FOUR DECADES OF R&D
ALL INDIA COORDINATED RESEARCH PROJECT ON
POST-HARVEST ENGINEERING AND TECHNOLOGY

Compiled & Edited by
Anil K. Dixit
S. N. Jha
S. K. Aleksha Kudos

ICAR-All India Coordinated Research Project on Post-Harvest
Engineering and Technology
ICAR-CIPHET, PO: PAU, Ludhiana-141 004, India
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MESSAGE

Post-harvest processing and preservation have become essential and integral components of agricultural production systems. Machinery and technology suitable for post-harvest processing are important to reduce the food losses in the post-production stages. I am glad to learn the 4 decades of research efforts made by the All India Coordinated Research Project on Post-harvest Engineering and Technology has given to our farmers and industry very useful technologies and machinery.

I appreciate and thank the scientists at various levels who have contributed to the science of post-harvest engineering and technology and bringing in appropriate technologies suitable for Indian farmers and industry. My appreciations are also to the coordinating cell of the AICRP on PHET in bringing this useful compendium as a ready reckoner for every stakeholder in the system.

(RADHA MOHAN SINGH)
MESSAGE

It gives me immense pleasure to learn that the Coordinating Cell of All India Coordinated Research Project on Post-Harvest Engineering and Technology (AICRP on PHET) functioning from ICAR-CIPHET, Ludhiana has compiled the useful technologies, processes and machinery that came out of four decades of tireless work rendered by the scientists in the country.

The post-harvest losses can be reduced and the livelihood of farmers can be enhanced only when the farmer becomes an entrepreneur and processes his produces before bringing to the market. Appropriate technologies processes and machinery are needed for the farmers to process, preserve, add value and store their commodities till good market prices are obtained and to avoid losses. The four decades of research on the subject of post-harvest engineering and technology has given numerous such technologies, processes and machinery that are popularly and successfully adopted by the stakeholders.

I appreciate those scientists who have created and made these technologies available to our farmers and industry. I congratulate the Coordinating Cell of AICRP on PHET in bringing out this compendium which will be highly useful to all the stakeholders.

Dated the 14th December, 2015
New Delhi

(S.Ayyappan)
Foreword

Effective management of agricultural commodities in the post-production system is very important in reducing losses, making more food available for domestic consumption and export markets and in achieving sustainable food security for all. During the initial few decades after independence the post-harvest food losses were rampant in the country and there were no suitable, appropriate and cost-effective technologies available to Indian producers, traders and industry. The losses to foods in the post-harvest system was of great concern and need for coordinated research on the subject was felt by the policy makers.

All India Coordinated Research Project on Post-harvest Engineering and Technology (called as AICRP on PHET in short) has been an earnest effort of ICAR in initiating, coordinating and conducting high quality research in areas of post-harvest processing and management of agricultural produce. The scheme which was initiated in 1972 was called as Coordinated Scheme on Harvest and Post-Harvest Technology initially. Later it was called by the name All India Coordinated Research Project on Post-Harvest Technology.

Currently 30 centres are being funded by the scheme. Of these 30 centres, 24 are in State Agricultural Universities, 4 are in ICAR institutes, one in IIT, Kharagpur and one in Central Agricultural University. A total of 449 staff (including 155 scientific, 217 technical, 39 administrative and 40 support staff) are being supported by the scheme in all these centres. The funding provided by ICAR rose from 11.5 crores in IX five year plan to 33.4 crores in X, 67.2 crores in XI and 132.7 crores in the current five year plan. These monies are supplemented by the respective State Governments by providing 25% of the support provided by ICAR.

The tireless works of numerous scientists, technical and other staff in these projects and the effective coordination provided by the SMD Agricultural Engineering and the Coordinating Cell, the scheme has resulted in numerous technologies, machinery and processes suitable to process, preserve, value add and store appropriately the India grown agricultural produce.

The compendium on Four Decades of Research in All India Coordinated Project on Post-Harvest Engineering and Technology is a good effort put up by Dr. Jha and his team in documenting the useful technologies, processes and machinery that came out of the research efforts of those numerous scientists who worked for 40 years in the scheme. I salute, thank and heart fully appreciate all these scientists who have created such useful technologies, processes and machinery for the country.

The compendium is very well prepared and meticulously presented. The material contained will be useful to the future researchers to identify the research gaps, producers and traders to locate suitable machinery and technology for processing and industry to learn and mass multiply the useful machinery. I appreciate the editorial team for their efforts in bringing this compendium at an appropriate time.

(K. Alagusundaram)
Deputy Director General (Agricultural Engineering)
Preface

The historical information is vital resource for further progress of science and developmental activities of any society. The publication on ‘Four Decades of Post-harvest Technologies and Engineering’ is the contribution of numerous scientists and covers salient achievements including gist of technologies, patents, awards, research papers and how the developed technologies are benefiting the intended stakeholders. The very purpose of this publication is to provide wider choice to farmers and entrepreneurs for rational decision on selection of postharvest technology on one hand and strengthening research capabilities and avoiding duplication on the other hand.

Post-harvest sector is considered as sun rise industry and a key for transforming the rural economy. It has great potential for flourishing in developing countries like India, though we need to have small gadgets, tools, machinery and process protocols for small and medium entrepreneurs so that they can opt for processing and value addition in the production catchment itself.

This will also be a guiding tool for policy makers with respect to promotion and popularization of potential post-harvest technologies through subsidy and other suitable measures. Besides it will be useful reference to potential entrepreneurs, research engineers and extension workers.

(Kanchan K Singh)
ADG (FE &PE)
Acknowledgements

We express our profound gratitude to Dr. S. Ayyappan, Secretary DARE and DG, ICAR; and Dr. K. Alagusundaram, DDG (Engg) and Dr. Kanchan K. Singh, ADG (FE/PE) for encouraging us to compile essence of achievements made by All India Coordinated Research Project on Post-harvest Engineering and Technology over four decades. We thank for all supports of Agricultural Engineering Division, ICAR and Director, ICAR-CIPHET during the course of the project.

Our heartfelt thanks to all previous and incumbent Research Engineers/ PI's and scientists of the AICRP on Post-Harvest Engineering and Technology centres situated in State Agricultural Universities, ICAR institutes, IIT and Central Universities. Their contributions in terms of (i) development of post-harvest technologies which are crop and region specific, (ii) recipient of awards and patents and (iii) enriching scientific pool by publishing research papers is highly appreciable. This will also be a guiding tool for policy makers with respect to promotion and popularization of potential post-harvest technologies through subsidy and other suitable measures.

We are extremely grateful to former DDGs (Engg), ADGs, Directors, ICAR-CIPHET and Project Coordinators, to name few Dr. M. M. Pandey DDG (Engg) and Dr. D. Rama Rao I/c DDG (Engg), Dr. K.K. Singh, Ex-ADG (PE) and Dr. R.T. Patil, Ex-Director, CIPHET, Dr. S. K. Nanda, Ex-PC (PHT), who have nursed this project at its different stages.

We are also grateful to Dr. R. K. Gupta, Director, ICAR-CIPHET for his support and contributions to this scheme. We thankfully acknowledge the support, motivation and guidance received from Head of Departments, all Scientists, Administrative and Technical staff of ICAR-CIPHET, Ludhiana. A special word of thanks is due to Dr. Sandeep Mann, Principal Scientist (AS&PE) for critical proof reading and Ms. Sukreeti Sharma, SRF for her help in compilation of this document. Thanks are also due to Mrs. Sunita Rana, and contractual staff working at Coordinating Unit of AICRP on PHET.

The task could not be completed without sincere efforts and prompt response of the Research Engineers/ Principal Investigators of AICRP on PHET centres, a fact for which we are grateful to all of them. We hope this document will be very useful to all stakeholders in years to come.

ICAR-CIPHET, Ludhiana
Date: 14-12-2015

Anil K. Dixit
S. N. Jha
S. K. Aleksha Kudos
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1. HISTORICAL BACKGROUND

The All India Coordinated Research Project on Post-Harvest Engineering and Technology (earlier named: Coordinated Scheme on Harvest and Post-Harvest Technology; and All India Coordinated Research Project on Post Harvest Technology) was sanctioned by the Indian Council of Agricultural Research, Department of Agricultural Research & Education, Ministry of Agriculture, Government of India, in September 1972. It started with R&D Centres at ten locations, viz., IARI New Delhi (Coordinating Centre), PDKV Akola, TNAU Coimbatore, CRRI Cuttack, JNKVV Jabalpur, IIT Kharagpur, PAU Ludhiana, GBPUA&T Pantnagar, UAS Raichur and MPUA&T Udaipur. The Coordinating Unit was shifted to ICAR-Central Institute of Agricultural Engineering Bhopal in February 1976 and thereafter shifted to ICAR-Central Institute of Post-Harvest Engineering and Technology, Ludhiana with effect from December 29, 1989.

During VI Five Year Plan (1978-83), four more centres namely GAU Junagadh, CAZRI Jodhpur, CPCRI Kasargod and CTCRI Trivandrum were approved. The objectives of the schemes were set as to: (i) find out right stage of harvesting based on proper moisture levels for maximum recovery and keeping quality of grains as affected by harvesting at different stages; (ii) improve efficiency of machines for harvesting, threshing and processing of grains and study the quality of processed seed and grains; (iii) study the drying behaviour and characteristics of grains, (iv) study of components of structure for improving the efficiency; (v) solve storage problems of grains including storage-grains-pest problems; (vi) effect of mechanization; and (vii) handling of grains for marketing.

During the VI, VII and IX Plans, eleven more centres were inducted into the scheme. In X Plan EFC, eight new centres were started and four existing centres were assigned enlarged mandate on dairy, fisheries, horticulture, and meat products. Besides, five ongoing centres of AICRP on Jaggery and Khandasari (RARS Anakapalle, SRS Buralikson, ICAR-IISR Lucknow, RS&JRS Kolhapur) were merged with the AICRP on PHT w.e.f. April 2004. During XI Plan, four new centres were approved and commenced at CAU Gangtok, BAU Ranchi, KVA&FSU Mangalore and MAFSU Mumbai; and the AICRP grew to the level of 38 centres. CAZRI Jodhpur was dropped at the end of XI Plan and few other centres such as AMU Aligarh, CIAE Bhopal, NDUAT Faizabad, RAU Jaipur, WBUA&FS Kolkata and GBPUAT Pantnagar were closed and one centre SRS Buralikson merged with AAU Jorhat centre on recommendation of QRT and EFC of XII Plan period, respectively.
Presently, the project is operating through 30 centres distributed almost throughtout India, covering almost all states and the ago-climatic regions (Fig. 1). The AICRP on PHT was renamed again as AICRP on Post-Harvest Engineering and Technology (PHET) in 2015. The organisational set up of the AICRP on PHET is depicted in Fig 2.

Fig. 1 Location of present centres of AICRP on PHET
Fig. 2. Organogram of All India Coordinated Research Project on Post-Harvest Engineering and Technology (AICRP on PHET)
2. MANDATE AND OBJECTIVES

- To develop location and crop/commodity specific post-harvest technologies for minimization of quantitative and qualitative losses to produce of agriculture and allied sectors.

- To adapt and develop improved post-harvest processes and equipment 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 (APC) to assure better economic returns to the farmers from their marketable surpluses.

- To assess, refine and transfer proven technologies.

Objectives

- To study the prevailing post-harvest 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.
Mandate & objectives

- 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 consciousness of post-harvest technology 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.
3. MANPOWER AND BUDGET

Personnel Served and Guided AICRP on PHET in Various Capacities

Four decades of AICRP on PHET has been served by many Project Coordinators and guided by distinguished and well known Scientists and Engineers in Capacities of Deputy Director General, Asstt. Director General and Directors of ICAR-CIPHET as listed below:

Deputy Director Generals

Dr. Jaswant S. Kanwar 1966-1973
Dr. Dev Raj Bhumbla 1974-1978
Prof. N. S. Randhawa 1979-1985
Prof. Gajendra Singh 1997-1998
Dr. Anwar Alam 1998-2003
Dr. Nawab Ali 2005-2009
Dr. M.M. Pandey 2009-2013
Dr. D. Rama Rao 2013-2014
Dr. K. Alagusundram 2014—At Present

Assistant Director Generals

Dr. R.P. Kachru 1998-2002
Dr. N.S.L. Srivastava 2002-2003
Dr. P. Chandra 2003-2009
Dr. S.K. Tandon 2009-2010
Dr. K.K. Singh 2010-2014
Dr. Kanchan K. Singh 2014—till date

Directors, ICAR-CIPHET, Ludhiana

Dr. Jai Singh, OSD 1991-1997
Dr. B. S. Bisht, Director (Acting) 1997-2000
Manpower and budget

Dr. S. M. Ilyas, Director 2000-2005
Dr. O. D. Wanjari, Director (Acting) 2005-2006
Dr. R. T. Patil, Director 2006-2011
Dr. R. K. Gupta, Director (Acting) 2011-2012
Dr. U. S. Shivhare, Director 2012-2013
Dr. S. N. Jha, Director (Acting) 2013-2014
Dr. R. K. Gupta, Director 2014 to till date

Project Coordinators
Prof. T.H. Nirmal 1972-1977
Dr. Anwar Alam 1978-1981
Dr. Nawab Ali 1981-1985
Dr. B.D. Shukla 1985-1989
Dr. R.P. Kachru 1989-1991
Dr. Jai Singh 1991-1996
Dr. B.S. Bisht 1996-2002
Dr. S.M. Ilyas 2002-2005
Dr. S.K. Nanda 2005-2013
Dr. R.K. Gupta 2013-2014
Dr. S.N. Jha 2014 – till date
Manpower of AICRP on PHET during different plan periods

It is difficult to get all information since inception of the AICRP on record. Manpower sanctioned however in last four plan periods are presented in Table 1.

Table 1. Consolidated manpower sanctioned in 9th-12th plan period

<table>
<thead>
<tr>
<th>S1. No.</th>
<th>Categories</th>
<th>IX Plan (21 Centres)</th>
<th>X Plan (34 Centres)</th>
<th>XI Plan (38 centres)</th>
<th>XII Plan (30 centres; w.e.f. 1-4-2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Scientific</td>
<td>96</td>
<td>115</td>
<td>161</td>
<td>155</td>
</tr>
<tr>
<td>2.</td>
<td>Technical</td>
<td>145</td>
<td>159</td>
<td>224</td>
<td>217</td>
</tr>
<tr>
<td>3.</td>
<td>Administrative</td>
<td>24</td>
<td>23</td>
<td>41</td>
<td>37</td>
</tr>
<tr>
<td>4.</td>
<td>Supporting</td>
<td>33</td>
<td>31</td>
<td>44</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>298</td>
<td>328</td>
<td>470</td>
<td>449</td>
</tr>
</tbody>
</table>

The growth and expansion of AICRP on PHET in terms of scientific strength is clearly evident from above mentioned manpower during IX Plan to XI Plan period. The scientific personnel engaged presently at headquarter of AICRP on PHET and the list of Research Engineers/PIs of Research centres are listed below and in Table 2, respectively.

Coordinating Unit, ICAR-CIPHET, Ludhiana

- Dr. S. N. Jha
  Project Coordinator, AICRP on PHET

- Dr. Anil Kumar Dixit
  Senior Scientist (Agricultural Economics)

- Dr. S.K. Aleksha Kudos
  Scientist (AS&PE), till 10.12.2015
## Manpower and Budget

### Table 2. Present Research Centres of AICRP on PHET

<table>
<thead>
<tr>
<th>S. No.</th>
<th>States</th>
<th>Name of Centres</th>
<th>Establishment (Plan &amp; Year)</th>
<th>Name of Incumbent RE/PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andhra Pradesh</td>
<td>Acharya N.G. Ranga Agricultural University, Bapatla</td>
<td>VII 1989</td>
<td>Dr. D. Bhasker Rao</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regional Agricultural Research Station Anakapalle</td>
<td>VII 1989</td>
<td>Dr. P. V. K. Jagannadha Rao</td>
</tr>
<tr>
<td>2</td>
<td>Assam</td>
<td>Assam Agricultural University, Jorhat</td>
<td>VII 1989</td>
<td>Dr. Abhijit Borah</td>
</tr>
<tr>
<td></td>
<td></td>
<td>College of Veterinary Science AAU, Khanapara</td>
<td>X 2004</td>
<td>Dr. Mineswar Hazarika</td>
</tr>
<tr>
<td>3</td>
<td>Bihar</td>
<td>Rajendra Agricultural University, Pusa</td>
<td>VII 1988</td>
<td>Dr. Mukesh Shrivastava</td>
</tr>
<tr>
<td>4</td>
<td>Chhattisgarh</td>
<td>Indira Gandhi Krishi Vishwa Vidyalaya Raipur</td>
<td>IX 2001</td>
<td>Dr. S. Patel</td>
</tr>
<tr>
<td>5</td>
<td>Gujarat</td>
<td>Junagadh Agricultural University, Junagadh</td>
<td>IV 1972</td>
<td>Dr. M. N. Dhobi,</td>
</tr>
<tr>
<td>6</td>
<td>Haryana</td>
<td>CCS Haryana Agricultural University, Hisar</td>
<td>X 2004</td>
<td>Dr. D. K. Sharma</td>
</tr>
<tr>
<td>7</td>
<td>Himachal Pradesh</td>
<td>Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan</td>
<td>X 2004</td>
<td>Dr. (Mrs.) Devina Vaidya</td>
</tr>
<tr>
<td>8</td>
<td>Jammu and Kashmir</td>
<td>Sher-e-Kashmir University of Agri. Sciences and Technology, Srinagar</td>
<td>IX 2001</td>
<td>Dr. Syed Zameer</td>
</tr>
<tr>
<td>9</td>
<td>Jharkhand</td>
<td>Birsa Agricultural University, Kanke, Ranchi</td>
<td>XI 2009</td>
<td>Dr. S. K Pandey</td>
</tr>
<tr>
<td>10</td>
<td>Karnataka</td>
<td>University of Agricultural Sciences, J-Block, GKV, Campus, Bangalore</td>
<td>IV 1972</td>
<td>Dr. S. Subramanya</td>
</tr>
<tr>
<td></td>
<td></td>
<td>University of Agricultural Sciences, Raichur</td>
<td>X 2004</td>
<td>Dr. Udaykumar Nidoni</td>
</tr>
<tr>
<td></td>
<td></td>
<td>College of Fisheries, Mathiyamangal, Mangalore</td>
<td>XI 2009</td>
<td>Dr. C. V. Raju</td>
</tr>
<tr>
<td>11</td>
<td>Kerala</td>
<td>Central Plantation Crop Research Institute, Kasargod</td>
<td>V 1976</td>
<td>Dr. M. R. Manikantan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Tuber Crops Research Institute, Thiruvananthapuram</td>
<td>V 1976</td>
<td>Dr. M.S. Sajeev</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kelappaji College of Agricultural Engineering and Technology, Tavanur</td>
<td>X 2004</td>
<td>Dr. Sathbi Mary Mathew</td>
</tr>
<tr>
<td>12</td>
<td>Madhya Pradesh</td>
<td>Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur</td>
<td>IV 1972</td>
<td>Dr. Ravi Aggarwal</td>
</tr>
</tbody>
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### Four Decades of R&D of AICRP on PHET

<table>
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<tr>
<th>S. No.</th>
<th>State</th>
<th>Name of Centre</th>
<th>Establishment Plan &amp; Year</th>
<th>Name of Incumbent RE/PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Maharashtra</td>
<td>Dr. Punjabkpr Deshmukh Krishi Vidyapeeth, Krishi Nagar, Akola</td>
<td>IV 1972</td>
<td>Dr. P. A. Borkar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regional Sugarcane &amp; Jaggery Research Station, Kolhapur</td>
<td>X 2004</td>
<td>Dr. B. G. Gaikawad</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bombay Veterinary college, Mumbai</td>
<td>XI 2009</td>
<td>Dr. R. J. Zende</td>
</tr>
<tr>
<td>14</td>
<td>Orissa</td>
<td>Orissa University of Agriculture &amp; Technology, Bhubaneswar</td>
<td>VIII 1995</td>
<td>Dr. M. K. Panda</td>
</tr>
<tr>
<td>15</td>
<td>Punjab</td>
<td>Punjab Agricultural University, Ludhiana</td>
<td>IV 1972</td>
<td>Dr. M. S. Alam</td>
</tr>
<tr>
<td>16</td>
<td>Rajasthan</td>
<td>Maharana Pratap University of Agricultural &amp; Technology, Udaipur</td>
<td>IV 1972</td>
<td>Dr. V. D. Mudgal</td>
</tr>
<tr>
<td>17</td>
<td>Sikkim</td>
<td>Central Agricultural University, Imphal</td>
<td>XI 2009</td>
<td>Dr. Ng. Joy Kumar Singh</td>
</tr>
<tr>
<td>18</td>
<td>Tamil Nadu</td>
<td>Tamil Nadu Agricultural University, Coimbatore</td>
<td>IV 1972</td>
<td>Dr. S. Ganapathy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tamil Nadu Veterinary and Animal Sciences University, Chennai</td>
<td>X 2004</td>
<td>Dr. Robinson J. J. Abraham</td>
</tr>
<tr>
<td>19</td>
<td>Uttar Pradesh</td>
<td>ICAR-Indian Institute of Sugarcane Research, Lucknow</td>
<td>VII 1988</td>
<td>Dr. Dilip Kumar</td>
</tr>
<tr>
<td>20</td>
<td>Uttarakhand</td>
<td>ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora</td>
<td>IX 2001</td>
<td>Dr. Sher Singh</td>
</tr>
<tr>
<td>21</td>
<td>West Bengal</td>
<td>Indian Institute of Technology Kharagpur</td>
<td>IV 1972</td>
<td>Dr. A. K. Datta</td>
</tr>
</tbody>
</table>

### Budgetary Support

ICAR is providing Grant-in-Aid support of 75 percent to State Agricultural Universities and 100 percent to ICAR institutes, Indian Institute of Technology and Central Universities. Plan-wise budget allocation indicates a quantum jump during XI over IX Plan in Table 3. A provision of establishment of Agro Processing Centres (APC) was kept during X and XII Plan periods. Tribal Sub-Plan component (TSP) was also included in the XII Plan. An outlay of Rs. 132.72 crore (ICAR share) was approved during XII Plan (Table 3).
### Table 3. Budget allocation (ICAR share) for AICRP on PHET during different plan periods

(Rs. in lakhs)

<table>
<thead>
<tr>
<th>Head</th>
<th>IX Plan (21 Centres)</th>
<th>X Plan (34 Centres)</th>
<th>XI Plan (38 Centres)</th>
<th>XII Plan (30 Centres w.e.f. 1-4-2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary</td>
<td>749.97</td>
<td>1941.77</td>
<td>4633.60</td>
<td>8826.85</td>
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<tr>
<td>Travelling allowance</td>
<td>34.67</td>
<td>119.00</td>
<td>158.50</td>
<td>300.00</td>
</tr>
<tr>
<td>HRD</td>
<td>13.97</td>
<td>9.13</td>
<td>-</td>
<td>120.44</td>
</tr>
<tr>
<td>Recurring Contingency</td>
<td>162.72</td>
<td>4777.44</td>
<td>783.10</td>
<td>2000.00</td>
</tr>
<tr>
<td>Non-Recurring Contingency</td>
<td>192.67</td>
<td>795.15</td>
<td>1145.40</td>
<td>2015.25</td>
</tr>
<tr>
<td>Total (ICAR share)</td>
<td>1154.00</td>
<td>3342.49</td>
<td>6720.60</td>
<td>13272.50</td>
</tr>
</tbody>
</table>
4. ACHIEVEMENTS

i. Technologies developed and commercialized

AICRP on PHET centres have developed large numbers of post-harvest machinery, tools, gadgets, process protocols and products over a period of time. These technologies are location and crop specific, user and environment friendly; and have been transferred and adopted by appreciable numbers of stakeholders. Majority of them are enumerated in Appendix I. Level of commercialization/ adoption of few selected technologies/ machines/ process are listed hereunder:

<table>
<thead>
<tr>
<th>Name of the technologies</th>
<th>Machinery/unit sold/adoted/ established (No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food grains (Machine/gadget)</td>
<td></td>
</tr>
<tr>
<td>i) PKV Mini Dal Mill</td>
<td>600</td>
</tr>
<tr>
<td>ii) Vivek Millet Thresher - cum- Pearler</td>
<td>730</td>
</tr>
<tr>
<td>iii) Multi Purpose Grain Mill</td>
<td>20</td>
</tr>
<tr>
<td>iv) Mini Dal Mill</td>
<td>160</td>
</tr>
<tr>
<td>v) Pedal - cum - Power Operated Cleaner</td>
<td>435</td>
</tr>
<tr>
<td>vi) Groundnut - cum - Castor Decorticator</td>
<td>728</td>
</tr>
<tr>
<td>vii) Parboiling Unit</td>
<td>250</td>
</tr>
<tr>
<td>viii) Insect Trap</td>
<td>4.0 lakh</td>
</tr>
<tr>
<td>ix) Grain Puffing Machine</td>
<td>200</td>
</tr>
<tr>
<td>x) Maize Dehusker - cum - Sheller</td>
<td>20</td>
</tr>
<tr>
<td>Horticulture (Machine/equipment)</td>
<td></td>
</tr>
<tr>
<td>xi) PKV Chilli Seed Extractor</td>
<td>04</td>
</tr>
<tr>
<td>xii) Fruit Grader</td>
<td>03</td>
</tr>
<tr>
<td>xiii) Tamarind Dehuller-deseeder</td>
<td>9</td>
</tr>
<tr>
<td>xiv) Manual Areca nut Dehusker</td>
<td>39</td>
</tr>
<tr>
<td>xv) White Peeper Making Machine</td>
<td>24</td>
</tr>
<tr>
<td>xvi) Turmeric Polisher</td>
<td>10</td>
</tr>
<tr>
<td>xvii) Multipurpose Polyhouse Solar Dryer</td>
<td>17</td>
</tr>
<tr>
<td>xviii) Fluidized Bed Drier for Mushroom</td>
<td>07</td>
</tr>
<tr>
<td>xix) Improved Turmeric Boiler</td>
<td>165</td>
</tr>
<tr>
<td>xx) Cumin Cleaner-cum-Grader</td>
<td>03</td>
</tr>
<tr>
<td>xxi) On Farm Fruit Grader</td>
<td>02</td>
</tr>
<tr>
<td>xxii) Fruits and Vegetable Washing Machine</td>
<td>10</td>
</tr>
<tr>
<td>xxiii) Hand Operated Cassava Chipping Machine</td>
<td>28</td>
</tr>
<tr>
<td>xxiv) Garlic Bulb Breaker</td>
<td>20</td>
</tr>
<tr>
<td>xxv) Electric-cum-Battery Heated Uncapping Knife</td>
<td>50</td>
</tr>
</tbody>
</table>
Achievements/ Success Stories

Process and product development

xxx) Safe Storage of Pulses 1000 units
xxvi) Osmo-dehydrated Pineapple Slices 02 units
xxvii) Apricot Kernel Oil Extraction 08 units
xxviii) Aloe Vera Processing 04 units
xxix) Garlic Dehydration Technology 03 units
xxx) Bottling of Sugarcane Juice 04 units
xxxi) Production of Cube Shaped Jaggery 40 units
xxxi) Agro Processing Centres 148 units

Livestock sector

xxxii) Mobile Poultry Processing-cum-Retail Meat Stall 01 unit
xxxiv) Model Retail Outlet for Hygienic Chicken Meat 01 unit
xxxv) Pedal Operated Ice Crusher 01 unit
xxxvi) Women Friendly Fish Vending Unit 01 unit

It is worth mentioning here that all technologies developed by AICRP on PHET have not been included due to obvious reasons of redundancy with time, non-availability of information due to change/transfer of Research Engineers/ Scientists and closer of centres. Here, 200 technologies have been listed under four broad sectors, i.e., Food grains and oil seeds sector (43 technologies); Horticultural crops sector (104 technologies); Livestock produce/ products sector (18 technologies); Jaggery and Khandari sector (35 technologies). (Appendix I). In addition upcoming 79 technologies (i.e. Machinery tools, equipment =31; Process, protocols and products = 48) and four pilot plants are listed in this appendix. Details of 200 technologies/ machinery/ tools etc are presented in Chapter 7.

ii. Success Story of Agro-Processing Centres (APC)

The concept of APC models was pioneered by AICRP on PHET, which is also appreciated by some national and international organizations. The centres of AICRP on PHET have been working on establishment, monitoring and promotion of Agro-processing Centres (APC) in the production catchment for value addition of agricultural produce and post-harvest loss reduction, while enhancing the profitability of farmers/entrepreneurs and providing gainful employment. The action plan carried out by the rural entrepreneur for Agro-processing centres basically comprises primary processing of the surplus agricultural produce in the production catchment itself. Establishment of APCs have been undertaken by Centres of AICRP on PHET such as Akola (Maharashtra), Almora (Uttarakhand), Bapatla (Andhra Pradesh), Bangalore (Karnataka), Bhubaneswar (Orissa), Coimbatore (Tamil Nadu), Jabalpur (Madhya Pradesh), Jorhat (Assam), Junagadh (Gujarat), Kasargod (Kerala), Ludhiana (Punjab), Pantnagar (Uttarakhand), Solan (Himachal Pradesh), Tavanur (Kerala)
and Udaipur (Rajasthan). Initially equipment and machinery were supplied by the AICRP and trained the rural farmers and entrepreneurs to adopt the developed technologies for the crops grown in the region. In latter stage, these centres have identified and motivated potential entrepreneurs, gave technologies and helped them in selection of processing equipment and their installation operations on their own cost, depending on the crops grown and marketable surplus of their farm produce and consumers demand.

Usually rural farmers sell their raw produce to middleman at low price, and subsequently buy processed products at high price from urban market. The APC established with objectives of providing income and employment opportunities in the rural catchments and checking capital drain and labour migration from rural to urban areas. Besides, the APCs have been recognized as an effective tool for women empowerment in rural and peri-urban areas. APCs managed only by women entrepreneurs and women workers have been established by Bangalore, Bhubaneswar and Coimbatore centres. These APCs have been quite effective in post-harvest loss reduction, value addition, income augmentation as well as employment generation in rural areas. AICRP on PHET had so far established 148 APCs in various parts of the country, out of these five have been established at the centres of AICRP on PHET itself. The remaining are owned and managed by individual farmer-cum-processors, SHGs etc. The established APCs with their full addresses, state-wise, are tabulated below:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>State</th>
<th>AICRP on PHET Centres</th>
<th>Address of APC established (Name of entrepreneur/firm, place and district)</th>
<th>Year of establishment</th>
<th>Total APC established (No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maharashtra</td>
<td>PDKV Akola</td>
<td>Prop. Shri Ramdas Raut, Village : Hiwarkhed (Rup)</td>
<td>2002</td>
<td>9</td>
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<td></td>
<td></td>
<td></td>
<td>Taluqa : Telhara</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>District : Akola</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>*Shri Deepak Shinde, Village : Nimkhed (Bazar)</td>
<td>2004</td>
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<td></td>
<td></td>
<td></td>
<td>Taluqa Anjangaon Surji</td>
<td></td>
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<td></td>
<td>District : Amaravati</td>
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<td></td>
<td></td>
<td></td>
<td>Smt. Ranjana Kaner, Taluqa : Deoli</td>
<td>2006</td>
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<td></td>
<td></td>
<td></td>
<td>District : Wardha</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Arjun APC</td>
<td>2007</td>
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<td></td>
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<td></td>
<td>Mrs. Ranjana Kaner Village and P.O. Deoli (MIDC Area) Taluqa : Deoli</td>
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<td></td>
<td></td>
<td></td>
<td>District: Wardha</td>
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<td></td>
<td></td>
<td></td>
<td>Shri Balabhau Kathalkar</td>
<td>2010</td>
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<td></td>
<td></td>
<td></td>
<td>Taluqa: Murtizapur</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>District: Akola</td>
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<tr>
<td>Sr. No.</td>
<td>State</td>
<td>AICRP on PHET Centres</td>
<td>Address of APC established (Name of entrepreneur/firm, place and district)</td>
<td>Year of establishment</td>
<td>Total APC established (No)</td>
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</tr>
</tbody>
</table>
| 2       | Uttarakhand | VPKAS Almora         | Smt Sarita Shyamsundar  
Taluqa : Murtizapur  
District : Akola  
Shri Nivrutti Barabde  
Taluqa : Anjangaon (Surji) District : Amravati  
Shri Shivanand Waghmare,  
Taluqa : Kanshivni District : Akola  
Shri Himmatrao Tekade  
Taluqa : Ruikhed District : Buldhana | 2014 | 3 |
| 2       | Uttarakhand | VPKAS Almora         | Shri Rajesh Pant S/o Shri Umesh Chandra Pant  
Village : Kotwal Goun  
Taluqa : Ganannath Vidyapith District : Almora  
Shri Shyam Singh Bisht S/o Shri Nar Singh Bisht  
Village : Raulsera  
P.O. Bagwali Pokhar  
Tehsil : Dwarahaat District : Almora  
Shri Puran Chander Pandey, S/o Shri Ramesh Chander Pandey, Dhaspar  
P.O. Suwakhan  
Tehsil : Bhanauli District : Almora | 2005 | 20 |
| 3       | Karnataka  | UAS Bangalore        | Gramin Vikas Swea SansthanAPC  
Village : Fatta Bangar District : Nainital  
Agro Processing Centre  
Jeeptur Negi, Manpur West  
Rampur Road, Haldwani | 1996 | 2 |
| 3       | Karnataka  | UAS Bangalore        | APC, Vyvasaya Seva Sahakara Sangha Ltd., Village : Aradesahalli  
Taluqa : Devanahalli District : Bangalore Rural  
Vyvasaya Seva Sahakara Sangha Ltd  
Village : Banawadi  
Taluqa : Magadi District : Ramanagara | 1989 | 16 |

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>State</th>
<th>AICRP on PHET Centres</th>
<th>Address of APC established (Name of entrepreneur/firm, place and district)</th>
<th>Year of establishment</th>
<th>Total APC established (No)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Karnataka</td>
<td>UAS Bangalore</td>
<td>*APC, Kathige Grama Panchayat Village : Kachige Taluqa : Honnali District : Davanagere</td>
<td>2001</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*APC, Maruthi Yuvaka Raitha Sangha Village : Manjenahalli Taluqa : Arasikere District : Hassan</td>
<td>2001</td>
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<td></td>
<td></td>
<td></td>
<td>APC Kandli, KVK Kandli, District : Hassan</td>
<td>2002</td>
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<td>APC, Sri Lakshmidevi Shririshakthi Mahila Svasahaya Sangha, Village : Kuchangi District : Tumakur</td>
<td>2006</td>
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<td></td>
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<td>APC, Kuthinagere Kirujalayana Abhivrudhi Ashottara Trust, Village : Kunthinagere Taluqa : Magadi District : Ramanagara</td>
<td>2003</td>
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<td></td>
<td></td>
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<td>APC, Sri Dhurthandeswara Mahanatha Shivayogi Matt Village : Babygrama Taluqa : Pandavapura District : Mandya</td>
<td>2004</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Anasosalu APC Village : Anasosalu District : Mandya</td>
<td>2004</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>*APC, Yasavshini Mahila Okkuta Village : Muthanallur, Taluqa : Anekal District:Bangalore Urban</td>
<td>2004</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>*APC, Saraswathi Svasahaya Gumpu Village : Setthihalli Taluqa : Anekal District:Bangalore Urban</td>
<td>2004</td>
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<tr>
<td>Sr. No.</td>
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<td>AICRP on PHET Centres</td>
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<td>APC, Indira Gandhi Mahila Swasahaya Sangha Village : Mallasandra District : Kolar</td>
<td>2008</td>
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<td>APC, Sri Channabasaveshwara Yuvaka Sangha Village : Chickkagundakallu District : Tumakur</td>
<td>2007</td>
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</tr>
<tr>
<td></td>
<td>UAS Raichur</td>
<td>Varun Chilli Powder Unit Village : Vadlamoddodi Taluqa : Raichur District : Raichur</td>
<td></td>
<td>2009</td>
<td>10</td>
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<tr>
<td></td>
<td></td>
<td>Govind Flour mill &amp; Chilli Powder Unit Village : Appanadoddi Taluqa : Raichur District : Raichur</td>
<td>2009</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Vaishnav mata Sharada Rice Mill Village : Tumukur Taluqa : Yadagir District : Yadagir</td>
<td>2010</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Kiran Bedi Agro Processing Unit Kiran Bedi Women Association, At Post: Uttangi village, Taluqa : Huvinahadagali District : Bellary</td>
<td>2012</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Teja Dhal Mill Shri. Hanumesh Taluqa : Turuvihal District : Raichur</td>
<td>2012</td>
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<tr>
<td>Sr. No.</td>
<td>State</td>
<td>AICRP on PHET Centres</td>
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<td>Total APC established (No)</td>
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</tr>
<tr>
<td>1</td>
<td>UAS Raichur</td>
<td>APC Sugreshwa Shri, Vinod kumar, J. H.No. 918-63/2, Maddipet</td>
<td>District: Raichur</td>
<td>2013</td>
<td></td>
</tr>
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<td></td>
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<td>APC Navnec Shri. Santosh M Thrimukhe</td>
<td>Taluqa: Basavakalyan</td>
<td>2013</td>
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<td></td>
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<td>APC K.M., Shri. Kallappa Mathapati</td>
<td>Taluqa: Aurad</td>
<td>2013</td>
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<td>Millet Processing Unit</td>
<td>Taluqa: Huvinahadagali</td>
<td>2015</td>
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<td>Dhal Mill</td>
<td>Taluqa: Manvi</td>
<td>2015</td>
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<td></td>
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<td></td>
<td>District: Raichur</td>
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<td>4</td>
<td>Madhya Pradesh</td>
<td>JNKVV Jabalpur</td>
<td>Agro Processing Centre</td>
<td>1990</td>
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<tr>
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<td></td>
<td></td>
<td>Krishi Nagar, Adhartal, Jabalpur (Madhya Pradesh)</td>
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<td>Agro Processing Centre, SRIDA, Barela, Block Barela, Mandla Road, Jabalpur (MP)</td>
<td>1994</td>
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<td></td>
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<td>Mahalakshmi Associates</td>
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<td>Katni Road, Suhagi, Jabalpur (MP)</td>
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<td>5</td>
<td>Andhra Pradesh</td>
<td>ANGRAU Bapatla</td>
<td>APC, Krisi Vingnana Kendram, Vinayasram, kavyuru-522 309</td>
<td>2006</td>
<td>2</td>
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<td>Village: Cherukupalli Mandal</td>
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<td>District: Guntur</td>
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<td></td>
<td>Kotra Sambasiva Rao</td>
<td>2011</td>
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<td></td>
<td></td>
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<td>Village: Abbur</td>
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<td>Sr. No.</td>
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<td>AICRP on PHET Centres</td>
<td>Address of APC established (Name of entrepreneur/firm, place and district)</td>
<td>Year of establishment</td>
<td>Total APC established (No)</td>
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<tr>
<td>6</td>
<td>Orissa</td>
<td>OUAT Bhubaneswar</td>
<td>M/s Jaya Durga Food Products P.O. : Bramheshwar Patna District : Khurda</td>
<td>2000</td>
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<td></td>
<td>Turmeric Processing Unit KASAM P.O. : Bandhagad District : Kandhamal</td>
<td>2001</td>
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<td></td>
<td>Dal and spices processing ADARA Village : Pipilli District : Puri</td>
<td>2002</td>
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<td>M/S Sri Chandi Rice Processing Unit P.O. : Ghatikia District : Khurda</td>
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<td>Pineapple processing CCD Village : Mandalsahi District : Gajapati</td>
<td>2005</td>
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<td>APC Centre for Community Development P.O. P.O. Paralakhemundi Village : Mandalsahi Block : Rayagada District : Gajapati</td>
<td>2005</td>
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<td></td>
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<td>Centre for Community Development Village : Mandalsahi District : Gajapati</td>
<td>2006</td>
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<td></td>
<td></td>
<td></td>
<td>Dal Processing Gram U/than, Rajkanika, District : Kendrapada</td>
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<td></td>
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<td>Aloe vera beverage processing M/s Uma Bhagaban Industry, Salepur District : Cuttack</td>
<td>2014</td>
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<td>Cashewnut processing Kaluram Pradhan, Kalikote District : Ganjam</td>
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<td>OUAT Bhubaneswar</td>
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<td>Dal Processing Dharitri Sanchhya Samiti, Siminai District : Dhenkana</td>
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<td>Oil processing Pradyumna Sahu, Naranpur, Nilagiri District : Balasore</td>
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<td>Tamil Nadu</td>
<td>TNAU Coimbatore</td>
<td>Mr. A.R. Narayanasamy, Arasampalayam Village, Taluqa: Kinathukadavu District: Coimbatore</td>
<td>2002</td>
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<td>Mr. K.P. Ponnusamy, Kanur Pudur, Anmur Block, Taluqa: Avinashi District: Coimbatore</td>
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<td>Mrs. Parvathiammal, Ponmalar SHG, Selvarajapuram, Village: Papampatty Pirivu, sulur Road District: Coimbatore</td>
<td>2005</td>
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<td>Sh. Tej Singh s/o Sh. Kishan Lal Village: Badra Distric: Bhiwani</td>
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<td>Manipur</td>
<td>CAU Imphal</td>
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<td>AAU Jorhat</td>
<td>Seuj Krish Samabai Samiti SHG Allengmora District: Jorhat</td>
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<td>Kerala</td>
<td>CPCRI Kasargod</td>
<td>Shri Fareni Seva Sahkari Mandali&lt;br&gt;Lid Fareni&lt;br&gt;Taluqa : Dhoraji&lt;br&gt;District : Rajkot&lt;br&gt;Shri Tadka Pipaliya Seva Sahakari Mandali Ltd. Tadaka Pipaliya&lt;br&gt;Taluqa : Bhesan&lt;br&gt;District : Junagadh&lt;br&gt;Ramdevji Seva Sahkari Mandli, Village : Virol&lt;br&gt;Taluqa : Mangrol&lt;br&gt;District : Junagadh&lt;br&gt;Loej Seva Sahkari Mandli, Village : Loej&lt;br&gt;Taluqa : Mangrol&lt;br&gt;District : Junagadh&lt;br&gt;Ekta Mahila Sahkari Mandli (Tribal Mahila Sangh)&lt;br&gt;Village : Vadala,&lt;br&gt;Taluqa : Talala,</td>
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<td>KAU Tavanur</td>
<td>APC, Central Plantation Crop Research Institute Kasargod (Kerla)-671124&lt;br&gt;KAU Tavanur&lt;br&gt;Friends APC, Smt. Jayasree A Karuvattumana, Sukapuram Village : Naduvattom&lt;br&gt;District : Malapuram&lt;br&gt;Pin : 679576</td>
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<td>IIT Kharagpur</td>
<td>Model APC, Kellappaji College of Agril Engg &amp; Technology, Tavanur- 679573 District : Malapurram</td>
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<td>APC, Grami Agro Limited P.O. Dahi Jhuri Village : Joal Bhanga District : Medinipur</td>
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<td>Trishna Food Products, Vill &amp; P.O. Bhimpur, P.S.- Salboni, Dist.- Paschim Medinipur, 721516</td>
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<td>Surya Swayam Sahayata Samooh, Vill.- Itapara, P.O.- Balarampur via Kharagpur, Dist. Paschim Medinipur</td>
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<td>Punjab</td>
<td>PAU Ludhiana</td>
<td>Choudhary Harbilas Ray Agro Process Industrial Complex, Village : Chakdiana Near Phillaur</td>
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<td>M/s Piara Singh and Harbans Singh Oil and Rice Mill Village : Dehlon District : Ludhiana</td>
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<td>Shri Om Parkash Dhurian Flour Mill, Mullanpur District : Ludhiana</td>
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<td>Sh. Gurudev Singh Agro Processing Complex Village : Hassanpur District : Ludhiana</td>
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<td>Sh. Dilbagh Singh De Atta Chakki Near Bus Stand Jodha District : Ludhiana</td>
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<td>S. Chamkaur Singh Near Bus Stand, Jodha District : Ludhiana</td>
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<td>Bhatia Dal and Flour mill Near Warehouse, District : Muktsar</td>
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<td>S. Jagjit Singh Village : Talwandi Rai District : Raikot</td>
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<td>S. Pritam Singh Brar Brar Agro Processing Complex Village : Lande Near Bagha Purana District : Moga</td>
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<td>S. Jaspreet Singh S/o S. Gurbachan Singh V.P.O. : Talwandi Rai, Jagraon District : Ludhiana</td>
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<td>S. Bhagwant Singh&lt;br&gt;Khira agro Mills&lt;br&gt;V.P.O. : Mahala Khurd, Bagha Purana, District : Moga&lt;br&gt;S. Harinder Singh S/O Balbir Singh</td>
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<td>S. Jagtar Singh&lt;br&gt;V.P.O. : Daudar&lt;br&gt;District : Ludhiana (Near Ajitwal)</td>
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<td>Sh. Randhir Singh Dhalial&lt;br&gt;Village : Tharaj&lt;br&gt;District : Moga</td>
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<td>S. Gurmeet Singh (Meeta)&lt;br&gt;V.P.O. : Dina Sahib&lt;br&gt;District : Moga</td>
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<td>Nahar Singh, Secretary&lt;br&gt;D. Sukhanand Bahanmantri Sehkari Khetibari Sewa sabah Ltd.&lt;br&gt;V.P.O. : Sukhanand District : Moga</td>
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<td>S. Chamkaur Singh Ubhi&lt;br&gt;Jodhan food products&lt;br&gt;Narangal road&lt;br&gt;V.P.O. : Jodhan&lt;br&gt;District : Ludhiana</td>
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<td>S. Harbans Singh Gill&lt;br&gt;Village : Salempura (Sidhawan Bet), Jagraon&lt;br&gt;District : Ludhiana</td>
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<td>Avtar Singh Master&lt;br&gt;S/o S Chand Singh&lt;br&gt;Village: Daroli Bhai District : Moga</td>
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<td>Navjeet Singh&lt;br&gt;VPO Harike&lt;br&gt;Atta Chaki&lt;br&gt;District : Muktsar</td>
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<td>Jamail Singh&lt;br&gt;S/o Mangal Singh&lt;br&gt;Jimedar processing mill, nehal singh wala,&lt;br&gt;District : Moga</td>
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<td>S Baljit Singh&lt;br&gt;S/o S Bahadur Singh&lt;br&gt;Village : Patti&lt;br&gt;District : Amritsar</td>
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<td>Harbhajan Singh&lt;br&gt;Budhlada road, Fuluwala dogra&lt;br&gt;District : Mansa</td>
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<td>Satnam Singh&lt;br&gt;S/o Paramjit Singh&lt;br&gt;Muglu Patti, Mandir road, Near lawrence school&lt;br&gt;Bagha purana&lt;br&gt;District : Moga</td>
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<td>17</td>
<td>Chhattisgarh</td>
<td>IGKVV Raipur</td>
<td>Agro-Processing Centre College of Agricultural Engg, Rajendra Agricultural University, Pusa District : Samastipur Pin : 848125</td>
<td>2009</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>Himachal Pradesh</td>
<td>YSPUH &amp; F Solan</td>
<td>Soya Processing Unit Swarnjyanta Swarojgar, SHG Village : Pathari District : Raipur</td>
<td>2011</td>
<td>1</td>
</tr>
<tr>
<td>19</td>
<td>Rajasthan</td>
<td>MPUAT Udaipur</td>
<td>APC on Apricot Oil Extraction M/s Sushree Khormoshu, Spilloe SHG Village : Spillow, Pooh, District : Kinnaur</td>
<td>2008</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>APC on Apricot Oil Extraction M/s World wide fund (WWF for Nature-India, Village : Rakcham, P.O. : Sangla District : Kinnaur</td>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Srinagar J &amp; K Total</td>
<td>SKUAST Srinagar</td>
<td>Agro-Processing Center Village : Sansera, Railmagra District : Rajsamand</td>
<td>2002</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Srinagar</td>
<td></td>
<td>M/s Shah Food, Khunmoh District : Srinagar</td>
<td>2004</td>
<td>5</td>
</tr>
</tbody>
</table>
Achivements/ Patents

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>State</th>
<th>AICRP on PHET Centres</th>
<th>Address of APC established (Name of entrepreneur/firm, place and district)</th>
<th>Year of establishment</th>
<th>Total APC established (No)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SKUAST</td>
<td>Srinagar</td>
<td>M/s Pakeeza Foods, Lassipora District : Pulwama</td>
<td>2013</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M/s Kashmir Gulbadan, Habak Hazratbal District : Srinagar</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>M/s Mannat Food Products, Bari Brahmana District : Jammu</td>
<td>2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td>148</td>
<td></td>
</tr>
</tbody>
</table>

Note: * APCs (7 nos.) have been closed due to internal problems and are not functioning presently.

Economic return, in a study conducted by Nanda et al. (2013), was found to be about Rs. 524526 per annum to an entrepreneur through these APCs. On an average, one APC is able to generate 10 persons employment (direct, 4 nos + indirect, 6 Nos) for a period of 240 days in a year. The indirect benefits to society are realized in terms of additional income to persons who are engaged in the supply of raw material and marketing of food and value added products as well as through saving to the consumers and/or retailers as a result of enhanced recovery and reduction in logistic cost. The replication of this model throughout the country with due caution of demand and supply can bring prosperity in rural areas.

**iii. Patents**

In initial stage of the AICRP, ICAR was not so serious about intellectual property rights and almost all technologies, package of practices, machines' design etc were being given free of cost. It was only for the farmers, and therefore culture of filing patents and publishing research papers were not so prevalent. With time, ICAR has also given importance to IPR and publications of research papers and so the AICRP on PHET. Patents therefore have only been filed for the technologies having potential of commercialization by private companies and organizations in recent years, which are listed below:

**Patents Granted**

i). Indian gooseberry prickling machine vide patent No. 0344, Design No. 194255, HISSAR.

ii) Vegetable washer vide patent No. 260635 dated 26/02/2014 (with Sh. Krishan Jangra, Manufacturer) HISAR.

iii) Tender nut punch and cutter. Patent No 233744, KASARGOD
Four Decades of R&D of AICRP on PHET

iv) Partially dehydrated coconut de-shelling machine. Patent No 233742, KASARGOD

v) Coconut/Arecanut climbing device. Patent No 268548, KASARGOD

vi) Shell fired copra dryer. Patent No 269186, KASARGOD.

vii) A system for extraction of essential oil from plants/ parts thereof bearing essential oil. Patent No, 202600, KHARAGPUR

**Patent Filed**

i) The unique tapered horizontal leather belt roller for cleaning of different grains using dal milling devices. Patent application No. 1855/MUM/2013, AKOLA.

ii) The unique tapered horizontal emery roller for dal milling devices. Patent application No. 1856/MUM/2013, AKOLA.


v) Mechanized Jaggery Granulator for producing jaggery granules. Patent application No. 1265/CHE/2013, ANAKAPALLE.

vi) Large scale drying of chillies in barns. Patent application No. 1403/CHE/2005, BAPATLA.


x) Raw stone apple (bael) slicer. Patent application No. 1239/KOL/2008, BUBANESWAR

xi) Heat pump assisted dehumidified air tray dryer. Patent application No. 1240/KOL/2008, BUBANESWAR

xiii) Onion Umbel pre-thresher, thresher and pre-cleaner. Patent application No. 5413/CHE/2014, COIMBATORE

xiv) Cleaner for onion seed. Patent application No 5417/CHE/2014, COIMBATORE


xvi) Portable Snowball tender nut machine. Application No. 2956/CHE/2007, KASARGOD.


xix) Rapid conditioning unit for raw cashew kernels. Patent applied, KCHARAGPUR

xx) Mechanized cashew kernel peeler. Patent applied, KCHARAGPUR


xxiii) Precision Computation of Automatic Weather Station Data. Patent application No. L-47275/2013, LUDHIANA.

xiv) A System for Storing, Displaying and Vending Foods vide patent application No. 3646/CHE/2014, dated 25/07/2014, MANGALORE.

xxv) Women Friendly Fish Vending and Display Unit. Patent application No IPR/FA/13013, MANGALORE

xxvi) Retail Chicken Slaughter Unit. Patent application No. 1842/MUM/2014, dated 01/04/2014, MUMBAI.

iv. Awards and Recognitions


**Best Poster Paper Award** conferred to Pampanagouda, K.B.Munishamanna and Shivabasu Khanagodar,(2015). Development of pearl millet *(Pennisetum glaucum)* based probiotic beverage by fermentation with *Saccharomycesboulardii* and *Lactobacillus acidophilus*. (Awarded First prize for Poster presentation, Proceedings of ICETF-2015 FEB-P-02, pp 68).

**Doordarshan Sahyadri Award** (2015) conferred to Smt. Sarita Shyamsundar, Kanzara, Tq. Murtizapur, Dist. Akola (Handicapped, Lady, Widow entrepreneur established and running successfully Agro Processing Centre under the technical guidance of AICRP on PHET, Dr. PDKV, Akola).

**Krishi Gaurav Award** (2015) conferred to Dr. P.A. Borkar, Research Engineer, AICRP on PHET, Dr. PDKV, Akola

**Outstanding Poster Appreciation Award** (2015) conferred to Dr Surekha Bhatia, Green packaging for foods: An environment friendly perspective during Regional Seminar on “Geospatial technology in natural resource management” organized by ISRS at PRSC, Ludhiana.


**Best Poster Paper Award** conferred to Shwetha, M.S., Ranganna, B., Munishamanna, K.B and Kalpana, B (2014) on Development of Jackfruit squash-A value added product for
rural cottage industries at the First National Student Conference on Food Technology (SCOFTECH-2014) held at IICPT, Thanjavur, India.

**Best Research Worker Award (Machinery/Equipment development) (2014)** conferred to Dr. A.C.Mathew, by Coconut Development Board, Kochi in recognition of his significant contribution in developing processing gadgets/equipment and technologies for development of value added products like virgin coconut oil, coconut chips and labour saving machineries for pre and post-harvest operations.

**Commendation Medal of Indian Society of Agricultural Engineers** (2014) conferred to Dr. Sanjaya Kumar Dash, OUAT, Bhubneswar Centre.

**Mahindra Krishi Samriddhi Award** (2014) conferred to Dr. PDKV, Akola centre for PKV Mini dal mill technology.

**TNAU Best Teacher Award** (2014) conferred to Dr. M. Balakrishnan, Coimbatore centre

**ICAR Best Teacher Award** (2014) conferred to Dr. M. Balakrishnan, Coimbatore centre

**Certificate of Merit and Cash Award (2013)** conferred to Mr K.B., Munishamanna, B. Kalpana, K.B. Suresha and V. Palanimuthu, for the project on “A Value Chain on Jackfruit and its Value Added Products”, at the Foundation Day on 5th October 2013, at UAS, GKV by UAS, Bangalore.

**Distinguished Service Certificate** (2013) conferred to Dr. M.R. Manikantan, by Indian Society of Agricultural Engineers for his outstanding contribution in the field of Agricultural Processing and Post Harvest Technology.

**TNAU Best Teacher Award** (2013) conferred to Dr. V. Thirupathi, TNAV Centre

**Women Scientist Award (2013)** conferred to Sheela Pandey, given by M.P. council of Science and Technology, Jabalpur centre

**Distinguished Services Certificate Award** (2012) conferred to Dr. M.S. Alam, PAU centre for Outstanding contribution in the field of Agricultural Engineering by National Society “Indian Society of Agricultural Engineers (ISAE).

**Dr. I.V. Subba Rao Rythu Nestham Purakshram** (2012) conferred to Dr. P.V.K. Jagannadha Rao, Ankapille centre. Special function held at FAPCCI Bhavan, Hyderabad organized by Rythunestham Monthly Magazine.

Best Paper (GOLD MEDAL) (2011) conferred to Dr (Mrs) K Rayaguru and Dr Md K Khan, Agricultural, Mechanical and Environmental Engineering Division during the 56\textsuperscript{th} Annual session of Orissa Engineering Congress held on 26\textsuperscript{th} February, 2011 at Bhubaneswar.

Best Poster Paper Award (2011) conferred to Dr D K Sharma, Hisar centre. Studies on Flow behaviour of multifloral melliferous honey (First prize) at honey festival-cum-experience exchange workshop organised at PAU, Ludhiana.

Best Poster Paper Award (2011) conferred to Er. Sandhya, Production constraints of Beekeepers in Ludhiana district (Second Prize) at honey festival-cum-experience exchange workshop organised at PAU, Ludhiana.

Best Research Team award (2011) conferred to Dr Md K Khan, Dr (Mrs) K Rayaguru, Dr U S Pal, Dr C K Bakhara and N R Sahoo, Bhubaneswar centre 45\textsuperscript{th} ISAE Annual convention cum international symposium at PDKV Nagpur campus.

Kunwar Saxena Bahadur SRDA Award (2011) conferred to Dr. M.S. Alam, PAU centre for Outstanding contribution in the field of Processing and Food Engineering by Society for Recent Development in Agriculture at International conference held at SVPUA&T, Meerut.

Second prize (2011) conferred to U S Pal and Dr Md K Khan, Bhubaneswar centre for article in Electrical and Electronics Engineering Division during the 56\textsuperscript{th} Annual session of Orissa Engineering Congress held at Bhubaneswar.

The Best Citizens of India Award (2012) conferred to Dr. P.V.K. Jagannadha Rao, Ankapalle centre International Publishing House, New Delhi, is the world's most leading biographical specialists.

ICAR Team Research Award (2011-12) conferred to Dr. G. Padmaja, Dr. J.T. Sheriff, A.N. Jyothi and Ms. L. Rajalekshmi, Trivendrum centre for Outstanding Interdisciplinary Team Research in Agriculture and Allied Sciences.

Young Scientist Award in Social Sciences (2010) conferred to Dr. Anil Kumar Dixit, PC Unit on 3\textsuperscript{rd} May 2011 during National Symposium on Technological Interventions for Sustainable Agriculture by Indian Society of Hill Agriculture.
Achievements/Awards

Samant Chandrasekhar Award (2010) conferred to Dr Md K Khan Bhubneswar centre from Odisha Vigyan Academy, Bhubaneswar, Orissa.

Shiksha Rattan Puruskar (2010) conferred to Dr. M.S. Alam, PAU centre for Meritorious services, Outstanding Performance and Remarkable role in the Profession, from India International Friendship Society, New Delhi by Governor of Tripura.

Young Scientist Award (2010) conferred to Er. P. Sreedevi, RARS Anakapalle Agricultural University for the year 2009.

Best Poster Award conferred to Dr. M.S. Alam (2009) PAU Centre. Post harvest management and value addition, International Conference on 'Grain legumes, quality improvement, value addition and trade held at Indian Institute of Pulse Research, Kanpur.

ICAR-Lal Bahadur Shastri Young Scientist Award for the Biennium 2007-08 (2009) conferred to Dr. M.S. Alam, PAU centre for outstanding contribution in the field of Agricultural Engineering.

Young Scientist Award (2009) conferred to Dr. M.S. Alam, PAU centre for outstanding/innovative research in the field of applied sciences from Punjab Academy of Sciences, Patiala during 12th Punjab Science Congress held at PAU, Ludhiana.

Best Research Team Award (2009-10) conferred to Dr Md K Khan, Dr (Mrs) K Rayaguru, Dr U S Pal, Dr C K Bakhara and N R Sahoo of Bhubneswar centre from ISAE for 2009-10.

