Sharma. 2014. Bio-efficacy of plant products against pulse beetle, *Callosobruchuschinensis*L. (Coleoptera: Bruchidae) in

stored green gram. Abstract in the proceeding ofInternational conference on "Changing scenario of pest problems in agri-horti ecosystem and their management"held at Rajasthan College of Agriculture, Udaipur during 27 to 29 November, 2014, Pp 153.

2. Jain, N. K. and K.C. Sharma, 2014. Machine for depoding and shelling of green bengal gram pods. 48th ISAE Annual Convention & Symposium held at MPUAT, Udaipur during Feb. 21-23, 2014.
3. Khokhar, D., Patel, S., Mishra, N., Pisalkar, P.S. and Geda, A.K. (2014). Essential Oil Recovery Optimization from Patchouli (*Pogostemon cablin* Benth.). Paper presented in the national conference on Biotechnology for Sustainable Agriculture at JNKKV, Jablapur. Sept. 8-9, 2014.
4. Lal, J., K. C. Sharma, H. K. Jain, Abhimanyu Singh and R. K. Meena, 2014. Management of lesser grain borer, *Rhizoperthadominica*L. (Coleoptera: Bostrichidae) through plant products in stored wheat.Abstract in the proceeding of International conference on "Changing scenario of pest problems in agri-horti ecosystem and their management"held at Rajasthan College of Agriculture, Udaipur during 27 to 29 November, 2014, Pp150.
5. Mathad P. F., Sandeep Singh Rana and Udaykumar Nidoni. 2013. Development of Fortified Fish Sausage using Low value, Under- utilized Fresh Water Fish (*Tilapia*). Proceedings of *Third International Conference on Food Technology held at IICPT, Thanjavur*
6. Mishra, N.K., Patel, S., Agrawal, A.K. and Naik, R (2013). Solar drying characteristics of winter vegetables and their quality evaluation (PDFE-2013-PHC-14). Paper presented in the 47th Annual Convention, Indian Society of Agricultural Engineers (ISAE) and International Symposium on "Bio-Energy - Challenges and Opportunities" held at Hyderabad. January 28-30, 2013.
7. Mudgal V.D., 2014. a lead paper presented in International conference on "Changing scenario of pest problems in agri-horti ecosystem and their management" at Rajasthan College of Agriculture, Udaipur during 27 to 29 November, 2014.
8. N Jayashankar Nagaraj Naik, Uadykumar Nidoni Mathad P F, Ambarish G and S K Nanda. 2014. Isolation, Methonine Producing Probiotics and Evaluation of egg production Parameters in Commercial Layers Giriraj Cheicks. *International Conference on Food, Biological and Medical Sciences (FBMS-2014), 28-29 , Bankok (Thailand)*
9. Naik, N., N Jayashankar, Uadykumar Nidoni Mathad P F, Ambarish G and S K Nanda. 2014. Isolation, Screening and Evaluation of Methonine Producing Probiotics on Production Performance of Giriraj Cheicks. *International Conference on Food, Biological and Medical Sciences (FBMS-2014), 28-29 , Bankok (Thailand)*
10. Nidoni, U., Ambrish G, Mathad, P F and Dhayalan Elangovan. 2013. Development of polymeric membrane based poly lactic acid-Metal organic farme work composite and evaluation of mass transport properties. Proceedings of *Third International Conference on Food Technology held at IICPT, Thanjavur*
11. Patel, S., Mishra, N.K., and Veenu Verma (2013). Innovative processing and value addition of finger millet (ragi) (PDFE-2013-PAC-18). Paper presented in the 47th Annual Convention, Indian Society of Agricultural Engineers (ISAE) and International Symposium on "Bio-Energy - Challenges and Opportunities" held at Hyderabad. January 28-30, 2013.
12. Pisalkar, P.S., Jain, N.K., Patel, S., Mishra, N.K. and Naik, R.K (2013). Effect of pretreatments and drying air temperature on drying behaviour of Aloe vera cubes (PDFE-2013-PHC-15). Paper presented in the 47th Annual Convention, Indian Society of Agricultural Engineers (ISAE) and International Symposium on "Bio-Energy - Challenges and Opportunities" held at Hyderabad. January 28-30, 2013.
13. Sharma, K.C. and V. D. Mudgal, 2014.Bio-efficacy of fly ash based herbal insecticides against pulse beetle, *Callosobruchuschinensis*L. (Coleoptera: Bruchidae) infesting cowpea. Abstract in the proceeding of International conference on "Changing scenario of pest problems in agri-horti ecosystem and their management"held at Rajasthan College of Agriculture, Udaipur during 27 to 29 November, 2014, Pp 147.