Best Scientist Award (2008) conferred to Dr. (Mrs) K. Rayaguru by OUAT, Bhubaneswar.

Best Teacher Award (2008) conferred to Dr. Sanjaya Kumar Dash by OUAT, Bhubaneswar.

Gold Medal and Citation for Research Work (for the year 2005-06) conferred to Dr. P. Jamuna, Bapatla centre 'Organic Farming in sugarcane in A.P.' donated by Smt. V.R. Durgamba Charitable in 2007.

Best Chapter Award (2006-07) conferred to Dr. M.S. Alam PAU centre. Overall performance in terms of professional activities of ISAC.


Distinguished Services Certificate (2006) conferred to Dr. Sanjaya Kumar Dash Bhubneswar centre by Indian Society of Agricultural Engineers.

Fellow of Institute of Engineers, India (2006) conferred to V K Sehgal, PAU centre For Outstanding contribution in the field of Agricultural Engineering.


Sri Konathala Ramunaidu B.Com., Memorial Prize and adjudged as “Best Research Officer” (2003). Dr. P.V.K. Jagannadha Rao, Ankapalle centre

Alapati Venkata Krishnaiah Memorial Prize (1996). conferred to Dr. S. Ramakrishna Rao, for eminent scientist in Agricultural Sciences, Ankapalle centre.

Vocational award (1996) conferred to Sri C. Lakshminarayana, Ankapalle centre for excellence in profession from Rotary club, Anakapalle.

M/s KCP Limited Prize (1993) conferred to Dr. S. Ramakrishna Rao, for outstanding research work on Sugarcane in A.P., Ankapalle centre.

Research scientist Award (1993) conferred to Dr. S. Ramakrishna Rao, of AP Agricultural University Ankapalle centre.

v. Publications in Refereed Journals, Workshop, Symposia, Conferences Proceedings

An attempt has been made to pool scientific capital generated in post-harvest engineering and technology sector under AICRP on PHET. The scheme initiated in mid of seventies with ten centres and interestingly good publications emerged in 1976, just after four years of inception. Over a period of time, AICRP on PHET has attained heights and spread wings across the country. The growth is evident from technology generated, probably largest among AICRPs and correspondingly to the body of scientific knowledge. Altogether, 1275 number of research papers covering wider aspects of post-harvest machinery, processing and value added products, storage, food safety and quality, biotechnological aspects, mathematical modeling and simulation, entrepreneurship development and impact assessment are listed. The number of research papers published in journals and workshop/symposia/conferences proceedings, etc have been presented under five sections, viz., (i) Food Grain and Oil seeds, (ii) Horticultural crops, (iii) Jaggery and Khandsari, (iv) Livestock and (v) others in table below.
### Achievements/ Publications

<table>
<thead>
<tr>
<th>S No.</th>
<th>Sector</th>
<th>Research papers in selected referred journals</th>
<th>Papers in Workshop/Symposia /Conferences/ Proceedings</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>Food Grains &amp; Oilseeds</td>
<td>204</td>
<td>156</td>
<td>360</td>
</tr>
<tr>
<td>ii.</td>
<td>Horticulture Crops</td>
<td>378</td>
<td>252</td>
<td>630</td>
</tr>
<tr>
<td>iii.</td>
<td>Livestock</td>
<td>22</td>
<td>35</td>
<td>57</td>
</tr>
<tr>
<td>iv.</td>
<td>Jaggery &amp; Khandsari</td>
<td>32</td>
<td>49</td>
<td>81</td>
</tr>
<tr>
<td>v.</td>
<td>Others</td>
<td>92</td>
<td>55</td>
<td>147</td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>728</td>
<td>547</td>
<td>1275</td>
</tr>
</tbody>
</table>

Needless to mention, all publications could not be compiled due to various reasons such as non-availability of old references, retirements of Research Engineers and scientists and closure of some centres. A perusal of data, as mentioned above, clearly revealed that the scientists gave due emphasis on publishing in refereed journals. Horticulture crop processing sector has highest publications (378 nos in referred journals and 252 others) followed by food grains and oilseed processing. Besides, 107 books/ reports and book chapters, 49 technical bulletins and 65 popular articles have been published. The detailed sector-wise list of publications compiled and placed as Appendix-11.
5. EXTERNALLY FUNDED PROJECTS

AICRP on PHET is unique amongst all the AICRPs of ICAR in a way that it has also conducted various externally funded projects of National Importance funded by other ministries and assigned by Standing Parliamentary Committee on Agriculture. It has conducted for first time, a scientifically designed study for assessment of quantitative harvest and post-harvest losses of 46 major crops and commodities of India twice and is also doing this job for Food Corporation of India to fix national norms for loss or gain of wheat, rice and maize. Brief summery of each of them are presented hereunder.

i. Assessment of Quantitative Harvest and Post-harvest Losses of Major Agricultural Crops and Commodities (2005-09) – Assigned by the Parliamentary Standing Committee on Agriculture

Securing an adequate food supply has been the fundamental concern of the mankind over the millennia and saving food means growing more food. Now, preserving what has been produced has become inevitable to attain food security. There are appreciable losses at each stage of harvest and post-harvest handling and storage of food and prevention of these postharvest losses becomes important not from economic, but also from social and environmental point of view. Moreover it is a moral obligation to avoid waste. Thus we need information on the extent of losses during the harvest and post-harvest operations so that the scientists and policy makers can work out modalities and strategies to curtail these losses in order to ensure national food security.

In this backdrop, Parliament Standing Committee on Agriculture (PSCA) in May, 2005 urged the Indian Council of Agricultural Research (ICAR) to assess the Harvest and Post-Harvest Losses of Major Crops and Livestock Produce in India. Accordingly, ICAR through this All India Coordinated Research Project had carried out survey (December 2005 to Feb 2007) for 46 agricultural crops/commodities in 14 Agro climatic Zones (ACZ) of India. The final report was presented to the PSCA on June 10, 2010 and subsequently, report published by Nanda et al., 2012. The study was unique not only in terms of wider coverage of geographical area and crops/commodities but also in its methodological approach, using both enquiry and observation methods. It was evident from the report that the annual value of post-harvest loss at national level was to the tune of Rs. 27802 crores per annum (i.e., Rs. 7614 crores in cereals, Rs. 999 crores in pulses, Rs. 3800 crores in oilseeds, Rs. 5694 crores in fruits and Rs. 3972 crores in vegetables, Rs. 1631 crores spices and plantation crops and Rs. 4902 crores in livestock produce) at national level, based on
production data of 2005-06. Further, with reference to the production year 2007-08 and wholesale prices of year 2009, the total economic value of losses of crops and livestock produce have been calculated and found to be about Rs. 44143 crore. The quantitative post-harvest loss in cereals ranged 3.9 percent (sorghum) to 6.0 percent (wheat); in oilseeds 2.8 (cottonseed) to 10.1 (groundnut); in fruits ranged 5.77 percent (sopota) to 18.05 percent (guava); whereas, in case of vegetables, it ranged from 6.88 percent (cauliflower) to 12.98 percent (tomato). In case of livestock it ranged from 0.8 percent (milk) to 6.9 percent in inland fishery.

ii. **Central Sector Scheme on Post-Harvest Technology and Management (CSS-PHTM), Demonstration (Component-III) and Training (Component-IV) – sponsored by Department of Agriculture and Cooperation, Govt. of India**

Central Sector Scheme was one of the thrust area approved by Prime Minister's Office (PMO) for the Department of Agriculture and Cooperation (DOAC), Ministry of Agriculture (Now Ministry of Agriculture and Farmer Welfare) during the XI Five Year Plan and the scheme was implemented by AICRP on Post-Harvest Engineering and Technology with the view to promote Post-harvest Technology. The Central Sector Scheme aimed to focus on lower end of the spectrum of Post-Harvest Management. This scheme consisted of four Components and only two components, i.e., Demonstration of Post-Harvest Technologies (Component- 3) and Training of Farmers, Entrepreneurs and Scientists (Component- 4) were given to AICRP on Post-Harvest Engineering and Technology. Total budgetary support of Rs. 247.77 lakh was given by DoAC under Component- 3, Demonstrations of proven technologies developed by AICRP on PHET Centres were taken up in the production catchments. The suitable technologies for demonstration and selection of sites were made depending upon easily accessibility and requirement of the farming community. Demonstrations of various manual operated and power operated machines were undertaken in the states of Karnataka, Kerala, Maharashtra, Rajasthan Tamil Nadu and Uttarakhand during 2008-09 to 2010-11. It is interesting to note that more than 11270 farmers were benefited and among them around 34 percent were women.

The very purpose of Component-4 was to develop the Human Resources in Post-Harvest Management. Therefore farmers were trained to improve upon the technical know-how pertaining to post-harvest technologies for its proper and effective utilization. Besides, manufacturers were encouraged to take up the commercial production of post-
harvest technologies. Scientists, extension and other government officers were also trained to further straighten the lower end of the spectrum of Post-Harvest Management. Training manuals were also prepared and distributed among the participants during the training programmes. Around 40 trainings were imparted which had covered the state of Kerala, Maharashtra, Karnataka, M.P, Orissa, Tamil Nadu, Rajasthan, Gujarat, Punjab, Haryana, Himachal Pradesh, and West Bengal, Uttarakhand. Besides, 19 post-harvest equipment/tools procured by cooperating centres and distributed to KVKs. Synergic impact of these two programmes with AICRP on PHET was evident. The impact in terms of promoting processing activities was rated high in some of the cases.

iii. Repeat Study on Assessment of Quantitative Harvest and Post-harvest Losses of Major Agricultural Crops and Commodities Studies (2012-15) – Sponsered by Ministry of Food Processing Industries, Govt. of India.

AICRP on Post-Harvest Engineering and Technology (ICAR) has taken another survey project on harvest and postharvest losses of major agricultural crops/commodities funded by Ministry of Food Processing Industries. Since the nature and extent of harvest and post-harvest losses vary from crop to crop and region to region and season to season, hence, a repeat study on assessing the harvest and post-harvest losses of 45 crops and livestock produce was taken-up using methodology developed under previous study to see the impact of post-harvest technologies developed and adopted in the production catchments. This study provides the estimates of losses in various operational and storage in different channels and also provides how the harvest and post-harvest loss changed over a period of time. The study was initiated in February 2012 with a budget provision of Rs. 539.91 lakh and project successfully completed in March 2015. The report was timely submitted to MoFPI after review by peers and Union Minister of Food Processing and Industries and accepted by the MoFPI. The losses estimated in cereals were in the range of 4.65% (Maize) to 5.99% (Sorghum) whereas, in pulses ranged from 6.60% (Green gram) to 8.41% (Chick pea). Use of improper threshers, delayed harvesting and improper storage practices were probably the main reasons of losses in pulses. Estimated losses of oilseeds ranged from 3.08% (Cottonseed) to 9.96% (Soybean). The losses in case of fruits ranged from 6.70% (Papaya) to 15.88% (Guava) whereas, in vegetables varied from 4.58% (Tapioca) to 12.44% (Tomato). In plantation crops and spices, the losses ranged from 1.18% (Black pepper) to 7.89% (Sugarcane). The losses of 7.19% (egg), 5.23% and 10.52% in inland fish and marine fish, respectively. The loss in sheep and goat meat was 2.71% whereas the loss in poultry meat was 6.74%. The loss of milk was observed to be 0.92%. In comparison to losses during 2005-07, the losses during 2013-14 have been reduced.
significantly for wheat, mustard, groundnut, mango, guava, mushroom, tapioca, arecanut, black pepper and coriander. Whereas, the estimated losses were significantly increased in comparison to 2005-07 for maize, sorghum, chickpea, soybean, sunflower, citrus, sapota, cauliflower, cashew, marine fish, meat and poultry meat. For remaining commodities, the changes in loss were statistically non-significant at 5% level of significance. Averaged range of losses altogether for food grains, oilseeds and fruits and vegetables were found to be 4.65% to 15.88%, which indicate that overall losses have gone down by about 2% as compared to previous study in 2005-07 despite tremendous increase of production in last 10 years.

The economic value of harvest and post-harvest losses of major agricultural and livestock produce was also calculated using production data of 2012-13, average wholesale prices of 2014, and results of this study. The estimated annual value of the losses is about Rs 92651 crore (Jha et al., 2015). The study suggested R&D interventions and investment in post-harvest infrastructure and mega Food Park along with appropriate policy and entrepreneurship/skill development programme for further reduction of losses.

iv. Tribal Sub-Plan (TSP)

The basic objectives of the Tribal-Sub Plan (TSP) was to bring 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. The major objective was 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 were undertaken by 14 AICRP on PHET centres in 13 districts (Table 5).

Table 5. State-wise name of districts in which TSP Component undertaken

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

Training and demonstrations were conducted 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, areca nuts, 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. Under this programme, 23 trainings and 55 demonstrations were conducted and more than 895 individuals from 133 villages were found to be benefitted.
v. **Determination of storage loss or gain in wheat procured under relaxed specification (URS) during 2015-16 sponsored by FCI, Govt. of India.**

During 2014-15 the unseasonal rain and hailstorm across North India and its caused heavy damage of Rabi crop harvest mainly in March 2015. In view of this, Govt. of India relaxed the uniform specification for wheat being procured during 2015-16 from Punjab, Haryana, Uttar Pradesh, Rajasthan, Madhya Pradesh and Bihar. The FCI therefore requested ICAR to undertake a three months study on to observe the loss or gain in weight and quality parameters of wheat procured under URS.

Storage loss or gain in wheat procured under relaxed specifications during the year 2015-16 was determined under godown and CAP storage systems in four agro-climatic regions comprising the states of Punjab, Haryana, Uttar Pradesh, Rajasthan and Madhya Pradesh. The initial moisture content of URS wheat at the time of procurement ranged between 8.40% and 12.55% wb. After three months of storage the moisture content was in the range of 9.20 to 12.55% wb. All the wheat stacks absorbed moisture during storage. The weight of wheat also increased in the range of 0.41% to 0.43% in godown and 0.25% to 0.42% in CAP neglecting the minimal change in the region of Upper Gangetic Plain during three months storage period where there were little losses in weight. In general we can conclude that there were appreciable gains in weight of URS wheat, whereas there were no changes in quality parameters during the three months storage period of the study.

vi. **Study on determining storage losses in food grains in FCI and CWC warehouses and to recommend norms for storage losses in efficient warehouse management sponsored by FCI, Govt. of India**

The project is underway by 20 centres of AICRP on PHET. 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 for such losses, to suggest ways and means to reduce the extent of storage losses in different unit operations. The project was started in July 2013 with a budget provision of Rs.320.53 lakh and likely to complete by June 2017.
6. IMPACT OF AICRP ON PHET

An assessment of economic and other social benefits of technologies from AICRP on PIHET Centres have been made based on the feedback of beneficiaries/users as well as response of the scientists who developed the technology. The results depict that these technologies are found to be helpful in reduction of post-harvest losses, achieving timeliness post-harvest operations and value addition and reduction of drudgery. The impact in terms of economic benefits of the technologies of AICRP on PHET was worked out to be Rs. 181.90 crore/year (Nanda et al., 2013). The summary of economic impact of selected technologies is presented in Table 6.

Table 6. Summary of economic impact of selected technologies

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Equipment and technologies developed</th>
<th>Economic benefits as contributed by technologies of AICRP on PHT (in Rs lakh)/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PVK Mini dal mill (Akola centre)</td>
<td>14900.00 (1853 to entrepreneurs + 13047 to society/consumer)</td>
</tr>
<tr>
<td>2.</td>
<td>Vivek thresher-cum-pearlier (Almora centre)</td>
<td>159.34 (145.91 to entrepreneurs + 13.44 to society/consumer)</td>
</tr>
<tr>
<td>3.</td>
<td>Multi purpose grain mill (Bhopal centre)</td>
<td>2.63</td>
</tr>
<tr>
<td>4.</td>
<td>Mini dal mill (Bhopal centre)</td>
<td>80.66</td>
</tr>
<tr>
<td>5.</td>
<td>Pedal cum power operated grain cleaner (Bhopal Centre)</td>
<td>276.26</td>
</tr>
<tr>
<td>6.</td>
<td>Groundnut decorticator (Bhopal centre)</td>
<td>509.00</td>
</tr>
<tr>
<td>7.</td>
<td>Household paddy parboiling unit (Coimbatore centre)</td>
<td>28.75</td>
</tr>
<tr>
<td>8.</td>
<td>Insect trap for stored grains (Coimbatore centre)</td>
<td>72.00</td>
</tr>
<tr>
<td>9.</td>
<td>TNAU Mini dal mill (Coimbatore centre)</td>
<td>7.28</td>
</tr>
<tr>
<td>10.</td>
<td>Grain puffing machine (Kharagpur centre)</td>
<td>6.71</td>
</tr>
<tr>
<td>11.</td>
<td>Mini dal mill (Pantnagar centre)</td>
<td>20.65</td>
</tr>
<tr>
<td>12.</td>
<td>Maize dehusker cum sheller (Udipur centre)</td>
<td>25.05</td>
</tr>
<tr>
<td>13.</td>
<td>PKV chilli seed extractor (Almora centre)</td>
<td>6.16</td>
</tr>
<tr>
<td>14.</td>
<td>PKV fruit grader (Akola centre)</td>
<td>7.42</td>
</tr>
<tr>
<td>15.</td>
<td>Tamarind dehuller-desseeder (Bangalore centre)</td>
<td>70.02</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Equipment and technologies developed</td>
<td>Economic benefits as contributed by technologies of AICRP on PHT (in Rs lakh)/year</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>16.</td>
<td>Manual arecanut dehusker</td>
<td>57.41</td>
</tr>
<tr>
<td>17.</td>
<td>White peeper making machine (Bangalore centre)</td>
<td>398.31</td>
</tr>
<tr>
<td>18.</td>
<td>Turmeric Polisher (Bapatla centre)</td>
<td>1.82</td>
</tr>
<tr>
<td>19.</td>
<td>Multipurpose polyhouse solar dryer (Bapatla centre)</td>
<td>10.62</td>
</tr>
<tr>
<td>20.</td>
<td>Fluidized bed drier for mushroom (Coimbatore centre)</td>
<td>2.53</td>
</tr>
<tr>
<td>21.</td>
<td>Improved farm level turmeric boiler (Coimbatore centre)</td>
<td>116.00</td>
</tr>
<tr>
<td>22.</td>
<td>Manual operated aonla pricking machine (Hissar centre)</td>
<td>0.25</td>
</tr>
<tr>
<td>23.</td>
<td>Cumin cleaner- cum- grader (Junagarh centre)</td>
<td>2.38</td>
</tr>
<tr>
<td>24.</td>
<td>On Farm Fruit Grader (Junagarh centre)</td>
<td>1.62</td>
</tr>
<tr>
<td>25.</td>
<td>Farm level fruit and vegetable washing machine (Ludhiana)</td>
<td>31.06</td>
</tr>
<tr>
<td>26.</td>
<td>Electric-cum cum-battery heated uncapping knife (Ludhiana centre)</td>
<td>1.56</td>
</tr>
<tr>
<td>27.</td>
<td>Power-cum-hand operated 8 frame radial honey extractor (Ludhiana centre)</td>
<td>3.29</td>
</tr>
<tr>
<td>28.</td>
<td>Solar Tunnel Dryer (Raichur centre)</td>
<td>21.92</td>
</tr>
<tr>
<td>29.</td>
<td>Hand operated cassava chopping machine (Trivendrum centre)</td>
<td>38.37</td>
</tr>
<tr>
<td>31.</td>
<td>Garlic bulb breaker (Udaipur centre)</td>
<td>6.85</td>
</tr>
<tr>
<td>32.</td>
<td>Improved four roller sugarcane crusher (Coimbatore centre)</td>
<td>7.18</td>
</tr>
</tbody>
</table>

**Process and Product Development**

| 33.    | Safe storage of pulses using sand layer (Bangalore centre)                | 0.60                                                                             |
| 34.    | Osmo-dehydrated pineapple slices/ rings (Bhubaneswar centre)              | 1.28                                                                             |
| 35.    | Extraction of apricot kernel oil (Solan centre)                           | 10.69                                                                            |
| 36.    | Aloe vera processing technology (Udaipur centre)                          | 27.44                                                                            |
| 37.    | Garlic dehydration technology (Udaipur centre)                           | 17.06                                                                            |
| 38.    | Bottling of sugarcane juice (Coimbatore centre)                           | 9.00                                                                             |
| 39.    | Production of Cube Shaped Jaggery (Lucknow/Anakapalle)                    | 1.62                                                                             |
| 40.    | Agro Processing Centres (APC=82 Nos),                                    | 1250 (430 to entrepreneurs +820 to society/consumer)                            |

**Total** 18190.79

*Source: Nanda S.K., Dixit, A.K. and Kudot SKA (2013). Impact Assessment of Technologies from AICRP on PHT Centres. All India Coordinated Research Project on Post Harvest Technology (ICAR).*
Further, the entrepreneurs of selected commercialized technologies were found satisfied on economic and social aspects, as examined from feedback. Intangible benefits to the entrepreneurs as well as to the society were most prominently noticed in case of Agro-processing centres. For instance, high level of satisfaction with the present work/profession, quality of their life, motivation towards group approach, and enhancement of income from animal husbandry.

The fact that AICRP on PHET has brought economic benefit to users and to the society as well, should be inspiring to enhance our efforts in developing new technologies and dissemination of potential technologies.

**Selected References:**


Nanda SK, Vishwakarma RK, Bathla HVL., Rai A and Chandra P (2012). Harvest and post-harvest losses of major crops and livestock produce in India. All India Coordinated Research Project on PostHarvest Technology (ICAR), Ludhiana.

Nanda SK, Dixit AK and Kudos SKA (2013). Impact Assessment of Technologies from AICRP on PHT Centres. All India Coordinated Research Project on PostHarvest Technology (ICAR), Ludhiana.

7. DETAILS OF AICRP ON PHET TECHNOLOGIES

Technical details and their status are described sector-wise in brief under this chapter

**Food Grains and Oilseeds**

Machinery/ Tools/ Equipments/ Structure

**Technology No. 1**

<table>
<thead>
<tr>
<th>i. Name of Technology</th>
<th>PKV Mini Dal Mill</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii. Application/ Use</td>
<td>Pulse milling (pigeon pea, green gram, black gram, chick pea) at rural level</td>
</tr>
<tr>
<td>iii. Description of Technology :</td>
<td></td>
</tr>
<tr>
<td>The pulses produced in rural areas are often transported to urban areas, where commercial dal mills are situated. If the pulses are processed in production catchment at village level, the transportation cost can be reduced. In order to have solution to these problems a small enterprise at rural level is necessary for which the PKV Mini dal mill is developed and further refined for its multipurpose use (cleaning, grading of grains and polishing of split dal). It operates using two horse power single phase electric motor. Almost all pulses can be dehulled with this machine and the products are quite comparable with that of commercial dal mills. The processing capacity of this dal mill is 100-125 kg/h for pigeon pea and 125-150 kg/h for green and black gram. The respective recoveries are 72-75% and 82-85%, which is higher than existing burr mill. This machine avoids dusty atmosphere and provides easy operation. The technology offers rural employment income generation opportunity in production catchment.</td>
<td></td>
</tr>
<tr>
<td>iv. Input/raw material</td>
<td></td>
</tr>
<tr>
<td>Machine</td>
<td></td>
</tr>
<tr>
<td>a) Overall dimension</td>
<td>1.5 x 1.3 x 1.8 m</td>
</tr>
<tr>
<td>b) Weight</td>
<td>170 kg</td>
</tr>
<tr>
<td>c) Prime mover</td>
<td>2 hp electric motor</td>
</tr>
<tr>
<td>d) Man power</td>
<td>1 skilled and 1 unskilled</td>
</tr>
<tr>
<td>e) Land</td>
<td>200 m²</td>
</tr>
<tr>
<td>f) Investment</td>
<td>Rs. 85,000/-</td>
</tr>
<tr>
<td>v. Output capacity</td>
<td>125 kg/h</td>
</tr>
<tr>
<td>vi. Unit cost (per machine)</td>
<td>Rs. 65,000/- (including prime mover)</td>
</tr>
<tr>
<td>vii. Suitability for crop/commodity</td>
<td>Pigeon pea, green gram and black gram</td>
</tr>
<tr>
<td>viii. Efficiency</td>
<td>72-75% recovery of dal (Pigeon pea) 82-85% recovery of dal (green gram, black gram, Bengal gram)</td>
</tr>
<tr>
<td>ix. Unit cost of operation</td>
<td>Rs. 100-120 /q</td>
</tr>
<tr>
<td>x. a) No. of Licensees</td>
<td>02</td>
</tr>
<tr>
<td>b) Addresses of Licensees / Manufacturer</td>
<td></td>
</tr>
<tr>
<td>1. M/s Shriram Associates, J/27, phase 3, MIDC Akola (MS) (M) 09823090002 (O) 0724-2258325</td>
<td></td>
</tr>
<tr>
<td>2. YMB Agri Machineries, W/37-38, Phase 3, MIDC Akola (MS) (M) 09850303202 (O) 0724-2258184</td>
<td></td>
</tr>
<tr>
<td>xi. Contact Address</td>
<td>Research Engineer, AICRP on PHET College of Agricultural Engineering Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, AKOLA -444 104 (Maharashtra)</td>
</tr>
</tbody>
</table>
Technology No. 2

i. Name of Technology : PKV Cleaner-Grader-Polisher

ii. Application/ Use : Cleaning, grading and polishing of agricultural commodities

iii. Description of Technology :

It consists of blower, rotary sieves and polisher. Hopper with feeding mechanism is provided for proper feeding of grain to rotary sieve. Before the grain reaches to sieve it is cleaned by blower and the size is graded through different sizes of sieves arranged in series. The stone and lumps are separated at the end. The machine can grade pigeonpea, green gram and black gram grains. Grading of pulse grains lead to better milling and higher dal recovery. Other pulses can also be graded by using proper sized sieve. Two screw conveyors are provided for polishing of pigeonpea dal. The machine has capacity of 4 to 5 q/h and it requires one horse power single phase electric motor.

iv. Input/raw material : Pulse grains/ unpolished dal

Machine

a) Overall dimension : 2.10 X 0.86 X 1.60 m

b) Weight : 120 kg

c) Prime mover : 1 hp single phase electric motor

d) Man power : 1 skilled and 1 unskilled

e) Land : 25 m²

f) Investment : Rs. 29,500/-

v. Output capacity : 400-500 kg/h

vi. Unit cost : Rs. 24,500/- (including prime mover)

vii. Suitability for crop/commodity : Cleaning, grading and polishing of agricultural produce

viii. Efficiency : Cleaner : 98%; Grader : 92%; Polisher : 91%

ix. Unit cost of operation : Rs.40/q

x. a) No. of Licensees : 01

b) Addresses of Licensees / Manufacturer :

YMB Agri Machineries, W/37-38, Phase 3
MIDC Akola (MS)
(M) 09850303202 (O) 0724-2258184

xi. Contact Address

Research Engineer, AICRP on PHET
College of Agricultural Engineering
Dr. Prabha Deshmukh Krishi Vidyapeeth,
Krishi Nagar, AKOLA - 444 104 (Maharashtra)
Technologies /Food Grains and Oilseeds

Technology No. 3

i. Name of the technology : Vivek Thresher-cum-Pearler

ii Application/ Use : Threshing and pearlimg of minor millets

iii Description of Technology :
Millets are important staple food grain in North Western Himalaya of India (NWHI). The threshing and pearlimg of millets involves severe drudgery for its growers. It is evident by arduous process of traditional threshing and pearlimg, which need five hours effort for threshing and pearlimg of 100 kg of finger millet grains. A lightweight millet thresher was developed for multipurpose uses, i.e., threshing, pearlimg, dehusking/dehulling and polishing at Vivekananda Institute of Hill Agriculture (ICAR), Almora, Uttarakhand, India. It works on the principle of impact and shear on the grain.

iv Input/raw material :
Machine
a) Overall dimension : 660×310×1040 mm
(L x B x H mm)
b) Weight : 45 kg
c) Prime mover : Electric motor
d) Power (hp) : 1 hp
e) Man power : 01
f) Investment : Rs. 28,000/-

v Output capacity :
Threshing capacity : 30-35 kg grain/h.
Threshing/ dehulling efficiency : > 98%
Pearling capacity (Finger millet) : 45 kg grain/h.
Dehulling capacity (Barnyard millet) : 4.0 – 5.0 kg/h.

vi Unit cost (per machine) : Rs. 25,500/-
vii Suitability for crop : Millets
viii Efficiency : >96 %

ix Unit cost of operation
Pearling cost : Rs 0.1 per kg
Dehulling cost : Rs 6.0 per kg
Threshing cost : Rs 0.20 per kg

x Patent obtained/applied : Patent Application No. 1199/DEL/05 dated 11.05.05

xi a) No. of Licensees : 01
b) Addresses of Licensees or Manufacturer : Punjab Agricultural Implements Pvt Ltd., Railway Road, Sanaranpur, UP – 247001

xii Contact Address : Research Engineer, AICRP on PHET ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, ALMORA –263 601 (Uttaranchal)
Four Decades of R&D of AICRP on PHET

Technology No. 4

i  Name of the Technology : VL Steaming Plant

ii  Application/ Use : Steaming of barnyard/ kodo/ sawan/ millet grains to facilitate threshing and pearl

iii  Description of Technology : For improving the dehulling characteristics of barnyard millet grain, a low cost steaming plant has been developed. This machine has five parts that are (1) Funnel, (2) Perforated conical container in side the drum, (3) Drum (4) Sliding type opening and (5) Iron pot for water boiling

iv  Input/raw material :
   a) Diameter of steaming drum : 610 mm
   b) Height of steaming drum : 914 mm
   c) Height of sieve from the bottom : 460 mm
   d) Weight : 65 kg
   e) Man power : 01
   f) Investment : Rs. 1,500/-

v  Output capacity : 45-50 kg/h.

vi  Unit cost (per machine) : Rs. 1,500/-

vii  Suitability for crop : Millets

viii  Efficiency : 92-95%

ix  Unit cost of operation : Rs. 0.15/kg

x  Contact Address : Research Engineer, AICRP on PHET ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, ALMORA –263 601 (Uttaranchal)
Technologies /Food Grains and Oilseeds

Technology No. 5

i Name of the Technology : VL Paddy Thresher

ii Application/ Use : Threshing of paddy

iii Description of Technology

VL Paddy Thresher was designed, fabricated and developed for the purpose of threshing paddy grain. This is a manual-cum-power operated paddy threshing machine. It works on the principle of impact on the grain for the purpose of threshing. The threshing drum is fitted with a wire loop as a beating device, which provides impact on the grain. In this thresher, sitting arrangement has been made for the easy operation. Chain-sprocket power transmission system with 1:7 speed ratio has been applied for providing rotational speed to the thresher. Threshing capacity and efficiency are largely affected by stem height, panicle height and 1000 grain weight of paddy crop.

iv Input/raw material
   a) Overall dimension : 1030×630×975 mm
   (L x B x H mm)
   b) Weight : 42 kg
   c) Prime mover : Either one man or 0.5 hp Electric motor
   d) Power (hp) : 0.5
   e) Man power : 02
   f) Investment : Rs. 37,000/-

v Output capacity : 60-100 kg/h.

vi Unit cost (per machine) : Rs 3700/-

vii Suitability for crop : Paddy

viii Efficiency : > 98%

ix Unit cost of operation : Rs 0.10 per kg paddy grain

x Contact Address : Research Engineer, AICRP on PHET
                   ICAR-Vivekananda Parvatiya Krishi
                   Anusandhan Sansthan,
                   ALMORA—263 601 (Uttarakhand)
Technology No. 6

i  Name of the Technology : Barnyard Millet Dehuller

ii  Application/ Use : Dehulling of barnyard millet

iii Description of Technology

In the recent times barnyard millet (*Echinochloa frumentacea* L.), are dehulled manually in the absence of suitable mechanical device. Therefore, a 5 hp electric motor driven millet dehuller of capacity 40–50 kg/h. was designed, developed and optimized for process and machine parameters. The special feature of this machine is application of canvas strip as an abrasive material on impeller and replaceable sieve arrangement in bottom of the dehulling chamber. The actual dehulling efficiency and broken grain obtained with optimized machine parameters (number of canvas strip over periphery of impeller = 9 and over hanging width of canvas strip =3 mm) and process parameters (peripheral speed=8.6 m s⁻¹; number of passes=5 and moisture content=8.4% db) were 88.3±2.8% and 6.1±1.1% respectively.

iv Inputs

a) Raw material : Barnyard millet

b) Machinery

Overall dimension : 1140 x 1107 x 2120 mm

Weight : 168 kg

Prime mover : Electric motor (5 hp)

c) Man power : One

d) Investment : Rs. 45,000/-

v  Output capacity : 45 - 50 kg/h

vi  Unit cost (per machine) : Rs 45, 000/-

vii  Suitability for crop : Barnyard millet

viii Efficiency : 98% (in 4-5 passes)

ix  Unit cost of operation : Rs 2/kg

x  Contact Address : Research Engineer, AICRP on PHET

ICAR-Vivekananda Parvatiya Krishi Anusandhan Sanasthan,

ALMORA –263 601 (Uttaranchal)
Technologies /Food Grains and Oilseeds

Technology No. 7

i Name of the Technology : Pedal Operated Winnower-Cleaner-Grader for Millets

ii Application/ Use : Winnowing of millets, pulses and other cereals such as wheat and paddy

iii Description of Technology :
A winnower-cleaner-grader suitable for winnowing, cleaning and grading of millet, cereal and pulses crops in single pass has been designed and developed. The major components of the machine were fabricated using fiber reinforced plastic material. It consists of a winnower, cleaning sieve and grading assembly. The total weight of the winnower cum cleaner cum grader is 60 kg. It can be operated by one person. The cleaning capacity of the machine is 250-300 kg/h for finger millet and 275-300 kg/h for barnyard millet. The average cleaning capacity of the machine for different crop is found to be 200-250 kg/h. The winnowing capacity of the machine is found to be 300-350 kg/h for finger millet and 350-400 kg/h for barnyard millet. The average winnowing capacity of the machine for different crop is found to be 300-350 kg/h. The cleaning efficiency of the machine for finger and barnyard millet is found to be 96 and 97%, respectively. The average cleaning efficiency of the machine for different crops is 97%. The winnowing efficiency of the machine for finger and barnyard millet is found to be 97 and 98%, respectively. The overall efficiency of the machine is found to be 97.5%.

iv Inputs :
   a) Raw material : Millets, wheat, paddy, lentil and soybean
   b) Machinery : 
      Overall dimension : 1450 x 1450 x 1210 mm
      Weight : 60
      Prime mover : Manual
   c) Man power : 01
   d) Investment : Rs. 8,000/-

v Output capacity : 250 - 300 kg/h

vi Unit cost (per machine) : Rs. 8,000/-

vii Suitability for crop : Millets, wheat, paddy, lentil and soybean

viii Efficiency : 96%

ix Unit cost of operation : Rs 0.04/kg

x Contact Address : Research Engineer, AICRP on PHET ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, ALMORA –263 601 (Uttaranchal)
Four Decades of R&D of AICRP on PHET

Technology No. 8

i. Name of the Technology : Mini Groundnut Decorticator-cum-Sunflower Thresher and Maize Sheller (3-in-1)

ii. Application/ Use : Suitable particularly for small farmers for decortication of groundnut seed pods and threshing of sunflower and maize seeds required during sowing season.

iii. Description of Technology :

It is a small hand-operated device with a mild steel body. The ribbed threshing cylinder consists of rubber cushions to facilitate smooth shelling of the pods inside the shelling chamber. The pods are fed through a 500 g capacity hopper. When the handle is rotated, the pods get shelled inside the shelling chamber and both the shell and kernel fall through the sieve at the bottom of the shelling chamber to be separated manually. The equipment is provided with two separate inter-changeable attachments for maize shelling and sunflower threshing which can be fitted to the shaft at the far end of the shaft.

iv. Input/ raw material :
   a) Machine
      Overall dimension : 58 x 30 x 45 cm
      Weight : 8 Kg
      Prime mover : -
   b) Man power : 01
   c) Investment : Rs. 2000/-

v. Output capacity : 15 kg groundnut pods / hour, 12-15 kg shelled maize or sunflower seeds

vi. Unit cost (per machine) : Rs.2000/-

vii. Suitability for crops/commodity : Groundnut, sunflower, maize

viii. Efficiency : 97%

ix. Unit cost of operation : Rs.2.25/kg

x. (a) No. of Licensees : One

(b) Addresses of Licensee or Manufacturer : M/s Dollar Engineering Industries Pvt. Ltd. #3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore - 560 058, India.

xi. Contact Address : Research Engineer, AICRP on PHET University of Agricultural Sciences, J- Block, GKVK Campus, BANGALORE-560 065 (Karnataka)
Technology No. 9

i. Name of the Technology : Safe Storage of Pulses using Sand Layer

ii. Application/ Use : Provides total control of bruchid infestation in stored pulse grains

iii. Description of Technology :
The technology developed is a two stage process involving extended sun-drying of pulse grains on a concrete threshing yard / black tarpaulin / black polyethylene sheet for 25 hours (spread over 3-5 days) in a single grain layer. The dried pulse grain is stored in a plastic or metal bin with one inch thick layer of sand spread uniformly on the top surface of the grain. Then the storage bin is closed with a tight lid without any disturbance to the sand layer till the end of storage period.

iv. Input/raw material : Concrete threshing yard / black tarpaulin / black polyethylene sheet for drying; plastic or metal drum of suitable capacity with tight lid for storage and well sieved river sand.

v. Capacity : Technology can be used for storage of pulses up to 1.0 tonne

vi. Unit cost (per machine) : Depends on the cost of the bin and black tarpaulin / black polyethylene required for drying

vii. Suitability for crops/commodity : Pulses

viii. Commercialization status : Transferred to farmers

ix. Contact Address : Research Engineer, AICRP on PHET University of Agricultural Sciences, J- Block, GKVK Campus, BANGALORE - 560 065 (Karnataka)
Technology No. 10

i. Name of the Technology : Maize Sheller-cum-Sunflower Thresher (2-in-1)

ii. Application/ Use : This gadget can be used for shelling maize cobs or for threshing sunflower earheads. It has been designed to cater to the threshing needs of small and marginal maize growers especially for seed production.

iii. Description of Technology :

It is motor driven equipment with separate inter-changeable attachments for shelling maize cob / threshing sunflower ear-heads. A shaft driven by an electric motor rotates at about 200 rpm. On both ends of the shaft, either the maize shelling (tubular sheller) or sunflower threshing attachments (disc with pins) are fixed. Individual cob / ear-head is shelled / threshed manually and the seed damage is bare minimum making it suitable for seed production.

iv. Input/raw material : Maize cobs (desheathed) / sunflower ear-heads
   Machine
   a) Overall dimension : 40 x38 x105 cm
   b) Weight : 32 kg
   c) Power : 0.25 hp single phase motor
   d) Prime mover : -
   e) Man power : Can be operated by one or two people simultaneously
   f) Investment : Rs 7500/-

v. Output capacity : 1 quintal of threshed maize grains per hour for 2 persons

vi. Unit cost (per machine) : Rs. 7500/-

vii. Suitability for crops/commodity : Maize and sunflower

viii. Efficiency : 99%

ix. Unit cost of operation : Rs.4.50/100kg

x. Commercialization status
   (a) No. of Licensees : Commercialized
   (b) Selected Addresses of Licensee/Manufacturer
     M/s Dollar Engineering Industries Pvt. Ltd.
     #3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore - 560 058, India.

xi. Contact Address : Research Engineer, AICRP on PHET
                      University of Agricultural Sciences,
                      J- Block, GKVK Campus,
                      BANGALORE - 560 065 (Karnataka)
Technologies / Food Grains and Oilseeds

Technology No. 11

i. Name of the Technology : Portable Winnower

ii. Application/ Use : For winnowing of agricultural produce after threshing

iii. Description of Technology :

The winnower consists of an axial flow fan operated by a 1 hp motor enclosed in a casing with adjustable shutter. The shutter can be tilted up or down to adjust the direction of the air-flow. The winnowing fan assembly is mounted on a tail frame with caster wheels to facilitate easy mobility of the unit especially in rural environment.

iv. Input/ Raw material : Threshed agricultural produce (uncleaned)

Machine :

a) Overall dimension : 68 x 68 x137 cm
b) Weight : 40 kg
c) Power : 1 hp motor
d) Prime mover : -
e) Man power : 02
f) Investment : Rs. 16 000/-

v. Output capacity : 10 qtl/h

vi. Unit cost (per machine) : Rs. 16,000

vii. Suitability for crops/commodity : Cereals, pulses and oilseed

viii. Efficiency : 99%

ix. Unit cost of operation : Rs.8.60/qtl

x. Commercialization status :

(a) No. of Licensees : Commercialized

One

M/s Dollar Engineering Industries Pvt. Ltd.
#3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore - 560 058, India.

(b) Address of Licensee / Manufacturer :

xi. Contact Address :

Research Engineer, AI CRP on PHET
University of Agricultural Sciences,
J- Block, GKVK Campus,
BANGALORE - 560 065 (Karnataka)
Four Decades of R&D of AICRP on PHET

Technology No. 12

i  Name of the Technology : Technique for the control of stored grain insects in milled rice

ii  Application/ Use : Eco friendly control of storage insects in milled rice

iii  Description of Technology :

This technology is useful for preventing or containing the insect infestation in milled rice at house-hold level. The technology involves mixing of pea protein (1%) or commercially available Ayurvedic Zandu Parad® tablet @1% (not powdered) with milled rice grains and storing the rice in a plastic or metallic container. Recent research on protein-enriched pea flour (Protein-enriched pea flour -protein 60%, starch 30%) showed that it has both toxic and repellent properties, while Zandu Parad tablet (made from Parad 60 mg and Khatika 120 mg; each tablet weighing 2g) is known to have repellent properties. Moreover, pea protein is not commercially available. Zandu Parad Tablets can be separated by hand picking the tablets before washing the rice for cooking and the pea protein is washed out in water just before cooking.

iv  Input/ Raw material : Metal or plastic container of suitable size of up to 10-20 kg capacity.

v  Unit cost : For 10 kg rice, 100 g of Zandu parad tablets (50 no.) are required that will cost about Rs 30/-

vi  Suitability for crops/ commodity : Milled Rice

vii  Efficiency : Zandu Paradtablet prevented build-up of insect infestation in milled rice for three months.

viii  Commercialization status : Technology ready for transfer

ix  Contact Address : Research Engineer, AICRP on PHET, University of Agricultural Sciences, GKVK, Bangalore –560065 (Karnataka)
### Technologies / Food Grains and Oilseeds

#### Technology No. 13

<table>
<thead>
<tr>
<th></th>
<th>Name of the Technology</th>
<th>On-Farm Paddy Dryer</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>Application/ Use</td>
<td>On-Farm Paddy dryer can be used to dry high moisture paddy even during long spells of rainy and cloudy days during monsoon season thereby reducing discoloration to the grains due to high moisture and grain quality can be preserved without much deterioration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description of Technology :</td>
<td>On-farm paddy dryer is a Mobile – Flat and fixed bed – Non Mixing type Paddy dryer (Mixing mechanism is optional). Paddy dryer consists of drying chamber and plenum chamber. Ambient air which is sucked by a blower is heated to a set temperature while drawn through an indirect type of heat exchanger fired by a fuel burner. Heated air is distributed in the plenum chamber and is directed to the drying chamber due to the configuration of plenum. Since, drying takes place in a fixed deep bed, drying proceeds from bottom layer to the top layer leaving the moisture laden air at the top drying chamber. Intermittent tempering of the grain during /after drying equalizes the moisture distribution within the grain and aid in uniform drying. Dried grains can be discharged through gravity outlets provided. Drying 5 tons of high moisture paddy from an initial moisture content of 22-24% to a final moisture content of 12-14% requires 6-8 h with a tempering time of 2-3 h. Milling tests resulted to yield lower broken percentage (&lt;3-4%). Farmers can store the dried produce in rural godowns till remunerative prices prevail in the market.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iv</td>
<td>Input/raw material</td>
<td>High Moisture Wet Paddy</td>
</tr>
<tr>
<td>a)</td>
<td>Overall dimension of dryer</td>
<td>7.7 m x 2.4 m x 1.6 m</td>
</tr>
<tr>
<td>b)</td>
<td>Weight</td>
<td>Empty weight 5.4 tons</td>
</tr>
<tr>
<td>c)</td>
<td>Prime mover/ machine</td>
<td>15 kVA Diesel generator or 3 phase A/C current</td>
</tr>
<tr>
<td>d)</td>
<td>Man power</td>
<td>06 (Manual loading mechanism) 02 (Elevator loading mechanism)</td>
</tr>
<tr>
<td>e)</td>
<td>Investment</td>
<td>Rs. 17.5 lakhs</td>
</tr>
<tr>
<td>v</td>
<td>Output capacity</td>
<td>5 tons/ batch</td>
</tr>
<tr>
<td>vi</td>
<td>Unit cost (per machine)</td>
<td>Rs. 17.5 lakhs</td>
</tr>
<tr>
<td>vii</td>
<td>Efficiency</td>
<td>Thermal efficiency : 58% (For Rabi Trial)</td>
</tr>
<tr>
<td>viii</td>
<td>Unit cost of operation</td>
<td>Rs.6019/ batch or Rs. 1.20/kg (Kharif) Rs.4369/ batch or Rs. 0.87/kg (Rabi)</td>
</tr>
<tr>
<td>x</td>
<td>a) No. of Licensees</td>
<td>01 (Developed on Collaborative mode)</td>
</tr>
<tr>
<td>xi</td>
<td>Contact Address</td>
<td>Research Engineer, AICRP on PHET Acharya N. G. Ranga Agricultural University, Bapatla-522 101; Guntur, Andhra Pradesh <a href="mailto:phtcbapatla@gmail.com">phtcbapatla@gmail.com</a></td>
</tr>
</tbody>
</table>
Technology No. 14

i  Name of the Technology : Multi Purpose Grain Mill

ii  Application/ Use : Grinding cereals, pulses, and spices

iii  Description of the Technology:
It is 1.0 HP single phase, electric motor operated equipment for grinding of cereals, coriander and pulses to produce flour/grits, powder, and split, respectively. The grains with 8-10% moisture content (wet basis) with low oil contents are most suitable. The mill consists of hopper, feed adjuster, vertical grinding wheels, etc. The overall dimensions of the equipment are 840x580x670 mm and weight is 69 kg.

iv  Input/raw material :
   a) Power (hp) : 1 hp single phase, 220 V, AC motor
   b) Man power : 2-5 man-h/q
   c) Land : 2x2 m area
   d) Investment : Rs. 15000/-

v  Output capacity :
   Cereal/Pulses flour : 11-20 kg/h
   Coriander : 10 kg/h
   Split pulses : 50-70 kg/h

vi  Unit cost (per machine) : Rs. 9500/-

vii  Suitability for crop/ commodity
    Cereals, pulses, and spices

viii  Efficiency : 88 %

ix  Unit cost of operation : Rs 17/- per q

x  a) No. of Licensees : 12 Farmer-cum-Processor and Entrepreneurs

b) Addresses of Licensees or Manufacturer
   (i) M/s Yashoda Engineering
       Laghu Udyog, Shed No. 12, Sector–1, Industrial Area,
       Govindpura, Bhopal – 462023, M.P.
   (ii) M/s Vinod Enterprises, Plot No. 104, Sector-1,
        Industrial Area, Govindpura, Bhopal – 462023, M.P.
   (iii) M/s Shri Manak Industries
        Plot No. 70-B, Sector-H, Industrial Estate
        Govindpura, Bhopal-462023, M.P.

xi.  Contact Address : Director
    ICAR-Central Institute of Agricultural Engineering,
    Nabibagh, Berasia Road,
    BHOPAL –462 038 (Madiya Pradesh)
Technologies / Food Grains and Oilseeds

Technology No. 15

i Name of the Technology : Manual Double Screen Cleaner with Sack Holder

ii Application/ Use : For cleaning/ grading of cereals, pulses and oilseeds

iii Description of Technology :
CIAE Manual double screen cleaner is a batch type hand operated equipment to replace traditional practice of horizontal/vertical sieving to clean the grains. It separates impurities like stubbles, chaff, dirt and broken from wheat, bengal gram, soybean and other cereals and pulses crops. It consists of a mainframe scalper/grading screen, draper rod, handle, shutter etc. and operated by hanging it an any elevated point with ropes. A batch of 5-10 kg is fed into the cleaner, which sieves the grain due to swinging action of the cleaner. The hanging ropes support complete load/ weight of the equipment and grain. The sack holder holds the sack in vertical open position for easy loading of cleaned grains. Its height can be adjusted to the size of the sack and suitable for all types of materials.

iv Input/raw material
   a) Weight : 17.6 kg
   b) Prime mover :
   c) Power (hp) : Manual
   d) Man power : 01

v Output capacity : 150-225 kg/h

vi Unit cost (per machine) : Rs. 4,000

vii Suitability for crop/commodity
   Wheat, Soybean, Chickpea, Pigeon pea, Green gram, Lentil etc.

viii Efficiency : 99 – 99.8 %

ix Unit cost of operation : Rs. 75 per ton

x a) No. of Licensees : 03
   b) Addresses of Licensees or Manufacturer
      (i) M/s Shri Manak Industries
          Plot No. 70 – B, Sector – H, Industrial Estate
          Govindpura, Bhopal 462 023
      (ii) M/s. Yashoda Engineering
           Laghu Udyog, Shed No. 12, Sector – I,
           Industrial Estate, Govindpura, Bhopal 462 023
      (iii) M/s. Vinod Enterprises
            104, Sector – I, Industrial Estate
            Govindpura, Bhopal 462 023

xi Contact person : Director
ICAR-Central Institute of Agricultural Engineering,
Nabibagh, Berasia Road,
BHOPAL -462 038 (Madhya Pradesh)
Technology No. 16

i Name of the Technology : Groundnut-cum-Castor Decorticator

ii Application/ Use : For shelling of groundnut or castor

iii Description of Technology :

It is manually operated equipment to separate kernels from groundnut and castor pods. The unit consists of frame, handle, oscillating arm and separate sieve for groundnut and castor. The pods are fed in batches of 5 kg and crushed in between concave and oscillating arm having cast iron/ nylon shoes to achieve shelling.

iv Input/raw material :
   a) Weight : 15 kg
   b) Man power : 01

v Output capacity : 60-68 kg/h

vi Unit cost (per machine) : Rs. 2,200

vii Suitability for crop/ commodity : Groundnut, Castor

viii Efficiency : 93 – 98%

ix Unit cost of operation : Rs. 180 per ton
   a) No. of Licensees : 04
   b) Addresses of Licensees or Manufacturer :
      (i) M/s Shri Manak Industries
          Plot No. 70–B, Sector–H, Industrial Estate
          Govindpura, Bhopal 462 023
      (ii) M/s. Yashoda Engineering
           Laghu Udyog, Shed No. 12, Sector–I,
           Industrial Estate, Govindpura,
           Bhopal 462 023
      (iii) M/s. Vinod Enterprises
           104, Sector–I, Industrial Estate,
           Govindpura, Bhopal 462 023
      (iv) M/s Venkatesh Agro Engineering
           Works, C-30, Additional MIDC,
           Jalna, Maharashtra–431203

xii Contact Address : Director
                    iCAR-Central Institute of Agricultural Engineering,
                    Nabibagh, Berasia Road,
                    BHOPAL -462 038 (Madhya Pradesh)
### Technology No. 17

<table>
<thead>
<tr>
<th>i</th>
<th>Name of the Technology</th>
<th>Pedal-cum-Power Operated Grain Cleaner</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>Application/ Use</td>
<td>To remove foreign matters and impurities from the threshed grains, viz., cereals, pulses and oilseeds</td>
</tr>
<tr>
<td>iii</td>
<td>Description of the Technology:</td>
<td>It is pedal cum power operated grain cleaner equipment to separate dust, dist, stones, straw, chaff etc and grade the cereals and pulses. It consists of 0.5 h.p. single phase electric motor, main frame, hopper, feeding mechanism, sieve box, scalping and grading sieves, eccentric unit, centrifugal blower, bicycle drive unit, etc. The overall dimensions of the machine are 1600x500x1000 mm and weight is 100-110 kg. The machine has top and bottom screens that can be changed according to the requirement of the grain to be cleaned. The machine gives cleaning efficiency of 99%. Its operating cost is Rs. 7.5/q.</td>
</tr>
<tr>
<td>iv</td>
<td>Input/raw material</td>
<td>Cereals, pulses, and oil seeds</td>
</tr>
<tr>
<td></td>
<td>a) Power (hp)</td>
<td>0.5 h.p. single phases electric motor</td>
</tr>
<tr>
<td></td>
<td>b) Man power</td>
<td>0.4 man-h/q</td>
</tr>
<tr>
<td></td>
<td>c) Land</td>
<td>6x3 m area</td>
</tr>
<tr>
<td></td>
<td>d) Investment</td>
<td>1500.00 (machine, Motor, continuier etc)</td>
</tr>
<tr>
<td>v</td>
<td>Output capacity</td>
<td>330-800 kg/h</td>
</tr>
<tr>
<td>vi</td>
<td>Unit cost (per machine)</td>
<td>Rs. 8500/-</td>
</tr>
<tr>
<td>vii</td>
<td>Suitability for crop/commodity</td>
<td>Cereals, pulses and oilseeds</td>
</tr>
<tr>
<td>viii</td>
<td>Efficiency</td>
<td>99 %</td>
</tr>
<tr>
<td>ix</td>
<td>Unit cost of operation</td>
<td>Rs. 7.5/q.</td>
</tr>
<tr>
<td>x</td>
<td>a) No. of Licensees</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>b) Addresses of Licensee or Manufacturer</td>
<td>(i) M/s Vinod Enterprises, Plot No. 104, Sector-1, Industrial Area, Govindpura, Bhopal –462023, M.P.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) M/s Shri Manak Industries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plot No. 70-B, Sector-H, Industrial Estate Govindpura, Bhopal-462023, M.P.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) M/s M.P. Iron Industries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Behind Zake Hotel, Quazi Camp, Berasia Road, Bhopal-462001 M.P</td>
</tr>
<tr>
<td>xi</td>
<td>Contact Address</td>
<td>Director ICAR-Central Institute of Agricultural Engineering, Nabibagh, Berasia Road, BHOPAL -462 038 (Madhya Pradesh)</td>
</tr>
</tbody>
</table>
## Technology No. 18

**Name of the Technology**: Dhal Mill  

**Application/ Use**: Dehusking and splitting of pulses (pigeon pea, black gram, green gram and lentil).

**Description of the Technology**:  
It is a 2 hp three phase electric motor operated equipment for dehusking and splitting of pigeon pea, black gram, green gram and lentil. It consists of carborendrum roller, feed hopper, concave and dhal outlet. The pulses to be milled are soaked in water for 30 minutes followed by drying and later on fed into the unit to achieve complete milling in two passes. The overall dimensions of the machine are 770x630x1020 mm and weight is 90 kg. The operating speed of roller is 900 rpm. The machine gives milling efficiency of 88% with broken grain in the range of 3-5%. The operating cost for pulses milling is Rs. 17/q.

<table>
<thead>
<tr>
<th>Input/raw material</th>
<th>Pulses (pigeon pea, green gram, black gram, and lentil)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Power (hp)</td>
<td>2 hp electric motor</td>
</tr>
<tr>
<td>b) Man power</td>
<td>1 man-3/hq</td>
</tr>
<tr>
<td>c) Land</td>
<td>5x5m closed room/shed</td>
</tr>
<tr>
<td>v) Output capacity</td>
<td>100 kg/h</td>
</tr>
<tr>
<td>vi) Unit cost (per machine)</td>
<td>Rs. 13,500 without motor</td>
</tr>
<tr>
<td>vii) Suitability for crop/commodity</td>
<td>Pigeon pea, black gram, green gram and lentil</td>
</tr>
<tr>
<td>viii) Efficiency</td>
<td>88%</td>
</tr>
<tr>
<td>ix) Unit cost of operation</td>
<td>Rs. 17/q</td>
</tr>
<tr>
<td>x) a) No. of Licensees</td>
<td>12</td>
</tr>
</tbody>
</table>
| x) b) Addresses of Licensees or Manufacturer | (i) M/s Yashoda Engineering  
Laghu Udyog, Shed No. 12, Sector-1, Industrial Area, Govindpura, Bhopal-462023, M.P.  
(ii) M/s Vinod Enterprises, Plot No. 104, Sector-1, Industrial Area, Govindpura, Bhopal-462023, M.P.  
(iii) M/s Shri Manak Industries  
Plot No. 70-B, Sector-H, Industrial Estate  
Govindpura, Bhopal-462023, M.P. |

**Contact Address**:  
Director  
ICAR-Central Institute of Agricultural Engineering,  
Nabibagh, Berasia Road,  
BHOPAL-462 038 (Madhya Pradesh)
Technologies /Food Grains and Oilseeds

Technology No. 19

i. Type of Technology : Pulse Mill Plant of 0.5 T/h Capacity based on the Design of CIAE Mini Dal Mill

ii. Application/ Use : Milling of various pulses for making dal

iii. Description of Technology :
It is complete dal milling plant consisting of two CIAE mini dal mills, cleaners/ graders, polishing machine, soaking machine and appropriate handling mechanisms, all being operated from a single electrical console. The mill is found very much suitable for milling of pigeon pea, however with proper arrangements and settings of the equipment, other pulses such as black gram, green gram etc. can also be milled in this plant.

iv. Input/raw material
   a. Overall dimension (L x B x H mm) : -
   b. Weight : -
   c. Prime mover : Electric motors
   d. Power (hp) : 15
   e. Man power : 4
   f. Land : 200 – 250 m²
   g. Investment : 25.00 lakh

v. Output capacity : 0.5 t/h

vi. Unit cost (plant and machinery only) : Rs. 22.00 lakh

vii. Suitability for crop/commodity : Pulses

viii. Efficiency : 96-99%, Dal recovery 75-78%

ix. Unit cost of operation : Rs. 19/kg (excluding value of by-products)

x. Patent obtained/applied : NA

xi. Commercialization status : Ready for commercialization
   a) No. of Licensees : Nil
   b) Addresses of Licensees or Manufacturer : Nil

xii. Contact Address : Research Engineer, AICRP on PHT
    Central Institute of Agricultural Engineering
    Nabibagh, Berasia Road Bhopal-462038


**Four Decades of R&D of AICRP on PHET**

**Technology No. 20**

i. **Name of Technology**: PKV Waste Fired Dryer

ii. **Application/ Use**: Drying of Grains, Pulses, Chilli, etc, using agricultural waste

iii. **Description of Technology**:

Waste fired dryer consists of three components; blower, furnace with heat exchanger and drying bin. Furnace is constructed from brick masonry and soil as mortar. Grate is provided for burning of fuel over which the heat exchanger is placed. Flue gases flow out through the chimney at top. The atmospheric air sucked by blower passes through heat exchanger where it gets heated and further enters in the plenum chamber. The drying bin with six quintals capacity is divided in two parts by inclined steel mat, the lower being plenum chamber and upper grain bin. Hot air removes grain moisture and thus drying takes place. The drying air temperature is controlled by burning the agricultural waste material in furnace under controlled rate. Electric heater can also be provided instead of furnace. The dryer can also be used for other crop produce such as cobs, grains, pods, etc.