(C) Technical Bulletin/leaflets, etc.

1. Laboratory manual on Post-harvest Technology
2. Laboratory manual on Food Packaging
3. Sorting and Grading of Horticultural Produce (in Hindi).
4. Mini oil refining unit Sarbabharatiya samanwita Gabesana prakalpa Amala parabarti Baisaika Gyana,
5. Post-harvest Management of Garlic
6. PKV Mini Dal Mil
7. PDKV Cherry (Tuty fruity) tantradnyan
8. Kaddhanya mullyawardhanasathi PDKV Dalmil(Marathi-Folder)
9. Cherry/Tutyfruity banwanyache PDKV navinyapurna tantradyan(Marathi folder)
10. Post Harvest Profile of Papaya
11. Roganchya pradurbhavamadhe biyanyanche mahatva
12. Jivanudware udbhavnarya soyabeanchya roganche kapani pashchat mahatva
13. Soyabeanvaril vishanujanya roganche kapani pashchat mahatva
14. 'Paudar gur' - a leaflet in Assamese
15. 'Choklet gur' - leaflet in Assamese
16. Improved Jaggery Plant for Hygienic Jaggery Production
17. Value added products like Buffalo tracheal treat, Buffalo tendon treat,
18. Fermented pork products.
19. Preparation of emu meat products.

Annexure- II

Agro processing centres established with the help of AICRP on PHT

APC Established	Sr. No	Name and Address of APC	Year of Establishment
Akola	1.	APC at Kanzara, Dist. Akola	2012
Hisar	2.	Sh. Mani Pal Singh, APC on Anola Processing Bhat Rai (Bhawani)	2012
	3.	Mr. Subash APC on Anola Processing, village Palwal, Jind (Haryana)	2012
Jaipur	4.	APC Jatwara, Jaipur	
Jorhat	5.	*Gopal Krishna Self Help Group* established APC in Merapani, Golaghat district	2013
Lucknow	6.	Developed mixer for value added jaggery with aonla (Lucknow)	2013
	7.	Jaggery fortified with Anola (Lucknow)	2013
Ludhiana	8.	S. Gurmeet Singh (Meeta) VPO Dina Sahib, Distt. Moga	2012
	9.	Nahar Singh, Secretary D. Sukhanand Bahumantri Sehkari Khetibari Sewa sabah Ltd. V.P.O Sukhanand , Distt- Moga	2012
	10.	S. Chamkaur Singh Ubhi Jodhan food products Narangal road, VPO Jodhan Ludhiana	2012
	11.	S. Harbans Singh Gill Vill Salempura (Sidhawan Bet) Teh. Jagraon, Distt-Ludhiana	2012
	12.	S. Teja Singh LMM Agro Processing Complex V.P.O Charik, Distt- Moga	2012
	13.	S. Jasbir Singh Gill Gill Agro Food Products Vill. Dhurkot, Distt. Faridkot	2013
	14.	S. Ranjit Singh Baba Jani Agro Food Processing Vill. Panj Garaiyan, Distt. Faridkot	2013
	15.	S Jaswant Singh S/o S Bahadur Singh Vill Rattian, Moga	2013
	16.	Avtar Singh Master S/o S Chand Singh Vill. Daroli Bhai, Moga	2013
	17.	Navjeet Singh VPO Harike Atta Chaki ,Dist .Muktsar	2013