![Image of a waste fired dryer]

iv. **Input/raw material**

   a) Overall dimension 1.35 X 1.35 X 1.00 m
   b) Weight -
   c) Prime mover 1 hp single phase electric motor
   d) Man power 1 unskilled
   e) Land 25 m²
   f) Investment Rs. 18,000/-

v. **Output capacity**

200 kg/batch of red chili in 10 sliding trays

vi. **Unit cost**

Rs. 18,000/- (including prime mover)

vii. **Suitability for crop/commodity**

Drying of chilli, grains, pulses also for drying of cobs, pods etc.

viii. **Efficiency**

Chilli dried from 73% m.c (wb) to 16 % m.c (wb)

ix. **Unit cost of operation**

Rs 42/q

x. **Contact Address**

Research Engineer, AICRP on PHET
College of Agricultural Engineering
Dr. Punjbrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, AKOLA - 444 104 (Maharashtra)
Technologies /Food Grains and Oilseeds

Technology No. 21

i  a. Name of the Technology : Straw Baler
ii  Application/ Use : To compress the straw to make bales

iii  Description of the Technology:

It is 3 hp three phase electric motor operated compression and bailing machine. During compression both sides' compression plates move forward and compress the straw in the compression chamber until automatically stopped by the timing switch. The bales are tied manually by inserting needle with wire in the start mode at the bottom, top and side portion. The compression plate is released and bales are taken out. The size of the bale prepared by this machine is 4000x800x2000 mm of 20 kg weight in the compression ratio of 3:1. The operating cost of the machine is Rs. 24/q of bales.

iv  Input/raw material : Paddy straw or locally available grasses
   a) Overall dimension : (L x B x H mm)
   b) Weight : -
   c) Prime mover : 3 phase electric motor (1440 rpm)
   d) Power (hp) : 3 hp
   e) Man power : 2 man-h/t
   f) Land : 15x5 m area
   g) Investment : Rs. 45000/-

v  Output capacity : 6-8 bales/h
vi  Unit cost (per machine) : Rs. 45000/-

vii  Suitability for crop/commodity : Paddy straw or locally available grasses

viii  Efficiency : NA

ix  Unit cost of operation : Rs. 24/ q

x  Patent obtained/applied : No

xi  Commercialization status : Ready for commercialization
   a) No. of Licensees : Nil
   b) Addresses of Licensees or Manufacturer : Not applicable

xii  Contact Address : Director
                       ICAR-Central Institute of Agricultural Engineering,
                       Nabigail, Berasia Road,
                       BHOPAL -462 038 (Madhya Pradesh)
## Technology No. 22

### i  a. Name of the Technology
- Manual Double Screen Cleaner

### ii  Application/ Use
- Suitable for cleaning of cereals and pulses

### iii  Description of the Technology:
It is a batch type hand operated equipment to replace existing traditional practices i.e. natural wind or horizontal/vertical sieving to clean the grains. It separates impurities, like stubbles, chaff, dirt, and broken of wheat, Bengal gram, soybean and other cereals and pulse crops. It consists of main frame scalper/grading screen, draper rod, handle, shutter, etc. and operated by hanging it on any elevated point with ropes. A batch of 5-10 kg is fed into the cleaner which later swings to and fro till the batch is sieved.

### iv  Input/raw material
- Cereals and pulses (wheat, Bengal gram, soybean, etc)
  
  a) Overall dimension (L x B x H mm)
  - 900x600x140 mm
  
  b) Weight
  - 17.6 kg
  
  c) Prime mover
  
  d) Power (hp)
  - Manual
  
  e) Man power
  - 0.5 man –h/q
  
  f) Land
  - 2x2 m² area
  
  g) Investment
  - Rs. 2000 with 5 sets of screen

### v  Output capacity
- 150-225 kg/h

### vi  Unit cost (per machine)
- 2000/-

### vii  Suitability for crop/commodity
- Wheat, Bengal gram, soybean and other
  - ls and pulses crops

### viii  Efficiency
- 99.0-99.8%

### ix  Unit cost of operation
- Rs 5.30/q

### x  Patent obtained/applied
- No

### xi  Commercialization status
- Commercialized
  
  a) No. of Licensees
  - 12
  
  b) Selected addresses of Licensees/ Manufacturer
  
  (i) M/s M.P.Iron Industries, Behind Zake Hotel, Quazi Camp, Berasia Road, Bhopal-462001 M.P.

  (ii) M/s Jay Kay Enterprises, Plot No. 163, C-Sector, Indrapuri, Bhopal-462022 M.P.

  (iii) M/s Vasundhara Krishi Yantra Udyog, Nishatpura, Berasia Road, Bhopal, M.P.

### xii  Contact Address
- Director
- ICAR-Central Institute of Agricultural Engineering, Nabibagh, Berasia Road, Bhopal -462 038 (Madhya Pradesh)
Technologies /Food Grains and Oilseeds

Technology No. 23

i. Name of the Technology : Mahua Seed Decorticator

ii. Application/ Use : Decortion of mahua seed

iii. Description of Technology :

The equipment consists of a rotary cylindrical drum (16 cm dia x 30 cm) with 6 nos. of wooden bars (30 cm x 2.5 cm x 2.5 cm each) fitted longitudinally along the periphery of the roller. A semicircular concave made up of 6 mm x 6 mm zigzag square bar with 9 mm gap is fitted below the roller assembly with a clearance adjustment varying from 10-20 mm. The upper half of the machine is housed with a M.S. sheet casing fitted with a hopper for feeding of the seeds. The decortion is done by compression and shear. The output capacity is 10 kg/h (batch type).

iii. Input :

a) Raw material : Mahua seed

b) Machinery :

- Overall dimension : 450 x 300 x 500 mm
- Weight : 14 kg
- Prime mover : Manually operated

c) Man power : 1 No (same person feed and rotate handle)

d) Investment : -

iv. Output capacity : 10 kg/h

v. Unit cost of operation : Rs 1.30 per kg

vi. Suitability for crops/commodity : Mahua seed

vii. Efficiency : 86.1 %

viii. Unit cost (per machine) : rs. 800/-

ix. Patent obtained/applied : -

x. Commercialization status : Transferred to tribal SHG

xi. Contact Address : Research Engineer, AICRP on PHET College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar-751 003 (Orissa)
Four Decades of R&D of AICRP on PHET

Technology No. 24

i. Name of the Technology : Small Scale Sunflower Oil Dewaxing System

ii. Application/ Use : Waxes have low solubility in oil at low temperatures, tend to crystallize and cause turbidity. Therefore, waxes in the oil are eliminated by winterization during the refining process in order to obtain completely clear oil that is not affected by low storage temperatures.

iii. Description of Technology :

The unit consists of overhead tank, water cooler (40 liter capacity), centrifugal pump (0.5 hp) and cylindrical filtration unit (12.5 cm dia x 45 cm length). The water cooler (with temperature control arrangement) is used for cooling the oil to crystallize the wax. A centrifugal pump is connected to the cooler outlet to force the oil through a cylindrical filtration unit to filter the wax. Agitators are provided to slowly rotate the oil for efficient heat transfer in overhead heating tank and cooler. The clear oil is then transferred to the cooler for cooling the oil to 10-12°C with residence time of 4 h. The temperature of oil in the cooler is maintained by a digital controller. The cooled oil after crystallization is forced through the cylindrical filtration unit for filtration of wax by centrifugal pump.

iv. Input :

a) Raw material : Sunflower
b) Machinery :

Overall dimension : 1800 x 600 x 2000 mm
Weight : 115 kg
Prime mover : Centrifugal pump 0.5 hp
Cooler  300 Watt

c) Man power : 01
d) Investment : Rs. 40,000/-

v. Output capacity : 80 l/day

vi. Unit cost of operation : Rs. 3.30/ litre

vii. Suitability for crops/commodity : Sunflower oil

viii. Efficiency : 72%

ix. Unit cost (per machine) : Rs. 35,000/-

x. Commercialization status : Ready for commercialization

xi. Contact Address : Research Engineer, AICRP on PHET
College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar- 751 003 (Orissa)
Technologies / Food Grains and Oilseeds

Technology No. 25

i Name of the Technology: Pearling of Minor Millets

ii Application/use: Pearling millets

iii Description of technology:
An abrasive type conical shaped pearler has been developed. A tapered stone roller of 23 and 15 cm diameters with 30 cm length has been fabricated. A concave is fitted over the abrasive roller, an aspirator and a cyclone to separate the dust from the milled grain. The milling unit is operated by 3 hp motor and the aspirator is operated by one HP single phase motor. The minor millets dried at 12% and pearled at 1200 rpm were found to be optimum.

iv Input
a) Raw material: Minor millets
b) Machinery
   Overall dimension: 980 x 490 x 1120 mm
   Weight: 75 kg
   Prime mover / power: Electrical motor, 3 hp motor
c) Man power: 01
   e) Investment: Rs.75,000/-

v Output capacity: 40 kg per 8 hours of operation with three passes

vi Unit cost/machine: Rs.50,000/-

vii Suitability for crops/commodity: Minor millets- Fox tail millet, little millet, common millet

viii Pearling efficiency: 70%

ix Unit cost of operation: Rs.4.5 / kg of minor millet

x Commercialization status: Commercialized
a) No. of licensees: 04
   (b) Addresses of Licensees / Manufacturer:
      • M/s. SSM Machinery and Fabrication, 43 NBC Nagar, G.N Mill (post), Coimbatore -641 029
      • M/s. Universal Agro Industries, S.F.No.374/5, Near Bimetal Bearings, Maruthamalai Road, PN Pudur, Coimbatore -641 041
      • M/s. AG Industries, 1/460, Balaji Complex, Thoppampati Pirivu, Mettupalayam Road, Coimbatore -641 031

xi Contact Address: Research Engineer, AICRP on PHET and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore -641 003
## Technology No. 26

### i. Name of the Technology
Minii Dhal Mill

### ii. Application/ Use
To split the grain legumes into dhal

### iii. Description of Technology
The dhal mill split all kinds of legumes into dhal. For making dhal all pulses have to undergo pre-milling treatments such as soaking in water, mixing with oil, drying, etc. It consists of a hopper to hold the pulse, an auger to feed the pulse to the dehusking chamber. In the dehusking chamber pulses flow between a rotating cast iron disc and a stationary rubber pad and get dehusked. Depending upon the size of the pulse, the clearance between the rotating disc and the rubber disc can be adjusted with the help of a hand wheel provided outside the dehusking chamber. By replacing the rubber disc with cast iron serrated disc, this can be used for pulverizing the dry grains into flour. The overall dimension of the unit is 385 x 365 x 865 mm.

### iv. Input/raw material
- Red gram, Green Gram, Bengal Gram, Black Gram
  - a) Power: One hp single phase electric motor
  - b) Man power: 01
  - c) Investment: Nil

### v. Output capacity
20 kg/h

### vi. Unit cost (per machine)
Rs.13, 000/-

### vii. Suitability for crops/commodity
Legumes

### viii. Efficiency
-

### ix. Unit cost of operation
Rs.5/h

### x. Patent obtained/applied
No

### xi. Commercialization status
Commercialized
- (a) No. of Licensees: 5 (Farmer –cum-Processor/ Entrepreneur)
- (b) Selected Addresses of Licensee / Manufacturer:
  1. M/s. Valampuri Industries, New Thillai Nagar, Behind Bimetal Bearings, PN Pudur, Coimbatore
  2. M/s. AG Industries, 1/460 Balaji Complex, Thoppampati Pirivu, Mettupalayam Road, Coimbatore - 641 031
  3. M/s. SSM Machinery and Fabrication, 43, NBC Nagar, G.N Mill (post), Coimbatore -641 029
  4. M/s. Universal Agro Industries, S.F.No.374/5, Near Bimetal Bearings, Maruthamalai Road, PN Pudur, Coimbatore- 641041

### xii. Contact Address
Professor and Head,
Agricultural Machinery Research Centre,
Tamil Nadu Agricultural University,
Coimbatore - 641 003.
Phone: 0422- 6611272; FAX: 0422-6611455;
e-mail: processing@tnau.ac.in
Technologies /Food Grains and Oilseeds

**Technology No. 27**

i. **Name of the Technology**: Household Paddy Parboiling Unit

ii. **Application/ Use**: To parboil paddy uniformly at household/farm level

iii. **Description of Technology**

   The parboiling drum is made of galvanized iron sheet of 20 gauge thickness with a lid. The drum is divided into three equal portions. The top two-third portion retains paddy for parboiling and bottom one-third portion holds water to produce steam for parboiling. A perforated slanting sheet with perforated pipes separates the steam chamber from parboiling chamber. The lateral perforated pipes attached to the main steam pipe divides the entire parboiling chamber into a number of small compartments and helps for uniform and simultaneous parboiling of paddy. Perforated sloping floor helps for natural unloading of parboiled paddy. The water in the drum can be heated by burning firewood or any agricultural waste. After the completion of parboiling, the remaining hot water can be used for next batch.

### iv. Input/raw material

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall dimension</td>
<td>-</td>
</tr>
<tr>
<td>Weight</td>
<td>-</td>
</tr>
<tr>
<td>Prime mover</td>
<td>-</td>
</tr>
<tr>
<td>Power</td>
<td>5 kg of firewood/batch</td>
</tr>
<tr>
<td>Man power</td>
<td>02</td>
</tr>
<tr>
<td>Investment</td>
<td>Rs. 13,000/-</td>
</tr>
</tbody>
</table>

### v. Output capacity

- 125 kg/ batch

### vi. Unit cost (per machine)

- Rs.10,000/-

### vii. Suitability for crops/commodity

- Paddy

### viii. Efficiency

- 92%

### ix. Unit cost of operation

- Rs.10 /h

### x. Patent obtained/applied

- No

### xi. Commercialization status

(a) No. of Licensees
   - Farmer—cum-Processor/ Entrepreneur
(b) Selected Addresses of Licensee / Manufacturer
   - Nil

### xii. Contact Address

- Professor & Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore -641 003.
- Phone: 0422-661 1272; FAX: 0422-6611455;
- e-mail: processing@tnau.ac.in
Technology No. 28

i. **Name of the Technology** : Household Insect Trap

ii. **Application/ Use** : To remove insects from stored grains

iii. **Description of Technology** :
The basic characteristics of the stored product insects, viz., affinity towards air, tendency to move towards aerated region, wander in the grain and active during dusk and dawn have been exploited in the development of the trap. The stored grain insects, like red flour beetle, saw toothed beetle, rice weevil, paddy moth, turmeric beetle, drug beetle, pulse beetle, groundnut bruchid, dermestid beetles, flat grain beetles, etc with the behavior of wandering in the bulk grain, reach the insect trap. These insects enter the trap through the perforations and reach the stem of the trap. In the stem, as the insects cannot move upward and escape, they move towards the bottom and reach the pit fall placed at the bottom.

iv. **Input/raw material** :
   a) Overall dimension : -
   b) Weight : -
   c) Prime mover : -
   d) Power : -
   e) Manpower : -
   f) Investment : Nil

v. **Output capacity** : Suitable for storage bin holding up to 25-50 kg

vi. **Unit cost (per machine)** : Rs.75/-

vii. **Suitability for crops/commodity** : Cereals, pulses and Oil seeds

viii. **Efficiency** : More than 85% insect control

ix. **Unit cost of operation** : NA

x. **Commercialization status** : Commercialized
   (a) No. of Licensees : 01
   (b) Address of Licensee /Manufacturer
       M/s. K.S.N.M Marketing, Hallmark Arpee Centre, 320 N, NSR Road, Saibaba Colony, Coimbatore -641 011

xi. **Contact Address** : Professor and Head,
   Agricultural Machinery Research Centre,
   Tamil Nadu Agricultural University,
   Coimbatore -641 003.
   Phone: 0422-6611272; FAX: 0422-6611455;
   e-mail: processing@tnau.ac.in
Technologies /Food Grains and Oilseeds

Technology No. 29

i. **Name of the Technology**
   : Groundnut Kernel Testa Remover

ii. **Application/ Use**
    : Groundnut kernels after removing testa can fetch higher prices in the market. Dairy analogues (milk, curd, paneer, etc.) from groundnut can be prepared after removing testa. Removal of testa with hand is costly and time consuming process.

iii. **Description of Technology:**
   Groundnut has an outer thick woody shell. Inside, normally there are 2 or 3 embedded seeds (kernel). The seed consists of 2 cotyledons and the germ covered by an outer thin skin called the testa (red, brown, purple or white color depending upon the variety). Testa constitutes about 4 to 5 percent of the weight of the kernel. The cotyledons constitute the bulk of the seed in the range of around 92 to 94 percent of the weight. The germ constitutes around 3 to 4 percent of the seed weight. Consumers preferred to take groundnut without testa and probably ready to pay higher prices. Presently entrepreneurs are removing testa with hand which is time consuming process. The groundnut testa remover mainly consists of three units, viz., feeding, shelling and cleaning. The shelling unit was tested and constructed as per BIS NO.8824-1977. The coefficient of wholeness is more important than coefficient of hulling for increasing the shelling efficiency. The capacity of the machine is 40 kg/h. The processing cost of machine was calculated rs.0.45 /kg.

iv. **Input**
   a. **Raw material**
      : Groundnut
   b. **Machinery**
      : Overall dimension : 1340 x 1220 x 600 mm.
      : Weight : 119 kg.
      : Prime mover : Electric Motor
   c. **Power**
      : 0.5 hp.
   d. **Man power**
      : 2
   e. **Land**
      : 12 x 10 ft.
   f. **Investment**
      : Rs. 35,000

v. **Output capacity**
   : 40 kg/h

vi. **Unit cost (per machine)**
   : Rs. 35,000

vii. **Suitability for crops/commodity**
    : Groundnut

viii. **Efficiency**
     : Shelling efficiency 66.68%”

ix. **Unit cost of operation**
    : Rs. 17 / h or Rs. 0.45 per kg.

x. **Commercialization status**
   : Ready for commercialization

xi. **Contact Address**
    : Research Engineer
    : AICRP on PHET,
    : College of Agricultural Engineering,
    : Jawaharlal Nehru Krishi Viswa Vidyalaya Jabalpur-482 004 (MP)
Technology No. 30

i  Name of the Technology : Single Drum Rotary Screen Grain Pre-cleaner

ii Application/ Use : Cleaning of grain prior to procurement in the grain market

iii Description of Technology :

The pre-cleaner basically consists of replaceable perforated rotary screen, a blower and a perforated vibratory discharge chute. All these parts are mounted on an angle iron frame which is supported on cast-iron wheels. The pre-Cleaner uses 1.5 hp electric motor. Power to the rotary screen is transmitted from the blower shaft. The single screen precleaner can be equipped with vibrating screens and work as grader with the capacity from 12 to 15 quintals per hour for wheat.

iv Input/raw material :
  a) Overall dimension  :  1.525 mm x 1.115 mm x 1.730 mm
  b) Weight  :  100 Kg
  c) Prime mover  :  Electric motor
  d) Power  :  1 kWh
  e) Man power  :  2
  f) Land  :  100 sq m
  g) Investment  :  Rs. 70,000/-

v  Output capacity  :  12 – 15 q/h

vi Unit cost (per machine)  :  Rs. 70,000/-

vii  Suitability for crops/commodity  :  Wheat and paddy

viii Efficiency  :  95%

ix  Unit cost of operation  :  Rs 0.25 /q

x  Patent obtained/applied  :  Nil

xi Commercialization status :
  (a) No. of Licensees to whom the technology has been transferred  :  01
  (b) Selected Addresses of Licensee or Manufacturer  :  M/s Hindsons Pvt Ltd. The Lower Mall, Patiala (Punjab)

xii Contact Address  :  Research Engineer, AICRP on PHET
  Department of Processing and Food Engineering,
  College of Agricultural Engineering Punjab Agricultural University Ludhiana-141004 (Punjab)
**Technologies /Food Grains and Oilseeds**

**Technology No. 31**

i **Name of Technology**: Chulha for Grain Puffing Machine

ii **Application**: *Chulha* for grain puffing machine for better/easy transportation and demonstration of the grain puffing machine. This saves tremendous amount of time, labour and money consumed in building new *chulha* at each site for each demonstration/use of grain puffing machine.

iii **Description of Technology**:
A useless metal drum of dia. 572 mm was cut at a height of 562.5 mm from the bottom. A passage was provided for the outlet of the puffing machine. A cut of size 235x200 mm was also made neat the bottom side of drum for firing the waste material in *chulha*. Two holes were provided for smoke exhaust and two conduit pipes of 25.4 mm dia. were fitted vertically into the smoke exhaust holes for proper exhaust of smoke in the air. Two cowl for chimneys (conduit pipes) were designed, fabricated and fitted to arrest the rain water. Three handles were also riveted outside the body of the drum for easy handling and transportations of whole assembly. To maintain a height of 190 mm from ground, three stands were provided. After fabricating the whole *chulha*, puffing machine was placed inside the drum keeping its outlet outside the drum. All the three legs of the machine were welded with the bottom of the *chulha*. Finally *chulha* was constructed with the help of bricks and mud to seal the machine inside the fabricated drum permanently.

iv **Input/raw material**

| a. Overall dimension (L x b x h), mm | Hardware material (M.S. Sheet, Angle, Flat, Rod, Pipe etc.) |
| b. Weight, kg | Diameter – 572mm, Height from ground – 190 + 563 mm |
| c. Prime mover, hp | NA |
| d. Man power | 1 skilled worker |
| e. Investment | Rs. 4000/- |

v **Output capacity**: Not applicable

vi **Unit cost (per machine)**: Rs. 4000/-

vii **Suitability for crop/commodity**: For puffing of paddy, rice, maize, peas, gram etc. in grain puffing machine encompassed in newly designed chulha

viii **Efficiency**: 85-90%

ix **Unit cost operation**: Rs. 0.50/kg.

x **Commercialization status**: Ready for commercialization

xi **Contact Address**: Sr. Research Engineer, AICRP on PHET Faculty of Agricultural Engineering, Rajendra Agricultural University, PUSA (SAMASTIPUR) –848125 (BIHAR)
Four Decades of R&D of AICRP on PHET

Technology No. 32

i. **Name of the Technology**
   - Process Variables for Maize Seed Processing

ii. **Application**
   - Maize is a very important crop of Bihar, which is grown round the year in this region. Seed processing is not only essential for proper harvesting, threshing, drying, cleaning and grading but also help in improvement of the seed quality called “value addition” through gravity separation, separation of weeds and diseased seeds, coating, colouring etc. It is also important in up-gradation of substandard seed lots, minimizing mechanical damage, seed extraction etc

iii. **Description of Technology**
   - Technology has been developed for gravity separation of graded maize seeds of five varieties namely *Laxmi*, *Deoki*, *Suwan*, *Shaktiman* – I and *Cargil* using Lab. model of specific gravity separator with different feed rates and oscillating deck speeds. There was a maximum recovery of grade III seeds (44.850 – 79.525%) among all fractions followed by grade II seeds and light seeds in that order in all varieties.

iv. **Input/ raw material**
   - **a. Overall dimensbn (L x b x h), mm**
     - Depending upon the model of separator employed for processing
   - **b. Weight, kg**
     - Depending upon the model of separator employed for processing
   - **c. Prime mover, hp**
     - 1.0 hp for Fan and 0.5 hp for Deck for 100kg/h capacity model of AGROSAW specific gravity separator
   - **d. Man power**
     - 1 or 2 skilled worker
   - **e. Investment**
     - Depending upon the model of separator employed for processing

v. **Output capacity**
   - Ranging from 75 kg/h to 4000 kg/h depending upon the model of cleaner-cum-grader

vi. **Unit cost (per machine)**
   - Approx. Rs. 1,30,000/- for AGROSAW specific gravity separator of 100 kg/h capacity.

vii. **Suitability for crop/commodity**
   - For Maize and other crops

viii. **Efficiency**
   - 90%

ix. **Unit cost of operation**
   - -

x. **Commercialization status**
   - Technology ready for commercialization or transfer to farmers/processors

xi. **Contact Address**
   - Sr. Research Engineer, AICRP on PHET
     - Faculty of Agricultural Engineering,
     - Rajendra Agricultural University,
     - Pusa (Samastipur) – 848125 (Bihar)
## Technologies /Food Grains and Oilseeds

### Technology No. 33

**i. Name of the Technology**: Tungabhadra Winnower

**ii. Application/ Use**: This is basically a winnowing fan for generating wind for cleaning of grains from chaff that can be operated using manual/electric/IC engine power depending upon available power source. This avoids the need for keeping the labour idle when no wind is blowing if winnowing is carried out manually on natural wind.

**iii. Description of Technology**:

This is a mechanical device consisting of a frame, 3-4 fan blades (1000-1250mm) fixed on the hub, an axle, bicycle pedal drive arrangement with seat, pulley belt transmission system and a grill partition. A pedal and chain transmission assembly for manual power and a pulley and belt arrangement for electric motor / IC engine power are provided to transmit the rotary motion to the fan blade assembly. An operator can easily generate the air flow with a velocity to clean the grains from chaff. Hundreds of such machines in different versions are being manufactured in local workshops and sold in Tungabhadra command area. Now it is spreading to other areas also.

**iv. Input/raw material**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Overall dimension</td>
<td>1610 x 840 x 1790</td>
</tr>
<tr>
<td>b) Weight</td>
<td>75 kg</td>
</tr>
<tr>
<td>c) Prime mover/ Plant &amp; Machinery</td>
<td>Nil</td>
</tr>
<tr>
<td>d) Man power</td>
<td>One or two persons</td>
</tr>
<tr>
<td>e) Investment</td>
<td>Rs. 3,500/-</td>
</tr>
</tbody>
</table>

**v. Output capacity**

500-600 kg per hour

**vi. Unit cost (per machine)**

Rs. 3,500/-

**vii. Suitability for crops/commodity**

All kinds of cereals, Pulses, Millets and oil seeds winnowing.

**viii. Efficiency**

90 – 95 %

**ix. Unit cost of operation**

Rs. 20/hour

**x. Commercialization status**

(a) No. of Licensees to whom the technology has been transferred

Commercialized

One fabricator

**xi. Contact Addresses**

Sr. Scientist & PI, AICRP on PHET
Dept. of Processing and Food Engineering,
College of Agricultural Engineering, UAS, Raichur.
Technology No. 34

i. **Name of the Technology** : Improved Groundnut Decorticator

ii. **Application/ Use** : Groundnut decortication is an important post harvest activity in this crop, in which rural women are involved as the main labour force. The developed technology helps to shell the groundnut pods and separate the kernels more efficiently. This equipment has become a boon to the farmers for its higher efficiency and drudgery reduction.

iii. **Description of Technology**:
It consists of an oscillating sector with sieve bottom and a handle. Several cast iron peg (shoes) assemblies are fitted in the oscillating sector unit. The groundnut pods are shelled between the oscillating sector and the fixed perforated concave screen. The decorticated shells and kernels fall down through the perforated concave sieve. The kernel and husk are collected at the bottom of the unit and separated annually. The advantages of the developed technology are; Clearance between the concave and oscillating sector is adjustable to suit the different varieties, Concave sieves are also replaceable depending upon pod size, The oscillating sector of the unit is fixed with an offset to the axis of the trough for effective rubbing action. The efficiency of the unit is 98%.

<table>
<thead>
<tr>
<th>iv. <strong>Input/raw material</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Overall dimension</td>
<td>1170 x 900 x 370 mm</td>
</tr>
<tr>
<td>b) Weight</td>
<td>32 kg</td>
</tr>
<tr>
<td>c) Prime mover/ Plant &amp; Machinery</td>
<td>Bending machine, welding machine</td>
</tr>
<tr>
<td>d) Man power</td>
<td>One person</td>
</tr>
<tr>
<td>e) Power</td>
<td>Manual</td>
</tr>
<tr>
<td>f) Investment</td>
<td>Rs.2,500 / -</td>
</tr>
</tbody>
</table>

| v. **Output capacity** | 50 kg per hour |
| vi. **Unit cost (per machine)** | Rs. 3,500/- |
| vii. **Suitability for crops/commodity** | Ground nut |
| viii. **Efficiency** | 90-95% |
| ix. **Unit cost of operation** | Rs 0.65-0.75 per kg |
| x. **Commercialization status** | Commercialized |
| a) No. of Licensees to whom the technology has been transferred | 45 Farmers and One fabricator |

xi. **Contact address** : Sr. Scientist & PI, AICRP on PHET Dept. of Processing and Food Engineering, College of Agricultural Engineering, UAS, Raichur.
Technologies / Food Grains and Oilseeds

Technology No. 35

i. **Name of the Technology** : Solar Heat Treatment Machine

ii. **Application/ Use** : The machine has utility in physical control of stored grain insect pests by killing all stages through exposure to a lethal temperature for a particular duration. It has potential for replacement of insecticides and other chemicals used for killing the stored grain insect pests.

iii. **Description of Technology**:

   The insecticides and other chemicals used for killing the stored grain insect pests have their residual effects on grains and sometimes become hazardous for human health. A machine with black body absorber at focal line of parabolic reflector, a screw auger and a hopper was developed to kill all stages of insect pests physically. The augur is rotated manually and has been designed such that the grains reach to the outlet in 2 minutes. The temperatures of black body and grains at outlet point rises up to 85 to 127 and 50 to 70 °C, respectively. All cereals, pulses and oil seeds can be disinfected, further the treatment is fully effective against all stages of insect pests i.e. egg, larva, pupa and adult with 100 percent mortality.

iv. **Input/ raw material**
   a) **Overall dimension** : 2750 mm x 1100 mm x 1650 mm
   b) **Weight** : 40 kg

c) **Prime mover** :

d) **Plant & Machinery** : Solar heat treatment machine, sack holder

   e) **Power** : Solar energy

   f) **Man power** : 1 unskilled labour

   g) **Land** : 50 Sqm

   h) **Investment** : Rs 20,000/-

   i) **Operational efficiency** : 100%

vii. **Output capacity** : 40-50 kg/hr

viii. **Unit cost (per machine)** : Rs 20,000/-

ix. **Suitability for crops/commodity**
   - Cereals, pulses and oil seeds

x. **Unit cost of operation** : Rs 25 per quintal

xi. **Commercialization status**
   a) **No. of Licensees to whom the technology has been transferred** : One SHG entrepreneur has adopted.

   b) **Selected Addresses of Licensee or Manufacturer**
      1. M/s Kalpana Enterprises.
         N.B. Complex, Pratap Nagar, Udaipur-1

xii. **Contact address** : Research Engineer, AICRP on PHET

   College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur- 313 001 (Rajasthan)
Technology No. 36

i. **Name of the Technology**: Multi Grain Mill

ii. **Application/ Use**: Multipurpose use as dhal milling, grain polishing/pearling, deawning of seed spices

iii. **Description of Technology**:
A 75 kg/hr multi mill has been developed for multiple uses viz. dhal milling, grain pearl/ polishing and deawning of coriander. The machine consists of an abrasive tapered roller, an aspirator, separation sieve box, mixer/conveyor, oil/water tank and a motor. The unit can be utilized for grading of grains and imparting oil/water pretreatment.

<table>
<thead>
<tr>
<th><strong>Input</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) <strong>Raw material</strong></td>
<td>Pulses, grains, coriander</td>
</tr>
<tr>
<td>b) <strong>Machinery</strong></td>
<td></td>
</tr>
<tr>
<td>Overall dimension</td>
<td>1200 x 900 x 1800 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>220 kg approx</td>
</tr>
<tr>
<td>Prime mover</td>
<td>Electric motor – single phase</td>
</tr>
<tr>
<td>c) <strong>Power</strong></td>
<td>2 hp</td>
</tr>
<tr>
<td>d) <strong>Man power</strong></td>
<td>one</td>
</tr>
<tr>
<td>e) <strong>Investment</strong></td>
<td>50000/</td>
</tr>
</tbody>
</table>

iv. **Output capacity**: 75 kg/h

v. **Unit cost (per machine)**: Rs. 50000/-

vi. **Suitability for crops/commodity**: Pigeon pea milling, wheat and maize pearl and coriander deawning / debearding

vii. **Efficiency**:
- Pigeon pea milling: 76%, maize pearl: 91-93%, wheat pearl: 93-96%, coriander deawning: 82%

viii. **Unit cost of operation**: Rs 100/q for dhal milling and Rs 70/q for deawning and pearl/ polishing

ix. **Commercialization status**
(a) No. of Licensees to whom the technology has been transferred: No

x. **Contact Person**: Research Engineer, AICRP on PHET
College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur-313 001 (Rajasthan)
Technologies /Food Grains and Oilseeds

Technology No. 37

i. Name of the Technology : Maize Dehusker-Sheller

ii. Application/ Use : The machine has application for dehusking and shelling of maize cobs simultaneously in single pass. It has utility for growers and seed industries.

iii. Description of Technology :
   It is a common practice to manually dehusk the maize cobs and shell after drying using power sheller/manual methods. This practice require more time and labour. The machine was developed for simultaneous dehusking and shelling of maize cobs in single pass. The main part of the machine is a cylinder, on whose periphery square cross section MS lugs and helical flights are welded for facilitating the desired operation & material movement. A perforated concave below the cylinder helps the maize kernels to pass through. The blower helps in cleaning off the grain and blow away the light maize sheath. The cob heart stem & maize sheath are discharged from the tail end of the cylinder and fall on the opposite side of trough, along which grains are collected. The Government of India has declared a subsidy equal to 25% of the cost on purchase of this machine. The machine has been field evaluated at many locations. Approx. 20 machines have been supplied.

iv. Input/raw material :
   a) Overall dimension : 2150 mm x 1140 mm x 1650 mm
   b) Weight : 300 kg
   c) Prime mover : Electric motor
   d) Plant & Machinery : Maize dehusker with motor-starter and trolley frame
   e) Power : 5 hp, 3 phase electric motor
   f) Man power : 3 unskilled labours
   g) Investment : Rs 80,000/=  
   h) Operational effi.: 75-80%

v. Output capacity : 800 kg cobs/hr

vi. Unit cost of operation : Rs 48,000/- (without motor)

vii. Suitability for crops/commodity : Maize

viii. Efficiency : Dehusking - 99 ; Shelling 97-98 % without any broken

ix. Unit cost (per machine) : Rs 15/q of grain

x. Commercialization status :
   a) No. of Licensees to whom the technology has been transferred : Three entrepreneur have started production
   b) Selected Addresses of Licensee / Manufacturer : M/s Nakoda Fabricators Glass Factory, Khempura Road, Udaipur – 313 001

xi Contact Person : Research Engineer, AICRP on PHT College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
Process Protocols and Products

Technology No. 38

i. Name of the Technology : Mahua Flower Beverages

ii. Application/ Use : Ready to Serve beverage, Squash, jam

iii. Description of Technology :

After removal of stigma from the dried flower it was cooked with water for 10 minutes. The pulp from the cooked mahua flower was prepared by wet grinder and utilized for preparation of jam and the clarified juice obtained after straining was used for preparation of ready to serve beverages.

iv. Input/raw material
   a) Prime mover : -
   b) Investment : -

v. Output capacity :

vi. Unit cost
   : Ready to Serve : Rs. 5.00/- per 200 ml glass bottle
      Squash : Rs. 15.00/- per 750 ml glass bottle
      Jam : Rs. 20.00/- per 500g glass jar

vii. Suitability for crops/commodity : Mahua

viii. Unit cost of operation : -

ix. Commercialization status
   (a) No. of Licensees : Ready for commercialization
                        Nil

x. Contact Address : Research Engineer, AICRP on PHET
                    College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar-751 003
### Technology No. 39

i. **Name of the Technology**: Utilization of Paddy Soaked for Days under Flood Water

ii. **Application/ Use**: Prevent loss of paddy due to flood

iii. **Description of Technology**:

   Paddy soaked under flood water up to 5 days should be washed for 2 minutes by hot water (60°C) in a cauldron. Water is drained using siphon technique leaving 10 cm depth of water at the cauldron bottom. Paddy is steamed up to the point of husk splitting, unloaded and dried.

iv. **Input/raw material**

   a) **Prime mover/Plant & Machinery**: Cauldron & steaming device with lid.

   b) **Power**: Wood & other agro-waste

   c) **Man power**: One

   d) **Investment**: Rs. 500/-

v. **Output capacity**: 30 kg per batch

vi. **Unit cost**: Rs. 30/- per batch

vii. **Suitability for crops/commodity**: Paddy

viii. **Unit cost of operation**: -

ix. **Commercialization status**

   a) **No. of Licensees to whom the technology has been transferred**: Nil

   b) **Selected Addresses of Licensee or Manufacturer**: Nil

x. **Contact Address**: PI and RE, AICRP on PHET Deptt. of Agril Enng Assam Agricultural University, Jorhat-13
Technology No. 40

i. **Name of the Technology**: Storage of Mechanical Damaged Grains using Castor Oil and Stored in Metal Bin.

ii. **Application/ Use**: To store of mechanical damaged grain for food as well as seed purpose.

iii. **Description of Technology with photograph attached**

   Generally farmers adopt combine harvester for harvesting wheat crop. It results in damaged grain. Storage of damaged grain is a problem due to insect infestation. Castor oil with 15ml/kg quantity can be used for 9% damaged grain in a lot for the storage upto 8 month in metal bin with 3% grain damage due to infestation and 90% germination.

iv. **Input/raw material**
   
   a. **Process**: Wheat grains after 8 month of storage with 15 ml/kg castor oil treatment and stored in metal bin

v. **Output capacity**: -

vi. **Unit cost**: Rs. 0.90/kg

vii. **Suitability for crop/commodity**: Wheat

viii. **Unit cost of operation**: Rs. 0.90/kg

ix. **Contact Address**: Research Engineer, AICRP on PHET

   Department of Processing & Food Engg.

   College of Agril. Engg. & Technology

   Junagadh Agricultural University

   Junagadh -362001

   Phone: 0285-2672080-90 Ext 479
Technologies /Food Grains and Oilseeds

Technology No. 41

i. Name of the Technology : Extrusion Technology (Peanut blended)

ii. Application/ Use : This extrusion technology has been used to produce a wide variety of food products including snacks, ready to eat cereals, confectioneries, texturized, extruded crisp breads and pet food products.

iii. Description of Technology :
In this technology, a single screw extruder is used with various dies for production of different types of peanut blended products. Partially defatted peanut flour (PDPF) was mixed with wheat, maida, rice and chickpea in different proportion and extruded products were developed. The optimum extrusion conditions for the preparation of extruded products should be 25% PDPF.

iv. Input/raw material : Raw materials: Peanut, wheat, maida, rice and chickpea flour

   a) Plant & Machinery Rs. 25 lakh
   b) Man Power 02
   c) Investment Rs. 30 lakh

v. Output capacity : Maida extruded products were best extruded products followed by rice, chickpea and wheat

vi. Unit cost : -

vii. Suitability for crops/commodity : Peanut & other cereals and pulses

viii. Unit cost of operation : -

ix. Commercialization status : Ready for commercialization

(a) No. of Licensees to whom the technology has been transferred : Nil

(b) Selected Addresses of Licensee/Manufacturer and Contact addresses : Nil

x. Contact Address : Professor and Research Engineer, AICRP on PHET College of Agricultural Engineering, Junagadh Agricultural University, Junagadh-362 001 (Gujarat)
**Technology No. 42**

i. **Name of the Technology** : Extrudates of Minor Millets

ii. **Application/ Use** : Extrusion cooking produce expanded ready-to-eat crispy products which can provide people with nutrients in the required quantity. Millets are highly nutritious, non-glutinous and non-acid forming foods.

iii. **Description of Technology** :

   Based on organoleptic and overall acceptability scores, the extrudates prepared with the combination of 25 per cent *kodo/kutik* and 75 per cent maize along with 10 per cent fortification of soy floor is liked very much by the panelists. The highest expansion of extrudates is obtained at 15 per cent moisture content of feed in case of *kodo* based extrudates and 12 per cent in case of *kutki* based extrudates.

iv. **Input/raw material** :
   - a) Plant & Machinery : Wenger X-5 extruder
   - b) Man power : 3
   - c) Power : -
   - d) Investment : Rs. 30 lakh

v. **Output capacity** : 10 kg extruded product/h

vi. **Unit cost** : Rs. 120/kg

vii. **Suitability for crops/commodity** : Minor millets

viii. **Unit cost of operation** : -

ix. **Commercialization status** :
   - (a) No. of Licensees to whom the technology has been transferred : Nil

x. **Contact Address** : Research Engineer, AICRP on PHET
   Department of Agricultural Engg,
   Indira Gandhi Krishi Vishwa Vidyalaya
   Raipur -492012 (Chhattisgarh)
Technologies /Food Grains and Oilseeds

Technology No. 43

i. Name of the Technology : Process for Quick Cooking Maize Rab Powder

ii. Application/ Use : The simple process technology developed has application for popularizing rab as quick cooking product.

iii. Description of Technology :
Rab is an ethnic product made by cooking maize grits in sour butter milk and used as a soup/appetizer and even as meal in hot and cold form by all class of people. A process has been developed and standardized for making instant rab powder. Traditionally rab is prepared in 2-3 h, but with the use of instant powder it can be prepared in 10-12 minutes, facilitating in adoption of product in fast moving urban and city conglomerates with ethnic taste. The process consists of pearling, soaking, boiling, drying and size reduction unit operations. The product has been found acceptable and generated alot of interest among individuals/caterers/hoteliers.

iv. Input/raw material :
   a) Prime mover : NA
   b) Plant & Machinery : Cleaner, pearler, pressure cooker, dryer, pulveriser
   c) Power : 3 hp 3 phase power connection
   d) Man power : 02 (unskilled)
   e) Investment : Rs 2,00,000/-

v. Output capacity :

vi. Unit cost (per machine) : NA

vii. Suitability for crops/commodity : Maize

viii. Efficiency :

ix. Unit cost of operation : Rs 7-8/ kg


xi. Commercialization status :
   a) No. of Licensees to whom the technology has been transferred : NA

xii. Contact address : Research Engineer, AICRP on PHET College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
Horticultural Crops
Machinery/ Tools/ Equipments
Technology No. 44

i Name of the Technology : PKV Chilli Seed Extractor

ii Application/ Use : Extraction of seeds from dried red chilli pods

iii Description of Technology :
Chilli is grown on about 58,700 ha in Vidharbha, which requires about nine tones chilli seed for raising seedling. Presently the chilli seed is extracted by filling in bags and beating with wooden sticks. This is a tedious method. Inhalations of fine particles result in continuous sneezing and irritation of labor's body. Due to this, it is difficult to get the labor for this operation. The problem becomes more severe on large scale i.e. in seed processing plants, seed companies, etc. This method has low output and efficiency. To avoid this drudgery, a chilli seed extractor was developed with 100-125 kg/h capacity operated by 2.0 hp single phase electric motor. The recovery of seed from chilli fruits is about 94-99% at 9-10% m.c. (wb) with no deterioration on seed germination. It being a closed system minimizes the sneezing and body irritation. The cost of machine is Rs. 43000/-. The unit is commercially available.

iv Input/raw material : Red dried chilli
   a. Overall dimension : 1.42 X 2.44 X 1.78 m
   b. Weight : 413 kg
   c. Prime mover : 2 hp single phase electric motor
   d. Man power : 1 skilled and 1 unskilled
   e. Land : 25 m²
   f. Investment : Rs. 43,000/-

v Output capacity : 100-125 kg/h

vi Unit cost : Rs. 43,000/- (including prime mover)

vii Suitability for crop/commodity : Dried chilli pod

viii Efficiency : 94-99% seeds from chilli fruits (at 9-10%m.c (wb))

ix Unit cost of operation : 64 Rs/q

x a) No. of Licensees : 01
   b) Addresses of Licensees or Manufacturer : 1. YMB Agri Machineries, W/37-38, Phase 3 MIDC Akola (MS) (M) 09850303202 (O) 0724-2258184

xi Contact Address : Research Engineer, AICRP on PHET
College of Agricultural Engineering
Dr. Punjabrao Deshmukh Krishi Vidyapeeth,
Krishi Nagar, AKOLA -444 104 (Maharashtra)
Technologies /Horticultural Crops

Technology No. 45

i Name of the Technology : PDKV Fruit Grader

ii Application/ Use : Grading of spherical fruits

iii Description of Technology :
The roller type fruit grader having four pairs of rollers (PVC pipes) of 100 mm diameter and 1500 mm length rotating (opposite and outward) at 80 rpm with adjustable diverging gap between each pairs of roller has been developed. The grader is useful for grading Nagpur mandarin, Sweet lime and sapota (spherical varieties) into 3 to 4 grades with 70 to 85 % grading efficiency.

iv Input/raw material :
a. Overall dimension : 2.30 X 1.50 X 1.50 m
b. Weight : 365 kg
c. Prime mover : 1 hp single phase electric motor
d. Man power : 2 unskilled
e. Land : 25 m²
f. Investment : Rs. 57,500/-

v Output capacity : 10 - 12 tonnes/day

vi Unit cost : Rs. 57,500/- (including prime mover)

vii Suitability for crop/commodity :
Grading of spherical fruits (Mandarin, sweet lime and sapota)

viii Efficiency : 70-80% grading efficiency (3 to 4 grades)

ix Unit cost of operation : 40 Rs/q

x Contact Address : Research Engineer, AICRP on PHET
College of Agricultural Engineering
Dr. Punjabrao Deshmukh Krishi Vidyapeeth,
Krishi Nagar, AKOLA-444 104
(Maharashtra)
Technology No. 46

i Name of the Technology : Solar Cabinet Dryer

ii Application/ Use : Drying of perishables, semi-perishables and wet processed food materials

iii Description of the Technology:
It is equipment for drying of high moisture perishable, semi-perishable and wet processed food material using solar energy. It is suitable for drying chilly, cauliflower, leafy vegetable, pea, potato chips etc. with reduced drying time because of aspirator. It consists of wooden cabinet, glass covers, aspirator, etc. The overall dimension of the machine is 2210x1130x980 mm and weight is 125 kg. The dryer can accommodate four number of drying trays.

iv Input/raw material : Vegetables, viz., chilly, potato chips, cauliflower, leafy vegetable etc.
   a) Man power : Manually operated for loading & unloading of material
   b) Land : 8x4 m plateform/open space
   c) Investment : Rs. 8500/

v Output capacity : 3-5 kg/batch

vi Unit cost (per machine) : Rs. 8,500/

vii Suitability for crop/commodity : Chilly, cauliflower, leafy vegetable, pea, potato chips

viii Efficiency : Thermal efficiency is 50%.

ix Unit cost of operation : Rs. 75/q

x Patent obtained/applied : No

xi Commercialization status : Commercialized

   a) No. of Licensees : 12

   b) Selected addresses of Licensees/ Manufacturers

      (i) M/s Agro Fab Engg. Enterprises, 1, Jogipura, Near Thana Talayya, Bhopal –462001 M.P.

      (ii) M/s Vinod Enterprises, Plot No. 104, Sector-1, Industrial Area, Govindpura, Bhopal –462023, M.P.

      (iii) M/s Yashoda Engineering, Laghu Udyog, Shed No. 12, Sector–1, Industrial Area, Govindpura, Bhopal –462023, M.P.

xii Contact Address : Director
                     ICAR-Central Institute of Agricultural Engineering, Nabibagh, Berasia Road, BHPAL -462 038 (Madhya Pradesh)
Technology No. 47

I Name of the Technology : Turmeric Slicer

ii Application/ Use : Slicing/cutting of turmeric rhizomes, potato, ginger into slices of desired thickness

iii Description of Technology :
The power operated turmeric cutting cum slicing machine has been developed using locally available materials as shown in Plate 3.1. The machine consists of the feeding unit, slicing mechanism, driving mechanism, frame and the housing. Centrifugal action principle with fix SS blade is adopted. The washed turmeric rhizomes fed through hopper are subjected to centrifugal force and strikes on the stationary SS blade fixed on the casing. The machine cuts the turmeric rhizomes into slices of desired thickness from (2 to 5 mm). The slices are collected through outlet provided below the blade. The components of the machine include striking unit, rhizome cutting unit and frame & power transmission unit.

iv Input/raw material :
  a. Overall dimension (L x B x H mm) : 610 x 458 x 1205
  b. Weight : 70 kg
  c. Prime mover : Motor operated
  d. Power (hp) : 1 hp
  e. Man power : 1
  f. Land : -
  g. Investment : Rs. 60,000/-

v Output capacity : 380 kg/h

vi Unit cost (per machine) : Rs. 60,000/-

vii Suitability for crop/commodity : Turmeric rhizomes, potato, ginger

viii Efficiency : 74.74%

ix Unit cost of operation : Rs. 22/q

x Patent obtained/applied : Nil

xi Commercialization status :
a) No. of Licensees : -
b) Addresses of Licensees or Manufacturer : -

xii Contact Address : Research Engineer, AICRP on PHET
College of Agricultural Engineering
Dr. Punjabrao Deshmukh Krishi Vidyapeeth,
Krishi Nagar, AKOLA - 444 104 (Maharashtra)
## Technology No. 48

### i. Name of the Technology
- Pilot Plant (100 kg/day capacity) for making Cherry/Tutty-Fruity

### ii. Application/ Use
- For preparation of Cherry/tutty-fruity from pumpkin and papaya

### iii. Description of Technology
A pilot plant (100 kg/day capacity) inclusive of Peeler, Hand cutter, Slicer and Cuber for making cherry/tutty-fruity from pumpkin was developed. The plant can be used alternatively for making cherry from papaya or other fruits.

### iv. Input/raw material
- **a. Overall dimension**<br>1430 x 1130 x 770 (L x B x H mm)
- **b. Weight**<br>3 q
- **c. Prime mover**<br>Motor operated
- **d. Power (hp)**<br>2 hp
- **e. Man power**<br>2 labours
- **f. Land**<br>-
- **g. Investment**<br>-

### v. Output capacity
- 1.08 q/day

### vi. Unit cost (per machine)
- 1,50,000/-

### vii. Suitability for crop/ commodity
- Pumpkin, papaya

### viii. Efficiency
- 82%

### ix. Unit cost of operation
- Rs. 35/kg

### x. Patent obtained/applied
- -

### xi. Commercialization status
- MoU with manufacturer is in process

- **a. No. of Licensees**
- -

- **b. Addresses of Licensees or Manufacturer**
- -

### xii. Contact Address
- Research Engineer, AICRP on PHET College of Agricultural Engineering Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, AKOLA -444 104 (Maharashtra)
Technologies / Horticultural Crops

Technology No. 49

i. **Name of the Technology**: Pricking Machine for *Petha* Preparation

ii. **Application/Use**: Ease the process of pricking of *petha* for *petha* sweet preparation

iii. **Description of Technology**:

In *petha* industry, most of the operations such as cutting, pricking, etc. are done manually which is labour intensive, time consuming, and also involves drudgery. Besides, manual cutting and pricking is unhygienic and shelf life is short. With the background, Hisar and Aligarh centres have developed jointly *petha* cutting and pricking machine using stainless steel needles. Suitable mould/ dies are required for uniform shape and size of *petha* sweet. This machine is helpful in increasing the capacity of production besides maintaining quality and hygienic conditions.

iv. **Input**

   a) Raw material
   b) Machinery
      - Overall dimension: 1220mm x 610mm x 990mm
      - Weight: 100 kg
      - Prime mover: 1.5 hp single phase motor with gear box
   c) Man power: One
   d) Land
   e) Investment: Depends on the project scale of operation

v. **Output capacity**

   - 200 kg/h

vi. **Unit cost (per machine)**

   - Rs 50,000

vii. **Suitability for crop/commodity**

   - *Petha*

viii. **Efficiency**

   - Pricking efficiency 95%

ix. **Unit cost of operation**

   - Rs 1.50/kg

x. **Patent obtained/applied**

   - No

xi. **Commercialization status**

   a) No. of Licensees: 1
   b) Addresses of Licensees / Manufacturer:
      - M/s Moti Engg Works, Hisar
      - Ganesh Nagar, Industrial Area, Hisar.

xii. **Contact Address**

   1) Research Engineer, AICRP on PHET
      College of Agril Engineering
      CCS Haryana Agricultural University,
      Hisar-125 004 (Haryana)

   2) Deptt. of Post Harvest Engg. & Tech.
      Aligarh Muslim University,
      Aligarh-202002 (UP)
## Technology No. 50

i. **Name of the Technology**: White Pepper Machine  
ii. **Application/Use**: Production of white pepper corns from freshly harvested mature green pepper berries; Can also be used for black pepper with additional microbial retting technique.

iii. **Description of Technology**:

The machine removes outer pericarp from steeped fresh mature pepper berries (also from black pepper) to get white pepper kernels. It consists of a rotor shaft attached with 4 nylon brushes that rub the steeped pepper berries against the perforated metallic concave cylinder. During the operation continuous water supply is provided to the pulping chamber so that the loosened pulp (pericarp) is washed away by water through the sieve and the natural white pepper kernels are collected at the far end. The product should be further dried to the storable moisture content. All the contact parts of the machine where the pepper move are made up of food grade materials.

iv. **Input/raw material**: Fresh green pepper berries soaked in water for 4 - 5 days/Black pepper berries steeped in water with microbial culture for a week

<table>
<thead>
<tr>
<th>a) Overall dimension</th>
<th>83x74x105 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Weight</td>
<td>45 kg</td>
</tr>
<tr>
<td>c) Power</td>
<td>Electric motor, 0.5 hp</td>
</tr>
<tr>
<td>d) Prime mover</td>
<td>One skilled and one unskilled person</td>
</tr>
<tr>
<td>e) Man power</td>
<td></td>
</tr>
<tr>
<td>f) Land</td>
<td>Building (100 sq ft)</td>
</tr>
<tr>
<td>g) Investment</td>
<td>Rs. 75,000 but depends on quantity to be processed</td>
</tr>
</tbody>
</table>

v. **Output capacity**: 125-150 kg/h  
vi. **Unit cost (per machine)**: Rs 25,000 (without motor)  

vii. **Suitability for crops/commodity**: White pepper  

viii. **Efficiency**: -  
ix. **Unit cost of operation**: -  

x. **Commercialization status**: Commercialized  
(a) No. of Licensees to whom the technology has been transferred: One  
(b) Selected Addresses of Licensee or Manufacturer:  
M/s Dollar Engineering Industries Pvt. Ltd.,  
#3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore-560 058, India.

xi. **Contact Address**: Research Engineer, AICRP on PHET University of Agricultural Sciences, J- Block, GKVK Campus, Bangalore -560065 (Karnataka)
**Technology No. 51**

i. **Name of the Technology** : Manual Areca nut Dehusker

ii. **Application/ Use** : Suitable for dehusking freshly harvested mature green arecanut. Developed to replace the traditional dehusking tool which involves drudgery.

iii. **Description of Technology** :
It is a manually operated unit where four persons can dehusk arecanuts simultaneously. The unit is made of mild steel body mounted on angle iron stand. The dehusking assembly consists of two sharp edged blades, one being stationary and the other movable, operated by a pedal through a linkage mechanism. The unit has a hopper to hold 20 kg raw nuts and the raw nut freely flows to the dehusking tray by gravity. The outer shell of freshly harvested nut is pierced by pressing the nut against the sharp edge of the blade and the leg pedal is operated to split the husk. About 2-3 strokes are required to completely dehusk a nut.

iv. **Input/raw material** :
   a) Overall dimension : 68 x 68 x137 cm
   b) Weight : 40 kg
   c) Power : Manual
   d) Machinery : Nil
   e) Prime mover : -
   f) Man power : 02
   g) Investment : Rs. 4500/-

v. **Output capacity** : 160 kg raw nut per day / person

vi. **Unit cost (per machine)** : Rs.4500/-

vii. **Suitability for crops/commodity** : Areca nut

viii. **Efficiency** : -

ix. **Unit cost of operation** : -

x. **Commercialization status** : Commercialized
   (a) No. of Licensees to whom the technology has been transferred : One
   (b)Selected Addresses of Licensee /Manufacturer : M/s Dollar Engineering Industries Pvt. Ltd.
   #3, Adjacent to BIS, Tumkur Road, 1st Stage,
   Peenya,
   Bangalore - 560 058, India.

xi. **Contact Address** : Research Engineer,
   AICRP on PHET
   University of Agricultural Sciences,
   J- Block, GKVK Campus,
   Bangalore -560065 (Karnataka)
Technology No. 52

i. **Name of the Technology** : Tamarind Dehuller-cum-Deseeder

ii. **Application/ Use** : Dehulling of freshly harvested matured dry tamarind fruits and then expelling seeds from dehulled fruits

iii. **Description of Technology** : This is a composite unit consisting of a tamarind dehulling unit and a deseeding unit. The dehulling unit consists of serrated mild steel rings mounted on two parallel shafts which rotate in opposite directions. Small pins welded on to the surface of the rings act as beaters to break and separate the brittle tamarind shell. The deseeding consists of a rotating fluted stainless steel roller and a stationary rasp bar. When the dehulled dry tamarind fruits pass between the fluted roller and the rasp bar, the seeds are squeezed out of the tamarind pulp. The expelled seeds are then separated manually.

iv. **Input/raw material** : Freshly harvested and well dried tamarind fruits
   a) Overall dimension : 68 x 68 x 137 cm
   b) Weight : 40 kg
   c) Power : Manual
   d) Machinery : Nil
   e) Prime mover : -
   f) Man power : 01
   g) Investment : Rs. 4500/-

v. **Output capacity** : Dehulling – 600 kg/h or Deseeding – 45 kg/h

vi. **Unit cost (per machine)** : Rs. 30,000/- (without motor)

vii. **Suitability for crops/commodity** : Tamarind

viii. **Efficiency** : -

ix. **Unit cost of operation** : -

x. **Commercialization status** : Commercialized
   (a) No. of Licensees to whom the technology has been transferred : One
   (b) Selected Addresses of Licensee / Manufacturer : M/s Dollar Engineering Industries Pvt. Ltd.
   #3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore-560 058, India.

xi. **Contact Address** : Research Engineer,
   AICRP on PHET
   University of Agricultural Sciences,
   J- Block, GKVK Campus,
   Bangalore -560065 (Karnataka)
Technologies /Horticultural Crops

Technology No. 53

i. **Name of the Technology**: Pedal Operated Coconut Dehusker

ii. **Application/ Use**: For dehusking coconut with ease and minimal effort; Can be conveniently used both by men and women

iii. **Description of Technology**: The dehusking assembly consists of two sharp edged blades, one being stationary and the other movable - operated by a foot pedal through linkage mechanism. The twin-blades are mounted on a tubular stand. The unhusked coconut is pierced on the wedge like blade and then the foot pedal is pressed to split open and separate a portion of the husk. The operation is repeated 3-4 times until complete dehusking is done.

iv. **Input/raw material**

   a) Overall dimension : 45 x 15 x 85 cm
   b) Weight : 6 kg
   c) Power : Manual
   d) Prime mover : -
   e) Man power : 01
   f) Investment : Rs. 600/-

v. **Output capacity** : 50-60 nuts /h

vi. **Unit cost of gadget** : Rs. 600/-

vii. **Suitability for crops/commodity** : Coconut

viii. **Efficiency** : -

ix. **Unit cost of operation** : -

x. **Commercialization status** : Commercialized

(a) No. of Licensees to whom the technology has been transferred : One

(b) Selected Addresses of Licensee or Manufacturer : M/s Dollar Engineering Industries Pvt. Ltd.
#3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya,
Bangalore - 560 058, India.