	18.	Jarnail Singh S/o Mangal Singh Jimedar processing mill, Tehsil nehal singh wala, Moga	2013
	19.	S Baljit Singh S/o S Bahadur Singh Vill Patti, Amritsar	2013
	20.	Harbhajan Singh Budhlada road, Fuluwala dogra, Mansa	2014
	21.	Satnam Singh S/o Paramjit Singh Muglu Patti, Mandir road, Near lawreance school, Bagha purana	2014
	22.	Jagmeet kaur C/o Jagjit singh Bhala Sandhu Floor Mill, VPO Vara Daraka Kotkapura	2014
	23.	S Binder Singh Bindi Agro Food Processing Model Vill. Kotshamir, Near Talwandi Sago, Bhatinda	2014
Tavanur	24.	APC, KCAET Campus, Tavanur, Kerala-679573	2014
	25.	WASP Jackfruit Processing Plant, Manathawadi, Wayanad, Kerala	In progress
Raichur	26.	Kiran Bedi Agro Processing Unit Kiran Bedi Women Association At Post: Uttangi village, Tq: Huvinahadagali, Distt: Bellary	2012
	27.	Teja Dhal Mill Shri. Hanumesh At Post: Turuvihal, Tq: Sindhanur Distt: Raichur	2012
	28.	Sugureshwar Agro Processing Unit Shri. Vinod kumar. J H.No. 9-18-63/2, Maddipet , Raichur, Tq & dt: Raichur	2013
	29.	Navneet Agro Processing Unit Shri. Santosh M Thrimukhe At Post: Manthal Tq: Basavakalyan Distt: Bidar,	2013
	30.	K.M. Agro Processing Unit Shri. Kallappa Mathapati. At Post : Chawar Dhabka Tq: Aurad Dt: Bidar	2013
	31.	Millet Processing Unit Uttangi Village, Tq: Huvinahadagali, Distt: Bellary	In Progress
	32.	Dhal Mill in Athanur Village Tq: Manvi, Distt: Raichur	In Progress
Tavanur	33.	Suma Foods, Kulukkallur (Post), Palakkad (Distt), Kerala	2013
Udaipur	34.	APC at Rajsamand and Bhilwara Districts	In progress

ALL INDIA COORDINATED RESEARCH PROJECT ON POST-HARVEST TECHNOLOGY
ICAR - CIPHET, Ludhiana - 141 004

PROGRAMME FOR THE 30th WORKSHOP

Venue : **UAS, Bangalore**

Dates : **06 - 09 January, 2015**

06-01-2015 Tuesday

09:00-10:00	:	**Registration**
10:00-11:15	:	**INAUGURAL SESSION**
10:00 - 10:05	:	Welcome Address – Dr. S. Subramanya, AICRP PHT, UAS Bengaluru
10:05 - 10:10	:	Opening Address – Dr. Kanchan K. Singh, ADG (Engg)
10:10 - 10:20	:	Coordinator's Report – Dr. S. N. Jha, PC (PHT)
10:20 – 10:25	:	Release of new publications (by the chief guest and other dignitaries)
10:25 - 10:30	:	Address by Director, CIPHET – Dr. R. K. Gupta
10:30 – 10:35	:	Dr. M. A. Shankar, Director Research, UAS Bengaluru
10:35 - 10:45	:	Brief Remarks of experts
10:45 – 10:55	:	Presidential Address – Dr. K. Alagusundaram, DDG (Engg)
10:55 - 11:05	:	Address of the Chief Guest, Dr. D. P. Kumar, I/c VC, UAS Bengaluru
11:05 - 11:10	:	Vote of thanks – Dr. V. Palanimutthu, Sectoral PI, UAS Bengaluru
Rapporteurs	:	Dr. U.K. Nidoni, Research Engineer, UAS, Raichur Dr. Sher Singh, PI, VPKAS, Almora
11:10-11:15	:	**Tea**
TECHNICAL SESSION – I **11:15-13:30**	:	**Presentation of Biennial Progress Reports** **(Centres:** Akola, Almora, Bangalore, Bapatla, Bhubaneswar and Coimbatore)
Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairpersons	:	Dr. Kanchan K. Singh, ADG (Engg), ICAR, New Delhi
	:	Dr. R. K. Gupta, Director, CIPHET
Expert Invitees	:	Dr. P.Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy
Coordinator	:	Dr. S. N. Jha, PC (PHT)
Sectoral PIs	:	Dr. Borker, Dr. Viswanathan, Dr. V. Planimutthu
Rapporteurs	:	Dr. M.N. Dabhi, Research Engineer, JAU, Junagadh Dr. Ravi Gupta, Research Engineer, CAU, Gangtok

(The Research Engineers/PI of the cooperating centres will present the salient Progress Report of their centres for 2012 to 2014 and technical programme for the next two years of approved project. Presentations will be arranged in alphabetical order to the name of the Centres as stated herein, and will be limited to 15 minutes for each centre including discussion).

13:30-14:30 : **Lunch**

14:30-17:30	:	**Technical Session – I continued** **(Centres:** Gangtok, Hisar, Jabalpur, Jaipur, Jorhat, Junagadh, Kasargod, and Kharagpur**)**
Rapporteurs	:	Dr. M.S. Alam, Research Engineer, PAU Ludhiana Dr. Sushil Pandey, RE, BAU Ranchi

07-01-2015 Wednesday

9:30-13:30	:	**Technical Session – I continued from day 1** **(Centres:** Ludhiana, Pusa, Raichur, Raipur, Ranchi, Solan, Srinagar, Tavanur, Trivandrum, and Udaipur**)**
Rapporteurs	:	Dr. D. K. Sharma, RE, HAU Hisar Dr. V. Thirupathi, RE, TNAU, Coimbatore
13:30-14:30	:	**Lunch**
TECHNICAL SESSION – II 14:30-16:00	:	**Presentation of Biennial Progress Reports – Livestock Produce** **(Centres:** Aligarh, Chennai, Khanapara, Kolkata, Mangalore, Mumbai, Raichur**)**
Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairpersons	:	Dr. Kanchan K. Singh, ADG (Engg), ICAR, New Delhi Dr. R. K. Gupta, Director CIPHET, Ludhiana
Expert Invitees	:	Dr. Dr. P.Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy
Coordinator	:	Dr. S. N. Jha, PC (PHT)
Sectoral PI	:	Dr. Robinson Abraham, Chennai
Rapporteurs	:	Dr. R. N. Borpuzari, PI, AAU, Khanapara Dr. C.V. Raju, PI, KVA&FSU, Mangalore
TECHNICAL SESSION - III 16:00-17:30	:	**Presentation of Biennial Progress Reports - Jaggery & Khandsari** **(Centres:** Anakapalle, Buralikson, Kolhapur, Lucknow**)**
Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairperson	:	Dr. Kanchan K. Singh, ICAR, New Delhi
Expert invitees	:	Dr. Dr. P.Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy
Coordinator	:	Dr. S. N. Jha, PC (PHT)
Rapporteurs	:	Dr. Dilip Kumar, RE, IISR Lucknow Dr. B.G. Gaikwad, PI, RS&JRS, Kolhapur

08-01-2015 Thursday

Workshop on MoFPI Sponsored Project

TECHNICAL SESSION: Presentation of a report on "Assessment of Harvest and Post-Harvest Losses of Major Crops and Commodities in India" for technical approval of experts

Chairpersons	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
	:	Dr. U. Venkateswarlu, JS MoFPI, New Delhi
Co-chairpersons	:	Dr. Kanchan K. Singh, ADG (PE), ICAR, New Delhi
	:	Dr. R. K. Gupta, Director CIPHET, Ludhiana
Expert invitees	:	Dr. P. Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy Dr. Anil Rai, IASRI New Delhi
Rapporteurs	:	Dr M. S. Alam, RE, PAU Ludhiana Dr. A. Borah, Research Engineer, AAU, Jorhat
09:30 - 09:35	:	Welcome – Dr. S. Subramanya, PI UAS Centre
09:35 – 10:15	:	Presentation of draft report – Dr. S. N. Jha, PC AICRP on PHT
10:15 – 11:15	:	Experiences sharing by PI of all centres (two minutes each)
11:15 – 13:00	:	**Panel discussion (experts, PIs, and project sponsores)**
13:00 – 13:25	:	Brief remarks of Chairperson (DDG, JS MoFPI)
13:25 – 13:30	:	Vote of thanks – Dr. R. K. Vishwakarma, Sr. Scientist PC Unit
13:30 – 14:30	:	**Lunch**

Workshop on FCI Sponsored Project

TECHNICAL SESSION: Presentation of progress report on "Study on determining storage losses in food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management"

Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairpersons	:	Dr. Kanchan K. Singh, ADG (PE), ICAR, New Delhi Dr. R. K. Gupta, Director CIPHET Ludhiana Executive Director/ General Manager, FCI HQ New Delhi
Expert invitees	:	Dr. P.Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy Dr. Anil Rai, IASRI, New Delhi
Rapporteurs	:	Dr. S K Aleksha Kudos, CIPHET Ludhaina Dr. Devina Vaidya, PI, YSPUH&F, Solan

14:30 – 14:35	:	Welcome – Dr. S. N. Jha, PC PHT
14:35 – 14:50	:	Progress Report presentation – S. N. Jha, PC PHT
14:50 – 15:15	:	Experience sharing by PIs of cooperating centres
15:15 – 15:30	:	Views of FCI/CWC officials
15:30 – 15:45	:	Brief expert opinions
15:45 – 16:15	:	Remarks by Co-chair and chairperson
16:15 – 16:20	:	Vote of thanks – Dr. Anil Kr Dixit, Sr. scientist PC Unit CIPHET
16:20 – 16:30	:	**Tea**

AICRP 30th Workshop continues...