xi. **Contact Address** : Research Engineer,
AICRP on PHET
University of Agricultural Sciences,
J- Block, GKVK Campus,
Bangalore -560065 (Karnataka)
Technology No. 54

i. **Name of the Technology** : Bulk Onion Curing Unit

ii. **Application/ Use** : Curing freshly harvested onions in bulk

iii. **Description of Technology** :

The onion curing unit is a forced hot air dryer modified to cure freshly harvested onions in bulk. The unit consists of a curing chamber with a perforated vertical hot air distribution duct and laterals. The walls of the chamber are actually fabricated with perforated sheet so that moisture laden air escape at all sides. An electrical heat bank and a blower supply of hot air at about 45°C for curing onions. The curing chamber is provided with two doors: one at the top for loading onion bulbs and the other in the front for unloading onions after the curing process. The electric heat bank consists of four 600 W finned heaters to obtain an inlet curing air temperature ranging from 30 to 80°C.

iv. **Input/raw material** :

   a) **Overall dimension** : 100 x 100 x100 cm + heat bank & motorized air blower

   b) **Power** : 0.5 hp blower; Heater - 3 kW

   c) **Machinery** : Nil

   d) **Prime mover** :

   e) **Man power** : 01

   f) **Land** :

   g) **Investment** : Rs. 4500/-

v. **Output capacity** : Cures 500 kg of freshly harvested onions

vi. **Unit cost** : Rs. 4500/-

vii. **Suitability for crops/commodity** : Onion

viii. **Contact Address** : Research Engineer,

    AICRP on PHET

    University of Agricultural Sciences,

    J- Block, GKVK Campus,

    Bangalore -560065 (Karnataka)
Technologies / Horticultural Crops

Technology No. 55

i. Name of the Technology : Mango Harvester

ii. Application/ Use : To pluck mango fruits from the tree without fruit damage

iii. Description of Technology :
The gadget is a simple and maintenance free unit comprising of a metal ring with a fixed knife edge at one end for cutting the petiole of the fruit. Nylon net is fixed to the metal ring to hold the plucked fruits. The unit needs to be fixed to a long pole of suitable length to reach the fruits on the tree.

iv. Input/raw material :
a) Overall dimension : 37 x 24 x 2 cm
b) Weight : 0.40 kg
c) Power : Manual
d) Machinery : Nil
e) Prime mover : -
f) Man power : 01

v. Output capacity : 750 fruits / h

vi. Unit cost : Rs. 90/-

vii. Suitability for crops/commodity :
Mango

viii. Commercialization status :
(a) No. of Licensees to whom the technology has been transferred
Commercialized
One

(b) Selected Addresses of Licensee / Manufacturer
M/s Dollar Engineering Industries Pvt. Ltd.
#3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore -560 058, India.

ix. Contact Address :
Research Engineer,
AICRP on PHET
University of Agricultural Sciences,
J- Block, GKVK Campus,
Bangalore -560065 (Karnataka)
Technology No. 56

i. Name of the Technology : Sapota Harvester

ii. Application/ Use : To pluck Sapota fruits from the tree without fruit damage

iii. Description of Technology :
The gadget is a simple and maintenance free unit comprising of a metal ring with a fixed knife edge at one end for cutting the petiole of the fruit. Nylon net is fixed to the metal ring to hold the plucked fruits. The unit needs to be fixed to a long pole of suitable length to reach the fruits on the tree.

iv. Input/raw material :
   a) Overall dimension : 35 x 17 x 3 cm
   b) Weight : 0.35 kg
   c) Power : Manual
   d) Machinery : Nil
   e) Prime mover : -
   f) Man power : 01

v. Output capacity : -

vi. Unit cost : -

vii. Suitability for crops/commodity : Sapota

viii. Efficiency : -

ix. Unit cost of operation : -

x. Commercialization status :
   (a) No. of Licensees to whom the technology has been transferred : Commercialized
   (b)Selected Addresses of Licensee / Manufacturer : M/s Dollar Engineering Industries Pvt. Ltd. #3, Adjacent to BIS, Tumkur Road, 1st Stage, Peenya, Bangalore -560 058, India.

xi. Contact Address : Research Engineer,
AICRP on PHET
University of Agricultural Sciences,
J- Block, GKVK Campus,
Bangalore -560065 (Karnataka)
Technology No. 57

i. **Name of the Technology**: Cardamom Dryer

ii. **Application/Use**: To dry freshly harvested cardamom capsules in cardamom plantations

iii. **Description of Technology**: It is basically a convective dryer. The vertical drying chamber is made-up of wood with wooden drying trays / racks. Hot air generated with electrical heaters is pushed through the trays containing freshly harvested cardamom capsules from bottom of the dryer using an electrical blower. The exhaust is at the top for the moisture laden air. With this drier, it is possible to reduce the moisture content of fresh cardamom capsules from 90% to 12% in about 10 hours.

iv. **Input/raw material**
   a) **Overall dimension**: 165 x 105 x 225 cm (including heat bank, air blower with motor)
   b) **Weight**: -
   c) **Power**: Electrical blower - 0.5 hp; Electrical heaters - 3 kW
   d) **Prime mover**: -
   e) **Man power**: 01
   f) **Investment**: Rs. 30,000/-

v. **Output capacity**: Dries 10 kg of fresh cardamom capsules

vi. **Unit cost (per machine)**: Rs. 30,000

vii. **Suitability for crops/commodity**: Cardamom

viii. **Efficiency**: -

ix. **Unit cost of operation**: -

x. **Contact Address**: Research Engineer, AICRP on PHET, University of Agricultural Sciences, J- Block, GKVVK Campus, Bangalore -560 065 (Karnataka)
Technology No. 58

i. **Name of the Technology**: Tubular Aeration System for improved on-farm storage of potato

ii. **Application/ Use**: The Tubular Aeration System is useful in reduction of storage losses during Kharif potato in Southern Karnataka (Mean temperature: max. 32°C & min. 15°C; Mean RH: Max. 89% & min. 42%; Average annual rainfall 893 mm). The physiological and rotting losses were reduced by 2.1% and 2.8% respectively when compared to traditional pit storage system over 2-3 months of storage.

iii. **Description of Technology**: The tubular aeration system consists of a horizontal perforated duct with vertical tubular risers. The main duct is made up of 100 mm diameter PVC pipe with 13 mm diameter perforations at a pitch distance of 50 mm along the axial direction. The length of the pipe will be equal to length of the potato heap. The hole-to-hole distance in the lateral direction (along the circumference) is 50 mm. There are air vents (risers) at a distance of 1 m between them. The vents are 60 mm in diameter and 1.2 m long PVC pipes whose bottom ends are connected to the main horizontal aeration duct and the top ends emerge out of the potato heap to the atmosphere. The vents help the warm air get collected inside the main duct to go up to the atmosphere. The main duct is placed horizontally along the length of potato heap at the centre, 0.30 m above the bottom surface and the ends of the duct protrude slightly outside the heap by about 50 mm. A gentle slope of about 2° to the horizontal is kept for the duct so that moisture, if any, that may condense, run down the slope of the duct and go out of the potato heap. The aeration system is designed in such a way that the main duct filled with warm air in the vicinity inside the potato heap goes out through air vents (risers) due to natural convection. The entire aeration system is placed inside the traditional potato heap or pit as explained earlier to reduce tuber losses during storage.

iv. **Input**
   a) **Raw material**: PVC pipes required to make aeration system to store 1 tonne of potato tubers: 100 mm – 3 m length, 1 no., 60 mm – 1.2 m, 2 nos.

   b) **Machinery/ equipment**
      **Overall dimension**: For 1 tonne storage, tuber heap length and width will be about 3.0 m and 1.5 m, respectively and the length can be increased to store more quantity of tubers.

   c) **Investment**: About Rs 600/- for new PVC pipes per tonne of tuber storage. The pipes can be reused for at least 10 years.

v. **Output capacity**: -

vi. **Unit cost**: Rs 600/t of potato storage

vii. **Suitability for crops/commodity**: Potato

viii. **Efficiency**: Reduction in physiological and rotting loss by 2.1% and 2.8% during storage (2-3 months) of potato tuber.

ix. **Unit cost of operation**: Depends on storage capacity.

x. **Contact address**: Research Engineer, AICRP (PHET), University of Agricultural Sciences, GKVK, Bangalore -560065 (Karnataka)
**Technologies / Horticultural Crops**

**Technology No. 59**

i **Name of the Technology**: Multipurpose Polyhouse Solar Dryer

ii **Application/ Use**: Drying of quality chillies-free from external contamination, unforeseen rains. Nursery raising and production of leafy vegetables can also be taken up in off season

iii **Description of Technology**:
The dryer essentially consists of an arch type poly house to hold chillies on two different tiers. The tiers are made of wire mesh trays fitted to a frame assembled by nuts and bolts. 2.5 tons capacity poly house solar dryer having a size of 12 x 7.8 x 2.4 m (L x B x H), arch type model with a tray area of 1600 sft (147 m²) has been developed. The whole frame structure is covered with a UV stabilized 150-gsm cross-laminated semi transparent polyethylene sheet. The poly sheet is provided with suitable ventilators both at the bottom and top to facilitate movement of air. Temperature of about 15-17°C higher than the ambient temperature was observed inside the dryer. Drying of hybrid such as BJ 304 can be completed in 6 to 7 days compared to 13-14 days in open yard sun drying (OYSD) method. The drying of LCA-334 variety was only 4 to 5 days in poly house when compared to 10 days in OYSD. The moisture was reduced from an initial value of 78-80% to 10% (w.b). The color of the pods is much superior than that dried in the open yard method. The percentage white pods are only 2-3% in comparison to 8-9% in OYSD. Poly house can be used to raise nursery during July to October by replacing the poly sheet with 50% shade net and dismantling the trays.

iv **Input/raw material**: Chilli
   a) **Overall dimension**: 12000 x 7800 x 2400 mm
   b) **Weight**: -
   c) **Prime mover**: -
   d) **Power**: One person
   e) **Man power**: -
   f) **Land**: 147 m²
   f) **Investment**: -

vi **Output capacity**: 7 qtl. dry chillies / batch

vi **Unit cost**: Rs. 1,14,000 -00

vii **Suitability for crop/commodity**: Chilli

viii a) **No. of Licensees**: One
    b) **Addresses of Licensees or Manufacturer**:
       M/s. Arfa Agro Products, D.No: 25-11-31 G.T.Road, Guntur-4, Ph:0863-5534386
       Mr Kareemulla, 09849788786

ix **Contact Address**: Research Engineer, AICRP on PHET Acharya N. G. Ranga Agricultural University, Bapatla-522101 (AP)
Technology No. 60

i. Name of the Technology : Mobile Stream Boiler for Turmeric

iii. Application/ Use : Improved Quality turmeric rhizomes with good colour, high curcumin, aroma and product free from microbial load, physical contamination. Blackening of the rhizomes can be avoided and subsequent drying time can be reduced significantly due to steam cooking in comparison to traditional method.

iv. Description of Technology :

Turmeric steam boiler consists of four drums each having a capacity of 125 kg of turmeric rhizomes per batch, a water tank, diesel burner, boiler, feed pump and a control panel for regulating water, pressure, and temperature. All the components are fixed on a tractor trolley to move the equipment from field to field. The water gets heated with diesel burner and the steam with a pressure of 2 kgf/cm² is sent to the drums. At a time the steam can be supplied to two drums, it takes 7 to 10 minutes to boil the rhizomes and the valves are changed to divert the steam into next two drums. In this way one ton rhizomes can be cooked in an hour.

i. Input/raw material :
   a. Overall dimension : 4500x1800x4500
   b. Prime mover/ machine : 1 hp for boiler feed pump, ¼ hp for diesel burner
   c. Man power : Four persons
   d. Investment : 6 lakh

v. Output capacity : 2 tons/ h (cooked rhizomes) 300 kg/ h (final dried produce)

vi. Unit cost (per machine) : Rs. 6 lakh

vii. Suitability for crop/ commodity : Turmeric

viii. Efficiency : 100% (cooking efficiency)

ix. Unit cost of operation :
   a) No. of Licensees : 02
   b) Addresses of Licensees or Manufacturer :
      2. South East Farm Equipment (P) Ltd Thirchi Main Road, Thammapatti P.O -6136113 Gangavalli Taluka, Salem, Tamil Nadu

xii. Contact Address : Research Engineer, AICRP on PHET Acharya N. G. Ranga Agricultural University, Bapatla -522101 (AP)
### Technologies & Horticultural Crops

#### Technology No. 61

<table>
<thead>
<tr>
<th>i</th>
<th>Name of the Technology</th>
<th>Barn Drying of Chilies</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>Application/ Use</td>
<td>Drying of quality chillies, free from external contamination, protection from unforeseen rains</td>
</tr>
<tr>
<td>iii</td>
<td>Description of Technology</td>
<td>Ten to twelve quintals of ripe chillies can be loaded in the existing tobacco barns to dry chillies. The barn can be converted to dry chillies by small modifications such as providing GI trays on the existing tiers of the barn. Galvanized iron wire mesh trays of size 105x75x7.5 cm (LBH) are suitable to hold chillies on the existing tiers of the barn. About 100 to 120 trays are required to load chilli depending upon the size of the barn, initial moisture content and type of chilli. The output of the dried produce is about 3 quintals per batch. Drying time required to reduce moisture from 75 to 9% (w.b) varied depending upon whether the chilli is hybrid or variety. Hybrid chillies require about 50 hours to dry whereas the other varieties require about 40 hours. The temperature and ventilator operation regimes are important to get good quality uniform dried produce. The operating regimes are optimized to dry both hybrids and varieties of chillies.</td>
</tr>
<tr>
<td>iv</td>
<td>Input/raw material</td>
<td>Ripe Chilli</td>
</tr>
<tr>
<td></td>
<td>a) Overall dimension</td>
<td>6000x6000x7500</td>
</tr>
<tr>
<td></td>
<td>b) Weight</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>c) Prime mover/ machine</td>
<td>Existing tobacco barns</td>
</tr>
<tr>
<td></td>
<td>d) Man power</td>
<td>One person</td>
</tr>
<tr>
<td></td>
<td>e) Land</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>f) Investment</td>
<td>-</td>
</tr>
<tr>
<td>v</td>
<td>Output capacity</td>
<td>300 kg of dried chilli / batch</td>
</tr>
<tr>
<td>vi</td>
<td>Unit cost (per machine)</td>
<td>Rs.14,000/-</td>
</tr>
<tr>
<td>vii</td>
<td>Suitability for crop/ commodity</td>
<td>Chilli</td>
</tr>
<tr>
<td>viii</td>
<td>Patent obtained/applied</td>
<td>Applied</td>
</tr>
<tr>
<td>ix</td>
<td>Commercialization status</td>
<td>ITC has implemented in 5 barns</td>
</tr>
<tr>
<td></td>
<td>a) No. of Licensees</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Addresses of Licensees / Manufacturer and contact person</td>
<td>M/s. Arfa Agro Products, D.No: 25-11-31, G.T.Road, Guntur-4, Ph:0863-5534386</td>
</tr>
<tr>
<td>x</td>
<td>Contact Address</td>
<td>Research Engineer, AICRP on PHET Acharya N.G. Ranga Agricultural University, Bapatla-522101 (AP)</td>
</tr>
<tr>
<td>Technology No. 62</td>
<td></td>
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<tr>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i. Name of the Technology</td>
<td>Turmeric/Ginger Washer</td>
<td></td>
</tr>
<tr>
<td>ii. Application/ Use</td>
<td>Washing of turmeric/ginger</td>
<td></td>
</tr>
<tr>
<td>iii. Description of Technology</td>
<td>Vertical cylindrical chamber having rotating base and provision of water spray through a perforated pipe fitted at the inside of the chamber. This washer is made of M.S. Angle and G.P. Sheets. The efficiency is 90% and the capacity is 3q/h. Machine is found suitable for washing of turmeric and ginger.</td>
<td></td>
</tr>
<tr>
<td>iv. Input/raw material</td>
<td>M.S. Angle, M.S.Flat, G.P.Sheet</td>
<td></td>
</tr>
<tr>
<td>a) Overall dimension</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>b) Weight</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>c) Prime mover</td>
<td>1 hp Single Phase A.C. Motor</td>
<td></td>
</tr>
<tr>
<td>d) Man power</td>
<td>One</td>
<td></td>
</tr>
<tr>
<td>e) Land</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>f) Investment</td>
<td>Rs. 15,000/-</td>
<td></td>
</tr>
<tr>
<td>v. Output capacity</td>
<td>3 q/h</td>
<td></td>
</tr>
<tr>
<td>vi. Unit cost of operation</td>
<td>Rs. 0.10 per kg</td>
<td></td>
</tr>
<tr>
<td>vii. Suitability for crops/commodity</td>
<td>Ginger, Turmeric</td>
<td></td>
</tr>
<tr>
<td>viii. Efficiency</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>ix. Unit cost (per machine)</td>
<td>Rs. 20,000/-</td>
<td></td>
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<tr>
<td>x. Patent obtained/applied</td>
<td>Nil</td>
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<tr>
<td>xi. Commercialization status</td>
<td>Ready for commercialization</td>
<td></td>
</tr>
<tr>
<td>a) No. of Licensees to whom the technology has been transferred</td>
<td>Nil</td>
<td></td>
</tr>
<tr>
<td>b) Selected Addresses of Licensee / Manufacturer</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
| xii. Contact Address | Research Engineer, AICRP on PHET  
College of Agricultural Engineering and Technology,  
Orissa University of Agriculture and Technology, Bhubaneswar- 751 003 |
Technology No. 63

i. **Name of the Technology**: Dehumidified Air Dryer

ii. **Application/ Use**: Drying of high value fruits and vegetables

iii. **Description of Technology**:
Samples can be dried at low temperature and low humidity condition to maintain the quality. The dryer is associated with heat pump to remove the moisture from exhaust air at the evaporator surface and recirculating the air to the dryer after heating to the desired level at the condenser.

iv. **Input/raw material**:
   a) **Overall dimension**: Compressor, Condensor, Evaporator, Heaters etc
   b) **Weight**: 1kW
   c) **Prime mover**: One
   d) **Man power**: -
   e) **Land**: -
   f) **Investment**: Rs. 1,10,000/-

v. **Output capacity**: 20kg/batch

vi. **Unit cost (per machine)**: Rs. 1,50,000/-

vii. **Suitability for crops/commodity**: Fruits, vegetables, spices, aromatic and medicinal plants

viii. **Efficiency**: 90%

ix. **Unit cost of operation**: Rs.2 to3/- per kg (depending on product)

x. **Patent obtained/applied**: Patent filed

xi. **Commercialization status**:
   a) **No. of Licensees to whom the technology has been transferred**: Nil
   b) **Selected Addresses of Licensee / Manufacturer**: -

xii. **Contact Address**:
Research Engineer,
AICRP on PHET
College of Agricultural Engineering and Technology,
Orissa University of Agriculture and Technology,
Bhubaneswar-751 003
Technology No. 64

i. **Name of the Technology**: Bael Slicer

ii. **Application/ Use**: To slice the raw bael fruit for further processing of it.

iii. **Description of Technology**: The raw bael is fixed within a tunnel and a motor operated circular saw slices the bael fruit. The spring and lever action shifts the fruit to the bottom of the saw for cutting at a desired thickness.

iv. **Input/raw material**
   a) Overall dimension : M.S.Angle, Flats, Spring, Circular Saw
   b) Weight : A 0.25 hp motor
   c) Prime mover : -
   d) Man power : One
   e) Investment : Rs. 15,000/-

v. **Output capacity** : 20kg/batch

vi. **Unit cost (per machine)** : Rs 12,000/-

vii. **Suitability for crops/commodity** : Bael (stone apple)

viii. **Efficiency** : 98%

ix. **Unit cost of operation** : Rs. 0.70 per kg

x. **Patent obtained/applied** : Patent filed

xi. **Commercialization status**
   a) No. of Licensees to whom the technology has been transferred : Nil
   b) Selected Addresses of Licensee / Manufacturer : Nil

xii. **Contact Address** : Research Engineer, AICRP on PHET College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar-751 003
Technology No. 65

i. **Name of the Technology**  :  Hand Operated Low Cost Aloe-Vera Gel Extractor

ii. **Application/ Use**  :  To extract aloe-vera gel for further processing

iii. **Description of Technology**  :
The unit consists of one pair of wooden rollers with S.S. lining. Each roller is fixed tightly with the help of bush and frame arrangement on both the sides. The rollers are tapered continuously from one end to other with a slope in order to have varying clearance to allow the leaves of varying thickness to be squeezed properly. The rollers are rotated with the help of a handle attached to the shaft. The bottom roller moves in clockwise direction and 2 numbers of wooden rollers while upper roller in anticlockwise direction. The whole assembly is fixed on a base frame which supports the unit during operation.

iv. **Input/ raw material**  :
- (a) Overall dimension
- (b) Weight
- (c) Prime mover
- (d) Man power
- (e) Investment  
  - M.S.Angle, flat, M.S.Sheet
  - -
  - -
  - -
  - one
  - Rs. 8000/-

v. **Output capacity**  :  20 kg/ hour

vi. **Unit cost (per machine)**  :  Rs 5,000/-

vii. **Suitability for crops/commodity**  :  Aloe-vera leaves

viii. **Efficiency**  :  95%

ix. **Unit cost of operation**  :  Rs. 0.60 per kg

x. **Patent obtained/applied**  :  Nil

xi. **Commercialization status**  :  Ready for commercialization

(a) **No. of Licensees to whom the technology has been transferred**  :  Nil

(b) **Selected Addresses of Licensee / Manufacturer**  :  Nil

xii. **Contact Address**  :
Research Engineer, AICRP on PHET  
College of Agricultural Engineering and Technology,  
Orissa University of Agriculture and Technology,  
Bhubaneswar-751 003
Technology No. 66

**i** Name of the Technology : Automatic Mango Grader Based on Internal and External Quality

**ii** Application/ Use : Grading of mangoes

**iii** Description of Technology :

It was developed with five sections viz. feeding, conveying, imaging, fruit separating and process controlling section. The mango fruits were fed one by one manually in the feeding section and then conveyed from the feeding section to separating section via imaging section. Imaging section consists of shade free imaging chamber, imaging device and fruit detecting sensor. In the fruit separating section, five numbers of outlets were given for five grades. The fruit detecting sensor was fixed perpendicular to the conveyor axis on the side wall of the imaging chamber at 15mm height from the surface of conveyor belt. Process control section consists of a computer with data I/O card (Arduino Mega 2560, Italy), 5V-four channel relay, PLC, rotary shaft incremental encoder and a fruit tracking sensor. The machine was evaluated by grading the three varieties of mangoes. The developed machine would be more suitable for online grading of mangoes based on external as well as internal quality.

**iv** Input/raw material : Mango

   a. Overall dimension (L x B x H mm) : 13x3x5 feet
   b. Weight : 100 kg.
   c. Prime mover : one motor
   d. Power (hp) : 1/2 hp
   e. Man power : 01
   f. Investment : Rs. 8 lakh

**v** Output capacity : 620 to 650 fruits/h or 200-300 kg/h

**vi** Unit cost (per machine) : Rs. 8 lakh

**vii** Suitability for crop/commodity : Mango

**viii** Efficiency :

   a) 98.6 per cent for Alphonso
   b) 96 per cent for Banganapalli
   c) 93.33 per cent for Neelam mango

**ix** Unit cost of operation : Rs.0.60 per kg of fruits

**x** Patent obtained/applied : -

**xi** Commercialization status : Ready for commercialization

**xii** Contact Address :

Research Engineer, AICRP on PHET
Professor and Head,
Agricultural Machinery Research Centre,
TNAU, Coimbatore -641 003.
Phone: 0422-6611272; FAX: 0422-6611455;
Technologies /Horticultural Crops

Technology No. 67

i. Name of the Technology : Fluidized Bed Dryer for Mushroom

ii. Application/ Use : To dry the oyster and milky mushroom

iii. Description of Technology :

The fluidized bed dryer consists of a centrifugal blower, holding bin, heating coils, motor and thermostat control. The blower is run by a 3 hp, three phase motor. The delivery of the blower is connected to the heater drum, provided four numbers of fin type electrical heaters of each 500 watts and controlled through a stem type thermostat. At the other end of the heater drum, the drying chamber is placed. Hot air of 50 to 90°C temperature at a flow rate of 8 to 32 m³ / minute can be obtained in this dryer. The whole assembly is placed on a suitable frame made of mild steel.

iv. Input/raw material :

   a) Power : 3 hp electric motor; 2000 W for heaters
   b) Man power : 1 person
   c) Investment : Rs. 50,000/-

v. Output capacity : 6 kg/batch

vi. Unit cost (per machine) :

   a) suitability for crops/commodity : Mushrooms
   b) Unit cost : Rs.40,000/-

vii. Efficiency : -

viii. Unit cost of operation : Rs. 50/kg of dry mushroom

ix. Patent obtained/applied : No

x. Commercialization status :

   a) No. of Licensees to whom the technology has been transferred : Commercialized
   b) Number : 5 Nos.
   c) Name : Farmer — cum — Processor/ Entrepreneur

xi. Selected Addresses of Licensee or Manufacturer :

   1. M/s. Valampuri Industries, New Thillai Nagar, Behind Bimetal Bearings, PNPudur, Coimbatore
   2. M/s. AG Industries, 1/460, Balaji Complex, Thoppampatti Pirnur, Metupalayam Road, Coimbatore - 641 031
   3. M/s. SSM Machinery and Fabrication
      43, NBC Nagar, G.N Mill (post), Coimbatore - 641 029
      M/s. Universal Agro Industries,
      S.F.No.374/5, Near Bimetal Bearings,
      Maruthamsalai Road, PN Pudur, Coimbatore - 641 041

xii. Contact Address :

   Professor and Head,
   Agricultural Machinery Research Centre,
   Tamil Nadu Agricultural University,
   Coimbatore - 641 003.
   Phone: 0422- 6611272; FAX: 0422-6611455;
   e-mail: processing@tnau.ac.in
Technology No. 68

i. Name of the Technology : Improved Farm Level Turmeric Boiler

ii. Application/ Use : To boil the turmeric rhizomes under hygienic condition

iii. Description of Technology :

It consists of one rectangular, larger size, solid outer container, made out of 20 SWG thick galvanized iron sheet to hold water and two to three inner containers to hold rhizomes. Washed rhizomes are loaded in the inner cylinder and required quantity of water is added in the outer cylinder. Rhizomes are boiled by the steam liberated from the boiling water. Sodium bicarbonate is added in the boiling water to ad colour. The inside containers which hold turmeric can easily be taken out without wasting boiling water, which can be reused and thereby fuel requirement can be considerably reduced.

iv. Input/raw material
   a) Power : 10 kg. of fire wood / batch
   b) Man power : Three person
   c) Investment : Rs.16, 000

v. Output capacity : 225 kg per batch

vi. Unit cost (per machine) : Rs.14, 000

vii. Suitability for crops/commodity Efficiency : Turmeric

viii. Unit cost of operation : Rs.6/h

ix. Patent obtained/applied : No

tax. Commercialization status : Commercialized
   (a) No. of Licensees to whom the technology has been transferred : 5
      Farmer –cum-Processor/ Entrepreneur

   (b) Selected Addresses of Licensee /Manufacturer

   2. M/s. AG Industries, 1/460, Balaji Complex, Thoppampati Pirivu, Mettupalayam Road, Coimbatore -641 031

xi. Contact Address : Professor and Head,
Agricultural Machinery Research Centre,
Tamil Nadu Agricultural University, Coimbatore-641003.
Phone: 0422-6611272; FAX: 0422-6611455;
e-mail: processing@tnau.ac.in
Technologies / Horticultural Crops

Technology No. 69

i. Name of the Technology : Aonla Pricking Machine (Manually Operated)

ii. Application/ Use : It has application in pricking of aonlas for the preparation of murabba (preserves)

iii. Description of Technology :

Aonla fruits are highly perishable in nature, and most difficult to store or transport over long distances. Still in industry, traditional method of hand tools are being used. This existing method of pricking is tiresome, time consuming and costly. Preparation of aonla preserve (Murabba) is very common practice to use and enhance shelf life. For making the preserve (Murabba), the pricking of aonla fruits is carried out. This is operated by pushing the handle manually

iv. Input/raw material : Aonla

a) Overall dimension : 400 mm x 220 mm x 400 mm

b) Machinery : Aonla Pricking Machine

c) Weight : 15 kg

d) Prime mover : NA

e) Power : Manual

f) Man power : One

g) Land : NA

h) Investment : Rs. 10000/-
i) Operational efficiency : 90%

v. Output capacity : 15-20 kg/h

vi. Unit cost (per machine) : Rs. 5000 - 6000

vii. Suitability for crops/commodity : Aonla

viii. Efficiency : Pricking efficiency 95% with 2mm thick needles

ix. Unit cost of operation : Rs. 1.50 (when the cost of labour is Rs. 150 per day)

x. Patent obtained/applied : Yes

xi. Commercialization status : Commercialized

(a) No. of Licensees to whom the technology has been transferred : 3

(b) Selected Addresses of Licensee / Manufacturer and contact address :

1. M/s Swarojgar Yojna Kendra (Regd.), Hisar

xii. Contact Address : Sr. Research Engineer, AICRP on PHET Deptt of Agril. Processing and Energy College of Agricultural Engineering & Technology CCS Haryana Agricultural University Hisar -125004
### Technology No. 70

**i. Name of the Technology**: Continuous Carrot Washer (Bahabalpur)

**ii. Application/Use**: It has application in washing of carrots

**iii. Description of Technology**:
Carrots are removed from earth and hence not safe for consumption. For its consumption the sellers clean/wash carrots with the help of this machine.

<table>
<thead>
<tr>
<th>iv. Input/raw material</th>
<th>:</th>
<th>Carrots</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Overall dimension</td>
<td>:</td>
<td>3000 mm x 1200 mm x 1200 mm</td>
</tr>
<tr>
<td>b) Machinery</td>
<td>:</td>
<td>Washing machine</td>
</tr>
<tr>
<td>c) Weight</td>
<td>:</td>
<td>500 kg</td>
</tr>
<tr>
<td>d) Prime mover</td>
<td>:</td>
<td>Diesel Engine</td>
</tr>
<tr>
<td>e) Power</td>
<td>:</td>
<td>5 h.p.</td>
</tr>
<tr>
<td>f) Man power</td>
<td>:</td>
<td>Four</td>
</tr>
<tr>
<td>g) Investment</td>
<td>:</td>
<td>Rs. 1,00,000/-</td>
</tr>
<tr>
<td>h) Operational efficiency</td>
<td>:</td>
<td>95%</td>
</tr>
</tbody>
</table>

| v. Output capacity     | : | 1,000 Kg/h |

| vi. Unit cost (per machine) | : | Rs. 80,000/- |

| vii. Suitability for crops/commodity | : | Carrots |

| viii Efficiency         | : | 95% |

| ix. Unit cost of operation | : | Rs. 0.30 (when the cost of labour is Rs. 150 per day) |

| x. Patent obtained/applied | : | Nil |

| xi. Commercialization status | : | Commercialized |

(a) No. of Licensees to whom the technology has been transferred:

<table>
<thead>
<tr>
<th>(b) Selected Addresses of Licensee / Manufacturer and contact address</th>
<th>:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/s Sanjeev Jangra Engg. Works (c/o Mistry Krishan Kumar Jangra)</td>
<td></td>
</tr>
<tr>
<td>village Badopatti, Bus Stand Bahbalpur (Hisar) Haryana</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>xii. Contact Address</th>
<th>:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr. Research Engineer, AICRP on PHET</td>
<td></td>
</tr>
<tr>
<td>Dept of Agril. Processing and Energy College of Agricultural Engineering &amp; Technology CCS Haryana Agricultural University Hisar-125004</td>
<td></td>
</tr>
</tbody>
</table>
### Technology No. 71

**i** Name of the Technology: HAU Aonla Pricking Machine (power operated)

**ii** Application/Use: Pricking the aonlas for the preparation of murabba

**iii** Description of Technology:

Motor operated Aonla pricking machine was design and developed by Hisar centre. The capacity of the machine is 80 kg/h. and the cost is approx. Rs. 60,000/-.

<table>
<thead>
<tr>
<th>iv</th>
<th>Input/raw material</th>
<th>v</th>
<th>Output capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Overall dimension (L x B x H mm)</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>b.</td>
<td>Weight</td>
<td>:</td>
<td>90 kg</td>
</tr>
<tr>
<td>c.</td>
<td>Prime mover</td>
<td>:</td>
<td>Electric motor</td>
</tr>
<tr>
<td>d.</td>
<td>Power (hp)</td>
<td>:</td>
<td>1 hp</td>
</tr>
<tr>
<td>e.</td>
<td>Man power</td>
<td>:</td>
<td>1 person</td>
</tr>
<tr>
<td>f.</td>
<td>Land</td>
<td>:</td>
<td>270 x 100 x 308 cm</td>
</tr>
<tr>
<td>g.</td>
<td>Investment</td>
<td>:</td>
<td>Rs. 60,000/-</td>
</tr>
</tbody>
</table>

**vi** Unit cost (per machine): Rs. 60,000/-

**vii** Suitability for crop/commodity: Aonla

**viii** Efficiency: 90%

**ix** Unit cost of operation: Rs. 0.10 per kilogram

**x** Patent obtained/applied: yes

**xi** Commercialization status:
- a) No. of Licensees: one
- b) Addresses of Licensees or Manufacturer: NRDC

**xii** Contact Address: Sr. Research Engineer, AICRP on PHET Deptt of Agril. Processing and Energy College of Agricultural Engineering & Technology CCS Haryana Agricultural University Hisar-125004

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Four Decades of R&D of AICRP on PHET

Technology No. 72

i. Name of Technology: Pineapple Harvester

ii. Application / Use: Harvesting pineapple in hilly slope areas of NEH

iii. Description of Technology:

A manually operated pineapple harvester is fabricated with mild steel rod of 30 mm diameter and 1500 mm length. A sharp cutting blade of 125 mm diameter made of mild steel is attached at the end of the main frame which is used to cut the stalk of the pineapple. Rotation of the cutting blade (125mm) is obtained through a transmission from a 1.5 hp petrol engine through a spiral rotating shaft. When the operator pulls the lever of the cranking wheel of engine mounted at the back of the operator which is connected to the cutting blade, the blade starts rotating and cuts the stalk just beneath the pineapple. The cut pineapple is held with the finger provide just above the cutting blade. The detached/cut pineapple will be shifted to a basket kept on the ground. A single operator is required for cutting the pineapple and putting it in the basket as well. The total weight of the machine is 9 kgs. The cutting blade can be sharpened or replaced when damaged.

iv. Input / raw material:

a. Overall dimension (LxBxH mm): 1500(L) x 130 (B)

b. Weight: 9 kgs.

c. Prime mover: Petrol engine

d. Power (hp): 1.5 hp

e. Man power: Single operator

f. Land: Hilly terrains/terrace land of NEH

g. Investment: Rs. 10,000/-

V. Output capacity

Field capacity is in the range of 250 to 280 harvested fruits per hour

VI. Unit cost (per machine):

Rs. 10,000/-

VII. Suitability for crop / commodity

Suitable for pineapple harvesting

a. This tool replaces the conventional chopping method which easily damages pineapples and injures the harvester.

b. The conventional method is not only time consuming and laborious but also causes backache as harvesters have to stoop while harvesting.

c. Harvesters will not suffer from sharp pricks of the pines or back pain because they need not bend to harvest.

VIII. Efficiency

70.44% (actual capacity =0.048 ha/day & theoretical cap.=0.068 ha/day) and fruit damage <5%

IX. Unit cost of operation:

Rs. 1.5 per harvested fruit

X. Commercialization status:

The developed pineapple harvester is well designed based on the field condition of hilly terrain region of NE states. It is now ready for commercialization.

XI. Contact Address:

P.I., AICRP on PHET, Directorate of Research, Central Agricultural University, Imphal-795004.
Technologies /Horticultural Crops

Technology No. 73

i. Name of the Technology : Water Chest Nut Decorticator (Manual)

ii. Application/ Use : The kernel of water chestnut contains 60-68% carbohydrates, 8-12% proteins, 2-6% sugar, 3-4% minerals and less than 1% fat. In Indian villages, it is generally used in breakfast. It has significant importance in manufacturing of starch and alcohol and therefore, this valuable crop has potential and needs to be exploited.

iii. Description of Technology :

At present water chest nut decortication is done manually by the growers which is slow, laborious and tiring one. Keeping in view the problems of the water chestnut growers, a manually operated water chestnut decorticator was developed. Hand operated water chestnut decorticator consists of a hopper and an oscillating shoe. Hopper is made from MS angle iron (25mm x 25mm x 3mm) having a sieve (slot of 44mm x 15mm size) in the bottom and two MS sheets on the sides. Oscillating sector consists of MS flat having three wooden rollers on the top which acts as handle and three cast iron shoes mounted at the bottom. The decortication of water chestnuts involves cracking and rubbing under pressure in between screen and the shoe. The screen is stationary whereas the shoe rotates. While rotating the shoe, the water chestnuts get cracked due to the frictional and rubbing action between the oscillating sector and the perforated concave sieve. Decorticated kernels along with husk pass through the screen and collects at the bottom of the unit. For this study, looking toward the size of water chestnuts, the screen was developed so that only dehusked kernels along with husk may pass through the screen. To avoid kernel damage, developed decorticator was operated at about 35 OPM. The capacity of water chestnut decorticator is determined as 60 kg/hr with about 99% efficiency. The cost of the machine is computed as Rs. 2500/-. The machine has been developed and can be purchased from AICRP on PHT, College of Agricultural Engineering, Jabalpur.

iv. Input/raw material :

a) Overall dimension : 250 x 500 x 1100 mm
b) Weight : 26 kg.
c) Prime mover : -
d) Power (HP) : Manual
e) Man power : 1+1
f) Land : 10 x 10 ft.
g) Investment : Rs. 5000.00 + Operational Expenditure.

v. Output capacity : 60 kg per hour.

vi. Unit cost (per machine) : Rs. 2500.00

vii. Suitability for crop/commodity : Water chest Nuts

viii. Efficiency : 99%

ix. Unit cost of operation : Rs. 40.00 per hour.

x. Commercialization status : Commercialized

a) No. of Licensees : 1

xi. Contact Address : Research Engineer, AICRP on PHET
College of Agricultural Engineering,
Jawaharlal Nehru Krishi Viswa Vidyalaya,
Jabalpur - 482 004 (Madhya Pradesh)
Technology No. 74

i. **Name of the Technology**: Fruit Grader (Manual)

ii. **Application/Use**: Sorting and Grading of Fruits

iii. **Description of Technology**:
The main component of multi fruit grader includes; feed trough, intermediate hopper, separating trough collecting platform and mainframe. Multi-fruit grader is designed on the principle of size basis and it is tested for guava, mosambi and orange. The multi-fruit grader is also an adjustable multi-fruit grader, which can be adjusted for a variety of spherical and oval shaped fruits. Multi-fruit grader can separate as small as 50mm size and as large as 130 mm fruits.
The moisture content of fresh fruits was determined as 78% in guava, 85% in mosambi and 89% in orange. Fruits were fed into the feed trough in batches. The position of baffles was decided on the basis of size of fruit and their rolling on that surface. Fruits were conveyed from feed trough to separating trough intermediate hopper, which is attached to the main frame. When the fruits were dropped in the separating trough they roll along with the length of separation trough due to the inclination. Separating trough is divided into four sections (i.e. 0-500, 500-1000, 1000-1500 and 1500-2000mm,) where fruit were separated into four grades (i.e. A: 50-70, B: 70-90, C: 90-110 and D: 110-130 mm.) Smaller fruits were separated out first while larger fruits rolled further and dropped according to their size in the larger opening provided for the purpose. Graded fruits were collected in the collecting boxes placed on collecting platform. Grading took place due movement under gravity over the variable opening slit and there is no need of any electrical or mechanical power.

iv. **Input/raw material**: Fruits & Vegetables like Citrus fruits, Potatoes, Onion etc.

   a) **Overall dimension**: 2100 x 300 x 1650 mm

   b) **Weight**: 63 kg.

   c) **Prime mover**: Manual

   d) **Power (HP)**: Not required

   e) **Man power**: 1

   f) **Land**: 12 x 10 ft.

   g) **Investment**: Rs. 10,000.00 + Operational Expenditure

v. **Output capacity**: 1200 kg per hour

vi. **Unit cost (per machine)**: Rs. 10,000.00

vii. **Suitability for crop/commodity**: Fruits & Vegetables like Citrus fruits, Potatoes, Onion etc.

viii. **Efficiency**: 90 – 95%

ix. **Unit cost of operation**: Rs. 40 per hour.

x. **Commercialization status**: Commercialized

   a) **No. of Licensees**: 1

   b) **Address of Licensees or Manufacturer**: -

xi. **Contact Address**: Research Engineer, AICRP on PHET
College of Agricultural Engineering,
Jawaharlal Nehru Krishi Viswa Vidyalaya,
Jabalpur -482 004 (Madhya Pradesh)
## Technologies / Horticultural Crops

### Technology No. 75

<table>
<thead>
<tr>
<th>i. Name of the Technology</th>
<th>Power Operated Pea Shelling Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>iii. Description of Technology</td>
<td>Manual removal of kernels from green pea pods takes a lot of time (3-3.5 kg of green peas in one hour) and it is laborious and tiring job. Therefore, it was felt necessary to develop a suitable power operated green pea pod sheller to meet the requirement of the pea growers. The sheller consisted of feeding hopper, roller, concave, frame and a 0.25 hp electric motor. The roller is fixed on a central shaft supported on two bearings. The roller rotates in the concave. The roller and concave assembly is mounted on a frame. The concave consists of galvanized iron sheet punched with holes of 16 mm dia. at a center to center distance of 26 mm. The pods were fed through the hopper from shelling operation. Green pea pods were shelled by uniform feeding at constant speed. The feed rate was controlled by the delivery lever and clearance was adjusted slightly less than the pod size. Pods with higher moisture content were shelled prior to the pods having lower moisture content. The pea pods get shelled due to friction between the roller, whose surface is abrasive made of punched sheet and concave and also due to impact developed during the rotation of roller. After completion of peeling operation, the different fractions of the shelled sample like whole kernels, damaged kernels and unshelled pods were collected cautiously. The capacity of the power operated pea shelling machine is 60 kg/hr with about 98% efficiency. The cost of the machine is computed as Rs. 20,000/- The machine has been developed by AICRP on PHT, College of Agricultural Engineering, Jabalpur.</td>
</tr>
<tr>
<td>iv. Input/raw material</td>
<td>Green Pea Pods</td>
</tr>
<tr>
<td>a) Overall dimension</td>
<td>1040 x 380 x 1240 mm.</td>
</tr>
<tr>
<td>b) Weight</td>
<td>105 kg.</td>
</tr>
<tr>
<td>c) Prime mover</td>
<td>Electric Motor</td>
</tr>
<tr>
<td>d) Power (HP)</td>
<td>0.5 hp.</td>
</tr>
<tr>
<td>e) Man power</td>
<td>1</td>
</tr>
<tr>
<td>f) Land</td>
<td>12 x 10 ft.</td>
</tr>
<tr>
<td>g) Investment</td>
<td>Rs. 15,000.00 + Operational Expenditure.</td>
</tr>
<tr>
<td>v. Output capacity</td>
<td>60 kg per hour.</td>
</tr>
<tr>
<td>vi. Unit cost (per machine)</td>
<td>Rs. 15000.00</td>
</tr>
<tr>
<td>vii. Suitability for crop/commodity</td>
<td>Green Peas</td>
</tr>
<tr>
<td>viii. Efficiency</td>
<td>98%</td>
</tr>
<tr>
<td>ix. Unit cost of operation</td>
<td>Rs. 40 per hour.</td>
</tr>
<tr>
<td>x. Commercialization status</td>
<td>Commercialized</td>
</tr>
<tr>
<td>a) No. of Licensees</td>
<td>1</td>
</tr>
<tr>
<td>b) Addresses of Licensees or Manufacturer</td>
<td>-</td>
</tr>
<tr>
<td>xi. Contact Address</td>
<td>Research Engineer, AICRP on PHET College of Agricultural Engineering, Jawaharlal Nehru Krishi Vidyaiaya, JABALPUR-482 004 (Madhya Pradesh)</td>
</tr>
</tbody>
</table>
## Technology No. 76

### i. Name of the Technology
Power Operated Green Bengal Gram Pod Stripping Machine

### ii. Application/Use
Shelling of Green Peas

### iii. Description of Technology:
Fresh Bengal gram is an intermediate product and is consumed as a vegetable in the northern states of the country. A Bengal gram stripper was developed at Jabalpur centre of AICRP on Post Harvest Technology by using spike tooth type stripping roller. The length of the roller was 300mm and height of the spikes was kept as 50mm. The spikes were fastened on mild steel flat of 25 mm x 4mm at a distance of 15mm. Each such flat was mounted on two plates of 110mm diameter. A bunch of green Bengal gram plants is held in front of the stripping machine in such a way that pods and leaves are projected towards the stripping loop and on rotation of the stripping cylinder, the pods are detached from the plants. In this way pods from entire plants can stripped in two or three bunches. The detached pods along with broken twigs and leaves while falling pass through a separating trough fitted on the lower part of the machine. Here the leaves and twigs are separated from the pods and pods can be collected separately. To calculate the stripping efficiency, weight of un-striped pods, weight of stripped pods, weight of stem, and weight of leaves were recorded. Considering the effect of plant's moisture content and speed of machine, the best efficiency of the machine was obtained as 98.82% at 350 rpm of the machine and 61.41% moisture content (wb). At this point the capacity of the machine was computed as 100 kg/hr. The cost of machine is calculated as Rs. 25,000/-. The machine has been developed by AICRP on PHT, College of Agricultural Engineering, Jabalpur.

### iv. Input/raw material
- **Green Pea Pods**
- **Overall dimension**: 1040 x 380 x 1240 mm
- **Weight**: 105 kg.
- **Prime mover**: Electric Motor
- **Power (HP)**: 0.5 hp.
- **Man power**: 1
- **Land**: 12 x 10 ft.
- **Investment**: Rs. 15,000.00 + Operational Expenditure.

### v. Output capacity
- **60 kg per hour.**

### vi. Unit cost (per machine)
- **Rs. 15000.00**

### vii. Suitability for crop/commodity
- **Green Peas**

### viii. Efficiency
- **98%**

### ix. Unit cost of operation
- **Rs. 40 per hour**

### x. Patent obtained/applied
- **Not yet.**

### xi. Commercialization status
- **Commercialized**
- **No. of Licensees**: 1
- **Addresses of Licensees or Manufacturer**: -

### xii. Contact Address
- **Research Engineer, AICRP on PHET**
- **College of Agricultural Engineering, Jawaharlal Nehru Krishi Viswa Vidyalaya, Jabalpur-482 004 (Madhya Pradesh)**
**Technology No. 77**

i  **Name of the Technology** : Ber Grader

ii  **Application/ Use** : Grading of ber

iii  **Description of Technology** :

Manually operated ber grader is simple in design, easy in operation. The grading of mixed lot others into three sizes i.e. > 35mm to 25mm and < 25mm at low cost with this machine. The capacity of the machine is of 500-600 kg/h. The screen area is 0.48m². The screens are provided with rubber sheet of 3 mm to avoid bruising of ber. There is a provision for change in angle of Screens (top 0-15°, middle: 0-20 ° and Bottom 5 ° slope) and for collection of graded material from each screens. The oscillation motion is provided to the two screens through single step V-belt arrangement. The complete unit is mounted on an angle iron frame and provided with flywheel with handle for operating the machine.

iv  **Input/raw material** :

   a)  Overall dimension (L x B x H mm) : -

   b)  Weight : -

   c)  Prime mover : -

   d)  Power (hp) : N.A.

   e)  Man power : One

   f)  Investment : -

v  **Output capacity** : 500-600 kg/ h

vi  **Unit cost (per machine)** : Rs.10,000/-

vii  **Suitability for crop/ commodity** : Ber

viii  **Efficiency** :

ix  **Unit cost of operation** : -

x  **Commercialization status** :

   a) No. of Licensees : Nil

   b) Addresses of Licensees or Manufacturer :

xi  **Contact Address** :

   Director,
   ICAR-Central Arid Zone Research Institute
   Jodhpur - 342003 (Rajasthan)
Four Decades of R&D of AICRP on PHET

Technology No. 78

i. Name of the Technology : Cleaner-cum-Grader for Cumin

ii. Application/ Use : Cleaning and grading of cumin seed and can be used for other seeds just by changing the sieves.

iii. Description of Technology :
The reciprocating type cumin cleaner cum grader consists of feed hopper, sieve box, blower and power transmission and drive unit and frame.

iv. Input/raw material : Cumin seed
   a) Overall dimension : 1210 x 1000 x 1000 mm
   b) Man power : 2
   c) Power : 1 HP (0.746 Kw), Single phase
   d) Investment : Rs. 35,000 + Material cost

v. Output capacity : 50 kg / hour

vi. Unit cost (per machine) : Rs. 35,000

vii. Suitability for crops/commodity : Cumin

viii. Efficiency : -

ix. Unit cost of operation : -

x. Commercialization status : Commercialized
   (a) No. of Licensees to whom the technology has been transferred : 2

   (b) Selected Addresses of Licensee/Manufacturer
       1. Shri Tadka Pipliya Seva Sahkari Mandli Limited, Tadka Pipliya, Taluka-Bhesan, Distt. Junagadh, Gujarat

xii Contact Address : Research Engineer, AICRP on PHET College of Agricultural Engineering, Junagadh Agricultural University, Junagadh - 362 001 (Gujarat)
Technology No. 79

i. Name of the Technology : Development of Shell Fired Copra Dryer

ii. Application/ Use : For production of quality copra for coconut oil extraction

iii. Description of Technology :
A shell fired copra dryer was designed and developed to dry coconut in 24 h which works on indirect heating and natural convection principles using coconut shell as fuel. The capacity of the dryer developed was 1000 nuts per batch. The drying air temperature in the drying chamber was 80 °C. The unique burner designed generated heat for 5 hours without tending and the heat is retained for one more hour. No electrical energy is used in this dryer making it farmer friendly. Once the fuel is charged it produces heat for 6 hours thereby allowing the farmer to do other useful work as compared to other dryers where in fuel is loaded once in 15-20 minutes. Smoke does not come into contact with the copra, hence the copra produced is of good quality. About 100 grams of shell charcoal is also produced during the final phase of heating.

iv. Input/raw material :
- a) Overall dimension : 22500x1500x15000
- b) Weight : 125kg
- c) Prime mover : NA
- d) Power (hp) : NA
- e) Man power : One
- f) Land : 100 sqm
- g) Investment : 75000

v. Output capacity : 1000 Nuts / batch

vi. Unit cost (per machine) : 45000

vii. Suitability for crop/commodity : Coconut and Arecanut

viii. Efficiency : 24.48% (Thermal)

ix. Unit cost of operation : 0.90/ nut

x. Patent obtained/applied : Applied

xi. Commercialization status :
- a) No. of Licensees : 30
- b) Addresses of Licensees or Manufacturer : Die Tech Industries, Industrial area, Vidyaganagar Kasaragod, Kerala-671121

xii. Contact Address : Research Engineer, AICRP on PHET ICAR-Central Plantation Crop Research Institute Kasargod - 671124 (Kerala)
Technology No. 80

i. Name of the Technology : Tender Coconut Punch and Cutter

ii Application/ Use : For making a hole in tender coconut and for cutting it into two halves

iii Description of Technology :
A simple tender nut punch has been developed. It mainly consists of a square base made of MS angle of 40 cm length. The tender nut is placed on the nut holder which is a circular and hollow in shape with a diameter of 10 cm. The tender nut can be placed on the nut holder and by operating the lever mechanism a hole of 12mm diameter is made in just 4-5 seconds. A straw is put in the hole and one can drink the nut water. A simple Tender Coconut Cutter was developed. It mainly consists of a wooden base of 50 cm length, a stand, a knife and a hand lever. The stand is mounted on the base. The cutting blade is mounted concentric to the stand and retained at a height of 15-20 cm.

iv Input/raw material :
   a) Overall dimension : 5000x1500x1500 (L x B x H mm)
   b) Weight : 15kg
   c) Prime mover : NA
   d) Power (hp) : NA
   e) Man power : One
   f) Land : 9sqm
   g) Investment : 15000

v Output capacity : 20 nuts/ h

vi Unit cost (per machine) : 12500

vii Suitability for crop/commodity : Coconut

viii Efficiency : 200 nuts/ h

ix Unit cost of operation : 0.15/nut

x Patent obtained/applied : No

xi Commercialization status : Ready for commercialization
   a) No. of Licensees : 2
   b) Addresses of Licensees or Manufacturer : Die Tech Industries, Industrial area, Vidyanagar Kasaragod, Kerala-671121

xii Contact Address : Research Engineer, AICRP on PHET
   ICAR-Central Plantation Crop Research Institute Kasargod-671124 (Kerala)
Technologies / Horticultural Crops

Technology No. 81

i  Name of the Technology : Coconut De-Shelling Machine

ii  Application/ Use : For separating coconut shell and kernel after partial drying

iii  Description of Technology :
Traditionally after partial drying of split coconut, the kernel and copra is separated using a traditional wooden mallet by taking the individual cups in hand. To overcome this problem, a power operated coconut de-shelling machine was designed and developed. The capacity of the machine was 400 half cups per batch. The optimum average moisture content for maximum de-shelling efficiency (92.16 %) was 35 % d.b. The optimum speed of the de-shelling machine is 10 RPM and the time taken for de-shelling was 4 minutes per batch.

iv  Input/raw material :
  a. Overall dimension (L x B x H mm) : 5000x1500x1500
  b. Weight : 15kg
  c. Prime mover : NA
  d. Power (hp) : NA
  e. Man power : One
  f. Land : 9 sq m
  g. Investment : Rs. 150000/-

v  Output capacity : 5000 nuts/ h

vi  Unit cost (per machine) : Rs 50000/-

vii  Suitability for crop/commodity : Coconut

viii  Efficiency : 200 nuts/ h

ix  Unit cost of operation : 0.15/nut

x  Patent obtained/applied : No

xi  Commercialization status :
  a) No. of Licensees : Nil
  b) Addresses of Licensees or Manufacturer :

xii  Contact Address : Research Engineer, AICRP on PHET
  ICAR-Central Plantation Crop Research Institute
  Kasargod -671124 (Kerala)
Technology No. 82

i  Name of the Technology : Coconut Slicing Machine

ii  Application/ Use : Slicing coconut kernel

iii  Description of Technology :
The machine consists of two stainless steel slicing blades fixed on a circular blade supporting disc, a feeder to insert coconut endosperm for slicing, an exit guide to guide the sliced coconut chips towards the outlet and an electric motor as a prime mover. The electric motor rotates the blade supporting disc using a V-belt. Coconut endosperm is pressed to the surface of the rotating wheel through the slot provided on the feeder at the top of the machine. When it comes in to contact with the blades the coconut endosperm gets sliced and chips are produced. The sliced coconut chips are then guided towards the outlet by the exit guide and are collected in a container. Coconut chips of uniform and required thickness could be produced using this machine. Capacity of the machine is 50 coconuts per hour. Fabrication cost of the machine is Rs.50,000/-

iv  Input/raw material
    a)  Overall dimension : 500X 210X450
       (L x B x H mm)
    b)  Weight : 20kg
    c)  Prime mover : Electrical motor
    d)  Power (hp) : 0.5
    e)  Man power : One
    f)  Land : Nil
    g)  Investment : Rs.50,000/-

v  Output capacity : 50 coconuts per hour

vi  Unit cost (per machine) : Rs.50,000/-

vii  Suitability for crop/commodity : Coconut, Banana, tuber crops, vegetables

viii  Efficiency : 50 coconuts per hour

ix  Unit cost of operation : Rs.0.5 per coconut

x  Patent obtained/applied : Applied

xi  Commercialization status
    a)  No. of Licensees : One
    b)  Addresses of Licensees or Manufacturer : NRDC, Bangalore

xii  Contact Address : Research Engineer, AICRP on PHET
                      ICAR-Central Plantation Crop Research Institute
                      Kasargod -671124 (Kerala)
Technologies /Horticultural Crops

Technology No. 83

i Name of the Technology : Coconut Testa Removing Machine

ii Application/ Use : Removing coconut testa

iii Description of Technology :
The machine consists of a circular wheel covered with an emery cloth or water paper. This friction wheel is rotated using an electric motor. Coconut kernel is pressed to the surface of the rotating friction wheel either by hand or using a fork. Removed testa is collected at the bottom. The emery cloth/ water paper needs to be replaced periodically when the surface gets smoothened. One person can remove testa of about 75 coconuts per hour. Fabrication cost of the machine is Rs.25,000/-

iv Input/raw material :
a) Overall dimension (L x B x H mm) : 750X550X950
b) Weight : 60kg
c) Prime mover : Electrical motor
d) Power (hp) : 1hp
e) Man power : Manual
f) Land : Nil
g) Investment : Rs. 25,000/-

v Output capacity : 25 coconuts per hour

vi Unit cost (per machine) : Rs. 15,000/-

vii Suitability for crop/ commodity : Coconut

viii Efficiency : 25 coconuts per hour

ix Unit cost of operation : Rs.0.30 per coconut

x Patent obtained/applied : Applied

xi Commercialization status :
a) No. of Licensees : One
b) Addresses of Licensees or Manufacturer : NRDC, Bangalore

xii Contact Address : Research Engineer, AICRP on PHET ICAR-Central Plantation Crop Research Institute Kasargod -671124 (Kerala)
Technology No. 84

Name of the Technology : Honey Processing Unit

Application/ Use : Integrated honey heating cum filtration system is used for processing of raw honey without deteriorating its quality. The machine cost is low as compared to commercially available and easy to handle.

Description of Technology :

The commercially available heating cum filtration units are very costly and small entrepreneurs could not buy. The small entrepreneur can process honey in production catchment itself with heating cum filtration unit designed by Ludhiana centre. The heating section consists of a double walled cylinder and two electric heating elements filled with water and attached with a pump for recalculate the water for maintaining uniform temperature profile throughout the heated honey. The heated honey is passed to the filtration unit through the hole provided at the bottom of the inner cylinder and extended through a pipe having gate valve. The filtration cylinder consists of lid of four layered muslin cloth. The operator was comfortable while working with the machine.

Inputs :

a) Raw material : Honey
b) Machinery :
   • Overall dimension : 686x686x524 mm
   • (L x B x H mm)
   • Weight : 80 kg (approximately)
   • Prime mover : 0.25 hp motor
c) Man power : One
d) Land : N.A.
e) Investment : Rs. 35000/ (cost of the machine only, as the machine is proposed for existing entrepreneurs)

Output capacity : 50 kg/ batch
Unit cost (per machine) : Rs. 35000
Suitability for crop/commodity : Honey

Efficiency : 99 %
Unit cost of operation : Rs. 2/ kg

Commercialization status : Ready for transfer and commercialization
a) No. of Licensees : 01
b) Addresses of Manufacturer : M/S H V Industries, K- 105 Focal Point, Phase VII, Dhandhari Kalan, Ludhiana (Punjab)

Contact Address : Research Engineer, AICRP on PHET
Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, PAU Ludhiana-141 004 (Punjab)
Technologies /Horticultural Crops

Technology No. 85

i. Name of the Technology : Hand Operated Wild Apricot Decorticator

ii. Application/ Use : Decortications of wild apricot

iii. Description of Technology:

Apricot decorticator (hand operated) is used to decorticate the bitter apricot pit into husk (stone) and kernels. Decortications of apricot stone (pit) is done by passing them in between two cylindrical rollers moving in inward direction.

iv. Input

a) Raw material : Apricot stone/kernels
b) Machinery :
   Overall dimension : 62x80 cm² floor area and 112 cm height
   Weight : 80 Kg
   Prime mover : NA
   Power : NA
d) Man power : 2
e) Land : NA
f) Investment : Rs 8700

v. Output capacity : 60 kg/h

vi. Unit cost (per machine) : Rs 8700

vii. Suitability for crops/commodity : Apricot and other nuts (plum, almond, etc.) can be decorticated

viii. Efficiency : 87% for decortications

ix. Unit cost of operation : Rs. 0.40/kg apricot stone

x. Commercialization status

(a) No. of Licensees to whom the technology has been transferred : Nil
(b) Selected Addresses of Licensee or Manufacturer : Nil

xi. Contact address : Head
   Department of Process and Food Engg.,
   College of Tech., G. B. Pant
   University of Agriculture & Tech.,
   Pantnagar -263 145 (Uttaranchal)
Technology No. 86

i. Name of the Technology : Apricot Stone Grader

ii. Application/ Use : To grade the bitter apricot pits according to their size

iii. Description of Technology:
Machine is used to grade the bitter apricot pits on the basis of size. Pits are graded in four grades using three sieves of different sizes and one pan at bottom. The grader is pedal operated.

iv. Input :
   a) Raw material : Apricot stone/kernels
   b) Overall dimension : 88x34 cm² floor area and 100 cm height
   c) Weight : 42 kg
   d) Man power : 2
   e) Investment : Rs 4000.00

v. Output capacity : 150 kg/h

vi. Unit cost (per machine) : Rs 4000.00

vii. Suitability for crops/commodity : Bitter apricot pit, apricot pit, almond

viii. Efficiency : 86 %

ix. Unit cost of operation : Rs 6500.00 per month

x. Commercialization status :
   (a) No. of Licensees to whom the technology has been transferred : Nil
   (b) Selected Addresses of Licensee or Manufacturer : Nil

xi. Contact Address : Head
    Department of Process and Food Engg,
    College of Tech., G. B. Pant University
    of Agriculture & Tech.,
    Pantnagar -263 145 (Uttaranchal)
<table>
<thead>
<tr>
<th>i.</th>
<th>Name of the Technology</th>
<th>Pedal Operated Fig Pressing Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii.</td>
<td>Application/ Use</td>
<td>Fig fruits are highly perishable in nature and can be kept for only a week at 0°C at 90% RH. The shelf-life of fig fruit can be enhanced by proper drying and can be stored for a longer period. The fig fruits are pressed by hand or by some crude country vice after drying in order to reduce their bulk for convenience of transportation. The developed fig pressing machine can be used to press the dried fig fruits locally and can replace the imported (from Afghanistan) figs in the local market. The capacity of the machine is 25 kg of dried fruits per hour. The pressed fruit can be stored in HDP pouches for about 3 months at ambient condition.</td>
</tr>
<tr>
<td>iii.</td>
<td>Description of Technology</td>
<td>The pedal operated fig fruit pressing machine is basically a sewing machine. The machine consists of a base plate fixed on plywood top and an upper movable plate for pressing the dried fruits. By operating the pedal of the machine, the crank wheel converts rotary motion into reciprocating motion and is transferred to the movable plate. The gap between the pressing plates is set at 70mm so as to allow the operator to keep the dried fruit on the base plate. At the end of pressing stroke, 7mm gap is provided to avoid damage to the fruit. One complete revolution of the crank gives the desired reciprocating motion. The time required for one revolution is 3 seconds. The capacity of the machine is 25 kg of dried fruit per hour.</td>
</tr>
<tr>
<td>iv.</td>
<td>Input/raw material</td>
<td>Sewing machine, pulleys, plates</td>
</tr>
<tr>
<td></td>
<td>a) Overall dimension</td>
<td>880 x 620 x 1170 mm</td>
</tr>
<tr>
<td></td>
<td>b) Weight</td>
<td>40 kg</td>
</tr>
<tr>
<td></td>
<td>c) Prime mover/ Plant &amp;</td>
<td>Nil</td>
</tr>
<tr>
<td></td>
<td>Machinery</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Man power</td>
<td>One person</td>
</tr>
<tr>
<td></td>
<td>e) Power</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>f) Investment</td>
<td>Rs. 1,500 / -</td>
</tr>
<tr>
<td>v.</td>
<td>Output capacity</td>
<td>25 kg per hour</td>
</tr>
<tr>
<td>vi.</td>
<td>Unit cost (per machine)</td>
<td>Rs. 3,500/-</td>
</tr>
<tr>
<td>vii.</td>
<td>Suitability for crops/commodity</td>
<td>Fig</td>
</tr>
<tr>
<td>viii.</td>
<td>Efficiency</td>
<td>95 – 98 %</td>
</tr>
<tr>
<td>ix.</td>
<td>Unit cost of operation</td>
<td>Rs. 0.52 / kg</td>
</tr>
<tr>
<td>x.</td>
<td>Commercialization status</td>
<td>Ready for Commercialization</td>
</tr>
<tr>
<td></td>
<td>(a) No. of Licensees to whom</td>
<td>56 Farmers</td>
</tr>
<tr>
<td></td>
<td>the technology has been</td>
<td></td>
</tr>
<tr>
<td></td>
<td>transferred</td>
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<tr>
<td>xi.</td>
<td>Contact Address</td>
<td>Sr. Scientist &amp; PI, AICRP on PHET</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dept. of Processing and Food Engineering,</td>
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<td></td>
<td></td>
<td>College of Agricultural Engineering, UAS Raichur</td>
</tr>
</tbody>
</table>
Technology No. 88

i. **Name of the Technology**: Natural Convection Solar Dryer  
   [Mini-multi rack solar dryer]

ii. **Application/Use**: Traditionally, the food products are dried by spreading in open sun in thin layer. Though this method is economical and simple, it has the drawbacks like; no control over the rate of drying, non-uniform drying, chances of deterioration and loss due to exposure of products to rain, dust, storm, birds, rodents, insects and pests. Whereas, solar drying system overcomes all those problems and ensures better quality of dried products, there by fetching higher price for the dried products.

iii. **Description of Technology**:  
The mini-multi rack solar dryer consists of a transparent glass cover for transmitting solar radiation, aluminium trays (five numbers) for loading the produce, GI sheet coated with dull black paint to absorb maximum solar radiation, a wooden cover with saw dust as insulating material to minimize the thermal losses and a main cabinet made out of wood for housing different parts of the dryer. The fresh air enters the cabinet through the holes made in the bottom of the dryer. The solar radiation falling on the dryer is transmitted by the transparent glass, which is absorbed by the absorber plate. Then the air gets heated and rises upwards as it becomes less dense. The hot air while moving upward removes the moisture from the product kept on the trays and exits through the holes made at the top of the dryer. This dryer saves 40 per cent of drying time with superior quality dried products over open sun drying.

a) Overall dimension : 1360 x 600 x1455  
b) Weight : 65 kg  
c) Prime mover/ Plant & Machinery : Nil  
d) Man power : 1 person  
e) Land : 3 square meter  
f) Investment : Rs. 2000/-

v. **Output capacity**: 15 kg of horticulture produce dried per batch

vi. **Unit cost per machine**: Rs. 4500/-

vii. **Suitability for crops/commodity**: Fruits & vegetables, fish, medicinal plants, snack foods

viii. **Efficiency**: 85-90%

ix. **Unit cost of operation**: Rs. 1.0 – 1.5 per kg

x. **Patent obtained/applied**: Nil

xi. **Commercialization status**: Ready for commercialization  
a) No. of Licensees : One fabricator and 12 farmers

xii. **Contact Address**: Sr. Scientist & PI, AICRP on PHET  
Dept. of Processing and Food Engineering,  
College of Agricultural Engineering,  
UAS, Raichur.
Technologies / Horticultural Crops

Technology No. 89

i. **Name of the Technology** : Forced Convection Solar Drying System

ii. **Application/ Use** : This system ensures the uniform drying and control over the rate of drying. Also this system avoids deterioration and loss of products due to dust, birds, rodents, insects and pests and ensures better quality of dried products, thereby fetching higher price for the dried products.

iii. **Description of Technology** :
The forced convection solar drying system consists of six air heaters, conveying unit, auxiliary heating unit, blower and two drying chambers. The solar radiation is transmitted by the glass cover of the air heater in which the air gets heated. This hot air is conveyed by an A.C. driven centrifugal blower into the drying chambers in which the products are kept in the trays. An electric heater is provided to supplement the heat during low solar radiation and for continuous drying during night period if required. This system ensures uniform drying of products and saves 50 per cent of drying time with superior quality dried products over open sun drying.

iv. **Input/raw material** :
   a) **Overall dimension** : 725 x 600 x 1800
   b) **Weight** : 60 kg
   c) **Prime mover/ Plant & Machinery** : Blower, Heater
   d) **Power** : 3 Phase power/supply
   e) **Man power** : 2 to 3 persons
   f) **Land** : 40 m² area of land for installation of the system
   g) **Investment** : Rs. 2,00,000/-

v. **Output capacity** : 70-80 kg of horticultural produce/batch

vi. **Unit cost (per machine)** : Rs. 60,000/-

vii. **Suitability for crops/commodity** : Cereals, Pulses, Fruits and vegetables

viii. **Efficiency** : 82 per cent

ix. **Unit cost of operation** : Rs. 2.5-3.0 per kg

x. **Commercialization status** :
   (a) **No. of Licensees to whom the technology has been transferred** : Ready for commercialization
   
   One Farmer and one entrepreneur

xi. **Contact Address** :
   Sr. Scientist & PI, AICRP on PHET
   Dept. of Processing and Food Engineering, College of Agricultural Engineering, UAS, Raichur.
Technology No. 90

i. Name of the Technology: Dried Apricot Grader

ii. Application/Use: For grading of Apricots on the basis of size particularly in Ladakh region.

iii. Description of Technology:
In Ladakh division, it was observed that the dried Apricots are sold as a mixed lot without any grade specification. Need was felt for size grading of dried apricots for better returns to the people involved in the trade. In this context a manually operated Apricot grader with 200-250 kg/h capacity was fabricated by Srinagar centre. The dimensions of sieve holes are: 1st Sieve = 3.8x3.8cm, 2nd Sieve = 2.54x2.54cm, 3rd Sieve = 2.10x2.10cm. The height of the grader above ground is 110 cm (body= 66 cm and base 43 cm) and length of the handle (arm) is 20 cm. Apricot can be graded into four grades base on the size of apricot. The specifications (i.e., length and breadth) of the grades are given as:
Grade 'A' = 29.73 x 28.60 mm
Grade 'B' = 26.34 x 22.66 mm
Grade 'C' = 23.30 x 20.44 mm
Grade 'D' = 18.33 x 15.26 mm

iv. Input:
   a) Raw material: Un-graded dried Apricots
   b) Machinery
      Overall dimension: Body (56x51 cm), Sieves (41x41 cm)
      Weight: 45kgs.
      Prime mover/ Power: Hand operated
   c) Man power: 02 persons/day for 8 hours
   d) Land: Can be operated with a space of 8x10 feet
   e) Investment: Rs 2800/-

v. Output capacity: 200-250 kg/h

vi. Unit cost (per machine): Approx. Rs 3500 - 4000/=

vii. Suitability for crops/commodity: Most suitable for grading of dried Apricots.

viii. Efficiency: 81.4 - 92.5 %

ix. Unit cost of operation: Rs 40/qt.

x. Commercialization status
   (a) No. of Licensees to whom the technology has been transferred: Ready for commercialization
   Nihil

xii. Contact Address: PI, AICRP on PHET
                   Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, Srinagar –191 121 (J&K)
Technologies/Horticultural Crops

Technology No. 91

i. **Name of the Technology** : Walnut Dehuller

ii. **Application/Use** : Walnut dehuller was developed to suit the hilly regions of J&K state.

iii. **Description of Technology**:
After harvesting green walnuts are heaped under the tree for 10-15 days to get the hulls loosen due to heat generation. The heaped green walnuts are then subjected to manual dehulling by either rubbing the green walnuts with one another or by beating them by wooden logs. The juglone dye (5-hydroxy-1, 4-naphthalenedione) present in the hull gets permanently stained on the hands of workers, which takes not less than two months to go off. In order to overcome the above mentioned problems, the Srinagar Center AICRP on PHET has developed a walnut dehuller and also standardized the pre-chemical treatment for hull dehiscence. The 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.

iv. **Input/Output**:
   a) **Raw material** : Green walnuts
   b) **Machinery**
      - **Overall dimension** : Front View: 1375 mm x 880 mm
      - **Side dimension** : 1375 mm x 480 mm
      - **Weight** : 65 kgs.
      - **Prime mover/ Power** : Power operated (1 HP Motor)
      - **Manpower** : 1 person for 4 hrs dehulling the one ton of green walnuts-one person is required for 4 hrs.
   d) **Land** : Can be operated with a space of 3.4 x 2 feet
   v. **Output capacity** : 250 kg/hour
   vi. **Unit cost (per machine)** : Approx. Rs 45,000/-
   vii. **Suitability for crops/commodity** : Suitable for dehulling of green walnuts
   viii. **Efficiency** : 95.97%
   ix. **Unit cost of operation** : Rs. 102/Tonne

x. **Commercialization status**:
   a) **No. of Licensees to whom the technology has been transferred** : 02
   b) **Selected Addresses of Licensee/Manufacturer**
      1. PI, RKVY sponsored project, SKUAST (K).
      2. Mr. Sanaullah Fruit Company, Khaag, Budgam

xi. **Contact Address**
   PI, AICRP on PHET
   Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, Srinagar – 191 121 (J&K)
Four Decades of R&D of AICRP on PHET

Technology No. 92

i. Name of the Technology : Walnut Bleacher-cum-Washer

ii. Application/ Use : For bleaching and washing of dehulled walnuts

iii. Description of Technology:
Inshell walnut quality depends upon shell colour, shell thickness, suture seal, kernel size, kernel colour, taste flavor and freeness from fungal infection and rancidity. Presently the manually dehulled walnuts are washed under running water from streams, and tap water by keeping them in half cut used water drums, troughs or woven vicker baskets. Nuts are stirred by wooden logs of 5-6 feet length or trampled by feet under running water, such practices break the shell seal results in moisture ingress which subsequently leads microbial growth, darkening of kernel and causes rancidity, despite being laborious and time consuming. Further some portion of hull remains on the nuts. The post harvest losses due to manual washing are in the range of 1.5-3%. In order overcome the above mentioned problems the Srinagar Center AICRP on PHET has developed a walnut bleacher-cum-washer.

iv. Input
   a) Raw material : Dehulled Walnuts
   b) Machinery
      Overall dimension : Front view: 133.5cm × 121cm
                       Side view: 59cm × 121cm
      Weight : 73 kgs.
      Prime mover/ Power : 1 HP motor for Rotating Drum
                           50 Watt for Fluid Discharge
   c) Manpower : 1 person for 8hrs dehulling the one ton of dehulled walnuts-one person is required for 8hrs.
   d) Land : Can be operated with a space of 3.5×2.5 feet

v. Output capacity : 130 kg/hour

vi. Unit cost (per machine) : Approx. Rs 48,000/-

vii. Suitability for crops/commodity : Suitable for bleaching-cum-washing of dehulled walnuts

viii. Efficiency : 94.47%

ix. Unit cost of operation Patent obtained/applied : Rs. 186/tonne

x. Commercialization status : Ready for commercialization
   (a) No. of Licensees to whom the technology has been transferred : Nil

xi. Contact Address : PI, AICRP on PHET
                     Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus,
                     Srinagar –191 121 (J&K)
Technology No. 93

i Name of the Technology : Black Pepper Decorticator

ii Application/ Use : For producing white pepper from black pepper

iii Description of Technology :

The developed black pepper decorticator decorticates the
presoaked berries by the combined effect of churning and centrifugal
action. Water is jetted inside the
decorticating drum to enhance the
removal of the outer pericarp of the
berries. The developed decorticator
has the following parts: feed hopper,
decorticating drum, main shaft, water supply system,
collecting tray and outlet arrangement. The main functional
part of the machine is the decorticating drum which houses the
main shaft. In order to facilitate the efficient decorticating, sixteen spikes are fixed in
staggered arrangement on the shaft. The shaft rotates at a speed of 142rpm. This
horizontal shaft is connected to a reduction gear unit having a gear ratio of 5:1 through
a flanged coupling. The gear unit is coupled with 0.5 hp single phase motor of 1440
rpm through a V-belt and pulley system.

iv Input/raw material : Black pepper

a. Overall dimension (L x B x H mm) : 60cm X 30cm X 50cm
b. Weight : 40kg
c. Prime mover : Nil
d. Power (hp) : 0.5 hp electric motor
e. Man power : One person
f. Land : 1800sqcm
g. Investment : Rs.1,00,000/-

v Output capacity : 20kg/hr

vi Unit cost (per machine) : Rs.45,000/-

vii Suitability for crop/ commodity : NA

viii Efficiency : 91.8%

ix Unit cost of operation : -

x Patent obtained/applied : Nil

xi Commercialization status : Ready for commercialization

a) No. of Licensees : N A
b) Addresses of Licensees or Manufacturer : N A

xii Contact Address : Research Engineer, AICRP on PHET
Kerala Agricultural University
Kelappaji College of Agricultural Engineering and
Technology, Tavanur, Kerala –679573
Technology No. 94

i. Name of the Technology : Cassava Rasper

ii. Application/ Use : The cassava rasper is efficient and an economical equipment for small scale processing of cassava roots.

iii. Description of Technology:
The rasper consists of a crushing cylinder made up of a mild steel pipe with blades sets fixed on the circumference. The crushing cylinder is fixed on a shaft which rotates inside bearing. The power is provided by 3 hp (3 phase electric motor) with belt and pulley. The drum is rotated inside the crushing chamber which is made up of two halves, the upper being rectangular shape and the bottom half portion acts as outlet for the crushed mash. Gap between the blade set and crushing chamber is adjusted by providing wooden planks fixed to it. A changeable sieve plate is provided in the bottom half to filter the starch pulp without any bigger pieces. While feeding the tubers, the tubers are expelled from the feed inlet and to avoid that a slanting projection was given at inlet point of the hopper.

iv. Input:
a) Raw material : Cassava tuber and water
b) Machinery
   a) Overall dimension : 800 mm x 800 mm x 1000 mm
   b) Weight : 135 kg
   c) Prime mover/ Power : 3 phase electric motor
   c) Man power : One
d) Land : -
e) Investment : -

v. Output capacity : 800 – 1000 kg/h
vi. Unit cost (per machine) : Rs.45,000/-
vii. Suitability for crops/ commodity : Cassava

viii. Efficiency : 87%
ix. Commercialization status : Commercialized through Institute

x. Contact Address : Research Engineer, AICRP on PHET
ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram – 695 017 (Kerala)
Technologies / Horticultural Crops

Technology No. 95

i. Name of the Technology : Cassava Peeling Knife

ii. Application/Use : Used for peeling (removal of the corky skin alone or along with the fibrous rind) of cassava tubers

iii. Description of the Technology:

On-site evaluation of the improved prototype showed that the average output of the peeling knife is 132 kg/h, comparable to that of the traditional knife used by professional workers. Additional labour cost per tonne of tubers peeled by the improved knife (@Rs.3/- per basket of 55-60 kg unpeeled tubers) is about Rs.12/- only; Flesh loss with the improved knife is only 1.38% compared to the 5.70% flesh loss by the traditional knife. The cost of the additional tuber loss by the traditional knife, or in other words the saving of tuber flesh by the improved knife, is nearly Rs 106/- at the factory rate of Rs 145/- per bag 70 kg of tubers. The traditional knife costs Rs 5/- each, and two to three knives are disposed by a labourer each week, with the minimum cost of operation being Rs 10/- . The cost of the improved knife is estimated at Rs 40/-

iv. Inputs required/ raw material

a) Over all dimensions : 230 mm
b) Weight (kg) : 0.075 kg
c) Prime mover : NA
d) Power : Manual
e) Man power : one

v. Output capacity : 132 kg/h

vi. Unit Cost : Rs 40/-

vii. Suitability for crops/commodity : Cassava

viii. Efficiency : 98%

ix. Unit cost of operation : Rs. 0.30 per kg tubers

x. Patents obtained/applied : NA

xi. Commercialization status : Commercialized though Institute

xii Contact Address : Research Engineer, AICRP on PHET ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram –695 017 (Kerala)
Technology No. 96

i. **Name of the Technology**: Cassava Chipping Machine (Hand Operated)

ii. **Application/Use**: Cassava chipping machine is an economic alternative to manual slicing of cassava tubers and reduces the tedium associated with manual slicing as well as increases the average turn out per hour.

iii. **Description of the Technology**:
Hand operated chipping machine consists of two concentric mild steel drums, the annular space between which is divided into compartments for feeding the tubers, supported on four MS legs. A rotating disc at the bottom of the drum carries the knives assembly. A pair of H.S.S. bevel gears is provided to operate the machine manually with a crank arm. Tubers are fed into the compartments from the top and the chips are collected at the bottom.

iv. **Inputs required**
- Raw material: Cassava tubers
- Machinery: 
- Over all Dimensions: 500 mm x 500 mm x 750 mm
- Weight (kg): 30 kg
- Power: Manual
- Man power: one
- Land: NA
- Investment: NA

v. **Output capacity**: 120 kg/h for 6.9 mm thick chips

vi. **Unit Cost**: Rs.9,000/-

vii. **Suitability for crops/commodity**: Cassava, yams etc.

viii. **Efficiency**: 95%

ix. **Unit cost of operation**: Rs. 0.30/- per kg tubers

x. **Patents obtained/applied**: Obtained

xi. **Commercialization status**
- Number of licensees to whom the technology has been transferred: One
- Selected Addresses of Licensee / Manufacturer: Kerala Agro Industries Corporation, Trivandrum NRDC, New Delhi-11 00 48

xii. **Contact Address**: Research Engineer, AICRP on PHET ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram –695 017 (Kerala)
Technologies /Horticultural Crops

Technology No. 97

i. Name of the Technology developed : Pedal Operated Cassava Chipping Machine

ii. Application/Use : Cassava chipping machine is an economic alternative to manual slicing of cassava tubers and reduces the tedium associated with manual slicing as well as increases the average turn out per hour

iii. Description of the Technology :

The pedal operated chipping machine is a modified version of the hand operated prototype with additional provision of a pivoted pedal for transmitting the power to the cutting disc through suitable belt and pulley drive mechanism. A trimming knife is also provided on the frame to remove the woody neck portion of the tubers before feeding into the compartments. Four castor wheels are fixed to the legs of the machine to make it portable.

iv. Inputs required

   a) Raw material : Cassava tubers
   b) Machinery : NA
   c) Over all Dimensions : 1170 x 930 x 950 mm
   d) Weight (kg) : 72 kg
   e) Power : Manual
   f) Man power : Two

v. Output capacity : 83 to 768 kg/h for increase in chip thickness from 0.9 to 6.9 mm.

vi. Unit Cost : Rs.14,000/-

vii. Suitability for crops/commodity : Cassava

viii. Efficiency : 95%

ix. Unit cost of operation : Rs.0.20 per kg tubers

x. Commercialization status : Commercialized through Institute

xi. Contact Address : Research Engineer, AICRP on PHET
ICAR-Central Tuber Crops Research Institute,
Thiruvananthapuram –695 017 (Kerala)
Four Decades of R&D of AICRP on PHET

Technology No. 98

i. **Name of the Technology**
   Motorized Cassava Chipping Machine

ii. **Application/Use**
   Cassava chipping machine is an economic alternative to manual slicing of cassava tubers and reduces the tedious associated with manual slicing as well as increases the average turn out per hour.

iii. **Description of the Technology**
   The motorized chipper developed runs with a 0.5 hp single phase motor through suitable belt drive. The feed hopper consists of two concentric rows of 25 cm high MS cylinders. The outer row of cylinders is of 10 cm dia while the inner row of cylinders meant for thinner tubers are of 7 cm dia. A MS circular disc of 87 cm dia and 10 mm thickness carries two pairs of stainless steel blades.

iv. **Inputs required**
   a) Raw material : Cassava tubers
   b) Machinery : NA
   c) Over all Dimensions : 1150 mm x 1000 mm x 900 mm
   d) Weight (kg) : 200 kg
   e) Power : 0.5 hp single phase
   f) Man power : One

v. **Output capacity**
   286, 655 and 1091 kg/h for chip thicknesses of 2.5, 5.3 and 9.9 mm

vi. **Unit Cost**
   Rs.35,000/-

vii. **Suitability for crops/commodity**
   Cassava, yams

viii. **Efficiency**
   95%

ix. **Unit cost of operation**
   Rs 0.05/- per kg tubers

x. **Commercialization status**
   Commercialized through Institute

   (a). Number of licensees to whom the technology has been transferred : Nil

   (b). Selected Addresses of Licensee /Manufacturer : Nil

xi. **Contact Address**
   Research Engineer, AICRP on PHET
   ICAR-Central Tuber Crops Research Institute,
   Thiruvananthapuram – 695 017 (Kerala)
Technologies /Horticultural Crops

Technology No. 99

i. Name of the Technology : Mobile Starch Extraction Plant

ii. Application/Use : The mobile starch extraction plant is a cost effective equipment permitting on-farm starch extraction by the producers and thus avoids the exploitation of the farmers by middlemen

iii. Description of the Technology:
The major components of the machine are hopper to feed the tubers, crushing disc or cylinder with nail punched protrusions rotating inside crushing chamber to crush the tubers, sieving tray to remove the fibrous and other cellulosic materials, stainless steel or plastic tanks to collect the sieved starch suspension, tuber storage chamber, handle and wheels for easy transportation from place to place and a frame to support these components. Addition of water during the processing can be controlled through a water pipe with holes fixed inside the hopper along its length and during sieving by a shower attachment connected to the water line. An electric motor (¾ hp) or a generator (kerosene–petrol) attached to the frame can be used as the energy source to operate the machine.

iv. Inputs required
Raw material : Cassava Tubers and water
Machinery :
Over all Dimensions : 1350 x 1800 x 1320 mm
Weight (kg) : 165 kg
Power : ¾ hp , single phase
Man power : one

v. Out put capacity : 120-200 kg/h.

vi. Unit Cost : Rs.90,000/-

vii. Suitability for crops/commodity : Cassava, sweet potato, Amorphophallus

viii. Efficiency : 85%

ix. Unit cost of operation : Rs.3/- per kg starch

x. Commercialization status : Commercialized through the Institute

xi. Contact Address : Research Engineer, AICRP on PHET ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram –695 017 (Kerala)
Four Decades of R&D of AICRP on PHET

Technology No. 100

i. Name of the Technology : Feed Granulator

ii. Application/Use : The granulator is a low cost device to granulate tuber corps based formulations for use as cattle or poultry feed. This can even be extended to fish meal

iii. Description of the Technology:
A drum type centrifugal granulator consists of a cylindrical drum mounted horizontally on a shaft installed on a trapezoidal angle iron frame work. Provisions were made to spray water using a knapsack sprayer through one side of the drum while the granulator is in operation. A rectangular slot is provided at the down slope of the drum for feeding the materials and to take out the granulated feeds. The machine can be operated manually and also by an electric motor (¾ hp). Feed granules of optimum properties can be obtained by adjusting the moisture content as 51-68%, rotational speed 40 rpm and rotational time 2-6 min depending upon the ingredients used in the feed.

iv. Inputs required
   a) Raw material : Dry floury feed ingredients, water
   b) Machinery : 
   c) Over all Dimensions : 1000 mm x 800 mm x 1000 mm
   d) Weight (kg) : 35 kg
   e) Power : Electric/Manual
   f) Man power : ¾ hp electric motor/one person

v. Output capacity : 20 kg/h

vi. Unit Cost : Rs. 5,000/- for manual
               Rs 12,000/- for motorised

vii. Suitability for crops/commodity : Byproducts of agricultural crops

viii. Efficiency : 95%

ix. Unit cost of operation : Rs. 1.60/- (manual operation) and Rs. 0.92/- (mechanical operation) per kg feed

xi. Commercialization status : Ready for commercialization

xii. Contact Address : Research Engineer, AICRP on PHET
                        ICAR-Central Tuber Crops Research Institute,
                        Thiruvananthapuram –695 017 (Kerala)
Technologies / Horticultural Crops

Technology No. 101

i. Name of the Technology : Garlic Bulb Breaker

ii. Application/ Use : Machine facilitates in the gentle separation of individual cloves from garlic bulbs. The machine has utility for garlic processors, pickle industries and seed industries for farmers.

iii. Description of Technology:

Bulb breaking i.e. separation of individual cloves from garlic bulbs is the first and foremost unit operation in processing of garlic. Further, the individual cloves are also used as seed material. The machine consists of a hollow cylinder with cushioned battens, a concave, an aspirator and a prime mover. The cloves are separated because of the beating action of battens and friction between bulb and concave. Aspirator separates the light paper skin, root and middle stem of bulb. Clean cloves are collected along the chute below the concave. A manual operated model with 50-kg/hr capacity is also available for small entrepreneurs & farmers. It has generated lot of interest in garlic cultivation belt of MP & Rajasthan for separating individual cloves for seed purposes.

iv. Input/raw material:

a) Overall dimension : 660 mm x 1000 mm x 1130 mm
b) Weight : 85 kg
c) Prime mover : Electric motor
d) Plant & Machinery : Machine with motor
e) Power : 1 hp, Single phase electric motor
f) Man power : 1 unskilled labour
g) Investment : Rs 24,000/-
h) Operational effi. : 80%

v. Output capacity : 800 kg bulb/hr

vi. Unit cost (per machine) : Rs 18,000 (without motor)

vii. Suitability for crops/commodity : Garlic

viii. Efficiency : Clove separation eff.: 94-95 %

ix. Unit cost of operation : Rs 2.50 /q of cloves

x. Commercialization status:

a) No. of Licensees to whom the technology has been transferred : 03

b) Selected Addresses of Licensee / Manufacturer : M/s Kalpana Entreprises
N.B. Complex, Pratap Nagar, Udaipur-313001

xi. Contact address : Research Engineer, AICRP on PHET
College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
Technology No. 102

i. **Name of the Technology**: Peeler-cum-Polisher for Ginger and Turmeric

ii. **Application/ Use**: The machine has application for peeling of fresh ginger rhizomes and smoothening/value addition of dried rhizomes of ginger and turmeric. It has utility for processors.

iii. **Description of Technology**: A simple machine was developed to peel the outer skin from fresh ginger rhizomes and abrade off outer shriveled skin of dried rhizomes of ginger and turmeric. The peeling operation helps in faster drying and polishing facilitates in value addition & quality improvement of dried rhizomes. The machine works on the principle of friction and abrasion. It consists of a perforated drum with a common opening for feeding and discharge of rhizomes. The machine has a perforated drum coated with emery strips at inner surface. The drum is rotated at 40 rpm. Water supply through hollow shaft helps in removal of peel/skin through the drum perforation. In case of polishing dehydrated rhizomes, water supply is disconnected. Effective output of machine has been worked out as 40-50 kg/h vis a vis 30 and 50 kg/day through manual and gunny bag peeling. 30 machines have supplied. About 30 machines have been supplied.

iv. **Input/raw material**: Ginger/turmeric rhizomes
   a) **Overall dimension**: 900 mm x 700 mm x 1070 mm
   b) **Weight**: 57 kg
   c) **Prime mover**: Electric motor
   d) **Plant & Machinery**: Peeler-Polishing machine, dryer
   e) **Power**: 1 hp single phase motor
   f) **Man power**: 1 unskilled labour
   g) **Investment**: Rs 20,000/-
   h) **Operational efficiency**: 75-80%

v. **Output capacity**: 8 kg batch in 8 to 10 min i.e. 40-50 kg/hr for peeling & 50-60 kg/hr for polishing

vi. **Unit cost (per machine)**: Rs 15,000/- (without motor)

vii. **Suitability for crops/commodity**: Ginger, carrot, turmeric

viii. **Efficiency**: 80%

ix. **Unit cost of operation**: Rs 25 /q rhizome

x. **Commercialization status**: Commercialized
   a) **No. of Licensees to whom the technology has been transferred**: 03
   b) **Selected Addresses of Licensee / Manufacturer**: M/s Kalpana Enterprises, N.B. Complex, Pratap Nagar, Udaipur-313001

xi. **Contact address**: Research Engineer, AICRP on PHET
   College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur-313 001 (Rajasthan)
Technologies /Horticultural Crops

Technology No. 103

i. **Name of the Technology** : Garlic Clove Flaking Machine

ii. **Application/ Use** : The machine facilitates in the gentle flaking of individual garlic cloves to fasten the dehydration process. The machine has utility for garlic processors.

iii. **Description of Technology** :

A garlic clove flaking machine has been developed to press the cloves gently in order to facilitate faster drying. The machine has 2 rollers fixed in horizontal plane side by side with clearance adjustment to accommodate the maximum size individual garlic clove. The roller rotates in opposite direction with the help of chain-sprocket arrangement. Roller clearance of 5 and 10 mm was found optimum for flaking of normal and bold size cloves, respectively. The machine can also be operated manually with capacity 80-100 kg/h. About 20 machines have been supplied.

iv. **Input/raw material** :

   a. **Overall dimension** : 75 mm x 550 mm x 1200 mm
   b. **Weight** : 65 kg
   c. **Prime mover** : Electric motor
   d. **Plant & Machinery** : Machine with motor-starter
   e. **Power** : 1 hp, Single phase electric motor
   f. **Man power** : 1 unskilled labours
   g. **Investment** : Rs 22,000/-
   h. **Operational efficiency** : 80%

v. **Output capacity** : 420 kg/hr (80-100 kg/hr manual operation)

vi. **Unit cost (per machine)** : Rs 17,000/- (without motor)

vii. **Suitability for crops/commodity** : Garlic

viii. **Efficiency** : 82-87%

ix. **Unit cost of operation** : Rs 5/q of cloves

x. **Commercialization status** : Commercialized

  a) **No. of Licensees to whom the technology has been transferred** : 03

  b) **Selected Addresses of Licensee or Manufacturer** :

     M/s Kalpana Enterprises
     N.B. Complex, Pratap nagar, Udaipur-313001

xi. **Contact address** :

    Research Engineer, AICRP on PHET
    College of Technology & Argil. Engineering,
    Maharana Pratap University of Agricultural & Technology,
    Udaipur–313 001 (Rajasthan)
Technology No. 104

i. Name of the Technology : Solar Dryer

ii. Application/ Use : The solar dryer is useful for drying of perishable & semi perishable commodities at production catchment.

iii. Description of Technology :
A natural convection, solar energy based tray type dryer was developed to dry various kind of perishables/semi-perishables. The dryer has 12 no. of wire mesh trays and two drought pipes with aspirator to induce the natural convection. The whole structure is made such that the front glass cover is inclined at an angle of latitude of Udaipur plus 15°. A 25-mm wide slit at the bottom of cabinet is provided for entry of fresh air to dryer. The dryer has capacity of 60 to 75 kg/batch and requires 2-3 man-hr/days.

iv. Input/raw material : Fresh ginger/ turmeric rhizomes
   a) Overall dimension : 2600 mm x 2100 mm x 1930 mm
   b) Weight : 270 kg
   c) Prime mover : Solar energy
   d) Plant & Machinery : Solar dryer
   e) Power : Solar energy
   f) Man power : 1 unskilled labours
   g) Land : 100 Sq m
   h) Investment : Rs 35,000/-
   i) Operational efficiency : 75%

v. Output capacity : 60 to 75 kg/batch

vi. Unit cost (per machine) : Rs 35,000/-

vii. Suitability for crops/commodity : Perishable and semi perishable agricultural produce

viii. Efficiency : 75%

ix. Unit cost of operation : Rs. 2-3 per kg

x. Commercialization status : Commercialized
   a) No. of Licensees to whom the technology has been transferred : One entrepreneur has started production
   b) Selected Addresses of Licensee or Manufacturer : M/s Kalpana Enterprises
                                                      N.B. Complex,
                                                      Pratapnagar, Udaipur-313 001

xi. Contact address : Research Engineer, AICRP on PHET
                     College of Technology & Argil. Engineering,
                     Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
## Technology No. 105

### i. Name of the Technology
Garlic Peel Remover for Dehydrated Flakes

### ii. Application/Use
To remove peels from dehydrated garlic flakes

### iii. Description of Technology:
A dry garlic clove peel remover/de-skinner machine with capacity of 50 kg/h was developed to detach and separate peel from dehydrated garlic flakes. The machine consists of a scrubber made of canvass strips which rotates in a barrel. The peels get detached due to abrasion and friction and an aspirator sucks the light peel and dehydrated clove flakes is obtained through the discharge trough. The machine results in saving of almost 300% in cost over conventional practice.

### iv. Input
- **a) Raw material**: Garlic clove
- **b) Machinery**: 
- **c) Overall dimension**: 1200 x 750 x 1150 mm
- **d) Weight**: 95 kg
- **e) Prime mover**: Electric motor- Single phase
- **f) Power**: 1 hp
- **g) Man power**: One
- **i) Investment**: Rs. 20000/-

### v. Output capacity
50 kg/h

### vi. Unit cost (per machine)
Rs. 17000/- (without motor)

### vii. Suitability for crops/commodity
Garlic

### viii. Efficiency
80-85%

### xi. Unit cost of operation
Rs 53/q dried flakes

### xi. Commercialization status
- **(a) No. of Licensees to whom the technology has been transferred**: Ready for commercialization
- **(b) Selected Addresses of Licensee /Manufacturer and contact person**: MoU with Manufacturer is in progress

### xi. Contact Person
Research Engineer, AICRP on PHET College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
## Technology No. 106

### i. Name of the Technology
Aloe Gel Extraction Machine

### ii. Application/Use
Machine has application for extracting clear gel from aloevera leaf. It has use for small entrepreneurs.

### iii. Description of Technology:
Aloin-free clear aloe gel without rind is required for making all kind of health drink/beverages and cosmetic/medicinal products. A gel extraction machine was developed which consisted of three pairs of stainless steel roller arranged in vertical plane. The front pair has more clearance than the rear pairs. The front pair just compresses the leaf while rear pairs helps in extraction. The clearance between rollers can be adjusted with the help of nuts provided on top frame according to the thickness of leaves. Maximum gel recovery could be obtained at roller speed 75-90 rpm. The machine has capacity for extracting 40-50 kg/h leaf. Two units have been supplied to a SHG village Ogna (Forest deptt).

### iv. Input/raw material
- **a) Overall dimension**: 950 mm x 550 mm x 850 mm
- **b) Weight**: 77 kg
- **c) Prime mover**: Electric motor
- **d) Plant & Machinery**: Gel extractor, pulper/grinder
- **e) Power**: 3 hp Single phase power connection
- **f) Man power**: 1 unskilled labour
- **g) Land**: 50 Sqm
- **h) Investment**: Rs 70,000/=  
- **i) Operational efficiency**: 70%

### v. Output capacity
100-150 lit/day

### vi. Unit cost (per machine)
Rs 45,000/= with 1 hp motor

### vii. Suitability for crops/commodity
Aloe vera

### viii. Efficiency
90%

### ix. Unit cost of operation
Rs 30/lit

### x. Commercialization status
Commercialized

- **a) No. of Licensees to whom the technology has been transferred**: 01
- **b) Selected Addresses of Licensee or Manufacturer**: -

### xi. Contact address
Research Engineer, AICRP on PHET  
College of Technology & Argil. Engineering  
Maharana Pratap University of Agricultural & Technology, Udaipur– 313 001 (Rajasthan)
Technologies / Horticultural Crops

Technology No. 107

i. Name of the Technology : Garlic Grader

ii. Application/ Use : For grading of garlic bulbs and cloves/flakes

iii. Description of Technology:

Garlic grading machine has been developed to grade garlic bulb/cloves on overall size basis. The machine consists of a rotary frame for mounting two sieves, an aspirator, a hopper and bottom discharge troughs for collection of graded material. As per Agmark specs. rules 2004 (http://agmarknet.nic.in/ veggmrules04. htm# garlic), the screen for machine was developed to separate garlic bulb in grades viz. less than 30 mm, between 30-40 mm (Class I & II) and more than 45 mm dia size (Extra class). The machine results in saving of almost 200 % cost over conventional practice.

iv. Input :
   a) Raw material
   b) Machinery
      • Overall dimension : 1700 x 700 x 1550 mm
      • Weight : 150 kg
      • Prime mover : Electric motor – single phase
   c) Power : 1 hp
   d) Man power : One
   e) Investment : 40000/-

v. Output capacity : 100 kg/h

vi. Unit cost (per machine) : Rs. 35000/- (without motor)

vii. Suitability for crops/commodity : Garlic

viii. Efficiency : 82%

ix. Unit cost of operation : Rs 30 / q

x. Commercialization status : Commercialized
   (a) No. of Licensees to whom the technology has been transferred : 01
   (b) Selected Addresses of Licensee / Manufacturer
      M/s Kalpana Entreprises
      N. B. Complex, Pratap nagar, Udaipur-1

xi. Contact Address : Research Engineer, AICRP on PHET
   College of Technology & Argil. Engineering,
   Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
Technology No. 108

i. Name of the Technology : Turmeric Polisher

ii. Application/ Use : Ginger and turmeric polishing

iii. Description of Technology :
The developed turmeric polisher mainly consists of polishing drum, power transmission system and supporting frame. The hexagonal abrasive drum is an important part of the surface abrasive polisher. Turmeric rhizomes were allowed to roll on internal abrasive surface of drum where polishing takes place due to abrasive action of protrusions and rhizomes.

iv. Input/raw material : Turmeric, polishing drum
   a) Overall dimension : 640x600x1200 mm
   b) Weight : 95 kg
   c) Prime mover : Electric Motor
   d) Power : 1 hp
   e) Man power : 01

v. Output capacity : 4-6 kg/batch

vi. Unit cost (per machine) : Rs. 25000

vii. Suitability for crops/commodity : Ginger and Turmeric

viii. Efficiency (Polishing ) : 97%

ix. Commercialization status : Ready for commercialization
   a) No. of Licensees to whom the technology has been transferred
   b) Selected Addresses of Licensee or Manufacturer

x. Contact address : Research Engineer, AICRP on PHET
   College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
Technology No. 109

i. **Name of the Technology** : Garlic Clove Peeler

ii. **Application/ Use** : Garlic Clove peeling

iii. **Description of Technology** :
The thin papery skin tightly adhered on garlic clove is to be removed for further processing, pickling, paste formulation etc. Batch type garlic clove peeler has been developed on the principal of impact and swirling action of compressed air. The capacity of the developed peeling machine was recorded as 400g/batch in 70 seconds with efficiency of 98 per cent. There is no bruising or damage to peeled cloves.

iv. **Input/raw material** : Garlic cloves
   a) Overall dimension : 540x460x1140 mm
   b) Weight : 70 kg
   c) Prime mover : Compressor
   e) Power : Compressed air of 10-15kg/cm²
   f) Man power : 1 unskilled
   g) Investment : Rs. 2 lakh

v. **Output capacity** : 400g/batch in 70 seconds

vi. **Unit cost (per machine)** : Rs. 60000

vii. **Suitability for crops/commodity** : Ginger

viii. **Efficiency** : 98%

ix. **Patent obtained/applied** : No

x. **Commercialization status** : Ready for commercialization
   a) No. of Licensees to whom the technology has been transferred :  
   b) Selected Addresses of Licensee or Manufacturer : -

xi. **Contact address** : Research Engineer, AICRP on PHET College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
**Technology No. 110**

i. **Name of the Technology**: Ginger peeler  

ii. **Application/ Use**: Ginger rhizome peeling  

iii. **Description of Technology**: Indigenous peeling methods are very laborious and time consuming and result in high loss of material and quality. The loss of ginger meat from underneath the skin would result not only in loss of weight but also heavy loss of economic value of ginger. On the demand of local ginger producers the ginger peeling machine was developed and the process parameters of the mechanical peeling were optimized to obtain high peeling efficiency with minimum ginger meat loss. The developed ginger peeler mainly consists of peeling unit, power transmission system and supporting frame. Ginger rhizomes were allowed to roll on abrasive surface of roller brushes where peeling takes place due to abrasive action of nylon wire brushes and rhizomes. Single phase 1 hp electrical motor was used as source of power and chain–sprocket mechanism was used for transmission of power. The developed ginger peeler was found to work satisfactorily with brush wire thickness of 150 gauges at a speed of roller brushes of 115 rpm for peeling time 10 min.

iv. **Input/raw material**: Ginger  
   a) **Overall dimension**: 560x480x1000 mm  
   b) **Weight**: 120 kg  
   c) **Prime mover**: Electric motor  
   d) **Power**: 1 hp  
   e) **Man power**: 1 unskilled

v. **Output capacity**: 5 kg/batch

vi. **Unit cost (per machine)**: Rs. 60000

vii. **Suitability for crops/commodity**: Ginger

viii. **Efficiency**: 92%

ix. **Unit cost of operation**: Rs. 0.50/kg.

x. **Commercialization status**: Ready for commercialization
   a) **No. of Licensees to whom the technology has been transferred**: -
   b) **Selected Addresses of Licensee or Manufacturer**: -

xi. **Contact address**: Research Engineer, AICRP on PHET  
   College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
i. **Name of the Technology**: Pineapple Peeler-cum-Corer-cum Slicer

ii. **Application/ Use**: Peeling, coring and slicing of pineapple

iii. **Description of Technology**: The device consists of a stainless steel central shaft to which slicing plate is attached in a spiral form. A stainless steel pipe of 2.5 cm diameter and 25 cm length is used for fabrication of the pineapple peeler-cum-slicer. One end of the pipe is serrated for easy of penetration. A stainless steel plate is attached to the pipe in a helical manner (7 cm diameter). The open ends of the ring are sharpened and have a gap of 1.5 cm between them forming a groove for cutting the pineapple rings. The peeler-cum-slicer is pressed against the pineapple and twisted to cut the peel by the side plate. The pineapple core is cut at the pipe end and inserted inside the pipe as the peeler rotated forward and finally removed from the pipe.

iv. **Input**
   a) **Raw material**: Pineapple
   b) **Machinery**
      - Overall dimension: 200 x 70 x 70 mm
      - Weight: 400 g
      - Prime mover: Manual
   c) **Man power**: 1 no

v. **Output capacity**: 20 fruits per h

vi. **Unit cost of operation**: Rs. 1.00 per pineapple

vii. **Suitability for crops/commodity**: Pineapple

viii. **Efficiency**: 94.5 % (peeling and slicing)

ix. **Unit cost**: Rs. 300/-

x. **Commercialization status**
   a) **No. of Licensees to whom the technology has been transferred**: Nil

   b) **Selected Addresses of Licensee / Manufacturer**: N.A.

xi. **Contact Address**: Research Engineer, AICRP on PHET College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar- 751 003 (Orissa)
Technology No. 112

i Name of the Technology: Sapota Cleaner

ii Application/Use: Cleaning of sapota after harvest

iii Description of Technology:
It is a hand-operated sapota cleaner with mild steel screen drum. The drum is supported by MS angle frame. The inside surface drum has been provided with jute cloth. The rubbing action of sapota surface over jute cloth gives shining to the surface. The sapota are fed by door provided on drum. The door is to be closed. A handle is provided to drum for revolving manually. The revolving action of drum clean and give the shining to the sapota surface.

iv Input/raw material
a. Prime mover Manual operated
b. Man power 1

v Output capacity 240 kg/hr

vi Unit cost Rs. 5000/-

vii Suitability for crop/commodity Sapota

viii Efficiency 99%

ix Unit cost of operation Rs. 0.50/kg

x Contact Address
Research Engineer, AICRP on PHET
Department of Processing & Food Engg.
College of Agril. Engg. & Technology
Junagadh Agricultural University
Junagadh -362001
Phone: 0285-2672080-90 Ext 479


**Technologies / Horticultural Crops**

**Technology No. 113**

i **Name of the Technology** : Farm Level Fruit and Vegetable Washing Machine

ii **Application/ Use** : A wide range of fruit and vegetables (carrot, potato, raddish, turnip, ginger, okra, tomato, spinach, turnip, kinnow and pears) can be mechanically washed and can replace the prevalent practice of washing which involves drudgery and unhygienic conditions.

iii **Description of Technology** :

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

iv **Input/raw material** : Carrot, potato, raddish, turnip, ginger, okra, tomato, spinach, turnip, kinnow and pears.

   a) **Overall dimension** : 860 x 760 x 1140 mm
   b) **Weight** : 200 kg
   c) **Prime mover** : Electric motor
   d) **Power** : 1 hp
   e) **Man power** : one

v **Output capacity** : 1 to 6 q/h.

vi **Unit cost (per machine)** : Rs 50,000-70,000 (for different capacity model)

vii **Suitability for crops/commodity** : Carrot, potato, raddish, turnip, ginger, okra, tomato, spinach, turnip, kinnow and pears.

viii **Efficiency** : 90.2-95.5% (Washing efficiency)

ix **Unit cost of operation** : Rs. 10/q

x **Commercialization status** : commercialized

xi (a) **No. of Licensees to whom the technology has been transferred** : 01

(b) **Selected Addresses of Licensee / Manufacturer** :


xii **Contact Address** : Research Engineer, AICRP on PHET

Department of Processing and Food Engineering, College of Agricultural Engineering Punjab Agricultural University Ludhiana-141004 (Punjab)
Technology No. 114

i. Name of the Technology : Turmeric Washing and Polishing Machine

ii. Application/Use : Turmeric washing and polishing machine is useful for removal of field soil, dust etc. but also removes spores of heat resistant bacteria.

iii. Description of Technology

A stainless steel, portable, electric power (1 hp) operated, rotary drum type turmeric washing and polishing machine has been designed and developed to wash and polish turmeric rhizomes. The drum washer made of stainless steel is 62cm in diameter and 61 cm in width with 6mm holes and is provided with a timer and an electric device to regulate precisely the rotational speed of the drum upto 100 rpm. Proper arrangements for feeding water into machine and drawing out dirty water and silt are provided. The machine when operated at optimum rotational speed for optimum time can wash 2.5-3.0 qph of turmeric rhizomes. At optimum performance parameters, i.e. 40 rpm for 5 min. there is no bruising in turmeric rhizomes, with a microbiological washing efficiency of 91%. For polishing purpose, the central perforated shaft (for sprinkling water) is removed. To increase the friction, three detachable perforated screens are attached along the inner periphery of the drum with abrasive surface on the inner side. The microbiological quality of turmeric rhizomes also increased by polishing because the surface microbial load was reduced to half.

iv. a) Input/raw material : Turmeric rhizomes
b) Overall dimension : 860 x 760 x 1140 mm
c) Weight : 200 kg
d) Prime mover : Electrimotor
e) Power : 1 hp motor
f) Man power : 01

v. Output capacity

Turmeric washer: 2-63.5 qph
Turmeric polisher: 1.0 qph

vi. Unit cost (per machine) : Rs 65,000-70,000 (for different capacity model)

vii. Suitability for crops/commodity : Turmeric

viii. Efficiency : Washing efficiency 91%

ix. Unit cost of operation : (washing) Rs. 5/q; Rs 7/q (Polishing)

x. Commercialization status

(a) No. of Licensees to whom the technology has been transferred : Commercialized
(b)Selected Addresses of Licensee or Manufacturer : Paradise Engg. Corp. 392, Industrial Area, Ludhiana-41 003 INDIA

xi. Contact Address : Research Engineer, AICRP on PHET
Department of Processing and Food Engineering, College of Agricultural Engineering Punjab Agricultural University Ludhiana-141004 (Punjab)
### Technology No. 115

**i. Name of the Technology**
- Electric-cum-Battery Heated Uncapping Knife

**ii. Application/Use**
- For uncapping of wax sealed cells filled with ripened honey, usually ordinary knife is used and it can be replaced by electric-cum-battery heated uncapping knife. This will help in fatigue less operation and will result in more number of frames to be uncapped in less time and can replace the prevalent practice of uncapping with non scientific and unhygienic conventional knives. This uncapping knife will be helpful for both the entrepreneurs as well as bee keepers.

**iii. Description of Technology**
The electrically-cum-battery heated uncapping knife has been designed to uncap the wax seals on the comb cells. The design is based on the dimensions of the frame over which the wax sheet containing the cells is present. The total length of knife is 37.5 cm comprising of 25.4 x 6.5 cm knife blade of 0.2 cm thick MS sheet. A fine nichrome wire is used for the heating element (of 1 amp. Current rating) on a 13 x 3.5 cm mica sheet. It has facilities to operate both on 220 VAC supply as well as 12 V DC power supply. Since this knife is fitted with an auto temperature cut off device, thus avoids overheating and can help in maintaining quality of honey which otherwise results in caramellization of sugar due to high temperature encountered in other electrical knives.

**iv. Input/raw material**
- Honey comb frame filled with honey
- Overall dimension: 238 x 71 x 3 mm (Knife blade)
- Weight: 542 gm
- Prime mover: Electric and Battery
- Power: Power supply/220 V AC – 1 amp current rating
- Man power: One

**v. Output capacity**
- 18 –22 sec/single frame

**vi. Unit cost**
- Rs. 300/-

**vii. Suitability for crops/commodity**
- Honey

**viii. Efficiency**
- 98-100%

**ix. Unit cost of operation**
- Rs 0.5/frame

**x. Commercialization status**
- Transfer to around 50 farmers
- 01

**xi. Selected Addresses of Licensee or Manufacturer**
- M/s H.V Industries, K-105 Focal Point, Phase VII, Dhandhari Kalan, Ludhiana

**xii. Contact Address**
- Research Engineer, AICRP on PHET
  Department of Processing and Food Engineering,
  College of Agricultural Engineering Punjab Agricultural University Ludhiana-141004 (Punjab)
Four Decades of R&D of AICRP on PHET

Technology No. 116

i Name of the Technology : Trolley Drier

ii Application/ Use : The drier can be used to dry at the farm itself to dry grains such as Paddy and vegetable such as chilli etc.

iii Description of Technology :
A tractor trolley available with farmer has been converted in to dryer (fig. 8.1). A multi-crop trolley drier was designed and got fabricated. The total size of screen on which the material to be placed for drying is 4267.2 x 2133.6 mm, whereas the perforated screen is of the dimension of 4054 x 2042 mm. The air is heated with electric heater. Hot air at desired temperature (ambient to 60oC) is blown through plenum chamber into the material to be dried. The drier consist of a set of three heaters (each of 20KW); which can be switched on as per the desired temperature requirement. The drier can hold about 3-4 qts of chilies and 1-1.5 ton of paddy per batch. The trolley drier has been tested at no load conditions and was found that the velocity of air throughout the plenum chamber was approximately +0.2 m/s and the flow rate of air was nearly 496.8 m3/min. The testing of trolley dryer on load is under process.

iv Input/raw material :
   a) Overall dimension : 4165 x 2340 x 2110 mm
   b) Weight : 1000 kg
   c) Prime mover : Electric Power
   d) Power : 24 kW (3 heaters each of 8kW).
   e) Man power : 2 mandays
   f) Land : 10 m x 10 m
   g) Investment : Rs. 1,50,000 – 2,00,000/-

v Output capacity :
The trolley drier can fold 2-3 q of chilies and 10-15 q of paddy per batch. The drier can dry 10 quintals per batch of paddy in 100 minutes for 5% moisture reduction and it can dry 2 quintals of red chilies from 80% to 10 % moisture in 28 hours

vi Unit cost (per machine) : Rs.1,50,000 – 2,00,000/-

vii Suitability for crops/commodity : Paddy and Chilli

viii Efficiency : N.A

ix Unit cost of operation :
   For Paddy (Rs 20/qtl), For chilies (Rs 90/qtl)

x Commercialization status : In the process of commercialization

xi Contact Address :
   Research Engineer, AICRP on PHET
   Department of Processing and Food Engineering,
   College of Agricultural Engineering Punjab Agricultural
   University Ludhiana-141004 (Punjab)
## Technology No. 117

### Name of the Technology:
Honey Heating-cum-Filtration System

### Application/ Use:
This heating cum filtration system save time and ease the cumbersome process of heating and filtration of honey simultaneously in one unit under hygienic conditions.

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

### Input/raw material:
- Overall dimension: 686 x 686 x 1524 mm
- Weight: 110 kg
- Prime mover: Electric Power
- Power: 4 kW
- Man power: 1
- Land: 1 x 1m
- Investment: Rs 35,000

### Output capacity:
50 Kg/ batch

### Unit cost (per machine):
Rs 35,000

### Suitability for crops/commodity:
Honey

### Unit cost of operation:
0.50/kg

### Commercialization status:
Commercialized

- No. of Licensees to whom the technology has been transferred: 01
- Selected Addresses of Licensee / Manufacturer:
  - M/s H.V Industries, K-105 Focal Point, Phase VII, Dhandhari Kalan, Ludhiana

### Contact Address:
- Research Engineer, AICRP on PHET
- Department of Processing and Food Engineering,
  College of Agricultural Engineering Punjab Agricultural University Ludhiana-141004 (Punjab)
Technology No. 118

i. **Name of the Technology**: Eight Frame Radial Honey Extractor

ii. **Application/ Use**: A stainless steel radial honey extractor with eight frames was used to extract honey from honey combs using the principle of centrifugal force.

iii. **Description of Technology**:

The extractor was so designed that it could be operated both manually as well as through 0.5 hp electric motor. The body of the extractor is made up of 22 gauge stainless steel sheet, having eight frames radially arranged at an angle of 45o to the central shaft for fast and easy extraction. A strainer is fitted just below the frames for primary filtration. It can store up to 1 qtl of honey.

iv. **Input/raw material**

   a) Overall dimension : 805 x 805 x 1310 mm
   b) Weight : 106 kg
   c) Prime mover : Electric Power
   d) Power : 0.5 hp
   e) Man power : 2
   f) Land : 1 x 1 m
   g) Investment : Rs. 40,000/-

v. **Output capacity** : 18-190 kg/hr

vi. **Unit cost (per machine)** : Rs. 40,000/-

vii. **Suitability for crops/commodity** : Honey

viii. **Efficiency** : 100%

ix. **Unit cost of operation** : Rs 11/qtl.

x. **Commercialization status** : Commercialized

   a) No. of Licensees to whom the technology has been transferred : 01

   b) Selected Addresses of Licensee or Manufacturer : Teewana Bee Farm, Doraha, Ludhiana (Punjab)

xi. **Contact Address** : Research Engineer, AICRP on PHET

   Department of Processing and Food Engineering, College of Agricultural Engineering Punjab Agricultural University

   Ludhiana-141004 (Punjab)
Technologies / Horticultural Crops

Technology No. 119

i. **Name of the Technology**: Storage of Ginger Rhizomes in Fresh Form

ii. **Application/ Use**: Increase shelf life up to 6 months after harvest.

iii. **Description of Technology**:

Fresh rhizomes can be stored safely in a bamboo rack placed in a covered and aerated space. The breadth of each shelf of the rack should be such that, it is easier to inspect the material. If it is made near the wall, it should be not more than 50 cm. The vertical distance between two shelves should be at least 25 cm so that it is easy to inspect the rhizomes. When the numbers of shelves increase, the numbers of posts should also be adjusted to bear the load of rhizomes and sand. The shelves should be made with bamboo mat, below which support should be given with un-split bamboo. The Bamboo mat is covered with gunny/ polythene bags. In one meter square area of each shelf, about 7.5 to 10 kg fresh rhizomes can be stored.