TECHNICAL SESSION – IV	:	**Presentation of Technical Programme for 2015 – 2016**
16:30-17:30	:	by **Sectoral PI** (Food Grains): Dr. R. Viswanathan and **Sectoral PIs** (Horticultural Crops): Dr. P.A. Borkar and Dr. V. Palanimuthu
Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairperson	:	Dr. Kanchan K. Singh, ADG (PE), ICAR, New Delhi
Expert Invitees	:	Dr. P.Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy
Coordinator	:	Dr. S. N. Jha, PC (PHT)
Rapporteurs	:	Dr. M.S. Sajeev, Research Engineer, CTCRI, Trivandrum Dr. M.K. Panda, Research Engineer, OUAT, Bhubaneswar

(The Sectoral PIs of AICRP on PHT to present the research projects and technical programme proposed to be undertaken during the years 2015-2016).

09-01-2015 Friday

09:30-11:00	:	**Technical Session – IV continued** by **Sectoral PI** (Livestock Produce): Dr. Robinson J.J.Abraham and **Sectoral PI/RE** (Jaggery): Dr. P.V.K. Jagannadha Rao
Rapporteurs	:	Dr. R.J. Zende, Research Engineer, MAFSU, Mumbai Dr. B. J. Gaikawad, PI, RS&JRS, Kolhapur
11:00 – 11:15	:	Tea
TECHNICAL SESSION - V	:	**Operational Issues**
11:15 - 13:00		
Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairpersons	:	Dr. Kanchan K. Singh, ADG (PE), ICAR, New Delhi
	:	Dr. R. K. Gupta, Director, CIPHET
Coordinator	:	Dr. S. N. Jha, PC (PHT)
Rapporteurs	:	Dr. Anil Kumar Dixit, CIPHET Ludhiana Dr. SK Aleksha Kudos, CIPHET Ludhiana

(In this Session, Research Engineers/PI of the centres will discuss the salient features of the functioning of their centres, and also administrative / technical problems, if any).

13:00 – 14:00 : Lunch

CONCLUDING SESSION

14:00-15:30

Chairperson	:	Dr. K. Alagusundaram, DDG (Engg), ICAR, New Delhi
Co-chairpersons	:	Dr. Kanchan K. Singh, ADG (PE), ICAR, New Delhi Dr. R. K. Gupta, Director, CIPHET, Ludhiana
Expert Invitees	:	Dr. P.Chandra, Dr. B. Ranganna, Dr. V.K. Seghal, Dr. S. Ganapathy
Coordinator	:	Dr. S. N. Jha, PC (PHT)
Rapporteurs	:	Dr. Anil K Dixit, CIPHET Ludihana Dr. Syed Zameer, PI, SKUAST, Srinagar

14:00 – 14:20	:	Presentation of recommendations of different sessions by rapporteurs
14:20 – 14:35	:	Comments and suggestions of expert invitees
14:35 – 14:55	:	Remarks of Co-chair and Chairpersons
14:55 – 15:00	:	Vote of thanks -Dr. S. Subramanya, AICRP on PHT (the Host Institute)
15:15 – 15:30	:	Tea

(15.30 – 17.30: Visit to nearby newly established APC and success stories)

(S. N. Jha)
I/c Project Coordinator
AICRP on PHT

CONTRIBUTORS

All Sectoral PIs

All Research Engineers / PI and Scientists of AICRP on PHT

RA, SRF and Field Investigators, Contractual and Other Staff of AICRP on PHT

COMPILED AND EDITED

Dr. S. N. Jha, PC (PHT), CIPHET Ludhiana

Dr. Anil K. Dixit, Senior Scientist, CIPHET Ludhiana

Dr. S. K. Aleksha Kudos, Scientist, CIPHET Ludhiana

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