For 1m² area, 10 kg sand is required to form a 1” layer of sand. Rhizomes to be stored are cleaned with water to remove the adhered soil. Only matured and healthy rhizomes are selected for storage. The rhizomes are placed near to each other over the sand layer. Again a 1” layer of sand is made to cover the rhizomes. Water should be sprinkled uniformly over the dry sand @ 3-4 l/m² area, so that the moisture content of the sand becomes about 30% on dry wt basis.

There is no problem from Jan to middle of April. However, April onward, sprouting starts which need to be broken manually, when these are 1”-2” in length. Rotten rhizomes should be discarded. Water should not be sprinkled up to one week after nipping the sprouts. By this method, rhizomes can be stored well up to 6 months retaining the quality of fresh ginger. During these 6 months, though 40-50 percent weight is lost, it is not visible in the appearance of the rhizomes, as water is absorbed during storage. The weight us lost due to respiration and it is mainly the carbohydrate, which is broken down as CO₂ and water during storage. However, the volatile oils and oleoresins imparting flavour and pungency respectively to the rhizomes are retained by this method of storage. Though 40-50% fresh weight is reduced, during the said period, the price of raw ginger is increased by 100-300% and as such, there is no chance of loss of profit, if rhizomes are stored. The structure made with the help of above mentioned materials can be used for storage of rhizomes for 5 years.

iii. **Input/raw material**

   a) **Overall dimension**

   b) **Investment**

   

   iv. **Output capacity**

   v. **Unit cost**

   vi. **Suitability for crops/commodity**

   vii. **Commercialization status**

   viii. **Contact Address**

   PI, AICRP on PHET
   Deptt. of Agrl Engg:
   Assam Agricultural University, Jorhat-13
Four Decades of R&D of AICRP on PHET

Process Protocols and Products
Technology No. 120

i. Name of the Technology : Ready-to-Serve Beverage from Jackfruit

ii. Application/Use : Production of Ready-to-Serve jackfruit beverage, a new product to the market; New avenue for food processing industry; contributes towards enhancing the farm income of rural people.

iii. Description of Technology
Well matured and ripe deseeded minimally processed jackfruit bulbs are mashed in a blender-mixer grinder to get pulp. Required quantity of pulp (12%), sugar (13%), citric acid (0.2%) are blended with boiling water (75–80 %) in a container and boiled for 15 minutes at 80-85°C. The contents are cooled and filtered through muslin cloth or filters. Potassium meta-bisulphate, the chemical preservative 100 mg per litre is added to the cooled, filtered juice. The juice is then filled into clean heat-sterilized glass bottles and sealed with cork using cork sealing machine. Cork sealed bottles are pasteurized in a water bath at 85–90°C for 20 minutes. The developed RTS beverage (13° Brix and 0.2% acidity) is ready to be served. The RTS beverage can be stored for 2 months under room temperature and 4 months under low temperature.

iv. Input/raw material
   a) Machinery : Minimally processed jackfruit deseeded bulbs, sugar, citric acid, potassium meta bi-sulphite (KMS)
   b) Machinery required for pulp extraction, juice filtration, pasteurization of the bottles and cork sealing Machine
   c) Investment : Depends on quantity of RTS bottles produced

v. Output capacity :

vi. Unit cost : Approx. Rs 3/- per bottle of 200 ml

vii. Suitability for crops/commodity : Jackfruit

viii. Efficiency :

ix. Unit cost of operation :

x. Patent obtained/applied : Not applied

xi. Commercialization status
   a) No. of Licensees to whom the technology has been transferred : Nil
   b) Selected Addresses of Licensee / Manufacturer : Nil

xii. Contact Address : Research Engineer, AICRP on PHET University of Agricultural Sciences, J- Block, GKVVK Campus, Bangalore -560 065 (Karnataka)
**Technology No. 121**

**i. Name of Technology**
Value Addition of Roselle Calyces

**ii. Application/Use**
Value added products (Sharabat, Jam, syrup, sweet pickle)

**iii. Description of Technology**

*Hibiscus sabdariffa* L., member of the family malvaceae (also known as Roselle calyces) is a tropical plant of considerable economic potential. Different value added products from Roselle calyces e.g. sharbat, Jam, syrup, pickle, Roselle supari etc were prepared.

Roselle sharbat was prepared with the proportion of sugar syrup in extract equivalent to 1:0.22. To prepare sharbat from 100 g extract, nearly 4 to 5 table spoon of sugar syrup is sufficient. For preparation of roselle concentrated syrup, calyces extract to sugar ratio was taken 1:0.75.

The supari powder was obtained from retained calyces, after their drying. The dried supari powder prepared by adding 0.30 g cumin powder, 0.40 g black salt, 5 g common salt in 10 g retained calyces.

The Roselle jam prepared from calyces obtained from 1 kg fresh Roselle fruit, 1 kg sugar and 1 liter of water was required. Roselle sweet pickles were prepared from the retained calyces obtained during concentrated syrup. 50 g of retained calyces were mixed with 50 g of sugars and heated till stickiness is lost.

**iv. Input/raw material**
Roselle calyces, sugar, water etc.

**Man power**
1 skilled 1 unskilled

**Land**
10 m²

**Investment**
Rs. 37,000/-

**v. Output capacity**
25 kg Roselle fruit/day

**vi. Unit cost**
Rs 32/kg for Jam
Rs 33/ lit for syrup (sweet pickle is byproduct)

**vii. Suitability for crop/commodity**
Roselle calyces

**viii. Unit cost of operation**
Rs 32/kg for Jam
Rs 33/lit for syrup (sweet pickle is byproduct of syrup)

**ix. Contact Address**
Research Engineer, AICRP on PHET
College of Agricultural Engineering
Dr. Punjabrao Deshmukh Krishi Vidyapeeth, Krishi Nagar, AKOLA -444 104 (Maharashtra)
# Technology No. 122

## i. Name of the Technology
Utilization of 'Patchouli spent charge' after Distillation of Essential Oil for the Manufacture of Agarbatti

## ii. Application/ Use
Wood powder, one of the raw materials used in the manufacture of agarbatti @15% level, can be replaced advantageously up to 10% with the powdered by-product namely, 'patchouli spent charge' with improved quality characteristics

## iii. Description of Technology:
Patchouli spent charge, the by-product (waste) obtained after extracting essential oil from patchouli herbage was sun dried and ground to 20-40 mesh powder using a shredder and a grinder. This powder can be substituted (up to 10%) for the wood powder normally used at about 15% level in the manufacture of agarbatti base sticks which are subsequently dipped in fragrance solutions to get commercial agarbattis. Since, the 'spent charge' powder also contains about 0.1-0.5% aromatic essential oil, the agarbattis can have added patchouli smell. Wherever patchouli oil is used in the agarbatti dip (fragrance) solution, in such cases, the costly essential oil usage is either reduced / replaced by using the above agarbatti base sticks prepared using the 'spent charge' powder. Wood powder requirement (2/3rd) is substituted with 'patchouli spent charge' powder (waste material) for manufacturing of agarbattis.

## iv. Inputs

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>a) Raw material</td>
<td>Patchouli 'spent charge' powder</td>
</tr>
<tr>
<td>b) Machinery</td>
<td>Shredder and Grinder</td>
</tr>
</tbody>
</table>

## v. Output capacity
About 4000 agarbatti base sticks per person

## vi. Unit cost
Rs. 8 per 24 sticks

## vii. Commercialization status
Ready for commercialization

## viii. Contact address
Research Engineer, AICRP (PHET), University of Agricultural Sciences, GKV, Bangalore – 560065 (Karnataka)
Technology No. 123

i. **Name of the Technology**: Cashew Apple Beverages

ii. **Application/ Use**: Ready to Serve beverage, Squash

iii. **Description of Technology**: After removal of astringency i.e., tannin the decanted juice was used to prepare different beverages.

iv. **Input/raw material**: Cashew apple, sugar, KMS, citric acid, polyvinyl pyrrolidone
   a) **Plant and Machinery**: Screw type fruit juicer, S.S Knives, S. S. Utensils
   d) **Man power**: 03

v. **Output capacity**: 100 kg of cashew apple and 30 kg sugar gives 400 bottle of 200 ml capacity RTS. 100 kg. cashew apple and 26 kg. sugar gives 75 bottles of 750 ml capacity squash.

vi. **Suitability for crops/commodity**: Cashew Apple

vii. **Unit cost**: Cashew apple RTS: Rs. 4.90/-per 200 ml glass bottle Cashew apple Squash: Rs. 16.75/- per 750 ml glass bottle

viii. **(a) No. of Licensees to whom the technology has been transferred**: Technology transferred to NGOs, SHGs at production catchments.

ix. **Contact Address**: Research Engineer, AICRP on PHET College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar-751 003
Technology No. 124

i. **Name of the Technology**: Zero Waste Technology for Osmo Dehydrated Pineapple Products

ii. **Application/ Use**: Osmo dehydrated pineapple rings, tidbits, RTS, Squash

iii. **Description of Technology**: After thorough cleaning of pineapples, they are sliced into 6-8 circular pieces. Skin is removed with the help of S.S. punches. Hard core is removed with S.S. corer. The circular pieces are kept in sugar syrup of 57-60°B for 8 hours. Then pieces are removed and adhering syrup wiped up. Then the pieces are dried at 70° C for 24 hours in a tray dryer. The broken pieces are dried in the same manner and tidbits are made. RTS and Squash are prepared from juice extracted out of thick skin/peel and leftover sugar syrup. The leftover of pineapple skin/peel with meat after juice extraction is called pineapple meal. This by product is used as an ingredient for cattle feed after drying and pulverization.

iv. **Input/raw material**
   - a) Plant and Machinery: S.S punches, S.S Corer, S.S Knives, S.S. Utensils
   - d) Man power: 02
   - f) Investment: Rs. 1.5 lakh

v. **Suitability for crops/commodity**: Pineapple

vi. **Unit cost of operation**

vii. **Unit cost**
   1. Osmo dehydrated pineapple ring: Rs. 10/- per 5 pcs. (100gm.)
   2. Pineapple tidbits: Rs. 9/- per 100gm.

viii. **Commercialization status**
   (a) **No. of Licensees to whom the technology has been transferred**: Commercialized

ix. **Contact Address**: Research Engineer, AICRP on PHET College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar-751 003
i. **Name of the Technology developed** : Aloe Vera Blended Ready to Serve Beverage

ii. **Application/ Use** : Ready to Serve Beverage

iii. **Description of Technology** :
After removal of a loin the clarified gel was used to prepare blended RTS beverage. Lemon and ginger juice has been added as blended material.

iv. **Input/raw material** : Aloe vers, lemon juice, ginger juice, sugar, KMS, citric acid
   a) **Plant and Machinery** : Aloe vera gel extractor, S.S knives, S. S. Utensils
   b) **Man power** : 02
   c) **Investment** : Rs. 2.15 lakh

v. **Output capacity** : 10 kg of aloe vera leave yields 100 no of bottles @200ml RTS

vi. **Unit cost** : Rs. 5.00/- per 200 ml glass bottle

vii. **Commercialization status** : Ready for commercialization
   (a) **No. of Licensees to whom the technology has been transferred** : Technology demonstrated among farmers/potential entrepreneurs

viii. **Contact Address** : Research Engineer, AICRP on PHET
  College of Agricultural Engineering and Technology,
  Orissa University of Agriculture and Technology,
  Bhubaneswar-751 003
Technology No. 126

i. **Name of the Technology**: Complete Process Protocol for Probiotic Apple Juice

ii. **Application/Use**: Highly stable and reconstitutable probiotic apple juice powder which is consistent with a broadly controlled intestinal flora that optimally supports the health of the consumer.

iii. **Description of Technology**: The process protocol for apple juice has been developed. The detail process for the production of probiotic fruit juice powder (flow chart) is given below.

```
Mature ripe fruits
  ↓
Washing
  ↓
Extraction of juice
  ↓
Filtration of juice (muslin cloth)
  ↓
Pasteurization (72°C for 15s)
  ↓
Incorporation of probiotic bacteria (1% v/v)
  ↓
Incubation (at 37°C for 48 hours)
  ↓
Addition of additive material
  ↓
Homogenization
  ↓
Spray drying of probiotic fruit juice
  ↓
Packaging (Aluminum foil pouches)
  ↓
Storage (room temperature)
```

iv. **Input/**: 
   - **Raw material**: Apple and orange
   - **Machinery**: Spray drier unit, Autoclave, Laminar flow chamber, etc.
   - **a) Man Power**: 03
   - **b) Investment**: 20 lakhs

v. **Output capacity**: 1150 kg/h

vi. **Suitability for crops/commodity**: Apple, orange

vii. **Unit cost**: Rs.900 per kg of probiotic powder

viii. **Commercialization status**: Ready for commercialization

ix. **Contact Address**: Research Engineer, AICRP on PHET and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore -641 003
Technologies /Horticultural Crops

Technology No. 127

i. Name of the Technology : Safe and Low Cost Holi Powder from Tapioca

ii. Application/ Use : To be used for playing ‘Holi’ during the ‘Holi’ festival time

iii. Description of Technology:

Safe holi colours extracted from food colours (FPO, 1955) approved. The colours index (FPO approved) were used, e.g. green (Tartrazine: 19140, Brilliant blue FCF: 42090), Orange (Carmoisine: 14720, Sun set yellow FCF: 15985), Red (Carmoisine: 14720).

The ‘holi powder’ making process is started with preparation of 10 % (volume by volume) uniformly mixed solution of food colour of choice (3.65% a.i.) in normal filtered water. To this solution tapioca flour is mixed uniformly in ratio 1:1 that is 1000ml solution is mixed to 1000gm dry flour and a dough is made. This dough is spread thinly (about 1cm thickness) over cloth or plastic sheet to dry under sun till moisture level less than 10%-13% (wet basis). Then, the colored flour is passed through hammer mill and sieving (250 micron), respectively to get the “holi powder”. The final product contains 0.365% active ingredient (dye). The ‘holi’ powders can be stored at room temperature inside polypropylene bags at dark.

iv. Input :

a. Raw material
50 kg tapioca flour, Fruits Products Order approved food color 5 litre
53-250 micron (tapioca flour), Fruits Products Order approved food colour

b. Machinery
Hammer mill and tray drier (optional)

v. Output capacity :
48 kg

vi. Suitability for crops/commodity :
Tapioca

vii. Unit cost of product :
Rs 75 to 80 per Kg (finished product)

viii. Commercialization status :
Ready for commercialization
No

(a) No. of Licensees to whom the technology has been transferred
No

(b) Selected Addresses of Licensee/Manufacturer

ix. Contact Address
Research Engineer
AICRP on PHET;
Deptt. of Agril Engineering
Assam Agricultural University, Jorhat-13
**Four Decades of R&D of AICRP on PHET**

**Technology No. 128**

i  **Name of the Technology**: Extraction of Pectin from Kesar Mango Peel by Resins

ii **Application/ Use**: For production of pectin from mango processing industrial waste (mango peel).

iii **Description of Technology with photograph attached**

Mango processing industries (mango canning plant) produces peel as waste every day. They have to get rid of these waste. This is a problem for environmental view also. Pectin are very much useful for various food industries. Use of resins produces better quality pectin from mango peel waste.

![Dried p](image1.png) ![Pectin powder](image2.png)

iv **Input/raw material**

a. **Plant and machinery**: Washing tank, grinder, ethanol holding tank, mixing chamber with heating facility, pH meter, Centrifuge assembly Precipitation tank, alcohol recovery plant, drying assembly, fine grinding and sieving assembly

b. **Man power**: 15 Nos.
c. **Land**: About 400 sq. mt.
d. **Investment**: Rs. 29.85 lakh

v **Output capacity**: 500kg/month

vi **Suitability for crop/commodity**: Mango

vii **Unit cost**: Rs. 600/kg

viii **Contact Address**: Research Engineer, AICRP on PHET, Department of Processing & Food Engg. College of Agril. Engg. & Technology, Junagadh Agricultural University, Junagadh -362001, Phone: 0285-2672080-90 Ext 479
Technology No. 129

i Name of the Technology: Extraction of Enzymes from Potato Peels Substrate using Bacillus group of Bacteria.

ii Application/ Use: For production of amylase and protease enzymes from potato processing industrial waste.

iii Description of Technology with photograph attached:

Potato processing industries produces peel as waste every day. They have to get rid of these waste. This is a problem for environmental view also. Amylase and protease enzymes are very much useful for various industries. Use of bacillus group of bacteria produces amylase and protease enzymes from potato peel waste.

Crude Enzyme Extract

iv Input/raw material:

a. Plant and Machinery
   Bio-fermenter, autoclave, refrigerated centrifuge, enzyme purification system, laminar air flow, pH meter, refrigerator, distilled water plant, spectrophotometer

b. Man power: 3 Nos.

c. Land: About 200 sq. mt.

d. Investment: Rs. 117.5 lakh

v Output capacity:

Amylase-4665/50 h batch;
Protease -14.76 gm/50 h batch

vi Suitability for crop/commodity:

Potato

vii Unit cost:

Rs. 1.09 lakh for production of 4665 g alpha-amylase and 14.76 gm protease

viii Contact Address:

Research Engineer,
AICRP on PHET
Department of Processing & Food Engg.
College of Agril. Engg. & Technology
Junagadh Agricultural University
Junagadh -362001
Phone: 0285-2672080-90 Ext 479
Four Decades of R&D of AICRP on PHET

Technology No. 130

i. Name of the Technology : Production of Sapota Powder

ii. Application/ Use : Sapota fruits are delicious and are eaten as desert fruit. Usually, only pulp is consumed but the fruit skin can also be eaten, since it is richer than pulp in its nutritive value. The changing life style and demand for soft drink concentrate supported the evolution of the technology of producing sapota powder. The sapota powder can be used as base material for the preparation of sapota juice and can very best be used as an additive @ 20 % by weight in the preparation of traditional sweet recipes viz., coconut burfi, banana milk-shake and banana shikarani, rava laddu

iii. Description of Technology : Procure ripe sapota fruits and wash them with clean water. Cut the fruits in to 5mm thick slices. Dry the fruit slices naturally under the sun or artificially by using hot air dryer at 60°C for 20 hours to reduce the moisture content to about 8% (w. b.). Grind the dehydrated fruit pieces in a mixer grinder. Sieve the mixture to get the fine powder (150 micron size). The sapota powder thus produced can be used by as an additive to the extent of 20% by weight in the preparation of sweets. The sapota powder can be stored in a HDPE pouches for 3 months under ambient condition.

iv. Input/raw material
   a) Plant and machinery : Solar/mechanical dryer, grinder, sieves
   b) Man power : 01
   c) Power : Solar / electric heater
   d) Investment : Rs. 5/- lakh

v. Output capacity : N.A.

vi. Suitability for crops/commodity : Sapota fruits

vii. Unit cost : Rs. 100/- per kg of sapota powder

viii. Commercialization status
      (a) No. of Licensees to whom the technology has been transferred : Commercialized

      One Bakery units and 27 farmers

ix. Contact Addresses : Sr. Scientist & PI, AICRP on PHET
                      College of Agricultural Engineering, UAS, Raichur.
Technologies / Horticultural Crops

Technology No. 131

i. **Name of the Technology** : Custard Apple Fruity

ii. **Application/ Use** : Custard apple is mostly consumed as table fruit. The processed product of Custard apple fruity is highly refreshing, thirst quenching and nutritionally for superior than many synthetic and aerated drinks.

iii. **Description of Technology** :

After removal of skin and seed the extracted pulp of custard apple (1 kg), sugar 75 gm, orange juice 750 ml and lime juice 100 ml was mixed using mixer/grinder.

iv. **Input/raw material** : Custard apple (1 kg), sugar 75 gm
Orange juice 750 ml and lime juice 100 ml

   a) **Prime mover/ Plant & Machinery** : Mixer/grinder
   b) **Man power** : 2
   c) **Space requirement** : 12sqm
   d) **Investment** : Rs. 2.5/- lakh

v. **Output capacity** : 2 lit /h

vi. **Suitability for crops/commodity** : Custard apple

ix. **Unit cost** : Rs. 8.00/150 ml

xi. **Commercialization status** :
   (a) **No. of Licensees to whom the technology has been transferred** : Ready to commercialize
   (b) **Selected Addresses of Licensee/Manufacturer** : Nil

xii. **Contact Address** : Research Engineer, AICRP on PHET
Department of Agricultural Engg, Indira Gandhi Krishi Vishwa Vidyalaya
RAipur - 492012 (Chhattisgarh)
Technology No. 132

i. **Name of the Technology** : Process for Mango Leather (Aam Papad), Mango powder and Mango Toffee

ii. **Application/ Use** : The local varieties of Mango in Chhattisgarh are screened for processed products like mango leather, mango powder (amchur), etc. The farmer may prevent distress sale.

iii. **Description of Technology** :
Mango toffee made by boiling (at 150-160°C) mango pulp and other ingredients like glucose/sugar, milk powder and edible fat. The fruit pulp was first concentrated to half of its volume. For one kilogram of concentrated pulp, 160 g of glucose, 320 g of milk powder and 200 g of ghee is added. This mixture is further heated to a thick consistency (75-80° Brix) followed by spreading (one cm thickness on a smeared flat tray) and allowed to cool. Then, these are cut into pieces (called as toffee) of desired size, wrap and store it in cool dry place. The mango leather required about 100 to 110 h to dry from the initial moisture content of around 76-86% (wb). The ideal moisture of mango leather to have storage stability is 15% or a little more with a relative humidity between 63-70%. It was found that mangoes at an optimum stage of maturity (9-10 weeks after fruit-set) are good for preparation of mango powder. Bisulphate treatment given to the slices to improve retention of colour and vitamin-C. A drying period of 8-10 h in tray dried and 15-18 h in sun is necessary to reduce moisture content to 2-3% when the tray load is 0.6 kg ft² with a drying temperature of 55± 5°C.

iv. **Input/raw material** : Mango powder-Raw Mango, potassium metabisulphite, Mango toffee, leather: Ripe mango, Sugar, Skim milk power, Ghee, Choco powder,

a) **Prime mover/ Plant & Machinery** : Tray drier, Gas Stove, Utensils, Mixer/Grinder, Solar dryer, Pulper Aluminum Tray

b) **Man power** : 5

c) **Space requirement** : 20sqm
d) **Investment** : Rs. 15-20 lakh

v. **Output capacity** : Mango Toffee - 300 no (8 g)
Mango leather -50 kg/day
Mango powder -10kg/day

vi. **Unit cost** : Mango Toffee - Rs. 0.5/toffee (8 g)
Mango leather – Rs 75/kg
Mango powder –Rs. 10/pouch of 50 g

vii. **Suitability for crops/commodity** : Mango

viii. **Commercialization status** : Ready for commercialization

ix. **(a) No. of Licensees to whom the technology has been transferred** : Nil

x. **(b) Selected Addresses of Licensee/Manufacturer** : Nil

xi. **Contact Address** : Research Engineer, AICRP on PHET
Department of Agricultural Engg.
IG KV Vidyalaya, RAIPUR - 492012 (Chhattisgarh)
## Technologies / Horticultural Crops

### Technology No. 133

<table>
<thead>
<tr>
<th>i.</th>
<th>Name of the Technology</th>
<th>Extraction of Kernel Oil from Apricot / Wild Apricot Seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii.</td>
<td>Application/ Use</td>
<td>Apricot stones are used for kernel oil extraction and oil being rich in polyunsaturated fatty acids and vitamin E is used as edible oil and for many medicinal and cosmetic purposes. It is used for body massage, baby massage, relieving joint pain, as face oil for dry skin and in preparation of facial creams, body lotion etc.</td>
</tr>
</tbody>
</table>

### Description of Technology:

The technology for extraction of apricot kernel oil consist of mechanical decortication, kernel separation with gravity method, extraction of kernel oil with table oil expeller, filtration and then packing of oil in bottles. The stone breaking efficiency of mechanical decorticator varies from 80-100 kg/hr against manual crushing of 3.2-4.6 kg stones per hour. The decorticated stones are immersed in 20% salt solution (1.889 specific gravity) and floated kernels are separated immediately from the crushed apricot stones. The separated kernels after immediate washing under tap water and drying under sun or in mechanical drier to remove surface moisture are passed through Table oil expeller for 3-4 times for extraction of oil from apricot kernels with an oil yield of 42-45%. The extracted oil is filtered through filter press prior to its packing in glass or plastic bottles. Add 0.02% TBHQ (tertiary butyl hydroquinone) for better storage quality of oil.

### Input/raw material

<table>
<thead>
<tr>
<th>a. Prime mover and machinery</th>
<th>Apricot/wild apricot Stones, Salt, TBHQ, Glass/Plastic bottles</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Power (hp)</td>
<td>Mechanical stone decorticator, Table oil expeller, Oil filter press, PP Cap sealing machine, Plastic tub, buckets etc.</td>
</tr>
<tr>
<td>c. Man power</td>
<td>Three phase electricity, 8 hp</td>
</tr>
<tr>
<td>d. Land</td>
<td>01</td>
</tr>
<tr>
<td>e. Investment</td>
<td>250 Square mts</td>
</tr>
<tr>
<td>f. Investment</td>
<td>Rs. 1.55 lakh</td>
</tr>
</tbody>
</table>

### Output capacity

| v.  | Output capacity | 80-100 kg stone/h, 5 kg kernel/ h and 2 kg oil/h |
| vi. | Cost of machinery | Rs. 55,000/- (table oil expeller) and Rs. 30000/- oil filter press |

### Suitability for crop/ commodity

| vii. | Suitability for crop/ commodity | Apricot and wild apricot |

### Efficiency

| viii. | Efficiency | More efficient than traditional practices |

### Unit cost of operation

| ix.  | Unit cost of operation | Rs. 275/-kg oil |

### Commercialization status

<table>
<thead>
<tr>
<th>x.</th>
<th>Commercialization status</th>
<th>Commercialized</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>No. of Licensees</td>
<td>02 manufacturers and 02 farmers cum processor</td>
</tr>
</tbody>
</table>
| b.  | Addresses of Licensees / Manufacturer | 1. M/S Sardar Engineering Company, Kanpur, India  
2. M/s Kishan Krishi Yantra Udyog, Kanpur, India  
3. M/s Sushree Khormoshu Self Help Group (SHG), Spillow  
4. M/s WWF (World wide fund for nation (India)) at Raksham, Sangla, Kinnaur. |

### Contact Address

| xi.  | Contact Address | PI, AIARP on PHET  
Department of Food Science & Technology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan -173 230 (HP) |
**Technology No. 134**

| i  | Name of the Technology          | : Technology for Preparation of RTU Mushroom tikki Mix |
|------------------------------|-------------------------------------------------------|
| ii | Application/ Use                | : Instant Mushroom Tikki is a very good alternative to commercially available noodles because of high nutritional composition and thus posses a very good scope for its industrialization |
| iii | Description of Technology      | : The following steps are used in preparation of Mushroom Tikki from Instant tikki mix All the ingredients are added in the mushroom powder (100g) and then 125-130ml of water is added and mixed well to form a dough till it does not stick to hands. Now make tikki of usual shape manually (15-20g). Make Frying in oil (3-4 minutes) |
| iv | Input/raw material             | : Mushroom flour (30g), Potato flour (50g), Corn flour (8.5g), Arra rot (6g), Onion powder (4g), Garlic powder (0.5g), Common salt (3g), Red pepper (3g), Black pepper (1g). |
|    | a) Plant and machinery         | : Mechanical dehydrator, grinder, fryer |
|    | b) Power (hp)                  | : 250 volts (Single phase) |
|    | c) Man power                   | : 1 |
|    | d) Investment                  | : Rs. 75,000/- |
| v  | Cost of machinery              | : Mechanical drier=50,000/-, steamer/frier=250/-, grinder=3000/- |
| vi | Suitability for crop/commodity | : Mushroom |
| vii | Unit cost of operation         | : Rs. 14.23 per 100g pack |
| viii | Commercialization status       | : Ready for commercialization/ transfer |
|     | a) No. of Licensees            | : Nil |
|     | b) Addresses of Licensees/Manufacturer | : Nil |
| ix  | Contact Address                | : Research Engineer/ PI, AICRP on PHET Department of Food Science & Technology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan-173 230 (HP) |
Technologies /Horticultural Crops

Technology No. 135

i Name of the Technology : Technology for Preparation of Mushroom Powder

ii Application/Use : White button mushroom which are not utilized for fresh market can be used for drying and preparation of different product. Mushroom powder can be utilized for the preparation of different value added products like soup powder, instant noodles, tikki powder etc and thus posses a very good scope for its adoption by the industry.

iii Description of Technology :

For the preparation of mushroom powder fresh mushrooms are washed and cut into 2 to 4 pieces. Cut mushrooms are blanched in a solution containing 0.05 per cent KMS + 0.1 per cent citric acid + 125 ppm EDTA , then drained the cut mushrooms and Cabinet Air Drying (at 60 °C). after that dried mushrooms are grind and packed and stored

iv Input/raw material : Mushrooms, KMS, EDTA, Citric Acid

a) Plant and machinery : Mechanical dehydrator, grinder
b) Power (hp) : Single phase (250 volts)
c) Man power : 01

Investment : Mechanical dehydrator=50,000/-, Grinder=3500/-

v Output capacity : 10-12kg per hour (vary on the basis of drying rate of commodities)

vii Suitability for crop/commodity : Mushroom

ix Unit cost of operation : Rs. 318/kg powder

x Patent obtained/applied : Applied

xi Commercialization status : Ready for commercialization

a) No. of Licensees : Nil
b) Addresses of Licensees /Manufacturer : Nil

xii Contact Address : Research Engineer/ PI, AICRP on PHET Department of Food Science & Technology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan - 173 230 (HP)
### Technology No. 136

<table>
<thead>
<tr>
<th><strong>i. Name of the Technology</strong></th>
<th>Technology for Preparation of Instant Mushroom Noodles.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ii Application/ Use</strong></td>
<td>Instant Mushroom Noodles are a very good alternative to commercially available noodles because of high carbohydrate and protein contents and thus posses a very good scope for its adoption by the industry.</td>
</tr>
<tr>
<td><strong>iii Description of Technology</strong></td>
<td>The following steps are used for preparation of instant mushroom noodles. Take Mushroom Powder. Add potato flour, wheat flour, Rice flour. Baking powder and edible oil Kneed with water (78%) to form dough. Pass through manual extruder. Steaming (3-4 minutes) Air Drying (24 hours). Packaging and Storage</td>
</tr>
<tr>
<td><strong>iv Input/raw material</strong></td>
<td>Mushroom flour (20g), Potato flour (20g), Wheat flour (40g), Rice flour (20g) Baking powder (0.2g), Edible oil (2.0ml)</td>
</tr>
<tr>
<td>a) Plant and machinery</td>
<td>Mechanical dehydrator, extruder, steamer and grinders</td>
</tr>
<tr>
<td>b) Power (hp)</td>
<td>250volts (single phase)</td>
</tr>
<tr>
<td>c) Man power</td>
<td>02</td>
</tr>
<tr>
<td>d) Investment</td>
<td>Rs. 15 lakh</td>
</tr>
<tr>
<td><strong>v Output capacity</strong></td>
<td>-</td>
</tr>
<tr>
<td>**vi Unit cost (per machine)</td>
<td>N.A.</td>
</tr>
<tr>
<td><strong>Suitability for crop/ commodity</strong></td>
<td>Mushroom</td>
</tr>
<tr>
<td><strong>vii Unit cost of operation</strong></td>
<td>Rs. 12.70 per 100g pack</td>
</tr>
<tr>
<td><strong>ix Commercialization status</strong></td>
<td>Technology is ready for transfer</td>
</tr>
<tr>
<td>a) No. of Licensees</td>
<td>Nil</td>
</tr>
<tr>
<td>b) Addresses of Licensees or Manufacturer</td>
<td>Nil</td>
</tr>
</tbody>
</table>
| **x Contact Address**       | Research Engineer/ PI, AICRP on PHET  
Department of Food Science & Technology,  
Dr. Y.S. Parmar University of Horticulture and Forestry,  
Nauni, Solan -173 230 (HP) |
Technologies / Horticultural Crops

Technology No. 137

i. Name of the Technology : Technology for Preparation of RTU Mushroom Soup Powder

ii. Application/ Use : Instant Mushroom Soup powder is a very good alternative to commercially available soup powder because of high protein and energy contents and thus posses a very good scope for its adoption by the industry.

iii. Description of Technology :
The following steps are required to prepare RTU Mushroom Soup Powder:
  • Take mushroom powder
  • Add different ingredients to make soup powder as per recipe (4)
  • Take Instant Mushroom Soup Powder (100g)
  • Add little water (50ml)
  • Add paste to boiling water (950ml)
  • Simmer, stir and boil for 4-5 minutes
  • Ready to serve

iv. Input/raw material : Mushroom flour (20g), Potato flour (15g), Milk Powder (38g), Corn flour (10g) Mushroom chunks (2g), dried carrot cubes 91g), Dried cauliflower (1g), dried peas (1g), Onion powder (2.5g), Garlic powder (0.5g), Ginger powder (0.5g), Common salt (8g), Sugar (1g), Edible oil (2.0ml), Citric acid (0.5g).

  a. Plant and machinery : Mechanical dehydrator, grinder
  d. Power (hp) : Single phase
  e. Man power : 02
  g. Investment : Rs. 5 lakh

v. Suitability for crop/commodity : Mushroom

vi. Unit cost of operation : Rs. 15.63 per 100g pack

vii. Commercialization status :
  a) No. of Licensees : Nil
  b) Addresses of Licensees/Manufacturer : Nil

viii. Contact Address : Research Engineer, AICRP on PHET Department of Food Science & Technology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan - 173230 (HP)
Technology No. 138

i Name of the Technology : Cloud Stable Cherry Squash

ii Application/ Use : Ready to serve cherry squash

iii Description of Technology :

The fruits were washed with running water to remove any adhered dirt and dust particles. The stalks were removed manually, only fully ripened fruits were selected for the product development. Rotten fruits were discarded and thereafter, the fruit was pulped by cold and hot break methods. In case of hot break method pulp was obtained by heating the fruit to 85 °C for 15 minutes. The pulp obtained by hot break method using pulper was preserved with 1000 ppm sodium benzoate and bottled in pre-sterilized glass bottles. The pulp obtained by was then utilized for product development as per the FPO standards. The hot sugar syrup was added to the strained pulp and mixed thoroughly. Then citric acid and sodium benzoate were added to the product and mixed thoroughly. The stabilizer used was Carboxymethyl cellulose (CMC) @ 0.75%. The squash was filled in pre-sterilized bottles (650 ml), capped, cooled, labeled and then stored at ambient temperature (15-30°C, R.H, 60-80%). Formulation having 25% pulp, 1.5% acidity, TSS 50% and 0.75% CMC was the best.

iv Input/raw material : Cherry pulp, Sodium benzoate as preservative, Sugar, Citric acid and Carboxymethyl cellulose, glass bottles, crown corks

a. Plant and machinery : Pulper 250 Kgs/hr Rs 30,000
   PP Caping Machine Rs 5,000
   Aluminium Patlas Rs 5,000
   Bottle washing machine Rs 15,000
   Refractometer Rs 4,000
   Weighing balance Rs 5,000
   Gas Bhati Rs 5000
   Working table Rs 5000

b. Man power : 4 man days for 120 days

c. Investment : Rs 1.2 lakh

v Output capacity : 1000 kg / day cherry

vi Unit cost (per machine) :

vii Suitability for crop/commodity : Cherry

viii Unit cost of operation : Rs 29.46/bottle

ix Commercialization status : Transferred to small scale farmer- cum- processor

a) No. of Licensees :

b) Addresses of Licensees or Manufacturer :

x Contact Address : PI, AICRP on PHET
Sher-e-Kashmir University of Agri. Sciences and Technology,
Shalimar Campus,
Srinagar – 191 121 (J&K)
Technologies / Horticultural Crops

Technology No. 139

i Name of the Technology : Cherry Candy

ii Application/ Use : Ready to eat cherry candy

iii Description of Technology :
Pitted cherry fruits were bleached using KMS 0.2 % for 3-4 weeks. The bleached fruits were then treated with 2.5% Calcium Chloride, 1.5% citric Acid and red colour 0.05% for 30 minutes. The dyed fruits were then dipped in 70% sugar solution for 24 hours, drained syrup, washed fruits in running water and after applying glycerin to trays of dehydrator dried product for 5 hrs at 60 °C.

iv Input/raw material : Cherry Fruit, Potassium metabisulphite, calcium chloride, Sugar, Citric acid, glycerin, red colour and LDPE packs

a. Plant and machinery :
   - Aluminium Patias Rs. 5,000
   - Refractometer Rs. 4,000
   - Weighing balance Rs 5,000
   - Gas Bhati Rs 5,000
   - Working table Rs 5,000
   - Sealing machine Rs 5,000
   - Drier Rs 30,000
   - Osmatic Tank Rs 5,000
   - Jerry cans 10 nos Rs 1,000
   - Washing tank Rs 5,000
   - Strainer Rs 2,000
   - Plastic Buckets Rs 1,000

b. Man power : 4 man days for 120 days

c. Investment : Rs. 1.05 lakh

v Output capacity : 10 kg candy per day

vi Unit cost (per machine) : 

vii Suitability for crop/commodity : Cherry

viii Unit cost of operation : Rs 11.40 per 100kg

ix Commercialization status : Transferred
   a) No. of Licensees : -
   b) Addresses of Licensees or Manufacturer : -

x Contact Address : PI, AICRP on PHET
                  Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, Srinagar – 191 121 (J&K)
Technology No. 140

Name of the Technology : Plum Appelter

Application/ Use : Delicious Drink

Description of Technology :
The sorted and selected fruits are washed to remove adherent dust particles and remove the stalks manually. Fruits are pulped using hot break method (mashed with 10 per cent water, heated to 85°C for 10 minutes). Then pulp extraction was carried out using junior pulper fitted with 1/32 sieve. The pulp obtained was weighed, hot filled in pre-sterilized glass bottles of 650 ml capacity, crown corked and then sterilized in boiling water for 30 minutes. The pulp is strained through double folded muslin cloth, hot sugar syrup is added to strained pulp and mixed thoroughly. Then spices extracts (cardamom, cumin, and black pepper, ginger juice and black salt and fresh mint) is added. The preserved pulp is utilized for product development as per specifications are added to it, followed by addition of mint and ginger extracts, later on citric acid was added to all formulations and sodium benzoate@ 120 ppm to control (Tj) only. The nectar is then hot filled in pre-sterilized turbo glass bottles of 200ml capacity. The bottles are crown corked, pasteurized in boiling water for 30 minutes, cooled, labeled and stored at ambient temperature (15-35°C; relative humidity 60-80%).

Input/raw material : Fresh plum, spices (cardamom, Cumin, black pepper, Black salt, common salt, fresh ginger and mint

a. Plant and machinery :
- Pulper 250 Kgs/hr  Rs.30,000
- Crown Corking Machine Rs.3,000
- Pasteurization Tank Rs.4,000
- Aluminium Patilias Rs.5,000
- Bottle washing machine Rs.15,000
- Refractometer Rs.4,000
- Weighing balance Rs.5,000
- Gas Bhatti Rs.5000
- Working table Rs.5000
- Mixer Grinder Rs.4000

b. Man power : 4 man days for 120 days
c. Investment : Rs. 1.2 lakh

Output capacity : 1055 bottles per day

Unit cost (per machine) :

Suitability for crop/ commodity : Plum

Unit cost of operation Rs.6.20 per bottle @ 190 ml

Commercialization status : Transferred

No. of Licensees : Nil

Addresses of Licensees or Manufacturer : Nil

Contact Address : PI, AICRP on PHET
Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, Srinagar –191 121 (J&K)
Technologies /Horticultural Crops

Technology No. 141

1. Name of the Technology: Walnut Kernel Incorporated Rice Based Extruded Snacks

2. Application/ Use: Utilization of broken walnut kernels and broken rice for development of Ready to serve products

3. Description of Technology:

Walnut kernel supplementation increases the nutritional value of starch based expanded snacks. A systematic study was conducted for optimizing the blending level of broken walnut kernels and broken rice for the production of expanded snacks through twin screw extruder by Srinagar Centre of AICRP on PHET. Response surface methodology was used to study the effects of feed composition, feed moisture, screw speed and barrel temperature on specific mechanical energy (SME), bulk density (BD), water absorption index (WAI), water solubility index (WSI), expansion ratio (ER), hardness and colour coordinates. With the increase in walnut kernel incorporation; bulk density, WSI, hardness, complexing index and oil loss were increased, while as SME, WAI and expansion ratio were decreased. With the increase in feed moisture SME, WSI and expansion ratio were decreased whereas, bulk density, WAI, hardness, complexing index and oil loss were increased. With the increase in screw speed, decrease in bulk density, WAI, hardness, complexing index, oil loss and increase in SME, WSI and expansion ratio were observed. With the increase in barrel temperature SME, bulk density, WAI and hardness were decreased, whereas, WSI, expansion ratio, complexing index and oil loss were increased. Optimized processing parameters by response surface methodology for preparation of extruded product where broken walnut kernel incorporation (10%), feed moisture (14%), screw speed (550 rpm) and barrel temperature 170° C.

4. Input/optimum processing conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material</td>
<td>Broken walnut kernel: Broken rice flour = 10:90</td>
</tr>
<tr>
<td>Feed moisture</td>
<td>14%</td>
</tr>
<tr>
<td>Screw speed</td>
<td>550 rpm</td>
</tr>
<tr>
<td>Barrel temperature</td>
<td>170° C</td>
</tr>
</tbody>
</table>

5. Proximate composition of final product

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>3.42%</td>
</tr>
<tr>
<td>Ash</td>
<td>0.60%</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>9.50%</td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>2.80%</td>
</tr>
<tr>
<td>Crude Fat</td>
<td>3.3%</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>80.38%</td>
</tr>
<tr>
<td>Sensory score</td>
<td>3.0 (good after 3 months of storage at ambient condition)</td>
</tr>
</tbody>
</table>

6. Unit Cost

Rs. 88/kg

7. Commercialization status

Ready to Commercialize

8. Contact Address

PI, AICRP on PHET
Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, SRINAGAR – 191 121 (J&K)
Technology No. 142

1. **Name of the Technology**: Lotus Stem and Broken Rice based Expanded Snacks

2. **Application/ Use**: Utilization of lotus stem and broken rice for development of Ready to serve products

3. **Description of Technology**:

   Lotus stem incorporation increase the fiber content of starch based extruded snacks. A systematic study was conducted for optimizing the blending level of lotus stem and broken rice for the production of expanded snacks through twin screw extruder by Srinagar Centre of AICRP on PHET. Response surface methodology was used to study the effects of feed composition, feed moisture, screw speed and barrel temperature on specific mechanical energy (SME), bulk density (BD), water absorption index (WAI), water solubility index (WSI), expansion ratio (ER), hardness and colour coordinates. Within the experimental range it was observed that:

   a) Effect of Barrel Temperature was most predominant on Expansion ratio and Color coordinates.

   b) Effect of Screw speed was most predominant on Breaking Strength and SME.

   c) Effect of Feed composition was most predominant on Bulk density, WAI and WSI

4. **Input/optimum processing conditions**

   - Raw material: Lotus stem flour:Broken rice = 40:60
   - Feed moisture: 15%
   - Screw speed: 500 rpm
   - Barrel temperature: 170°C

5. **Proximate composition**

   - Moisture: 4.20%
   - Ash: 0.98%
   - Protein: 8.20%
   - Crude Fiber: 2.82%
   - Carbohydrate: 83.32%
   - Crude Fat: 0.48%
   - Sensory score: 3.5 (good after 3 months of storage at ambient condition)

6. **Unit Cost**: Rs. 250/kg

7. **Commercialization status**: Ready to commercialize

8. **Contact Address**: PI, AICRP on PHET
   Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, SRINAGAR – 191 121 (J&K)
Technology No. 143

1. Name of the Technology: Cloud Stable Health Drink from blend of Apricot and Sea buckthorn.

2. Application/Use: Ready to serve

3. Description of Technology:
   Sea buckthorn despite having highly acidic nature and exotic flavor is having good potential for producing various products like ready-to-serve beverages, squash, syrup, jam and jelly. Judicious blending of sea buckthorn with apricot pulp in different ratios could be promising way for value addition of both these crops leading to development of a beverage with health benefits. The uniform distribution of pulp with cloud stabilization in fruit juices and beverages adds the aesthetic appeal of the products. Pulp particles in bottled fruit juice and beverages like nectar and squashes tend to coalesce and settle at the bottom or float at the top, leaving a clear or hazy serum which results in an unattractive appearance of the product. Hence this study was taken with the aim of developing cloud stable apricot-seabuckthorn blended nectar using hydrocolloids. Seabuckthorn and Apricot cv. Khantay pulps were blended in six ratios; 0: 100, 10: 90, 20: 80, 30: 70, 40: 60 and 50: 50. Nectars were developed as per FPO specification.

   ➢ Out of six treatment combinations health drink from T3, i.e. combination of 10% sea buckthorn and 90% apricot pulp was rated superior to other treatment combinations in terms of physico-chemical and organolapic quality attributes.
   ➢ In order to have uniform appearance in the best selected blended nectar, three hydrocolloids viz., sodium alginate, carboxymethylcellulose and guar gum were used @ 0.00, 0.25, 0.50, 0.75 and 1.00 per cent.
   ➢ Out of different treatment combinations of hydrocolloids, carboxy methyl cellulose (CMC) at 1% and sodium alginate (0.75%) proved effective in maintaining the cloud stability.

4. Input/ optimum processing conditions
   Raw material: Seabuckthorn and Apricot pulp = 10:90

5. Proximate composition
   TSS: 18.0%
   Titratable acidity: 0.34%
   Reducing sugars: 5.1%
   Total Sugars: 13.9%
   Total Carotenoids: 1.22 mg/100 g
   Vitamin C: 3.55 mg/100 g
   Sensory score: 4.0 (good after 6 months of storage at ambient condition)

6. Unit Cost
   Rs. 110/litre

7. Commercialization status
   Commercialized
   M/s Food Processing Unit, Kargil.

8. Contact Address
   PI, AICRP on PHET
   Sher-e-Kashmir University of Agri. Sciences and Technology, Shalimar Campus, SRINAGAR – 191 121 (J&K)
### Technology No. 144

**i** Name of the Technology : Curing of Vanilla Beans

**ii** Application/ Use : For curing the vanilla beans for the development of flavour

**iii** Description of Technology :
The existing method of curing vanilla beans is by Bourbon method. The improved method developed by this centre is faster, less energy intensive and produces quality output in terms of vanillin content. In this, vanilla beans are killed using hot water at 63°C for 3 minutes. Instead of sun drying they are subjected to mechanical drying at 55°C for 90 minutes/day for nearly 12 days so that the initial weight of vanilla beans reduced to half. It is then slow dried at 70% relative humidity for nearly 7 days to reduce the initial weight to one third. At this time the moisture content of vanilla beans are 25%. The slow dried beans are kept for conditioning for three months in suitable packaging material.

**iv** Input/raw material : Fresh Vanilla beans

**v** Suitability for crop/ commodity : Vanilla beans

**vi** Commercialization status :

<table>
<thead>
<tr>
<th>a) No. of Licensees</th>
<th>b) Addresses of Licensees or Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>one</td>
<td>Tomy, Thakkanadi, Edamala, Malappuram</td>
</tr>
</tbody>
</table>

**vii** Contact Address :
Research Engineer, AICRP on PHET
Kerala Agricultural University
Kelappaji College of Agricultural Engineering and Technology, TAVANUR, Kerala – 679573
Technologies /Horticultural Crops

Technology No. 145

i. Name of the Technology : Fried Snack Foods from Cassava based Composite Flour

ii. Application/Use : Fried food products from composite flour based on cassava have high nutritional and textural quality as well as longer shelf life. They can easily capture the urban markets.

iii. Description of the Technology:
Ten fried food products viz., hot fries, hot sticks, sweet fries, sweet dimons, salty fries, salty delight, murukku, crisps, nutrichips (with egg) and nutrichips (without egg) were prepared and nutritive value assessed. Edible grade cassava flour can be mixed with maida, rice flour, bengal gram flour or other ingredients depending upon the type of products. The sweet products had sugar content from 31-38% while the salty and hot fries had sugar content of 3-4%. The fat content in the various products ranged from 15 to 26%, The crude protein content was generally in the range of 5-11%.

iv. Inputs required
a) Raw material : Cassava flour, cereal flour, legume flour, cooking oil etc.


c) Investment : 20.00 lakhs

v. Output capacity : 75 tonnes per annum

vi. Suitability for crops/commodity : Cassava

vii. Unit cost : Rs. 15/-100g packet

viii. Commercialization status : Commercialized
(a) Number of licensees to whom the technology has been transferred : Two

(b) Selected Addresses of Licensee /Manufacturer
1. M/s Triums Exporters
BP Angadi, Tirur, Malappuram, Kerala
2. M/s Highlands Foods
Theyyalingal, Malappuram, Kerala

ix. Contact Address : Research Engineer, AICRP on PHET
Central Tuber Crops Research Institute,
Thiruvananthapuram – 695 017

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Four Decades of R&D of AICRP on PHET

Technology No. 146

i. **Name of the Technology** : Process Technology for Garlic Flakes and Powder

ii. **Application/ Use** : The technology has application for dehydration of garlic for making flakes and powder at catchment level.

iii. **Description of Technology** :
Garlic has medical property and used in the form of powder, flakes and paste in various food preparations and medicines. India is exporting garlic in whole and powder form to various countries. Simple processes were developed to dehydrate garlic cloves and make its flakes and powder. The individual cloves are separated from bulb through a garlic bulb breaker. The cloves are then flattened/ pressed mildly through a garlic flaking machine or cut into 4-6 mm long pieces through a slicer/steel knife. This operation facilitate in rupture of papery skin of cloves to enhance the drying rate considerably. Then the cloves are dehydrated using a solar dryer (2-3 days) or a mechanical tray dryer (65°C for 7-8 h). The dehydrated flakes/slices could be stored and used as such or could be converted into powder after size reduction to 75 mesh size. Special care has to be taken for hermetic storage/packaging of powder in a glass bottle / HDPE bottle/pouches, as it is very hygroscopic in nature and if kept in open for a short while it will absorb moisture from atmospheric and clump formation occur.

iv. **Input/raw material** : Sound garlic bulbs
   b) Power : 5 hp, 3 phase power connection
   c) Man power : 3 unskilled labours
   d) Land : 200 Sq m
   e) Investment : Rs 2,50,000/= 

v. **Output capacity** : 30-50 kg/day depending on dryer capacity

vi. **Unit cost (per machine)** : Rs 2,50,000/= 

vii. **Suitability for crops/commodity** : Garlic

viii. **Efficiency/recovery** : 75-80%; Flakes/powder recovery: 28-30%
ix. **Unit cost of operation** : Rs 15/kg of dehydrated product 
x. **Patent obtained/applied** : NA 

xi. **Commercialization status** :
   a) No. of Licensees to whom the technology has been transferred : Farmer-cum-processort/entrepreneur
   b) Selected Addresses of Licensee or Manufacturer : - 

xii **Contact address** : Research Engineer, AICRP on PHET
College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur—313 001 (Rajasthan)
Technologies / Horticultural Crops

Technology No. 147

i. Name of the Technology : Technology for Ginger and Turmeric Processing

ii. Application/ Use : Processing of fresh ginger and turmeric into dried/powder form in production catchment enhance income of the farmer

iii. Description of Technology : Spices are one of the essential elements of Indian recipes besides taste & aroma. They are also being used for medicinal values since ancient times. Ginger & Turmeric have an important place in spices. World's 50% ginger and 90% turmeric are produced in India. A technology package has been developed for processing of fresh ginger and turmeric into dried and powder form. In order to clean and remove adhered soil with rhizomes, ginger and turmeric are washed with water. Ginger is peeled with knife or by rubbing against gunny bags in order to fasten the drying process. Due care is taken to avoid the loss of material during peeling. The turmeric is cooked in water with 0.1% Sodium bicarbonate for 40-50 min to obtain good colour and even distribution of colour in the flesh. Drying is performed in solar dryer for 3 days. The outer surface of rhizomes shrivels due to drying and does not appeal properly. Polishing is therefore, required for smoothing the dried rhizomes. Like other spices, ginger and turmeric rhizomes can be powdered using a pulverizer. The material is shifted to 50 mesh & packaged in appropriate size polyethylene bags, sealed & marketed. The Turmeric powder need impregnated packaging material to prevent the loss of volatile oil. Ginger peeling machine, Solar dryer and Polisher have been developed to facilitate these operations in efficient manner.

iv. Input/raw material : Fresh ginger and turmeric rhizomes
   a) Plant & Machinery : Washing vessel, Peeling machine, Blanching vessel, Solar dryer/ mech. dryer, Polisher, Pulveriser, heat sealing machine etc.
   b) Power : 2 hp 3 phase power connection
   c) Man power : 2 unskilled labours
   d) Land : 200 Sq m
   e) Investment : Rs 2,50,000/-

v. Output capacity : 50-60 kg rhizomes/day

vi. Unit cost (per machine) : Rs 2,50,000/-

ix. Suitability for crops/commodity : Ginger and turmeric

vii. Unit cost of operation : The cost of ginger & turmeric processing into the form of well-dried rhizomes was estimated as Rs. 2.75 and 1.55 per kg, respectively.

viii. Commercialization status : Commercialized
    a) No. of Licensees to whom the technology has been transferred
    b) Selected Addresses of Licensee or Manufacturer

ix. Contact address : Research Engineer, AICRP on PHET College of Technology & Argil. Engineering, Maharana Pratap University of Agricultural & Technology, Udaipur–313 001 (Rajasthan)
<table>
<thead>
<tr>
<th>i</th>
<th>Name of the Technology :</th>
<th>Mobile Poultry Processing Unit-cum-Retail Meat Stall</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>Application/ Use        :</td>
<td>Mobile poultry processing unit-cum-retail meat stall was designed to address the hygiene status of slaughter and dressing of poultry and to serve as an ideal street meat vending stall in cities where commercial space is highly prohibitive in cost and availability</td>
</tr>
<tr>
<td>iii</td>
<td>Description of Technology :</td>
<td>Mobile poultry processing unit-cum-retail meat stall has all the necessary features for hygienic slaughter and dressing of poultry such as a poultry crate to hold live birds, a bleeding unit, a novel scalding component, a Teflon coated cutting board, water receptacles with tap, an insulated trough, a wastes collection chute and an improvised power supply system with good artificial lighting. It is made of stainless steel frame structures.</td>
</tr>
<tr>
<td>iv</td>
<td>Input/raw material :</td>
<td>7 feet and 11 inches X 4 feet and 5 inches X 6 feet and nine inches (Length X Breadth X Height)</td>
</tr>
<tr>
<td></td>
<td>a. Overall dimension (L x B x H mm) :</td>
<td>800 kg (Fully stainless steel body)</td>
</tr>
<tr>
<td></td>
<td>b. Weight :</td>
<td>400 Kg (Aluminum Body with stainless steel at all surfaces that may get in contact with meat)</td>
</tr>
<tr>
<td></td>
<td>d. Power (hp) :</td>
<td>1Hp, 0.75 Kva motor for scalding;</td>
</tr>
<tr>
<td></td>
<td>e. Man power :</td>
<td>Two.</td>
</tr>
<tr>
<td>f.</td>
<td>Land :</td>
<td>Sufficient to park the vehicle</td>
</tr>
<tr>
<td>g.</td>
<td>Investment :</td>
<td>Rs 5.5 lakhs (Fully stainless steel body)</td>
</tr>
<tr>
<td>v</td>
<td>Output capacity :</td>
<td>Rs 3.5 lakhs (Aluminum Body with stainless steel at all surfaces that may get in contact with meat)</td>
</tr>
<tr>
<td>vi</td>
<td>Unit cost (per machine) :</td>
<td>Rs 3.5 lakhs (Aluminum Body with stainless steel at all surfaces that may get in contact with meat)</td>
</tr>
<tr>
<td>vii</td>
<td>Suitability for crop/commodity :</td>
<td>Chicken</td>
</tr>
<tr>
<td>viii</td>
<td>Efficiency :</td>
<td>90 %</td>
</tr>
<tr>
<td>ix</td>
<td>Unit cost of operation :</td>
<td>Rs 3/- bird</td>
</tr>
<tr>
<td>x</td>
<td>Patent obtained/applied :</td>
<td>Under process</td>
</tr>
<tr>
<td>xi</td>
<td>Commercialization status :</td>
<td>Yes</td>
</tr>
<tr>
<td>a)</td>
<td>No. of Licensees :</td>
<td>01</td>
</tr>
<tr>
<td>b)</td>
<td>Addresses of Licensees or entrepreneur :</td>
<td></td>
</tr>
<tr>
<td>xii</td>
<td>Contact Address :</td>
<td>PI, AICRP on PHET Department of Livestock Products Technology (Meat Science) Madras Veterinary College, Chennai-600 007</td>
</tr>
</tbody>
</table>
Technology No. 149

i. Name of the Technology : Feed Block Making Machine

ii. Application/Use : A manually operated feed block making machine was developed for the preparation of feed block. The feed block is useful in increasing utilization efficiency through the increased acceptability by the animals, increasing storability and transportability.

iii. Description of Technology :
The processing unit consists of a handle, square threaded screw, sliding wooden block and an angle iron supporting frame. The feed block die is made of 1.5 mm mild steel sheet which has been provided with hinges and latches for quick dissembling operations. The supporting bench has been made using four pieces of mild steel angle iron 35 x 35 x 5 mm and 3 mm thick mild steel plate.

iv. Input/raw material : Name of Ingredients Qty (kg)
Wheat straw 1.750
Groundnut haulms 1.750
Groundnut cake 0.700
Molasses 0.150
Common salt 0.500
Urea 0.150
Total 5.000

a) Overall dimension : 525 x 300x1280 mm
b) Weight : 40 kg
c) Man power : Two persons can produce about 40 blocks in a day
d) Investment : Rs. 7000/- Machine cost + Raw materials cost

v. Output capacity : 4 to 5 block per hour
vi. Unit cost (per machine) : Rs. 7000/- Machine cost
vii. Suitability for crops/commodity : Feed
ix. Unit cost of operation : -

x. Commercialization status :
(a) No. of Licensees to whom the technology has been transferred : NGO's and farmers
(b) Selected Addresses of Licensee/Manufacturer : Nil

xii. Contact Address : Professor and Research Engineer, AICRP on PHET
College of Agricultural Engineering, Junagadh Agricultural University, Junagadh -362 001 (Gujarat)
### Technology No. 150

**i** Name of the Technology : Women Friendly Fish Vending and Display Unit

**ii** Application/ Use : Addresses the issue of post harvest loss in terms of extending the keeping quality of seafood and fresh water fishes with ice storage and avoid the drudgery of the fisher women in procuring fish on regular basis from various places in bulk.

**iii** Description of Technology :

The unit mainly consists of A. Storage box B. Waste collection box C. Lid with Glass D. Box for water E. Box for detergent F. Tray for display, G. Cash box and boxes for storage of utilities. Generally icing of fish adds to cost and transportation expenses. Since this technology has well insulated storage space for fish, it reduces the ice melting rate, thereby reducing the selling cost incurred for ice This technology extends the keeping quality of fish for 4 to 5 days and increases the marginal benefit to fish vendors. Also the technology helps to change the existing practice of unhygienic handling and marketing of fish.

**iv** Input/raw material  

<table>
<thead>
<tr>
<th>a. dimension (W x D x H mm)</th>
<th>Food grade stainless steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>storage box (850 X 460 X 440 mm)</td>
<td>waste collection tank (200 X 270 X 440 ) mm</td>
</tr>
<tr>
<td>box for storing water (140 X 200 X 440 ) mm</td>
<td></td>
</tr>
</tbody>
</table>

**v** Output capacity : Capacity =175L (upto 100 kg fish apart from ice)

**vi** Unit cost (per machine) : Rs. 25,000

**vii** Suitability for crop/commodity : Fish

**viii** Efficiency : Good Insulation with a ice melting rate of 10% per day

**ix** Unit cost of operation : -

**x** Patent obtained/applied : yes

**xi** Commercialization status : Ready for commercialization

<table>
<thead>
<tr>
<th>a) No. of Licensees</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Address of Licensees or Manufacturer</td>
<td>-</td>
</tr>
</tbody>
</table>

**xii** Contact Address : PI-AICRP on PHET  
Department of Fish Processing Technology  
College of Fisheries, KVAFSU Mangalore
### Technology No. 151

<table>
<thead>
<tr>
<th>i</th>
<th>Name of the Technology</th>
<th>Model Retail Outlet for the Production of Hygienic Chicken Meat</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>Application/Use</td>
<td>A modern chicken outlet has been designed and developed which is helpful in production of clean and hygienic meat that reduces the spread of the meat borne pathogens and disease outbreaks.</td>
</tr>
<tr>
<td>iii</td>
<td>Description of Technology:</td>
<td>In India, meat production is carried out by organized i.e. commercial processing plants as well as unorganized i.e. retail chicken shops, sectors. Since, Indian consumers generally prefer to purchase poultry meat from a retail market wherein birds are slaughtered in front of them, unfortunately in most of the unorganized retail shops, poultry processing procedures are carried out in the small part; butchers do not wash the carcasses and uses wooden block for making cuts of chicken. Therefore, chances of contaminations are more thus; there is great risk of getting cases of food borne illness/infections. Considering the present unhygienic meat production at unorganized retail shops, there is a need to have better facility for hygienic chicken meat production. Keeping in view, a modern chicken outlet has been designed and developed under the sub-head project entitled as “Establishment and demonstration of model retail outlet for chicken.” which is helpful in production of clean and hygienic meat that reduces the spread of the meat borne pathogens and hence disease outbreaks.</td>
</tr>
<tr>
<td>iv</td>
<td>Input/raw material</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Overall dimension</td>
<td>8X2X3 feet</td>
</tr>
<tr>
<td></td>
<td>b. Weight</td>
<td>150 Kg</td>
</tr>
<tr>
<td></td>
<td>c. Prime mover</td>
<td>Movable</td>
</tr>
<tr>
<td></td>
<td>d. Man Power</td>
<td>2 Person</td>
</tr>
<tr>
<td></td>
<td>e. Land</td>
<td>15X10 feet</td>
</tr>
<tr>
<td></td>
<td>f. Investment</td>
<td>Rs 1,25,000/- only</td>
</tr>
<tr>
<td>v</td>
<td>Output capacity</td>
<td>50-100 Chicken processing/day</td>
</tr>
<tr>
<td>vi</td>
<td>Unit cost</td>
<td>Rs 1,25,000/- only</td>
</tr>
<tr>
<td>vii</td>
<td>Suitability for crop/commodity</td>
<td>Poultry Processing</td>
</tr>
<tr>
<td>viii</td>
<td>Efficiency</td>
<td>Highly Efficient</td>
</tr>
<tr>
<td>ix</td>
<td>Unit cost of operation</td>
<td>NA</td>
</tr>
<tr>
<td>x</td>
<td>Contact Address</td>
<td>PI-AICRP on PHET Department of Veterinary Public Health and Epidemiology, Bombay Veterinary College Parel, Mumbai –400 012. Maharashtra (INDIA)</td>
</tr>
</tbody>
</table>
Four Decades of R&D of AICRP on PHET

Technology No. 152

i. Name of the Technology : Pedal Operated Ice Crusher

ii. Application/Use : Pedal operated ice crusher is useful to crush the block ice on broad and in the fish landing centers and fish retail markets. The crushed ice is effective in preservation and handling of fish in the best possible condition after the catch. This also helps to minimize the post harvest losses and keeps the catch fresh during the transit that fetches good price in the market.

iii. Description of Technology :
Pedal operated ice crusher consists of a crushing cylinder with spikes, casing, feeding chute, outlet slots, discharge chute, flywheel, chain and sprocket power transmission system with pedal and seat arrangement. The speed of crushing cylinder is about 485–500 rpm for an average pedaling speed of 90-95 rpm, which is sufficient to crush the ice blocks. The average capacity of the crusher is around one tonne per hour. Unit cost of production of pedal operated ice crusher is Rs. 16,000/-.

The cost of operation is Rs. 1.56/- for crushing one block of ice weighing 50 kg. The technology helps the fishermen to save about 40-60% of ice requirement when it is used on board

iv. Input/raw material :
   a) Overall dimensions : 1500 x 1000 x 1200 mm
   b) Weight : 120 kg
   c) Prime mover/ Plant & Machinery : Pedal
   d) Power : Nil
   e) Man power : 2 labourers
   f) Land : 9 square meter
   g) Investment : Rs. 16,000/-

v. Output capacity : 1 tonne/hour
vi. Unit cost (per machine) : Rs. 16,000/-

vii. Suitability for crops/commodity : Ice blocks

viii. Efficiency : 95-97 per cent

ix. Unit cost of operation : Rs.1.56 per 50 kg ice block

x. Patent obtained/applied : Not applied

xi. Commercialization status :
   (a) No. of Licensees to whom the technology has been transferred : -
   (b) Selected Addresses of Licensee/Manufacturer : Sr. Scientist, AICRP on PHET Dept. of Processing and Food Engineering, College of Agricultural Engineering, UAS, Raichur.
Livestock

Process Protocols and Products

Technology No. 153

i. Name of the technology
   : Pet Food from slaughter house waste by-products

ii. Application/ Use
    : Cost wise offal/waste of slaughterhouses is cheaper as compared to lean meat. Pets particularly dogs have habits of biting and chewing house hold articles such as shoes, toy sticks. Products based on slaughter house meat by products viz hide, skins & their trimming, head shanks and tails hides, and bones etc.) could be developed for this purpose.

iii. Description of Technology:
    Presently M/S Nestle, Purina Pet Care, Hyderabad, M/S Al-pets (Allana & Sons), Unnao and M/S J.S. International, Unnao are engaged in production of pet food/dog chew. The purpose of this investigation is to develop cheaper pet food at micro/small level to develop this fast emerging sector in India. This technology has been developed for manufacturing of pet food by using selected meat offals mixed in 40 to 50% ratio by weight, residues of potatoes and cereals.

iv. Input Required:
   
a) Raw material
   : Ingredient  40% offal incorporation  50% offal incorporation
   Offal (meat trims)  40  50
   Wheat flour  40  30
   Potato  15  15
   Milk powder  2.5  2.5
   Baking powder  0.6  0.6
   SHMP  0.3  0.3
   Salt  0.6  0.6
   Vegetable fat  1.0  1.0

b) Plant and machinery
   : (i) Low cost pet food making machine with motor (capacity 10 kg/hr)  Rs. 50,000/-
   (ii) Heat sealing machine  Rs. 35,000/-
   (iii) Tray dryer  Rs. 65,000/-

   a) Overall dimension  Length 51”X width 10”Xheight 31”
   b) Weight  60 kg
   c) Power  01 HP
   d) Man power  1 Skilled and one unskilled labour
   e) Land  30’X20’ shed with pucca flooring
   f) Investment  2,00,000/-

vi. Output capacity  80 kg/day (8 hrs basis)

vii. Unit cost  Rs. 50/kg

viii. Contact address
      HOD
      Department of Post Harvest Engineering and Technology
      Aligarh Muslim University, Aligarh 202002 (UP)
Technology No. 154

i. **Name of the technology** : Pet Food Preparation

ii. **Application/ Use** : Pet feed from slaughter house waste/ by-products

iii. **Description of Technology** :

   This centre has also developed pet food by utilizing only slaughter house offals, without any pulses, fruits, vegetable and cereal residue to further reduce the cost of production and also to increase the nutritional value of pet food.

   Offals (Heart, tongue, head meat and udders), guar gum, sugar, salt, vegetable oil and sodium nitrate are the major raw materials used for the pet food production. The meat is washed, cooked, minced, and added the other ingredients and mixed properly. The dough is fed in a mincer attached with a biscuit die for the production of pet biscuit. Biscuit will be dried in an oven/dryer. Initially the temperature of oven was kept at 80°C for two hr & 100°C for 30 minutes and for rest of the eight hrs 50°C maintained.

iv. **Input required** :

v. **a) Raw Material** Offals, Salt, Sugar, Guar gum, Vegetable oil, potassium sorbate as preservative

vi. **a) Plant and machinery**

   (i) Meat mincer attached with a biscuit die (capacity 10 kg/hr) : Rs. 50,000/-

   (ii) Heat sealing machine : Rs. 35,000/-

   (iii) Tray dryer : Rs. 65,000/-

   b) Overall dimension : Length 395mmX width 360 mm X height 485mm

c) **Weight** : 18 kg

d) **Power** : 1.1kw / 1.5hp

e) **Man power** : 1 Skilled and one unskilled labour

f) **Land** : 30'X20' shed with pucca flooring

f) **Investment** : 2,00,000/-

vii **Output capacity** : 80 kg/day (8 hrs basis)

viii **Unit cost** : Rs. 50/kg

ix **Contact address** : HOD

   Department of Post Harvest Engineering and Technology

   Aligarh Muslim University, Aligarh-202002 (UP)
Technology No. 155

i. Name of the technology : Soya Protein Isolate in Buffalo Sausage Preparation

ii. Application/Use : For human consumption

iii. Description of technology:
Buffalo meat emulsion sausage was developed by incorporation of soya protein isolate to increase the protein content. Meat and fat was chopped to a very fine particles form in bowl cutter. 20% ice was added to reduce the temperature during chopping. Spices and condiments were added after 5 minutes of mixing. Finally soya protein isolate was added in different proportion to get smooth emulsion. The emulsion was transferred to stuffing machine and sausages were stuffed in cellulosic casing and finally cooked in sausage cooker (steam cooking at 110°C for 15 minutes).

iv. Input
a) Raw material : Lean meat, animal fat, soya protein isolate, spice mixer, condiments (garlic, ginger, and onion paste), salt etc.

b) Plant and machinery
i. Bowl chopper (Cost: Rs. 2.5 lakhs; Dimension: 63 cm x 52cm x61cm; Weight: 25 kg).
ii. Stuffing machine (Cost: Rs. 60,000; Dimension: 56 cm x 34cm x 27 cm; Weight: 7 kg).
iii. Sausage cooker (Cost: Rs. 55,000; Dimension: 76 cm x 41 cm x 52 cm; Weight: 20 kg).

c) Man power required : One skilled labor
d) Land required : 12’x15”
e) Investment : Approx. 4.0 lakhs

v. Output capacity : 80 kg/day (8 h basis)

vi. Unit cost : Rs. 150 per kg

vii. Contact Addresses
PI, AICRP on PHT
HOD
Department of Post Harvest Engineering and Technology
Aligarh Muslim University, Aligarh-202002 (UP)
Technology No. 156

i. **Name of the Technology**: Honey Treated Deep Fried Chicken Nuggets

ii. **Application/ Use**: Meat Processing

iii. **Description of Technology**:
Spent chicken was dressed as per standard procedure and hot deboning process was followed to separate the lean and fat. The lean and separable fat were stored at (-) 20°C and (-) 26°C, respectively until use. The lean was cut into small pieces of weighing approximately 30-50g. The lean pieces of chicken were then packed tightly in polyethylene bags and stored in a deep freeze maintained at -20°C. The separable chicken fat was also cut into smaller pieces of about 20-30g and after packing these were stored at (-) 26°C. The lean of spent chicken stored at -20°C were first thawed for overnight and then vacuum tumbled for 3-4 hours. The chicken fat was, however, not thawed and introduced in to the bowl chopper in frozen state. The tumbled lean and frozen fat were mixed according to different formulation and bowl chopped for 1min at slow speed followed by 2min at high speed. Spices and curing ingredients were directly added as per the recipe to the chopped meat in the bowl chopper.

The sausage emulsions thus prepared were kept overnight in the refrigerator maintained at 10-12°C. Finely crushed ice crystals at about 1% of the sausage mix were added during bowl chopping. The chicken emulsions were then filled into moulds and cooked in a preset time temperature combination in a cooking vat. Immediately after cooking, the meats with the mould were immersed in ice-cold water. The cooked meat were then cut into desired shape and soaked in honey syrup for overnight. Following soaking, the meat cubes were washed in running tape water and allowed to dry. Chicken nuggets thus prepared were deep fried in cooking medium and on cooling packaged in a polyethylene bag.

iv. **Input/raw material**: Chicken and honey

vii. **Suitability for crop/ commodity**: -

ix. **Unit cost of operation**: -

xi. **Commercialization status**: Ready for commercialization

a) **No. of Licensees**: -
b) **Addresses of Licensees or Manufacturer**: -

xii. **Contact Address**: Sr. Scientist & PI, AICRP on PHET (Meat & Meat Products)
Livestock Products Technology Dept.
College of Veterinary Science
i. **Name of the Technology**: Intermediate Spent Chicken Meat

ii. **Application/ Use**: Meat Processing

iii. **Description of Technology**:
Deboned leg and breast cuts of spent chicken were placed in between stainless steel sheets and a weight of 100kg was placed for overnight to pressure remove the free water from the meat samples. After removal of free water meat pieces were dry cured by using salt, salt petre and sugar as per formula given below and were stored at 4±1°C for overnight. After storing for overnight, the meat pieces were then tumbled for 1 hour in a vacuum tumbler. Meat pieces then were put in polyethylene bags and stored at 10±1°C for 2 days. Thereafter, the meat pieces were washed thoroughly in running tape water for 1h to remove excess of the curing mixture. The samples were then air dried for 6hours in a clean room.

After the air drying process was completed, a thick paste of the spices prepared with fenugreek, garlic, black pepper, red chilli powder and cumin was applied to all sides of the meat pieces in a thick layer and then stored hung at room temperature.

iv. **Input/raw material**: Meat piece, fenugreek, garlic, black pepper, red chilli powder and cumin was applied to all sides of the meat pieces in a thick layer and then stored hung at room temperature.

v. **Output capacity**: Not defined

vi. **Unit cost**: Not defined

vii. **Suitability for crop/commodity**: -

viii. **Unit cost of operation**: -

ix. **Commercialization status**: Nil
a) No. of Licensees: Nil
b) Addresses of Licensees or Manufacturer: Not available

x. **Contact Address**: Sr. Scientist & PI, AICRP on PHET (Meat & Meat Products) Livestock Products Technology Dept. College of Veterinary Science AAU, Khanapara, Guwahati–781002
Name of the Technology : Spent Chicken Meat Pickle

Application/ Use : Meat Processing

Description of Technology :
The meaty cuts (breast and legs) of spent chicken were deboned and washed properly. Common salt (1.0% w/w) and sugar (0.5% w/w) were then added and rubbed all over the surface thoroughly. Meat pieces were then vacuum tumbled for 30 minutes and stored at refrigeration temperature for overnight. After storage the meat pieces were cut into small cubes of approximately 1.5cm size and transferred to a wide mouth glass jar/beker and filled with vinegar diluted with water in the ratio of 1:3 and further stored for overnight at refrigeration temperature. The excess of the vinegar was then drained off and the meat cubes were allowed to dry for some time at room temperature.

The meat cubes were then deep fried in mustard oil with the addition of paste of onion, ginger, garlic, cumin powder, red chilli powder and coriander powder. Initially, the product is cooked at simmering temperature till it is properly done and thereafter it is cooked at high temperature till development of a brownish color on the surface. After cooling to room temperature, the product is stored in PET jar/glass bottles or polyethylene bags and stored at room temperature.

Input/raw material : Meat cubes were then deep fried in mustard oil paste of onion, ginger, garlic, cumin powder, red chilli powder and coriander powder

Output capacity : Not defined

Unit cost (per machine) : Not defined

Suitability for crop/commodity : Poultry

Unit cost of operation : -

Commercialization status : Nil

No. of Licensees : Nil

Addresses of Licensees or Manufacturer : -

Contact Address : Sr. Scientist & PI, AICRP on PHET (Meat & Meat Products) Livestock Products Technology Dept. College of Veterinary Science AAU, Khanapara, Guwahati– 781002
Technologies /Livestock

Technology No. 159

i. Name of the Technology : Ready-To-Eat Extruded Fishery Products

ii. Application/ Use : Development of Ready-To-Eat extruded fishery products for retail sale incorporating low value fishes. The process developed will help in proper utilization and value addition to fish species that have little or no commercial value in unprocessed form due to low meat content and poor consumer preference.

iii. Description of Technology :
Food extrusion is relatively a new technology that has been practiced for more than fifty years. In fisheries, the major extrusion work includes the development of product with surimi and soybean protein, extruded rice flour and mince carp, etc. Extrusion cooking is a high temperature short time process with advantage of high versatility. The Kolkata centre standardized the extrusion temperature, moisture and percentage of minced meat incorporation in extruded products developed from minced meat of locally available low value fishes using a twin screw extruder. An optimum production procedure was standardized that may be used to develop extruded fishery products.

iv. Input/raw material : low value fish, soybean protein, rice flour, mince carp

v. Output capacity : 5-10 kg/hr

vi. Cost of unit : Rs. 8.5 lakh

vii. Suitability for crop/commodity : Mince of low value fishes

viii. Commercialization status :

a) No. of Licensees : None

b) Addresses of Licensees or Manufacturer : Dean
Faculty of Fishery Sciences,
5 Budherhat Road, PO:
Panchasayar, Kolkata-700094,
Tel & Fax: 033-24328763
Technology No. 160

i. **Name of the Technology**: Process for Extraction of Flavor from Shrimp Waste

ii. **Application/ Use**: It is estimated that during shrimp processing nearly 80% waste is generated in the form of shrimp head, exoskeleton, hepatopancreas, eye stalk, residual meat and the material lost in liquid from. Utilization of this waste for extracting flavor active compounds will put this waste into useful marketable products. This minimizes the pollution problem and at the same time maximizes the profits of the processors.

iii. **Description of Technology**: The flavor of seafood like shrimp flavor is hard to synthesize and it is almost necessary to produce from natural products. Many methods have been reported for isolation of flavor active components and utilization of shrimp wastes. One of the best methods of using shrimp wastes would be its conversion into “value added” products by extracting flavor active components from the waste and using them as useful marketable products. The AICRP on PHT, Kolkata centre attempted a study on shrimp flavor extraction and value addition. During the study, the procedure for extraction of shrimp flavor was standardized using shrimp head.

iv. **Input/raw material**: Shrimp waste

v. **Unit cost (per machine)**: -

vi. **Suitability for crop/commodity**: Shrimp waste

vii. **Commercialization status**: Product ready for commercialization

viii. a) **No. of Licensees**: None

    b) **Addresses of Licensees or Manufacturer**: -

ix. **Contact Address**: Dean Faculty of Fishery Sciences, 5 Budherhat Road, PO: Panchasayar, Kolkata-700094. Tel & Fax: 033-24328763
Technology No. 161

i  Name of the Technology : Development of Fish Soup with Shrimp Flavour

ii  Application/ Use : It is estimated that during shrimp processing nearly 80% waste is generated in the form of shrimp head, exoskeleton, hepatopancreas, eye stalk, residual meat and the material lost in liquid from. Utilization of this waste for extracting flavour active compounds will put this waste into useful marketable products. This minimizes the pollution problem and at the same time maximizes the profits of the processors. The shrimp flavour when incorporated in soup yields ready to eat products.

iii  Description of Technology :
Shrimp flavour was extracted from shrimp wastes and the application rate of the same was standardized for fish soup. For preparation of fish soup low cost fish was used as raw material and the final product was dried, pulverized and packed. The fish soup powder can be prepared by boiling 5 gms of it in 100 ml of water with addition of shrimp flavour powder. The mixture is boiled for 5 mins and served hot.

iv  Input/raw material : Fish and Shrimp

v  Unit cost (per machine) : -

vi  Suitability for crop/commodity : Shrimp waste, low valued fish.

vii  Commercialization status : Product ready for commercialization
a) No. of Licensees : None
b) Addresses of Licensees or Manufacturer : -

viii  Contact Address : PI, AICRP on PHET, Kolkata Centre, Faculty of Fishery Sciences, 5 Budhera at Road, PO: Panchasayar, Kolkata-700094, Tel & Fax: 033-24328763
Technology No. 162

i. **Name of the Technology** : Development of Vegetable soup with Shrimp Flavour

ii. **Application/ Use** : It is estimated that during shrimp processing nearly 80% waste is generated in the form of shrimp head, exoskeleton, hepatopancreas, eye stalk, residual meat and the material lost in liquid from. Utilization of this waste for extracting flavour active compounds will put this waste into useful marketable products. This minimizes the pollution problem and at the same time maximizes the profits of the processors. The shrimp flavour when incorporated in soup yields ready to eat products.

iii. **Description of Technology** :
Shrimp flavour was extracted from shrimp wastes and the application rate of the same was standardized for vegetable soup. For preparation of vegetable soup tomatoes, carrots, beans and cabbage were used as raw material and mixed with white sauce. The vegetable soup powder is served after addition of 15% shrimp flavour powder.

iv. **Input/raw material** : Vegetables and Shrimp

vii. **Suitability for crop/ commodity** : Shrimp waste, vegetables.

xi. **Commercialization status** :
   a) **No. of Licensees** : None
   b) **Addresses of Licensees or Manufacturer** : -

xii. **Contact Address** : Dean
    Kolkata Centre, Faculty of Fishery Sciences,
    5 Budherhat Road, PO: Panchasayar,
    Kolkata-700094.
Technology No. 163

i. **Name of the Technology** : Low Calorie Ice Cream (using stevia powder) for Diabetic Patients

ii. **Application/Use** : As a dessert for calorie conscious people

iii. **Description of Technology**:
Low calorie ice cream could be prepared from milk cream, Skimmed milk powder, Raftline (as a fat replacer), Sorbitol powder (fat replacer), Stevia (as a sugar replacer), Stabilizers (Gaur gum (as a stabilizer) and Carrageenan (stabilizer) in ratio 5:2 respectively) and Emulsifier (80% GMS (emulsifier) and 20% Polysorbate 80(as a emulsifier). All mixes contained 11% milk SNF, and varied amount of fat, raftline, sorbitol, stevia, stabilizers and emulsifiers. Four kilogram ice cream mix was made per batch and heated to 80 °C held for 25 s, homogenized in two stages (1000 psi and then 500 psi), cooled at 4°C and held for 8 hrs. After ageing vanilla flavor (2.35 ml/kg ice cream mix) was added and frozen in a 10 liter batch ice cream freezer. Ice cream was frozen (40-60 min) till the product achieved sufficient stiffness to almost hold its shape. The frozen ice cream was hardened at -18 to -20°C in a deep freezer.

iv. **Input**
   a) Raw material : Milk, SMP, stabilizers and stevia
   b) Machinery
      - Mixing Hopper - 40 kg
      - Balance Tank – 100 lit. (for mixing dry and wet ingredients)
      - Chiller – 100lit/hr
      - Pasteurizer (Batch) – 100lit.
      - Ice cream Freezer – 40 lit.
      - Hardening chamber /Deep freezers (100lit.)
   c) Investment : Rs. 5 lakh

v. **Unit cost** : Rs. 8 per 200 ml cup

vi. **Suitability for crops/commodity** : Milk

vii. **Efficiency/suitability** : 43.75 % less calorie (Contains 99 kcal/100 ml as compared to normal ice cream (176 kcal/100 ml)

viii. **Commercialization status** : Ready for commercialization

ix. **Contact address** : Head,
Department of Process and Food Engg. College of Tech.,
G. B. Pant University of Agriculture & Tech.,
Pantnagar - 263 145 (Uttaranchal)
Technology No. 164

i. Name of the Technology : Value Added Product (fish sausage) by using Low Value Marine and Freshwater Fish

ii. Application/Use : The developed indigenous technology provides hygienically processed value added fish products for the domestic and export markets using under-utilized and low value fish harvested from marine and fresh water sources.

iii. Description of Technology :
Procure fresh Bull’s eye fish (*Priacanthus hamurur*) from the fish landing centre in iced condition. Dress the fishes to remove scales, head and viscera and then wash in clean chilled water. Separate the meat from the bones using meat picking machine. Reduce the size of the meat in a meat mincer. Add the spices with minced meat as per the standard recipe and grind the mixture in a silent cutter for 10-15 min. Transfer the fine paste in sausage filler and stuff the paste into synthetic casing. Ring the sausage using aluminium wire. Wash the outer surface of the casing in soap water and then in clean water. Thermally process the sausages at 80-90°C for 45 min. and allow them to get cooled to the room temperature. Re-boil the sausages at 100°C for one minute to remove the wrinkles and to get smooth appearance. The sausages can be wiped and stored in refrigerated condition ($5 \pm 2°C$) or in a deep freezer (-20°C) for a period of 28 days and 6 months respectively.

iv. Input/raw material :
   a) Prime mover/ Plant & Machinery : Cleaning table, meat picking machine, silent cutter, pressure cooker, sausage filler, sausage ringer etc.
   b) Man power : Two persons

v. Output capacity : As per the requirement

vi. Unit cost / selling cost : Rs. 200/- per kg

vii. Suitability for crops/commodity : Low value or under utilized fishes

viii. Unit cost of operation : Rs. 76-85/kg

ix. Commercialization status :
   (a) No. of Licensees to whom the technology has been transferred : 4 Fishermen and one entrepreneur
   (b) Selected Addresses of Licensee/Manufacturer : -

x. Contact Address : Sr. Scientist & PI, AICRP on PHET
                    College of Agricultural Engineering,
                    UAS, Raichur
Technology No. 165

i. **Name of the Technology**
   - Value Added Product (Fish Balls) Using Low Value Marine Fish (Squilla)

ii. **Application/ Use**
   - Indian fishery is multi-species and the catch consists of some very small sized fishes, which often cannot be put to any economic use. Such fish catch is discarded over board or at landing centres. The low value fish constitute a sizable part of the countries’ total marine catches. Discarding of these fishes, which are rich in protein, is therefore, a loss to the nation where such cheap protein food is very much needed. The producers and processors reject these fishes only because they don't have any commercial value. The developed technology helps the grass root fishermen to utilize low value and underutilized fishes, through processing and preparation of value added products acceptable to the consumers.

iii. **Description of Technology**
   - Procure low value fish (Squilla) from landing centre in iced condition, dress the squilla to remove head and shell, wash in clean chilled water. Blanch the Squilla by using saturated brine solution and boil for about 10-15 minutes. Allow the blanched meat to get dried and then make a fine paste in a grinder and cook for 10 min in pressure cooker. To prepare the masala, cook the potatoes, make a fine paste and mix with spice ingredients. Fry onion and ginger in oil and mix thoroughly with blanched meat along with masala paste. Prepare the balls of 25 gm each, dip in egg white and roll in bread crumbs. The balls are packed in polyethylene pouches and can be stored in deep freezer (-20°C) up to 120 days without spoilage. The frozen fish balls can be fried in oil at 160 – 170°C for 4 – 5 min and served with tomato sauce.

iv. **Input/raw material**
   - Squilla, spice ingredients, refined vegetable oil, bread crumbs, egg white, salt.
   - Cleaning table, Grinder, pressure cooker
   - Two persons

v. **Output capacity**
   - As per the requirement

vi. **Unit cost (per machine) /cost of selling**
   - Rs. 150/- kg

vii. **Suitability for crops/commodity**
   - All kinds of fishes

viii. **Unit cost of operation**
   - Rs. 55-60/kg

ix. **Patent obtained/applied**
   - NII

x. **Commercialization status**
   - Ready for commercialization
   - 20 Fishermen and one entrepreneur

xi. **Contact Address**
   - PI, AICRP on PHET
     College of Agricultural Engineering, UAS, Raichur
Jaggery
Machinery/ Tools/ Equipments/ Structure
Technology No. 166

i Name of the Technology : Crystal Jaggery Making Machine

ii Application/ Use : Crystal (<3.0mm) can be prepared by manually or by using the machine

iii Description of Technology :
A Crystal (<3.0mm jaggery) making unit consists of hemispherical drum of stainless steel (for holding thick hot jaggery syrup) having 275 mm radius, 400 mm width and 800 mm length and is provided with perforated guard at the top having 475 mm width and 845 mm length for allowing natural cooling. The drum is provided with a circular opening of 114 mm diameter at the centre of bottom for discharge of crystal jaggery. An iron shaft (1300 mm long) is placed laterally in the drum leaving a gap of 100mm and fixed with bearings for easy rotation with the help of a handle. A total of 33 blades (each of 8 mm thick and 100mm long) arranged in 3 rows on the shaft in zigzag manner for facilitating scraping of hot thick jaggery syrup into crystal/crystal form. Crystal jaggery making machine further modified by keeping rectangular projections (of 30 mm width and 32 mm length) with sharp edges at the end of the blades and were welded for easy shearing of jaggery into crystal form. This machine is superior in terms of saving time and drudgery.

iv Input/raw material :
Iron and Stainless steel for machine making Sugarcane juice for crystal jaggery

a) Overall dimension :
Outer length –840mm, width –470mm, radius 235mm,
Stand length –900mm, width, 600mm and height 550mm

b) Weight :
145 kg.
c) Prime mover :
Lathe machine, Drilling machine, Welding machine and other accessories of workshop.
d) Man power :
4 No.
f) Investment :
Rs. 30,000/-

v Output capacity :
25kg crystal jaggery/hour

vi Unit cost (per machine) :
Rs. 30,000/-

vii Contact Address :
PI, AICRP on PHET
Regional Agricultural Research Station
Anakapalle – 531 001
(Andhra Pradesh)
Technology No. 167

i Name of the Technology: Mechanized Jaggery Granulator for Production of Free Flowing Jaggery Granules

ii Application/ Use: Preparation of granular jaggery

iii Description of Technology
Scraping of concentrated sticky mass into granules is being practiced manually in different countries including India. This process is tedious, labour intensive and not free from extraneous contamination. Development of a mechanized jaggery granulator for this sticky substance will reduce the cost of production and obtaining uniform size of granular jaggery, which could replace slow, unhygienic and labour intensive manual operation. First time, this was developed at this centre. Indian Patent on “Mechanized Jaggery Granulator” was filed in the name of “Acharya N.G.Ranga Agricultural University and Project Coordinator, AICRP on PHT” at Patent Office, Chennai through application No.1265/CHE/2013 dt.22-03-2013, which is under process.

iv Input/raw material: Sugarcane
   a. Overall dimension: 1.0 m × 1.2 m
   b. Weight: 850 kgs
   c. Prime mover: 2.0 HP
   d. Man power: 5 Persons
   e. Land: 2.0 acres
   f. Investment: Total equipment cost: 16.0 Lakhs excluding land and buildings. The equipment includes crusher, juice collecting tank, juice clarifier, juice settling tank, pre heating pans, juice boiling pans, ladies, trays, hydraulic system for movement of boiling pan, mechanized jaggery granulator, hot air tray dryer, mechanical siever, packaging machine.

v Output capacity: 150 kg granular jaggery/batch

vi Unit cost: Mechanized jaggery granulator unit cost: 3.1 lakhs

vii Suitability for crop/ commodity: Suitable for production of granular jaggery

viii Efficiency: 80%

ix Unit cost of operation: Rs.60.0 per kg

x Contact Address: PI & Principal Scientist (Ag.Engg.), Regional Agricultural Research Station, Anakapalli -531 001 (A.P.), Visakhapatnam dt. E-Mail: phl.akp@gmail.com
Technology No. 168

i Name of the Technology: Steam Boiling System using Bagasse for the Preparation of Good Quality Jaggery.

ii Application/ Use: The steam boiling system for the boiling of sugarcane juice during the preparation of jaggery, which reduces the boiling time by 20% and also produce export quality jaggery with good colour under hygienic conditions.

iii Description of Technology:
The preparation of jaggery involves: collection of juice by crushing canes, its filtration and concentration by open boiling, cooling of concentrated juice followed by moulding, drying and storage. The juice boiling is the main unit operation in preparation of solid, liquid and granular form of jaggery. Traditionally open pan boiling is being practiced by the jaggery producers which consume time as well as energy. Also the entire process is unhygienic as boiling of juice is carried out with direct burning of bagasse in open grate furnace. The combustion and heat utilization efficiency of commonly used furnace by the farmers is a low as 20% and consume high quantum of bagasse. Also, the quality of the jaggery is highly affected with smoke and contamination with ash particles, not suitable for export.

The steam boiling system for the boiling of sugarcane juice during the preparation of jaggery was developed at AICRP on PHET, Regional Agricultural Research Station, Anakapalle consists of 500 kg juice capacity stainless steel (SS 304 grade) steam jacketed pan provided with glass wool insulation and tilt mechanism. The boiler and steam jacketed pan are connected through steam lines, used for the preparation of 80 kg jaggery per batch of 2.5 hrs. The whole system could be used for the production of 320.0 kg jaggery in a day and reduces the boiling time by 20% as compared to farmer’s practice of traditional boiling (240 kg jaggery in a day). Also it produces export quality jaggery with golden yellow colour.

iv Input/raw material:
a. Overall dimension: Length: 12.0 m; Width: 2.0 m
b. Prime mover: Bagasse based furnace
c. Man power: 5 Persons
d. Land: 2.0 acres (Building size: 12.2 m length and 6.2 m width)
e. Investment: Rs. 9 lakh excluding land and buildings

v Output capacity: 320 kg jaggery in a day

vi Unit cost: Rs.9,00,000-00

vii Suitability for crop/ commodity: Suitable for preparing good quality jaggery under hygienic conditions.

viii Efficiency: 60%

ix Unit cost of operation: Rs.40/kg

x Contact Address:
PI & Principal Scienlist (Ag.Engg.), Regional Agricultural Research Station, Anakapalli -531 001 (A.P.), Visakhapatnam dt.
E-Mail: pht.akp@gmail.com
**Technology No. 169**

i. **Name of the Technology** : Improved Four Roller Sugarcane Crusher  

ii. **Application/ Use** : To extract the juice by crushing sugarcane

iii. **Description of Technology:**  
There are four rollers provided in this crusher compared to the three rollers in the conventional crushers. Through the shafts and gear wheels, power is transmitted to the rollers and extracts the juice by crushing the cane. About 60 – 70% of the available juice can be extracted from sugar cane. Thus 8-10% additional juice is recovered than the conventional crushers. The overall dimension of the unit is 1210 x 510 x 1100 mm.

<table>
<thead>
<tr>
<th>iv. <strong>Input/raw material</strong></th>
<th>Sugarcane</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Overall dimension</td>
<td>-</td>
</tr>
<tr>
<td>b) Weight</td>
<td>-</td>
</tr>
<tr>
<td>c) Prime mover</td>
<td>-</td>
</tr>
<tr>
<td>d) Power</td>
<td>7.5 hp</td>
</tr>
<tr>
<td>e) Man power</td>
<td>Two Persons</td>
</tr>
</tbody>
</table>

| v. **Output capacity**     | 250 kg/h   |
| vi. **Unit cost (per machine)** | Rs. 50,000/- |
| vii. **Suitability for crops/commodity** | Sugarcane |

| viii. **Efficiency**       | 60-70%     |
| ix. **Unit cost of operation** | Rs. 25/h   |
| x. **Patent obtained/applied** | No       |

<table>
<thead>
<tr>
<th>xi. <strong>Commercialization status</strong></th>
<th>Commercialized Farmer – cum-Processor/ Entrepreneur</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) No. of Licensees to whom the technology has been transferred</td>
<td>M/s. Kesavan Industries, 87, Dharapuram Road, Udumalpet – 642 126, Tamil Nadu. Phone: 04252 – 223939 (Office/factory)</td>
</tr>
<tr>
<td>(b) Selected Addresses of Licensee /Manufacturer</td>
<td>Professor and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore – 641 003. Phone: 0422- 6611272 ; FAX : 0422-6611455 ; e-mail : <a href="mailto:processing@tnau.ac.in">processing@tnau.ac.in</a></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>xii. <strong>Contact Address</strong></th>
<th></th>
</tr>
</thead>
</table>

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Technology No. 170

i. Name of the Technology : Modified Electronic Thermometer

ii. Application/ Use : Jaggery and liquid jaggery is prepared by the semi skilled / skilled labours on the basis of visual observations. Little error in judgment to remove boiling pan from furnace may lead to deterioration of quality of jaggery. Hence to indicate the striking point temperatures at liquid jaggery and jaggery stages modified electronic thermometer is useful. It would help to obviate the need of the skilled labour.

iii. Description of Technology : Digital display thermometer is provided with cable and probe for sensing and recording the temperature. The cable is passed through SS tube (11 mm OD, 1075 mm length) to which probe is fixed at one end by nylon bush. The thermometer fitted in SS casing is attached to the other end tube in inclined position. A provision has been made to clamp the thermometer to the sidewall of boiling pan. The probe is kept in juice sample in pan. The temperature (0-150°C) is read directly from the digital display screen of thermometer.

iv. Input/raw material : Digital display thermometer, SS tube, nylon bush, probe
   a) Overall dimension : 970 x 110 x 100 mm
   b) Weight : 700 gm
   c) Prime mover/ Plant & Machinery : NA
   d) Man power : NIL
   e) Power : Electricity / battery
   f) Investment : Rs. 3500/-

v. Output capacity : NA

vi. Unit cost (per machine) : Rs. 3500/-

vii. Suitability for crops/commodity : Sugarcane juice

viii. Efficiency : NA

ix. Unit cost of operation : NA

x. Patent obtained/applied : Nil

xi. Commercialization status : Commercialized
   a) No. of Licensees to whom the technology has been transferred : 1. Shri. Gopalrao Manku Patil At/post- Hinwade Khalsa Tal – Karveer Dist. Kolhapur (Cell : 9423040691)
   2. Shri. Ramchandra Tukaram Budkar At/post – Shirol (Pulachi ), Tal- Hatkangle Dist- Kolhapur

xii Contact address : PI, AICRP on PHET Regional Sugarcane & Jaggery Research Station, Opp. Market yard, Mahatma Phule Krishi Vidhyapeeth, Rahuri ) Kolhapur-416005 ( MS)
Technologies / Jaggery

Technology No. 171

i. Name of the Technology : Churner

ii. Application/ Use : It is used during rigorous boiling of juice for mechanical defrosting. It makes the operation smooth with minimum drudgery.

iii. Description of Technology :

Churner is tetra-parallel-vane type and made up of stainless steel. It is light in weight. Its blades are fitted at spokes with specific angle of about 30° on the main shaft which prohibits overflow of juice at the time of frothing. The unit is fitted on two ball bearing one each on two edges of the pan.

iv. Input/raw material :

a) Overall dimension : Stainless steel, Ball bearings
   : 4572 x 1143 x 1143 mm

b) Weight : 25 Kg

c) Prime mover/ Plant & Machinery : NA

d) Man power : 01 (man - h / batch)

e) Power : Manual operated

f) Land :

g) Investment : Rs. 7000/-

v. Output capacity (Churning) : 20 rpm

vi. Unit cost (per machine) : Rs. 7000/-

vii. Suitability for crops/commodity : Sugarcane juice

viii. Patent obtained/applied : No

ix. Commercialization status : Commercialized

x. (a) No. of Licensees to whom the technology has been transferred : Farmer-cum processor

xi. (b) Selected Addresses of Licensee or Manufacturer :

1. Shri. Khanderao Ghadge
   At/post- Kadam wadi, Tal - Karveer , Dist. Kolhapur

2. Shri. Shamrao Medhe
   At/post Bapat Camp, Tal - Karveer , Dist- Kolhapur

xii. Contact address :

PI, AICRP on PHET, Regional Sugarcane & Jaggery Research Station, Opp. Market yard, Mahatma Phule Krishi Vidhyapeeth , Rahuri Kolhapur-416005 (MS)
Four Decades of R&D of AICRP on PHET

Technology No. 172

i. Name of the Technology : Modified Hardness Tester

ii. Application/ Use : Hardness tester is used for testing hardness of solid jaggery. It is useful in distinguishing the jaggery samples for storage, transport and various other purposes.

iii. Description of Technology :

Hardness tester used for pharmaceutical purpose is modified with provision of special bracket at bottom. The jaggery sample of adequate size (approx 2.5 cm cube) is held inside the bracket and pressure is applied manually by tightening the knob till the rupture point is obtained. Hardness (kg /cm²) readings are read on the dial marked by arrow.

iv. Input/raw material : -
   a) Overall dimension : 295 x 45 x 45 mm
   b) Weight : 1,0385 Kg
   c) Prime mover/ Plant & Machinery : NA
   d) Man power : 01
   e) Power : Manually operated
   f) Land : NA
   g) Investment : Rs. 1800/-

v. Output capacity : 1 jaggery cube/min.

vi. Unit cost (per machine) : Rs. 1800/-

vii. Suitability for crops/commodity : Jaggery

viii. Commercialization status :
   (a) No. of Licensees to whom the technology has been transferred : -
   (b) Selected Addresses of Licensee/Manufacturer and Contact addresses : -

ix. Contact address : PI, AICRP on PHET, Regional Sugarcane & Jaggery Research Station, Opp. Market yard, (Mahatma Phule Krishi Vidhyapeeth, Rahuri), Kolhapur-416005 (MS)
Technologies /Jaggery

Technology No. 173

i. **Name of the Technology** : Juice Boiling Pan

ii. **Application/ Use** : It is used for concentration of sugarcane juice and preparation of quality liquid jaggery and jaggery. It is made up of stainless steel and prohibits release of iron in juice which imparts dark colour to jaggery.

iii. **Description of Technology** :

   It is open type of boiling pan and trapezoidal in cross section. The top and bottom of the pan is circular with 3658 mm and 2420 mm diameters, respectively. The height of the pan is 686 mm. It has 8 rings fixed at equal distance on the top edge. The rings facilitate removal of boiling pan manually from the furnace. Sugarcane juice from 1000 to 1200 liters can be processed at a time per batch in this pan.

![Juice Boiling Pan](image)

iv. **Input/raw material** :

   a) Overall dimension : 3685 x 3685 x 790 mm
   b) Weight : 100 Kg
   c) Prime mover/ Plant & Machinery : NA
   d) Man power : NA
   e) Power : Bagasse / Agril. Waste for boiling juice
   f) Investment : Rs. 1,00,000/-

v. **Output capacity** : 240 Kg jaggery per batch

vi. **Unit cost (per machine)** : Rs. 1,00,000/-

vii. **Suitability for crops/commodity** : Sugarcane juice

viii. **Commercialization status** :

   a) No. of Licensees to whom the technology has been transferred : Farmer- cum processor

   b) Selected Addresses of Licensee/Manufacturer : Shri. Khanderao Ghadge
   At/post-Kadam wadi , Tal -Karveer, Dist. Kolhapur (MS)

ix. **Contact address** :

   PI, AICRP on PHET, Regional Sugarcane & Jaggery Research Station, Opp. Market yard, ( Mahatma Phule Krishi Vidhyapeeth , Rahuri) Kolhapur-416005 ( MS)
Technology No. 174

i. **Name of the Technology**: Sugarcane Juice Collection and Settling Tank

ii. **Application/Use**: Tanks are useful for collection and settling of juice during jaggery processing. It facilitates collection of impurities at the bottom of the tank. Specially developed bottoms of tanks are helpful in easy and complete removal of juice impurities. It is also helpful for fast cleaning of tank during batch processing.

iii. **Description of Technology**:

Juice collection and settling tanks are prepared from 18 gauge stainless steel. Juice collection tank is partly cylindrical and partly conical in shape while juice settling tank is cylindrical in shape. Both the tanks are provided with ball valves at bottom for quick discharge of the juice and/or impurities. To avoid mixing of outside dust and to maintain the hygiene the tanks are provided with lids.

iv. **Input/raw material**
   a) **Overall dimension**
   : Collection Tank – Dia. 1100 mm, Height 900 mm
   : Settling Tank – Dia. 700 mm, Height 900 mm
   b) **Prime mover/Plant & Machinery**
   : Electric motor
   c) **Man power**
   : NIL
   d) **Power**
   : 0.5 hp ele. motor for juice pumping in overhead settling tank
   e) **Investment**
   : Rs.40,000/-

v. **Output capacity**
: 500 kg juice storage

vi. **Unit cost (per machine)**
: Rs.40,000/-

vii. **Suitability for crops/commodity**
: Sugarcane juice

viii. **Commercialization status**
   (a) **No. of Licensees to whom the technology has been transferred**
   : Ready for commercialization
   : Farmer- cum processor
   (b) **Selected Addresses of Licensee/Manufacturer**
   : Nil

ix. **Contact address**
: PI, AICRP on PHET,
  Regional Sugarcane & Jaggery Research Station,
  Opp. Market yard, ( Mahatma Phule Krishi Vidhyapeeth , Rahuri)
  Kolhapur-416005 (MS)
### Technology No. 175

#### i. Name of the Technology
Boiling Pan Tipping Mechanism

#### ii. Application/ Use
It facilitates easy and smooth removal of boiling pan containing hot jaggery from the furnace. This mechanism also helps to save labour with minimization of risk and hazards during the tipping operation.

#### iii. Description of Technology
Tipping mechanism consists of frame - wheel - track arrangement to carry the boiling pan up to cooling pit. Lifting of pan and tilting of pan is carried out simultaneously. The collar-cap system is fitted at bottom of pan for removal of hot jaggery from pan into cooling pit.

#### iv. Input/raw material
- b) Overall dimension: 1820 x 1820 x 150 mm
- c) Power: Manual
- d) Investment: Rs. 8,000/-

#### v. Output capacity
NA

#### vi. Unit cost (per machine)
Rs. 8,000/-

#### vii. Suitability for crops/commodity
Jaggery

#### viii. Efficiency
NA

#### ix. Unit cost of operation
NA

#### x. Patent obtained/applied
Nil

#### xi. Commercialization status
(a) No. of Licensees to whom the technology has been transferred: Nil
(b) Selected Addresses of Licensee/Manufacturer and Contact addresses: Nil

#### xii. Contact address
PI, AICRP on PHET, Regional Sugarcane & Jaggery Research Station, Opp. Market yard, (Mahatma Phule Krishi Vidhyapeeth, Rahuri) Kolhapur-416005 (MS)
Four Decades of R&D of AICRP on PHET

Technology No. 176

i. Name of the Technology : Jaggery Moulding Frame

ii. Application/Use : Production of cube shaped jaggery

iii. Description of Technology:
The equipment is made of mild steel flats. Six small grooves are cut in each flat. The flats are fitted in these grooves. Each flat is electroplated to make the surfaces smooth. At one end of the each flat, a small hole is made, in which a rod is inserted. Two flats are separated with a steel spacer. The fitted molding frame is kept on a wooden (wrapped with aluminum sheet). The equipment is easy to fit and dismantle.

iv. Input/raw material:
   a) Overall dimension : 625x 675 mm
   b) Weight : 17 Kg
   c) Man power : 01 No.
   d) Investment : Rs. 6000/-

v. Output capacity : 7 kg per batch

vi. Unit cost (per machine) : Rs. 6000/-

vii. Suitability for crops/commodity : Sugarcane/ jaggery

viii. Efficiency : 90 %

ix. Unit cost of operation : Rs 1.50 /kg

x. Patent obtained/applied : Not applied

xi. Commercialization status:
   a) No. of Licensees to whom the technology has been transferred : 01
   b) Selected Addresses of Licensee/Manufacturer : M/s Vishkarma Krishi Yantra, Kalli Bazar
   Kalli Bazar, Mohanlal Ganj, Lucknow.

xii. Contact addresses:
    Director or Research Engineer
    ICAR-Indian Institute of Sugarcane Research,
    Lucknow (UP)
    Phone: 0522-2480726   Fax: 0522-2480748
Technologies / Jaggery

Technology No. 177

i. **Name of the Technology** : Rectangular Shaped Jaggery Moulding Frame

ii. **Application/ Use** : Production of rectangular shaped jaggery

iii. **Description of Technology** :

   This equipment is made of 6x12x625 mm thick bright flat. 19 slots of 6 mm deep and 6 mm width each are cut in each flat of 625 mm length on one side. Similarly 18 slots of same size are cut in the bright flat of 625 mm length. These flats are fitted in these grooves. For making the surfaces smooth bright bar flats are electroplated. The steel spacer is provided to separate these two flats. Thus arranged tightened rectangular frame is then kept on the aluminium wrapped wooden platform. The fitting and dismantling of this frame is quite easy.

iv. **Input/raw material** :

   a) Overall dimension
   - 625 x 625 mm

   b) Weight
   - 25 kg

   c) Prime mover/ Plant & Machinery
   - N.A.

   d) Man power
   - 01 No.

v. **Output capacity**

   - 3.5 kg/batch

vi. **Unit cost (per machine)**

   - Rs.4000

vii. **Suitability for crops/commodity**

   - Sugarcane/ jaggery

   - 95%

viii. **Efficiency**

   - Rs 2 / kg

ix. **Unit cost of operation**

x. **Patent obtained/applied**

   - Not applied

xi. **Commercialization status**

   a) No. of Licensees to whom the technology has been transferred
   - --

   b) Selected Addresses of Licensee/Manufacturer
   - Nil

xii. **Contact addresses**

   Director or Research Engineer
   ICAR-Indian Institute of Sugarcane Research,
   Lucknow (UP).
   Phone: 0522-2480726 Fax: 0522-2480748
   email:iisrlko@sanchamet.in
Four Decades of R&D of AICRP on PHET

Technology No. 178

i. Name of the Technology : Drying-cum-Storage Bin

ii. Application/Use : Drying and storage of jaggery

iii. Description of Technology:
It is used for drying cum storage of jaggery for a family of six members for one year. It works on the principle of natural drying/natural draft. It is made of a circular GI sheet of 20 gauge. Towards bottom side, four holes of 10 mm diameter are made. These holes are open during summer and closed during monsoon. For loading the jaggery, a lid is provided on top. On bottom, a circular perforated plate having 10 mm diameter holes rests on a wooden cross.

iv. Input/raw material : G.I. sheet:2100 mm x 900mm, wooden plank
   (2Nos. of 600 mm x 250mm x 25 mm)
   a) Overall dimension : Height 770 mm and diameter 540mm

v. Output capacity : 100 kg per batch

vi. Unit cost : Rs 2500/-

vii. Suitability for crops/commodity : Jaggery

viii. Efficiency : 90%

ix. Unit cost of operation : NA

x. Commercialization status : Commercialized
   (a) No. of Licensees to whom the technology has been transferred
      M/s Vishkarma Krishi Yantra
      Kali Bazar, Mohanlal Ganj, Lucknow
   (b) Selected Addresses of Licensee/Manufacturer
      M/s Vishkarma Krishi Yantra
      Kali Bazar, Mohanlal Ganj, Lucknow

xi. Contact addresses : Director or Research Engineer
   ICAR-Indian Institute of Sugarcane Research,
   Lucknow (UP).
   Phone: 0522-2480726 Fax: 0522-2480748
   email:iisrfko@sancharnet.in
Technology No. 179

i. Name of the Technology : IISR Two Pan Furnace with Forced Draft System

ii. Application/Use : Boiling and concentration of sugarcane juice

iii. Description of Technology:
It is two pan furnace, one for boiling and other for preheating of juice. Main parts of the furnace are; pans, combustion chamber, flue passage and chimney. The pans are made of mild steel sheet whereas other components are made of masonry structure. The bagasse is used as fuel. For transferring the preheating juice from preheating pan to boiling pan, gate valve is fitted.

iv. Input/raw material : M.S. sheet (10 mm thick 8’x4’x2 No)
   Flats 35 x 35 x 5 mm) size 30 ‘ length,
   Wooden planks (150x1000x50 mm size –10 Nos.)
   and blower
   a) Overall dimension : 2x5 m
   b) Man power : 04
   c) Power : Bagasse fed
   d) Land : 10 m²
   e) Investment : Rs 50000

v. Output capacity : 115 kg juice/h and 21 kg jaggery/ h

vi. Unit cost (per machine) : Rs. 50000/-

vii. Suitability for crops/commodity : sugarcane juice

viii. Efficiency : 32 %

ix. Unit cost of operation : Rs 20/ kg

x. Commercialization status : Commercialized
   (a) No. of Licensees to whom the technology has been transferred
   M/S Sun Light Foundry, Barabanki
   (b) Selected Addresses of Licensee/Manufacturer
   M/S Sun Light Foundry, Barabanki

xi. Contact addresses : Director or Research Engineer
   ICAR-Indian Institute of Sugarcane Research,
   Lucknow (UP).
   Phone: 0522-2480726  Fax: 0522-2480748
   email: isrlko@sancharnet.in
**Technology No. 180**

i. **Name of the Technology**: Improved Triple Pan Furnace

ii. **Application/ Use**: Boiling and concentration of sugarcane juice

iii. **Description of Technology:**
   
   It is three pan furnace; one for boiling and other two are for preheating the juice. The pre-heated juice is transferred to boiling pan by gravity drop system.

<table>
<thead>
<tr>
<th>iv. <strong>Input/raw material</strong></th>
<th>:</th>
<th>M.S. sheet, Mild steel flats, Wooden planks</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Overall dimension</td>
<td>:</td>
<td>2x6 m</td>
</tr>
<tr>
<td>b) Weight</td>
<td>:</td>
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</tr>
<tr>
<td>c) Prime mover/ Plant &amp; Machinery</td>
<td>:</td>
<td>NA</td>
</tr>
<tr>
<td>d) Man power</td>
<td>:</td>
<td>04 no.</td>
</tr>
<tr>
<td>e) Power</td>
<td>:</td>
<td>Bagasse fed</td>
</tr>
<tr>
<td>f) Land</td>
<td>:</td>
<td>12 m²</td>
</tr>
<tr>
<td>g) Investment</td>
<td>:</td>
<td>Rs. 65000</td>
</tr>
</tbody>
</table>

v. **Output capacity**: 120 kg juice per hour
                        25 kg/hour jaggery

vi. **Unit cost (per machine)**: Rs. 65000/-

vii. **Suitability for crops/commodity**: sugarcane juice

viii. **Efficiency**: 34%

ix. **Unit cost of operation**: Rs18 /kg

x. **Patent obtained/applied**: Not applied

xi. **Commercialization status**: Commercialized
   
   (a) No. of Licensees to whom the technology has been transferred: M/S Sunlight Foundry, Barabanki
   
   (b) Selected Addresses of Licensee/Manufacturer: M/S Sunlight Foundry, Barabanki

xii. **Contact addresses**: Director or Research Engineer
                      
                      ICAR-Indian Institute of Sugarcane Research, Lucknow (UP).
                      Phone: 0522-2480726
                      Fax: 0522-2480748
                      email: iisrko@sancharnet.in
Technology No. 181

i. Name of the Technology: Modified Juice Heating /Boiling/ Concentrating Pans

ii. Application/ Use: Heating/boiling and concentration of sugarcane juice

iii. Description of Technology:
Fins (40 x 5 mm at 60 mm spacing) have been provided to the bottom of main and gutter pan of IISR 2-pan furnace for increasing area of heat receiving surface. With fins more heat is transferred to the juice hence the processing time of juice is reduced. This results in saving of fuel and time, and increase in jaggery productivity.

iv. Input/raw material:
   a) Overall dimension
      Circular main pan: Dia.: top 1555 mm, bottom 1270 mm, Height 304 mm
      Rectangular gutter pan:
      Length: 1220 mm, Width: 660 mm, Height: 304 mm
   b) Weight: 150 kg
   c) Prime mover/ Plant & Machinery: N.A.
   d) Man power: 02
   e) Power: Manual
   f) Land: 2x5 m
   g) Investment:

v. Output capacity:
   120 kg juice/h:
   22 kg jaggery/h
   Rs 20000

vi. Unit cost (per machine): Sugarcane Juice
vii. Suitability for crops/commodity: 34%
viii. Efficiency:
ix. Unit cost of operation: Rs 18/kg
xi. Commercialization status:
   a) No. of Licensees to whom the technology has been transferred: -
   b) Selected Addresses of Licensee/Manufacturer: -

xii. Contact addresses:
Director or Research Engineer
ICAR-Indian Institute of Sugarcane Research,
Lucknow (UP).
Phone: 0522-2480726 Fax: 0522-2480748
email:isrisko@sanchareti.in
Technology No. 182

i. **Name of the Technology** : Waste Heat Recovery System for Open Pan Jaggery Furnace

ii. **Application/ Use** : Recovery of waste heat for other useful purposes

iii. **Description of Technology:**
A counter-current type of heat exchanger has been installed in the flue gas channel of open pan jaggery furnace for heating of fresh air drawn through this system with the help of a blower. The heated air can be used for drying of jaggery/bagasse or space conditioning.

iv. **Input/raw material**
   a) Overall dimension : 2.4x2 m
   b) Weight : 50 kg
   c) Prime mover/ Plant & Machinery : 0.20 electric motor kW
   d) Man power : 01
   e) Power : Electricity for running the blower
   f) Land : NA
   g) Investment : Rs. 5000

v. **Output capacity** : 30 C higher to input

vi. **Unit cost (per machine)** : Rs. 5000/-

vii. **Suitability for crops/commodity** : sugarcane juice

viii. **Efficiency** : 85%

ix. **Unit cost of operation** : NA

x. **Patent obtained/applied** : -

xi. **Commercialization status**
   (a) No. of Licensees to whom the technology has been transferred : -
   (b) Selected Addresses of Licensee/Manufacturer and Contact addresses : -

xii. **Contact addresses**
    Director or Research Engineer
    ICAR-Indian Institute of Sugarcane Research, Lucknow (UP).
    Phone: 0522-2480726
    Fax: 0522-2480748
    email: iisrko@sanchamet.in
Technology No. 183

i Name of the Technology : Sugarcane Peeler

ii Application/ Use : Reduction in human drudgery during cane cleaning

iii Description of Technology :
The peeling unit consists of four peeling blades attached inside a square frame of 15 cm. The blades are attached at uniform spacing through the slots in the inner plate and inter-connected with four springs to provide uniform tension. The other ends of the blades are hinged to outer plate of the frame. The peeling blades are tapered and are 15cm long having 22-25 teeth. The peeling unit is mounted on a hollow shaft with bearings to facilitate rotation. The whole unit is mounted on a rectangular frame. The unit is operated by electric motor(1 h.p.) through belt and pulley arrangement.

iv Input/raw material : Sugarcane
   a. Overall dimension (L x B x H mm) : -

   b. Weight : -

   c. Prime mover : Electric motor

   d. Power (hp) : 1 hp

v Output capacity : 100 kg sugarcane/h

vi Unit cost (per machine) : Rs. 15,000

vii Suitability for crop/commodity : Sugarcane

viii Efficiency : 85%

ix Commercialization status : Ready for commercialization
   a) No. of Licensees : -

   b) Addresses of Licensees or Manufacturer : -

x Contact Address : Director,
ICAR-Indian Institute of Sugarcane Research,
Raebareli Road, Lucknow,
Phone: 0522-2480726, Fax: 0522-2480748
Email: isriko@sanchamet.in
Four Decades of R&D of AICRP on PHET

Technology No. 184

i Name of the Technology : IISR 3-Roller Horizontal Power Driven Crusher

ii Application/ Use : Higher jaggery recovery

iii Description of Technology :
The king roller of crusher has been provided with 25 mm thick and 35 mm deep collar for proper feeding of cane.

iv Input/raw material : Sugarcane
   a. Power (hp) : 10 h.p.

v Output capacity : 8-10 quintal per hour

vi Unit cost (per machine) : Rs. 45000

vii Suitability for crop/commodity : Jaggery

viii Efficiency : 65%

ix Commercialization status :
   a) No. of Licensees : 1
   b) Addresses of Licensees or Manufacturer : Sunlight Foundry, Lucknow Road, Barabanki

x Contact Address :
   Director,
   ICAR-Indian Institute of Sugarcane Research,
   Raebareli Road, Lucknow
   Phone: 0522-2480726, Fax: 0522-2480748
   Email: iisrIko@sancharnet.in
Technology No. 185

i Name of the Technology : Small Capacity Cane Crusher

ii Application/ Use : Fresh juice availability under hygienic conditions at low cost

iii Description of Technology :
A compact small capacity sugarcane crushing unit consisting of one set of three horizontal rollers (king, feed and extraction rollers), a 1 h.p. electric motor, speed reduction gear box and a chain sprocket arrangement to get 15 rpm roller speed, sugarcane entry and bagasse exit port, rectangular framing plate and a stand. It performs smoothly without making any noise and has single and double pass capacity of 60 and 30 kg/h with 30% and 60% juice recovery respectively.

iv Input/raw material :
   a. Overall dimension (L x B x H mm) : -
   b. Weight : -
   c. Prime mover : -
   d. Power (hp) : 1 h.p.

v Output capacity :
   Single pass : 60 kg/h
   Double pass : 30 kg/h

vi Unit cost (per machine) : Rs. 30,000

vii Suitability for crop/commodity : Sugarcane

viii Efficiency :
   Single pass : 30%
   Double pass : 60%

ix Unit cost of operation : -

x Commercialization status :
   Commercialized
   a) No. of Licensees : 1
   b) Addresses of Licensees or Manufacturer :
      M/S Prabh Enterprizes, Subhash Nagar, Alambagh, Lucknow

xi Contact Address :
   Director,
   ICAR-Indian Institute of Sugarcane Research,
   Raebareli Road, Lucknow
   Phone: 0522-2480726, Fax: 0522-2480748
   Email: iisrlko@sancharnet.in

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Four Decades of R&D of AICRP on PHET

Technology No. 186

i Name of the Technology : Mechanical Cane Juice Filtration Unit

ii Application/ Use : Reduction in impurities results in better quality jaggery, which has more demand

iii Description of Technology :

The filtration unit consists of a prefilter and four synthetic filters. Each filter is made of plastic cartridge. Inside cartridge, synthetic candle filter media are kept. The diameter and length of the candle is 70 mm and 260 mm respectively. The raw juice is passed to the unit from one end and filtered juice comes out through other end. A small submersible pump of capacity 800 l/h is used for pumping the juice. The system is operated with an electric motor of 12 watt.

iv Input/raw material : Sugarcane juice

a. Power : 12 watt

v Output capacity : 300 l/h of filtered juice

vi Unit cost (per machine) : Rs. 7000

vii Suitability for crop/commodity : Jaggery

viii Efficiency : 75% of insoluble impurities present in the cane juice are filtered.

ix Commercialization status : Ready for commercialization

a) No. of Licensees : -

b) Addresses of Licensees or Manufacturer : -

x Contact Address : Director,
ICAR-Indian Institute of Sugarcane Research,
Raebareli Road, Lucknow
Phone: 0522-2480726, Fax: 0522-2480748
Email: iisrlko@sancharnet.in
Technology No. 187

i  Name of the Technology : Boiling Juice Churning Device

ii  Application/ Use : Uniform heating and mixing of juice for better quality jaggery

iii  Description of Technology :
The device is used for mixing of hot juice during the boiling operation. It is operated when juice boils in the open pan. It is operated at the speed of 11-15 rpm. Each set of rotor lifted the juice from the boiling pan and poured it back to the boiling pan during the rotary motion of the rotor. It is operated by a manual labourer.

iv  Input/raw material : Sugarcane juice

    - Overall dimension (L x B x H mm)
    - Weight
    - Man power : 1

v  Output capacity : 20 l/h

vi  Unit cost (per machine) : Rs. 3000

vii  Suitability for crop/commodity : Jaggery

viii  Efficiency : 92%

ix  Commercialization status : Commercialized

    - No. of Licensees : 1
    - Addresses of Licensees or Manufacturer

x  Contact Address : Director,
ICAR-Indian Institute of Sugarcane Research,
Raebareli Road, Lucknow
Phone:0522-2480726,Fax:0522-2480748
Email: iiisrkko@sancharnet.in
## Technology No. 188

**i** Name of the Technology : Scum Settling Tank  
**ii** Application/ Use : Juice loss reduction  
**iii** Description of Technology :  
The scum, which is removed in the process of juice clarification, contains about 54 per cent juice by volume. This juice is normally lost. Scum settling tank helps in recovery of this trapped juice. For this, scum is settled for some time in the settling tank and then the tap is opened. Clear juice comes out. Recovery of this juice helps in reduction of losses in jaggery making.

<table>
<thead>
<tr>
<th>iv</th>
<th>Input/raw material</th>
<th>:</th>
<th>Jaggery</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Overall dimension (L x B x H mm)</td>
<td>:</td>
<td>-</td>
</tr>
<tr>
<td>b</td>
<td>Weight</td>
<td>:</td>
<td>-</td>
</tr>
<tr>
<td>c</td>
<td>Man power</td>
<td>:</td>
<td>-</td>
</tr>
<tr>
<td>v</td>
<td>Output capacity</td>
<td>:</td>
<td>20 litre of scum per batch</td>
</tr>
<tr>
<td>vi</td>
<td>Unit cost</td>
<td>:</td>
<td>Rs. 300</td>
</tr>
<tr>
<td>vii</td>
<td>Suitability for crop/commodity</td>
<td>:</td>
<td>Jaggery</td>
</tr>
<tr>
<td>viii</td>
<td>Efficiency</td>
<td>:</td>
<td>-</td>
</tr>
<tr>
<td>ix</td>
<td>Unit cost of operation</td>
<td>:</td>
<td>-</td>
</tr>
<tr>
<td>x</td>
<td>Commercialization status</td>
<td>:</td>
<td>Commercialized</td>
</tr>
<tr>
<td>a</td>
<td>No. of Licensees</td>
<td>:</td>
<td>1</td>
</tr>
<tr>
<td>b</td>
<td>Addresses of Licensees or Manufacturer</td>
<td>:</td>
<td>Vindhyavasini Traders, Lucknow</td>
</tr>
</tbody>
</table>
| xi | Contact Address | : | Director, ICAR-Indian Institute of Sugarcane Research, Raebareli Road, Lucknow  
Phone:0522-2480726,Fax:0522-2480748  
Email: iisrlko@sancharnet.in |
## Technology No. 189

**i** Name of the Technology : Mechanical Jaggery Dryer

**ii** Application/ Use : Improved quality of dried jaggery helps producer/farmer to earn more income

**iii** Description of Technology :
The dryer consists of an air blower for supply of forced air, a heating device for heating of supplied air and a drying chamber for housing of jaggery to be dried. A thermostat is provided to regulate the temperature of supplied air. Thermo-hygrometers are provided for recording temperature and relative humidity of the air entering into and leaving from the drying chamber. The capacity of dryer is 100kg/batch.

**iv** Input/ raw material :
- Jaggery

| a. Overall dimension (L x B x H mm) | - |
| b. Weight | - |
| c. Prime mover | Electric motor |
| d. Power (hp) | 1 hp |

**v** Output capacity : 100kg/batch

**vi** Unit cost (per machine) : 40,000 cost of dryer and 1.85 per kg drying cost of jaggery

**vii** Suitability for crop/ commodity : Jaggery

**viii** Efficiency : 75%

**ix** Commercialization status :
- Ready for commercialization

| a) No. of Licensees | - |
| b) Addresses of Licensees or Manufacturer | - |

**x** Contact Address :
Director,
ICAR-Indian Institute of Sugarcane Research,
Raebareli Road, Lucknow
Phone: 0522-2480728, Fax: 0522-2480748
Email: lisniko@sancharnet.in
### Technology No. 190

**i** Name of the Technology : Solar Dryer for Jaggery  
**ii** Application/ Use : Facilitates jaggery packaging and elongates its' shelf life.

**iii** Description of Technology :  
Solar drier consists of solar collecting device, drying chamber, plenum inlet, chimney with aspirator and metallic stand. It has eight wooden trays each having capacity of holding 12.4 kg of jaggery. The dryer works on the principle of faster low grade thermal drying with the help of solar energy and natural draft of the air flow.

<table>
<thead>
<tr>
<th>iv</th>
<th>Input/raw material</th>
<th>Jaggery</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Overall dimension (L x B x H mm)</td>
<td>-</td>
</tr>
<tr>
<td>b</td>
<td>Weight</td>
<td>-</td>
</tr>
<tr>
<td>c</td>
<td>Prime mover</td>
<td>-</td>
</tr>
<tr>
<td>d</td>
<td>Power (hp)</td>
<td>Solar</td>
</tr>
<tr>
<td>e</td>
<td>Man power</td>
<td>-</td>
</tr>
<tr>
<td>f</td>
<td>Land</td>
<td>100 m²</td>
</tr>
<tr>
<td>g</td>
<td>Investment</td>
<td>Rs. 30,000/-</td>
</tr>
</tbody>
</table>

**v** Output capacity : 100 kg per batch  
**vi** Unit cost (per machine) : Rs. 30,000  
**vii** Suitability for crop/commodity : Jaggery  
**viii** Efficiency : 80%  
**ix** Unit cost of operation : Rs. 0.3/kg.  

**x** Commercialization status : Ready for commercialization  
 a) No. of Licensees : -  
 b) Addresses of Licensees or Manufacturer : -  

**xi** Contact Address : Director, Indian Institute of Sugarcane Research, Raebareli Road, Lucknow  
Phone: 0522-2480726, Fax: 0522-2480748  
Email: isrlko@sancharnet.in
Technology No. 191

i. Name of the Technology : Drying -cum-Storage Jaggery Bin

ii. Application/ Use : Storage of jaggery to retain its physical and chemical characteristics

iii. Description of Technology :
Bin is made of GI Sheet. It is rectangular in shape, having four compartments of equal size. Each compartment has two holes at the bottom for entry of air. A thick wire mesh is placed at the bottom of each compartment and jaggery is stored above the mesh. There is a chimney with a lid on the top of each compartment for passage of air. During summer season the stored jaggery dries naturally, due to aeration process inside the bin and its moisture content decreases up to 6-7% from its initial moisture content 13-14%. Before rainy season the lid and holes of the bin are closed tightly and the jaggery retains its physical and chemical characteristics unchanged during storage.

iv. Input/raw material :
- GI sheet, wire mesh, chimney with a lid
  a) Overall dimension : (74’×61’×67’).
  b) Weight : Information not available
  c) Prime mover : Not applicable
  d) Power : Not applicable
  e) Man power : One
  f) Land : 100’×100’
  f) Investment : Rs. 2500/-

v. Output capacity : 175 kg

vi. Unit cost (per machine) : Rs. 2500/-

vii. Suitability for crops/commodity : Jaggery

viii. Efficiency : Good

ix. Unit cost of operation : Rs. 0.5/kg.

x. Patent obtained/applied : Not applied

Commercialization status :
(a) No. of Licensees to whom the technology has been transferred : 01
(b) Selected Addresses of Licensee /Manufacturer :
- UP Small machinery corporation
  - Near Kashipur Road, Gandhi Colony, Rudrapur

xi. Contact Address :
- Head,
  Department of Process and Food Engg,
  College of Tech.,
  G. B. Pant University of Agriculture & Tech.,
  Pantnagar -263 145 (Uttaranchal)
Four Decades of R&D of AICRP on PHET

Process Protocols and Products
Technology No. 192

i. Name of the Technology : Bottling of Sugarcane Juice

ii. Application/Use : To preserve the sugarcane juice in bottles

iii. Description of Technology :
A technology has been developed for preserving the sugarcane juice in bottles for a period up to six months. The process of preserving the sugarcane juice involves peeling, crushing, filtration, pasteurization and bottling. Sodium Benzoate @ 125 ppm is added as preservative. The bottled juice can be stored without any loss in the quality and flavour for six months at room temperature. The cost involved for the production of one bottle (200 ml) of juice is Rs. 3.00. Consumer acceptability of the preserved juice was evaluated and found to be 98 per cent.

iv. Input/raw material : Sugar cane
   a) Overall dimension
   b) Plant & Machinery : Sugar cane crusher, Filtration unit, Double wall steam kettle, bottle washer, Auto clave, Bottle closer
   c) Power : Depending on the production capacity
   d) Man power : Depending on the production capacity
   e) Land : Nil
   f) Investment : Minimum Rs. 5, 00,000 depending on the capacity

v. Output capacity : Depending on the production capacity
vi. Unit cost : Minimum 2 lakhs investment
vii. Suitability for crops/commodity : Sugarcane
viii. Efficiency : -
ix. Unit cost of operation : Rs. 3 per bottle of 200 ml (excluding bottle)
x. Patent obtained/applied : No
xi. Commercialization status : Commercialized
   (a) No. of Licensees to whom the technology has been transferred : 3
   (b) Selected Addresses of Licensee / Manufacturer :
      1. Mr. J. Sethupathy, G-3 unit Industrial Estate, S. Vellalapatty, Karur - 639004, Tamil Nadu.
      2. Mr. Rasi Ramalingam (Rasi Masala), 22, 1st street, Ghere Pukasham Nagar, Pondicherry-605008

xii. Contact Address : Professor and Head, Agricultural Machinery Research Centre, Tamil Nadu Agricultural University, Coimbatore - 641 003.
    Phone: 0422- 6611272; FAX: 0422-6611455;
    e-mail: processing@tnau.ac.in
**Technologies /Jaggery**

**Technology No. 193**

i. **Name of the Technology** : Okra Plant Stalk Powder for Clarification

ii. **Application/ Use** : Okra plant stalk powder is ready to use form of vegetative clarificant which can be used for efficient clarification during jaggery processing. This RTU form of clarificant is useful in areas of non availability of fresh okra plant or in off season of okra plant.

iii. **Description of Technology** :

The wild species of okra (Abelmoschus esculentus) plants of 75 to 90 days crop age are used for preparation of powder. The okra plant stalks are chopped into small pieces of about 2 cm length then dried it in shed for the period of 15-20 days. Dried pieces are ground to get the fine powder. This powder is sieved through 1 mm sieve and stored in air tight plastic containers. During jaggery processing this powder is applied @ 1.6 Kg/ 1000 liters of sugarcane juice. It has same clarification efficiency as that of fresh okra plant.

iv. **Input/raw material**

   a) **Overall dimension** : Fresh Okra plant stalk
   b) **Weight** : NA
   c) **Prime mover/ Plant & Machinery** : Chopper machine, Grinding machine, 1 mm sieves, plastic containers
   d) **Man power** : 02 / day
   e) **Power** : 4.0 hp
   f) **Land** : NA
   g) **Investment** : Rs. 25,000/-

v. **Output capacity** : 50 kg /day

vi. **Suitability for crops/commodity** : Okra stalk

vii. **Efficiency** : NA

viii. **Unit cost** : Rs. 30 / kg

ix. **Patent obtained/applied** : Nil

x. **Commercialization status**

   a) **No. of Licensees to whom the technology has been transferred** : Ready for commercialization
   b) **Selected Addresses of Licensee/Manufacturer and Contact addresses** : Nil

xii. **Contact address** : PI, AICRP on PHET, Regional Sugarcane & Jaggery Research Station, Opp. Market yard, (Mahatma Phule Krishi Vidhyapeeth), Rahuri Kolhapur-416005 (MS)
Technology No. 194

i. Name of the Technology : Value Added Jaggery

ii. Application/ Use : Promotion of Nutritionally Rich Jaggery

iii. Description of Technology:

*Aonla* as a natural source of vitamin C has been added in jaggery in suitable form and quantity and at a proper stage of jaggery preparation. Value-added jaggery cubes and bars have been prepared. Such kind of jaggery if included in the menu of mid-day meal being given to rural school going children will help in fighting malnutrition.

iv. Input/raw material : Aonla and sugarcane juice

   a) Overall dimension : 50x25x25 mm
   b) Weight : 25 g
   c) Prime mover/ Plant & Machinery : NA
   d) Man power : 02
   e) Power : Manual
   f) Land : NA
   g) Investment : Rs. 6000

v. Output capacity : 7 kg/batch

vi. Unit cost : Rs 6000

vii. Suitability for crops/commodity : juice

viii. Efficiency : 90%

ix. Unit cost of operation : 2 Rs/kg

x. Patent obtained/applied : -

xi. Commercialization status : Ready for commercialization

   a) No. of Licensees to whom the technology has been transferred : -

   b) Selected Addresses of Licensee/Manufacturer and Contact addresses : -

xii. Contact addresses : Director or Research Engineer

   ICAR-Indian Institute of Sugarcane Research,
   Raebareli Road, Lucknow
   Phone: 0522-2480726, Fax: 0522-2480748
   Email: iisrko@sanchamet.in
Technologies /Jaggery

Technology No. 195

i. **Name of the Technology** : Rectangular Shaped Jaggery

ii. **Application/ Use** : Production of rectangular shaped jaggery

iii. **Description of Technology** :

   The boiling and concentration of sugarcane juice is done in the open pan on two/ three pan furnace up to the striking point. Thus concentrating juice is transferred from boiling pan to a wooden cooling pan. It is allowed for cooling for about 10 minutes which is followed by manual puddling for about 10 minutes and is left for cooling in continuation for about 08-10 minutes. Then the concentrating juice starts solidifying in the form of slurry which is, then pored into the rectangular moulding frame for rectangular shaped jaggery. It is then left for setting/ solidification. After about 25 minutes, the rectangular frames are dismantled and rectangular shaped jaggery weighing about 10-12gm each piece is taken out and is put for shade or solar drying prior to packaging.

iv. **Input/raw material** :
   a) **Overall dimension** : 12x25x25 mm
   b) **Weight** : 10-12 g/cube
   c) **Prime mover/ Plant & Machinery** : manual
   d) **Man power** : 01 No.
   e) **Land** : NA
   f) **Investment** : Rs 4000

v. **Output capacity** : 3.5 kg/batch

vi. **Unit cost (per kg)** : Rs. 35 /kg

vii. **Suitability for crops/commodity** : Sugarcane

viii. **Efficiency** : 95%

ix. **Unit cost of operation** : Rs 2.0/kg

x. **Patent obtained/applied** : Not applied

xi. **Commercialization status** : Ready for commercialization
   (a) **No. of Licensees to whom the technology has been transferred** : --
   (b) **Selected Addresses of Licensee/Manufacturer** : Nil

xii. **Contact addresses** : Director or Research Engineer
    ICAR-Indian Institute of Sugarcane Research, Raebareli Road, Lucknow
    Phone:0522-2480726,Fax:0522-2480748
    Email: iisrilko@sancharnet.in
### Technology No. 196

<table>
<thead>
<tr>
<th>Description of Technology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugarcane juice clarified with vegetative clarificant is boiled and concentrated up to the striking point. At striking point, it is taken out from the boiling pan to a wooden cooling pan. It is kept for 5-10 minutes for cooling. Then, it is puddled for 5-10 minutes and left for further cooling. At this stage, the concentrated juice starts solidifying. It is then poured in moulding frames and left for solidification. After 20-30 minutes, the moulding frames are dismantled and one-inch cubes of jaggery (22-25g) are taken out. It is then dried and packed.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input/raw material</th>
<th>Jaggery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output capacity</td>
<td>7 kg per batch</td>
</tr>
<tr>
<td>Suitability for crop/commodity</td>
<td>Jaggery</td>
</tr>
<tr>
<td>Efficiency</td>
<td>N.A.</td>
</tr>
<tr>
<td>Unit cost</td>
<td>Rs. 48/kg of jaggery</td>
</tr>
<tr>
<td>Patent obtained/applied</td>
<td>Not</td>
</tr>
<tr>
<td>Commercialization status</td>
<td>Commercialized</td>
</tr>
<tr>
<td>a) No. of Licensees</td>
<td>3</td>
</tr>
<tr>
<td>b) Addresses of Licensees or Manufacturer</td>
<td></td>
</tr>
<tr>
<td>1. M/S Vindhyawasini Traders, Patna (Bihar)</td>
<td></td>
</tr>
<tr>
<td>2. M/S Amit Agro, Rampur (U.P.)</td>
<td></td>
</tr>
<tr>
<td>3. Mr Gurpreet Singh Khanna, Gurdaspur (Punjab)</td>
<td></td>
</tr>
<tr>
<td>Mr Anand Singh, Gonda (U.P.)</td>
<td></td>
</tr>
<tr>
<td>Contact Address</td>
<td>Director</td>
</tr>
<tr>
<td></td>
<td>ICAR-Indian Institute of Sugarcane Research, Raebareli Road, Lucknow</td>
</tr>
<tr>
<td></td>
<td>Phone: 0522-2480726, Fax: 0522-2480748</td>
</tr>
<tr>
<td></td>
<td>Email: <a href="mailto:lislio@sancharnet.in">lislio@sancharnet.in</a></td>
</tr>
</tbody>
</table>
Technologies/Jaggery

Technology No. 197

i Name of the Technology : Process Technology for Production of Value-added Jaggery Cubes and Bars

ii Application/ Use : Fights malnutrition, increased income to the farmers and improved socio-economic status of the farmers

iii Description of Technology :

A process technology for production of value-added jaggery using aonla as a natural source of vitamin C has been developed. Using this technology nutritionally rich jaggery having vitamin C can be prepared in cubes and bars. Dried aonla shreds @ 75g/kg of jaggery is added in cooling pan in the process of jaggery making. Value-added jaggery produced using aonla as a natural source of vitamin C has a good palatability besides being rich in vitamin C.

iv Input/raw material : Jaggery, sugarcane juice, anola

v Output capacity : 30 kg of value-added jaggery per batch

vi Unit cost (per machine) : Rs. 70 per kg

vii Suitability for crop/commodity : Jaggery

viii Commercialization status

a) No. of Licensees : -
b) Addresses of Licensees or Manufacturer : -

ix Contact Address : Director
ICAR-Indian Institute of Sugarcane Research,
Raebareli Road, Lucknow
Phone: 0522-2480726, Fax: 0522-2480748
Email: iiisrlko@sancharnet.in

243
Technology No. 198

i Name of the Technology : Liquid Jaggery

ii Application/ Use : Storability is better. It can be used as a substitute for honey and can give better profitability

iii Description of Technology :
Sugarcane juice is extracted, filtered and heated over jaggery furnace. On heating, lime (100g lime in 5 l water/100 kg juice) is added to raise the pH from 5.2-5.4 to 6.5-7.0 for coagulation of impurities. After removal of impurities, mucilaginous extract of vegetative clarificant is added for further clarification. Now juice is made acidic by adding phosphoric acid and is vigorously boiled. As soon as the temperature reaches 105-106°C, it is removed from pan, cooled and packed in glass or PET bottles. Addition of citric acid @ 0.04% and 0.1% potassium metabisulphite or 0.5% benzoic acid help in preventing crystallization and increasing shelf life respectively.

iv Input/raw material : Sugarcane
a. Man power : 02
b. Land : 200 m²
c. Investment : Rs. 2.5 lakh

v Output capacity : 1000 bottle/day

vi Unit cost : Rs. 20/300 ml

vii Suitability for crop/commodity : Jaggery

viii Commercialization status : Commercialized
a) No. of Licensees : 1
b) Addresses of Licensees or Manufacturer : M/s Gurpreet Singh Khanna, Gurdaspur (Punjab)

ix Contact Address : Director
ICAR-Indian Institute of Sugarcane Research, Raebareli Road, Lucknow
Phone: 0522-2480726, Fax: 0522-2480748
Email: iisrisko@sancharnet.in
Technology No. 199

i Name of the Technology : Powder/Granular Jaggery

ii Application/ Use : It can easily be packed and stored.

ii Description of Technology :
Sugarcane juice is extracted, filtered and heated over jaggery furnace. On heating, mucilaginous extract of vegetative clarificant is added and the scum is removed. Now the juice is vigorously boiled till the temperature reaches to 120-122°C. Then it is transferred to wooden tray and cooled by continuous puddling. When it starts solidifying, it is rubbed using ladle and between palms/wooden plates and made into powder/granular form. It is then dried under sun, sieved/graded and packed in polythene packets.

iv Input/raw material : Sugarcane

v Unit cost : Rs. 70/kg

vi Suitability for crop/commodity : Jaggery

vii Commercialization status : Commercialized
   a) No. of Licensees : M/s Gurpreet Singh Khanna, Gurdaspur (Punjab)
   b) Addresses of Licensees or Manufacturer :

viii Contact Address : Director
ICAR-Indian Institute of Sugarcane Research,
Raebareli Road, Lucknow
Phone:0522-2480726,Fax:0522-2480748
Email: iisrko@sancharnet.in
Technology No. 200

i. Name of the Technology : Jaggery Chocolate

ii. Application/ Use : A novel confectionary product

iii. Description of Technology :

   The nature of jaggery in terms of its color, texture and
   sweetness, would make it very suitable for a chocolate like
   product. Therefore, jaggery would be a healthier
   alternative due to its low fat and higher mineral content. It is
   much commonly used by rural people as a rich source of
   energy and minerals and has been a part of their traditional
   affairs as ‘Desi Sweet’.

iv. Input/raw material :
   a) Overall dimension : 3”x2”
   b) Weight : 50g
   c) Prime mover : Not applicable
   d) Power : 4-5 unit/h
   e) Man power : Skilled workers (2)
   f) Land : 20’x40’
   f) Investment : Rs. 5 lakh

v. Output capacity : Information not available

vi. Unit cost of operation : Rs. 14.00

vii. Suitability for crops/commodity : Jaggery/ Sugarcane

viii. Efficiency/taste of consumer : Good

ix. Unit cost (per machine) Patent obtained/applied :
   a) Rs. 14/- per piece (50g) s
   b) applied

x. Commercialization status :
   a) Nil

xi. Selected Addresses of Licensee/Manufacturer :
   Nil

xii. Contact Address : Head,
    Department of Process and Food Engg,
    College of Tech., G.
    B. Pant University of Agriculture & Tech.,
    Pantnagar -263 145 (Uttaranchal)
Appendix I

List of major technologies developed under the AICRP on PHET

Food Grains and Oilseeds

Post-harvest Machinery, Tools, Equipment and Structures

1. PKV Mini Dal Mill
2. PKV Cleaner-Grader-Polisher
3. Vivek Thresher-cum-Pearler
4. VL Steaming Plant
5. VL Paddy Thresher
6. Barnyard Millet Dehuller
7. Pedal Operated Winnowing-Cleaner-Grader for Millets
8. Mini Groundnut Decorticator-cum-Sunflower Thresher and Maize Sheller (3-in-1)
9. Safe Storage of Pulses using Sand Layer
10. Maize Sheller-cum-Sunflower Thresher (2-in-1)
11. Portable Winnower
12. Technique for the Control of Stored Grain Insects in Milled Rice
13. On Farm Paddy Dryer
14. Multipurpose Grain Mill
15. Manual Double Screen Cleaner with Sack Holder
16. Groundnut-cum-Castor Decorticator
17. Pedal-cum-Power Operated Grain Cleaner
18. Dhall Mill
19. Pulse Mill Plant of 0.5 t/h Capacity based on the Design of CIAE Mini Dal Mill
20. PKV Waste Fired Dryer
21. Straw Baler
22. Manual Double Screen Cleaner
23. Mahua Seed Decorticator
24. Small Scale Sunflower Oil Dewaxing System
25. Pearl of Minor Millets
26. Mini Dhal Mill
27. Household Paddy Parboiling Unit
28. Household Insect Trap
29. Groundnut Kernel Testa Remover
30. Single Drum Rotary Screen Grain Pre-cleaner
31. Chulha for Grain Puffing Machine
32. Process variables for Maize seed processing
33. Tungabhadra Winnower
34. Improved Groundnut Decorticator
35. Solar Heat Treatment Machine
36. Multi Grain Mill
37. Maize Dehusker Sheller

Process Protocols and Products

38. Mahua Flower Beverages
40. Storage of Mechanical Damaged Grains using Castor Oil and Stored in Metal Bin
41. Extrusion Technology (Peanut blended)
42. Extrudates of Minor Millets
43. Process for Quick Cooking Maize Rab Powder

**Horticultural Crops**

**Post-harvest Machinery, Tools, Equipment and Structures**

44. PKV Chilli Seed Extractor
45. PDKV Fruit Grader
46. Solar Cabinet Dryer
47. Turmeric Slicer
48. Pilot Plant (100 kg/day capacity) for making Cherry/Tutty-Fruity
49. Pricking Machine for Petha Preparation
50. White Pepper Machine
51. Manual Arecanut Dehusker
52. Tamarind Dehuller-cum-Deseeder
53. Pedal operated Coconut Dehusker
54. Bulk Onion Curing Unit
55. Mango Harvester
56. Sapota Harvester
57. Cardamom Dryer
58. Tubular Aeration System for Improved On-Farm Storage of Potato
59. Multipurpose Polyhouse Solar Dryer
60. Mobile Stream Boiler for Turmeric
61. Barn Drying of Chillies
62. Turmeric/Ginger Washer
63. Dehumidified Air Dryer
64. Bael Slicer
65. Hand Operated Low Cost Aloe-vera Gel Extractor
66. Automatic Mango Grader based on Internal and External Quality
67. Fluidized Bed Dryer for Mushroom
68. Improved Farm Level Turmeric Boiler
69. Aonla Pricking Machine (manually operated)
70. Continuous Carrot Washer (Bahabalpur)
71. Aonla Pricking Machine (power operated)
72. Pineapple Harvester
73. Water Chest Nut Decorticator (Manual)
74. Fruit Grader (Manual)
75. Power Operated Pea Shelling Machine
76. Power Operated Green Bengal Gram Pod Stripping Machine
77. Ber Grader
78. Cleaner-cum-Grader for Cumin
79. Development of Shell fired Copra Dryer
80. Tender Coconut Punch and Cutter
81. Coconut De-Shelling Machine
82. Coconut Slicing Machine
List of Technologies

83. Coconut Testa Removing Machine
84. Honey Processing Unit
85. Hand Operated Wild Apricot Decorticator
86. Apricot Stone Grader
87. Pedal Operated Fig Pressing Machine
88. Natural Convection Solar Dryer [Mini-multi rack solar dryer]
89. Forced Convection Solar Drying System
90. Dried Apricot Grader
91. Walnut Dehuller
92. Walnut Bleacher-cum-Washer
93. Black Pepper Decorticator
94. Cassava Rasper
95. Cassava Peeling Knife
96. Cassava Chipping Machine (Hand operated)
97. Pedal Operated Cassava Chipping Machine
98. Motorized Cassava Chipping Machine
99. Mobile Starch Extraction Plant
100. Feed Granular
101. Garlic Bulb Breaker
102. Peeler-cum-Polisher for Ginger and Turmeric
103. Garlic Clove Flaking Machine
104. Solar Dryer
105. Garlic Peel Remover For Dehydrated Flakes
106. Aloe Gel Extraction Machine
107. Garlic Grader
108. Turmeric Polisher
109. Garlic Clove/Peeler
110. Ginger Peeler
111. Pineapple Peeler-Cum-Corer-Cum Slicer
112. Sapota Cleaner
113. Farm Level Fruit and Vegetable Washing Machine
114. Turmeric Washing and Polishing Machine
115. Electric-cum-Battery Heated Uncapping Knife
116. Trolley Drier
117. Honey Heating-cum Filtration System
118. Eight Frame Radial Honey Extractor
119. Storage of Ginger Rhizomes in Fresh Form

Process Protocols and Products

120. Ready-to-Serve Beverage from Jackfruit
121. Value Addition of Roselle Calyces
122. Utilization of ‘Patchouli Spent Charge’ after Distillation of Essential Oil for the Manufacture of Agarbatti
123. Cashew Apple Beverages
124. Zero Waste Technology for Osmo Dehydrated Pineapple Products
125. Aloe vera blended Ready to Serve Beverage
126. Complete Process Protocol for Probiotic Fruit Juice (Apple)
127. Safe and Low Cost Holi Powder from Tapioca
128. Extraction of Pectin From Kesar Mango Peel By Resins
129. Extraction of Enzymes from Potato Peels Substrate using Bacillus group of Bacteria.
130. Production of Sapota Powder
131. Custard Apple Fruity
132. Process for Mango Leather (Aam Papad), Mango powder and Mango
133. Extraction of Kernel Oil from Apricot /Wild Apricot Seed
134. Technology for Preparation of RTU Mushroom Tikki Mix
135. Technology for Preparation of Mushroom Powder
136. Technology for Preparation of Instant Mushroom Noodles
137. Technology for Preparation of RTU Mushroom Soup Powder
138. Cloud Stable Cherry Squash
139. Cherry Candy
140. Plum Appetizer
141. Walnut Kernel Incorporated Rice based Extruded Snacks
142. Lotus Stem and Broken Rice based Expanded Snacks
143. Cloud Stable Health Drink from blend of Apricot and Sea Buckthorn.
144. Curing of Vanilla beans
145. Fried Snack Foods from Cassava Based Composite Flour
146. Process Technology for Garlic flakes & powder
147. Technology for Ginger and Turmeric Processing

**Livestock**

**Post-harvest Machinery, Tools, Equipment and Structures**

148. Mobile Poultry Processing Unit-cum-Retail Meat Stall
149. Feed Block Making Machine
150. Women Friendly Fish Vending and Display Unit
151. Model Retail Outlet for the Production of Hygienic Chicken Meat
152. Pedal Operated Ice Crusher

**Process Protocols and Products**

153. Pet Food from Slaughter House Waste by-products
154. Pet Food Preparation
155. Soya Protein Isolate in Buffalo Sausage Preparation
156. Honey Treated Deep Fried Chicken Nuggets
157. Intermediate Spent Chicken Meat
158. Spent Chicken Meat Pickle
159. Ready-to-Eat extruded Fishery Products
160. Process for Extraction of Flavor From Shrimp Waste
161. Development of Fish Soup with Shrimp Flavour
162. Development of Vegetable Soup with Shrimp Flavour
163. Low Calorie Ice Cream (using stevia powder) for Diabetic Patients
164. Value Added Product (Fish sausage) by using Low Value Marine and Fresh Water Fish.
165. Value Added Product (fish balls) using low value marine fish (Squilla)
List of Technologies

Jaggery

Post-harvest Machinery, Tools, Equipment and Structures
166. Crystal Jaggery Making Machine
167. Mechanized Jaggery Granulator for Production of Free Flowing Jaggery Granules
168. Steam Boiling System Using Bagasse for the preparation of Good Quality Jaggery
169. Improved Four Roller Sugarcane Crusher
170. Modified Electronic Thermometer
171. Churner
172. Modified Hardness Tester
173. Juice Boiling Pan
174. Sugarcane Juice Collection and Settling Tank
175. Boiling Pan Tipping Mechanism
176. Jaggery Moulding Frame
177. Rectangular Shaped Jaggery Moulding Frame
178. Drying-cum-Storage Bin
179. IISR Two Pan Furnace with Forced Draft System
180. Improved Triple Pan Furnace
181. Modified Juice Heating /Boiling/ Concentrating Pans
182. Waste Heat Recovery System for Open Pan Jaggery Furnace
183. Sugarcane Peeler
184. IISR 3-Roller Horizontal Power Driven Crusher
185. Small Capacity Cane Crusher
186. Mechanical Cane Juice Filtration Unit
187. Boiling Juice Churning Device
188. Scum Settling Tank
189. Mechanical Jaggery Dryer
190. Solar Dryer for Jaggery
191. Drying-cum-Storage Jaggery Bin

Process Protocols and Products
192. Bottling of Sugarcane Juice
193. Okra Plant Stalk Powder for Clarification
194. Value Added Jaggery
195. Rectangular Shaped Jaggery
196. Cube Shaped Jaggery
197. Process Technology for Production of Value -added Jaggery Cubes and Bars
198. Liquid Jaggery
199. Powder/Granular Jaggery
200. Jaggery Chocolate
Upcoming technologies from AICRP on PHET

Post-harvest tools/equipment/machinery

1. Continuous low cost turmeric washer (Akola)
2. Stripping machine for chick pea pod stripping (Akola)
3. Hand operated Winnower-cum-cleaner (Almora)
4. Steam boiling system for the production of export quality jaggery (Anakapalle)
5. Mechanized paper sweet making machine for the production of jaggery fortified paper sweet (Anakapalle)
6. Amaranthus popping unit (Bhubaneswar)
7. Mahua Stamen removal machine (Bhubaneswar)
8. Manual and Motorised Sausage Stuffer (Chennai)
9. Cocoa pod breaker-Modified (Coimbatore)
10. Solar dryer for cocoa bean with biomass backup heater (Coimbatore)
11. Mango destoner cum pulper (Coimbatore)
12. Carrot de-hairing machines (Hisar)
13. Carrot twig plucker (Hisar)
14. Storage methods/structure for Kharif onion (Hisar)
15. Dryer for Important Spices of North Eastern States (Imphal)
16. Gadget for making “pitha” (Jorhat)
17. Modified low cost storage system of jaggery (Jorhat)
18. Semi-automatic Jaggery moulding machine (Lucknow)
19. Vacuum based tank for jaggery (Lucknow)
20. Refinement of inbuilt filtration system in (Ludhiana)
21. Fish Vending cum Display Unit-Modified with Composite Material (Mangalore)
22. Animal Skin Holder (Mumbai)
23. Honey comb structured packaging material for fresh fig fruits (Raichur)
24. Multimode dryer designed for drying of grapes, fig and chilli (Raichur)
25. Apple seed corer (hand operated and paddle operated), Solan centre
26. Modified Apricot stone descorticating attached with dust separator (Solan centre)
27. Walnut grader (Srinagar)
28. Modified wax applicator for coating on passion fruit (capacity: 300 kg/h) (Tavanur)
29. Power operated pepper descorticating (Tavanur centre)
30. Banana peeler (Tavanur)
31. Green gram depoder cum sheller (Udaipur centre)
List of Technologies

**Process protocol and products**

1. Process technology for value added products of pumpkin (Akola centre)
2. Jaggery with carotenes, beta carotene and vitamin C (Anakapalle)
3. Process protocol for Jaggary cubes (Anakapalle)
4. Probiotic Low-fat Dahi from Small Millets (Bangalore)
5. Fermented alcoholic & Non-alcoholic Beverages from Kokum/Tomato (Bangalore)
6. Jackfruit Ice cream and Jackfruit Peda (Bangalore)
7. Cowpea medu vada mix (Bangalore)
8. Ready-to-serve small millet one-dish meal (Bangalore)
9. Ready-to-Cook malted white ragi based dairy food (Bangalore)
10. Process protocol standardized for processing of industrially processed fruit wastes viz., mango peel, mango seed/kernel and tomato pomace (Bangalore)
11. Nutri-Rich Energy Food using Small Millets (Bangalore centre)
12. Developed process for kokum and tomato beverage (Bangalore centre)
13. Watermelon beverage (Bhubaneswar)
14. Modified Atmospheric Packaging of Jamun with scavengers (Bhubaneswar)
15. Ready To Eat mushroom curry in retortable pouches (Coimbatore)
16. Primary process technology package for cocoa (Coimbatore)
17. Utilisation of ruminal contents in formulation of Japanese quail feed (Chennai)
18. Bio-Preservation of meat using beneficial bacterial cultures (Chennai)
19. Effect of edible coating of hydrocolloids and cinnamon oil on meat (Chennai)
20. Coco based mulhati guava products (bar & nuggets) (Hisar)
21. Extrudates from different blends of by-products of dal mill, maize, sorghum, and pearl millets blends (Jabalpur)
22. Dried fermented bamboo shoots (Jorhat)
23. Low cost good quality gum from tapioca starch (Jorhat)
24. Utilization of de-oiled cake from groundnut kernels (Junaghar)
25. Extrudates from VCO cake, broken rice, maize and pearl millet (Kasargod)
26. Dietary fibre enriched pork nuggets and sausage (Khanapara centre)
27. Value addition to pork sausage with banana pseudostem flour (Khanapara)
28. Foxtail millet incorporated buffalo meat products (Khanapara)
29. Process for removal of Amorphous silica from rice husk (Kharagpur)
30. Technology for production of pork and chicken nuggets and sausage with dietary fibre (Khanapara)
31. Process for Restructured pork ham using liquid whey up to 50% (Khanapara)
32. HACCP Protocol for liquid jaggery manufacturing (Kolhapur)
33. Organic clarificant (soybean DOC @ 1 kg per 1000 liters of sugarcane juice) for jaggery processing (Kolhapur)
34. Reduction of sugarcane staling losses (with application of sodium hypochlorite) (Kolhapur)
35. Probiotic guava, kinnow and mango juice (Ludhiana)
36. Ready to eat and ready to cook fishery products (Mangalore)
37. Ready-to-eat fish ham with shrimp chunks (Mangalore)
38. Ready-to-eat fish ham in fibrous casings and synthetic casings (Mangalore)
39. LAMP assay technology has been standardized for easy and rapid detection of *S. aureus* and *Salmonella* spp (Mumbai)
40. Value added products from white button mushroom (Solan)
41. Optimized method for extraction of ginger oil/oleoresin (Solan)
42. Characterize the enzyme from kiwi fruit (Solan)
43. Value addition and shelf life improvement of pear (Srinagar)
44. Process protocol for thermal processing of “Varikka” variety of tender jackfruit (Tavanur)
45. Extruded RTE products from rice, and *Nendran* banana (Tavanur)
46. Multistage grinding of spices (Tavanur)
47. Cassava starch-nano clay composite based biodegradable film (Trivandrum)
48. A prototype green gram depoder cum sheller developed (Udaipur centre)

**Pilot Plants**

1. Pilot plant for extraction of pectin from kinnow peel/waste (Ludhiana)
2. Pilot plant for production of probiotic and synbiotic juice from guava, kinnow and mango (Ludhiana)
3. Protocol and pilot plant for extraction of pectin from apple pomace (Solan)
4. Pilot plant for value chain of turmeric processing.
Appendix-II

List of Publications

Research Journals

(i) Food Grain and Oilseeds Processing


Das, A., Patgiri, P Sarmah, B.K. (2005). Callosobruchus chinensis L. (Bruchids) cause damage to a number of important pulse during storage. Legume Research, 28(1) 74-76.


Mudgal, V.D. and J.S. Bordia (Accepted) (2011). Studies on Depulping of Tumba (Cittrulluscolocynthis) for Seed Separation. The Institution of Engineers


Rayaguru, K., Pal, U.S.,(2011). Development and evaluation of Betel Leaf Conditioning Chamber, Agricultural Mechanization in Asia, Africa and Latin America, 42(3) :61-65


(ii) Horticulture Crop Processing


Publications in Journals/Horticulture


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Alam M S, Sehgal V K, Tarsem Chand, Arora M and Bhatia S (2012). Evaluation of Trolley-


Singh V.K., Sheela Pandey, Akash Pare, R.B. Singh (2012). Optimization of process parameters for the production of spray dried Ber (Liziphus jujubel) powder. Journal of Food Science and Technology, published online.


Pushpapria and Munishamanna K.B. (2013). Lactic acid fermentation of blended tomato juice for value addition, Mysore Journal of Agricultural Sciences, 47(3): 576


Reshi Monica, Anju Bhat, Raj Kumar Kaul & Munazah Mehraj (2015). Nutrient composition of raw and processed products from Jammu potato cultivars. Green farming (Accepted)


(iii) Livestock Processing


(iv) Jaggery and Khandasari


v. Others


Singh, M.N. and R.K. Jain. (1989). Evaluation of bamboo cement bin in humid hot region. Accepted for the publication in the Journal of Institution of Engineers (India.)


B. Research Papers in Workshop/Symposia/Conferences Proceedings

Food Grains & Oilseeds Processing


Singh M N (1988). Performance of different insecticides treated cloth bags against the pulse beetle, callosobruchus chinensis L. Paper presented in the 9th annual session of academy of environmental Biology India at JAI research foundation.


Singh M N (1988). The growth and development of the pulse beetles callosobruchus chinensis L during different months and on different food media, Paper presented in the 9th annual session of academy of environmental biology India at JAI research foundation.


Sharma, S.K. and Mandhyan, B.L. (1990). Engineering, milling and hydration characteristics of Kodo, Proceeding of 26th annual convention of ISAE.


Singh M N and RK Jain. (1990). Weight loss of rice in FCI godown of Midnapore and Bankura Dist of WB. Accepted for presentation and publication in 26th annual convention of ISAE held at HAU.
Singh, D.S. and Singh Dilip (1990). Effect of moisture content and time on pearling efficiency of sorghum proceeding of 26th annual convention of ISAE.


Singh, M.N. and R.K. Jain (1990). Weight loss of rice in FCI godowns of Midnapur and Bankura district of West Bengal. 26th annual convention of ISAE will be held at HAU, Hissar from 7 to 9 Feb., PFE -1.


Publications in Proceedings/Food Grains

utilization of by-products from Agriculture and Food Processing Sectors organized by Indian Society of Environmental Science and Technology on January 30-31, 2002 held at MPKV's College of Agriculture, Pune


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Dange M.M., P.A.Borkar, P.H.Bakane. Design and development of Animal Feed mill. 48th Annual Convention of Indian Society of Agricultural Engineers (ISAE) and Symposium on Engineering Intervention in Conservation Agriculture at CTE, MPUAT, Udaipur, Rajasthan.


ii) Horticultural Crops Processing


Sajeev M.S., Saraswathy Eswaran and Jesupriya Poornakala. (1998). Effect of dewaxing treatment on dehydration characteristics of grapes. XIII National Convention of Agricultural Engineers. Organised By Institution of Engineers (India) and Tamil Nadu Agricultural University, Coimbatore. October 23-24


Rajesh G.K., V.V.Sreenarayanan and M.S.Sajeev (2000). Treatability studies of cassava starch factory effluent. XII Kerala Science Congress, Kumli, Jan 27-29. 608-610.


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Sharma P C, Raj D and Gupta A (2010). Oil from wild apricot fruits: technology and value addition. In: Advance training course on wild and underutilized fruits at Regional Centre National Afforestation and Eco-development Board (Ministry of
Environment and Forests, GOI. Dr YS Parmar University of Horticulture and Forestry Nauni, Solan w.e.f. 22nd July- 11th August, 2010.


Kaushal M and Sharma PC. (2011). Nutritional Composition and Value Addition of Seabuckthorn (Hippophae sp). In: Book of Abstracts Food Xplore National Seminar on Emerging Technologies in Food Processing For Ensuring Food safety and Quality

340


Opportunities for Tuber Crops (NSCFT 20110, 20-22, January, 2011, Indian Society for Root Crops, Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala


Changing Agro-Climate (ICTRT 2013), 09-12 July 2013, organised by Indian Society for Root Crops (ISRC) and Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram, Kerala, India


Menon Renjusha, G. Padmaja and M. S. Sajeev. (2013). Nutritional, cooking and starch digestibility characteristics of native and pre-treated legume flour fortified sweet potato spaghetti. International Conference on Tropical Roots and Tubers for Sustainable Livelihood Under Changing Agro-Climate (ICTRT 2013), 09-12 July 2013, organised by Indian Society for Root Crops (ISRC) and Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram ,Kerala, India.


Nair Soumya, M. S. Sajeev and A.N. Jyothi. (2013). Cassava starch/montmorillonite nanocomposite films:preparation and characterization International Conference on Tropical Roots and Tubers for Sustainable Livelihood Under Changing Agro-Climate (ICTRT 2013), 09-12 July 2013, organised by Indian Society for Root Crops (ISRC) and Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram ,Kerala, India
Neethu Raj S, Saranya S, Shruthi P Kumar, Sufayya S and JT Sheriff (2013) Influence of extrusion parameters on characteristics of sweet potato and turmeric powder blended RTE snack extrudate. 3rd INCOFTECH 2013 4th & 5th January 2013 at IICPT Thanjavur

Padmaja, G, Renjusha Menon, Jyothish G. Krishnan and M. S. Sajeev. (2013). Cassava and sweet potato pasta as novel functional foods with low starch digestibility and high nutritional value. International Conference on Tropical Roots and Tubers for Sustainable Livelihood Under Changing Agro-Climate (ICTRT 2013), 09-12 July 2013, organised by Indian Society for Root Crops (ISRC) and Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram, Kerala, India


Prakash C.N., Lakshmisha I.P. & Raju C.V. (2013). “Quality and refrigerated storage stability of patties prepared from Pangasius hypophthalmus formulated using button mushroom (Agaricusbispors”)”, International symposium on Greening Fisheries: Towards green technologies in fisheries”, which is to be held at Kochi, Kerala, India during 21-23, May, 2013, organized by CIFT.


Technology organized by MOFPI, GOI, at Thanjavur during January 4-5, 2013 at Thanjavur.


Sajeev M.S., G Padmaja and J.T. Sheriff. (2013). Novel value addition technologies to change the status of traditional crops into high value commodities: Experience in tuber crops. National Conference on Tuber crops for sustainable agriculture and livelihood security in the climate change scenario, 29 April 2013, Assam Agricultural University, Jorhat, Assam

Sajeev, M. S., A. N. Jyothi and J. T. Sheriff. (2013). Physico-mechanical and hygroscopic properties of modified cassava starch based biodegradable films International Conference on Tropical Roots and Tubers for Sustainable Livelihood Under Changing Agro-Climate (ICTRT 2013), 09-12 July 2013, organised by Indian Society for Root Crops (ISRC) and Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram, Kerala, India

Sheriff J.T. (2013). Tuber Crops in the technical Session Technological advancements in value addition and product diversification in crops at the National seminar on value addition and product diversification in agriculture and food processing-status and strategies, Kerala Agri Food Pro Meet organized by Department of Industries and commerce, Government of Kerala at Kochi on 18.02.2013


Sheriff J.T., Sanni Lateef O and Keith Tomlins (2013). Comparative Assessment on the Production of High Quality Cassava Flour (HQCFF) in India and Nigeria International Conference on Tropical Roots and Tubers for Sustainable Livelihood under Changing Agro-climate, held between 09-12 July 2013, at Thiruvananthapuram


Borah, A and Hazarika, K. (2014). Simulation and Validation of a Suitable Model for Thin Layer Drying of Ginger Rhizomes in an Induced Draft Dryer. Proceedings of 18th World Congress of Agricultural and Biosystems Engineers, China National Convention Centre, Beijing, China


Publications in Proceedings/ Horticulture


Kavya, S.E and Munishamanna, K.B (2014). Evaluation of tomato varieties for probiotic beverage juice by yeast and lactic acid bacteria: In the Proceedings of National Conference on productivity and Sustainability – Agriculturally Important Microorganisms, held at Department of Agricultural Microbiology, Bangalore during 10-12, April 2014, pp 127.

Kavya, S.E. and Munishamanna, K.B. and Palanimuthu, V. (2014). Microbial Processing of blended tomato juice for Fermented beverage and Vinegar production: In the Proceedings of National Conference on productivity and Sustainability – Agriculturally Important Microorganisms, held at UAS, Bangalore, during April 10 -12, 2014, pp 127.


Latha, B, Munishamanna,K.B .and Shivaprasak, M.K. (2014). Fermentation of blended kokum juice by yeast and lactic acid bacteria for nutritional improvement: In the Proceedings of National Conference on productivity and Sustainability – Agriculturally Important Microorganisms, held at UAS, Bangalore during April 10 -12, 2014. pp 128


Sajeev M.S and Jyothi A.N. 2014. Biodegradable packaging films from cassava (Manihot esculenta Crantz.) starch. National Seminar on Green Revolution through Agricultural Engineering Technologies, organised by Institution of Engineers (I), Kerala state Centre, 22-23, February 2014, Trivandrum


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on Engineering Solutions for Sustainable Agriculture and Food Processing held at PAU, Ludhiana from 23-25 Feb 2015 pp-56.


Publications in Proceedings/ Livestock

Sustainable Agriculture and Food Processing during February 23rd-25th, 2015 at Punjab Agricultural University, Ludhiana.


iii. Livestock


Thangavel K., A.Manickavasagan, R.Kailappan and M.S.Sajeev. (1998). Development and testing of single hydrocyclone for cassava starch milk concentration. XIII National Convention of Agricultural Engineers, Organised By Institution of Engineers (India) and Tamil Nadu Agricultural University, Coimbatore. October 23-24.


conservation and sustainability of coastal living resources of India, 1 - 3rd December, 2009, Cochin.


Raju, C.V., & Lakshmisha, I.P. (2012) “Women Friendly Fish Vending and Display Unit”, in the National conference on Research, Production & Marketing of Value Added Fish Products-Present status & Future directions, on 4 to 5, Oct, 2012 conducted by CSIR-CFTRI, Mysore.

Raju, C.V., & Lakshmisha, I.P. (2012). A Poster presentation was made on “Women Friendly Fish Vending and Display Unit”. Raju, C.V., & Lakshmisha, I.P., in Global Symposium on Aquatic Resources for Eradicating Hunger and Malnutrition – Opportunities and Challenges, on 4 to 6, Dec, 2012.


Raju C.V., & Lakshmisha I.P. (2013): “Comparative studies on the quality of ice stored fatty and lean fish in indigenously developed women friendly fish vending and display unit” by in an International symposium on Greening Fisheries: Towards green technologies in fisheries”, which was held at Kochi, Kerala, India during 21-23, May, 2013.


Meat Science Association (IMSACON-V) on “Emerging Technological changes to meet the demands of Domestic and Export meat sector” at Hyderabad on 7-9th February, 2013, pp. 281.


iv. **Jaggery & Khandsari**


problems and prospects of jaggery and khandsari in India held on Decembern2-3, 1999 at IISR, Lucknow, Souvenir with Abstract, P70.


Rao Ramakrishna S., Jaganandha Rao, P.V.K. and Prasad, R.S.I.K.M. (2002). “Effect of refrigerated cold storage on quality of jaggery from immature, mature and overaged cane under different stacking strengths and its impact on jaggery quality during post cold storage period - Research paper was presented in 37th Indian Society of Agricultural Engineers (ISAE), Annual convention and symposium held on January, 29-31, 2002 at Udaipur (Rajasthan).


v. Others


Sarao L K and Arora M . (2011). Probiotics as an ecological tool to reduce environmental pollution- A critique. Paper presented and Summary Published in the Crop Improvement, Extended summaries, International Conference, Preparing Agriculture for Climate Change, held on Feb, 6-8, 2011 at PAU, Ludhiana.

Sarao L K and Arora M. (2011). Microbes as climate engineers. Paper presented and Summary Published in the Crop Improvement, Extended summaries, International Conference, Preparing Agriculture for Climate Change, held on Feb, 6-8, 2011 at PAU, Ludhiana.


C. BOOKS/REPORTS/MANUALS/ BULLETINS, ETC.

i) Books/Book chapters/Manuals/Reports


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Anonymous (2006) Compendium of Technologies, AICRP on Post Harvest Technology, University of Agricultural Sciences, Bangalore


Munishamanna, K.B., Ranganna, B., Subramanya S., Chandru, R and Palanimuthu, V. (2008). Value addition to Jackfruit, AICRP on Post Harvest Technology, University of Agricultural Sciences, Bangalore


R. N. Borpuzari (2010) Traditional Meat Products of NE India, AICRP on Post Harvest Technology, Department of Livestock Products Technology, Faculty of Veterinary Science, Assam Agricultural University, Khanapara, Ghy-22.

Das, P. (2011) Asamat Udyag Sasyasanrangkhyan: Udyogmukhtaritamanbabyaharik dish” In “Adhunik Krishi Kotha, Published by AankBaak, Guwahati and Edited by Dr P. Mishra.


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Department of LPT and AICRP on PHET, Khanapara Centre (2015) Report on seminar cum awareness programme for meat entrepreneurs published in the newsletter of Assam Agricultural University


P.T. Sharma, Ng. Joykumar Singh and Y. Jekendra (2015) Farm mechanization for increasing productivity and profitability of rice for different rice cultural systems of NEH region (Chapter) in the book Compendium of Workshop on Location specific advances in rice production technology for NEH region, Director of Research, CAU, Imphal.


ii. Bulletins


Das, P; Sharma, S.K (2005) Value added products from ginger.

380


Arora Sadhna, Kumar Satish and Alam MS. (2010). Salient achievements in research on value addition of agricultural produce related to the Department of Processing and Food Engineering since inception Chapter In: Specialized bulletin on Post Harvest Value addition of Agricultural Produce. Compiled & Edited by: Sehgal VK, Alam MS and Verma Aseem, Punjab Agricultural University, Ludhiana, India.


Subramanya (2013) Dhany shekarana parisaradalali keetagala paathra. Doora Shikshana Patya Pusthaka. Distance Education Unit, UAS, Bangalore.

Subramanya (2013) Dhanyagala surakshitha shekarane. Doora Shikshana Patya Pusthaka Distance Education Unit, UAS, Bangalore.

Subramanya (2013) Dvidhala dhaanyagalalli keeta/peedegala samagra hathoti. Doora Shikshana Patya Pusthaka Distance Education Unit, UAS, Bangalore.

Subramanya, S (2013) Dhanyagala Shekaraneyalli Dhoopikarana. Doora Shikshana Patya Pusthaka (Distance Education Unit, UAS, Bangalore.)

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iii. Popular Articles


Sajeev M.S., G.Padmaja and S.K. Nanda. (2006). Marachheni namukkum samskarikkam (Cassva processing),Kerala Karshakan, November,
Ch.V.V.Satyanarayana, Cr Sukumaran. (2008).” Panta Kota Ananthara Parignanam Mariyu Yantra Parikaralu”. Telugu Book.
Ch.V.V.Satyanarayana. Pachi Rotta Eruvulatho Rythuku Melu Published In Eenadu Daily News Paper Dt : 3-5-09.
Ch.V.V.Satyanarayana. Sagulo Vyavasaya Yantrakaranaka Avasaram Published In Eenadu Daily News Paper Dt : 5-5-09.
G Ramachana Rao. Yelukalanu Nirmuliste Adika Digubadulu Published In Eenadu Daily News Paper Dt : 4-5-09.
Ch.V.V.Satyanarayana. Sagulo Vyavasaya Yantrakaranaka Avasaram Published In Eenadu Daily News Paper Dt : 5-5-09.
Ch.V.V.Satyanarayana. (2009).” Post Harvest Technology And Machinery”. Vyvasaya Panchangam.


Ch.V.V. Satyanarayana. (2009). Book chapter “Post harvest management of chillies” in a telugu book on vegetable production through accelerated technological advancement & post harvest management. Souvenir, National Horticultural Research and development foundation, Kurnool, A.P.


Post-Harvest Engineering and Technology

Stepping Stone for Agricultural Growth

Agriresearch with a Human touch