Cooperation Mechanism for HRD on Sustainable Agricultural Mechanization

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Vision

To modernize Indian agriculture by improvement in crop productivity through agricultural mechanization, harnessing energy from renewable sources, efficient management of irrigation water, reduction in post-harvest losses and promote agri-business with a view to enhance income and generate employment in rural sector.

Mandate

• Research on agricultural mechanization, post-harvest food processing, and energy management in agriculture
• Human Resource Development and capacity building through outreach and training programs; commercialization and utilization of agricultural engineering technologies
ICAR-CIAE INFRASTRUCTURE

- Director’s Office
- Administrative Sections
- Library
- Technology Transfer Division

- Agricultural Mechanization Division
- Research Workshop
- AICRP on FIM
- AICRP on UAE
ICAR-CIAE INFRASTRUCTURE

- Agro Produce Processing Division
- Agricultural Energy & Power Division
- Irrigation & Drainage Engineering Division
- AICRP on EAAI
- AICRP on ESA

Centre of Excellence in Soybean Processing & Utilization
ICAR-CIAE INFRASTRUCTURE

CIAE Guest House
(44)

International Training Centre
(18)
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Major Issues

- Dwindling availability of labourers for agricultural operations
- Reducing cost of cultivation and increasing productivity
- Doubling farmers’ income
- Mechanization of small farms
- Reduction in drudgery, enhancing safety
- Food and Nutritional Security
- Energy and Water security
- Mitigation of climate change
- Knowledge building and skill enhancement
Engineering Interventions for

Increasing -
• Production and Productivity
• Comfort and Safety
• Return and Profitability to Farmer

Reducing -
• Cost of Cultivation
• Drudgery

Through
• Enhanced Input use Efficiency
• Timeliness of Operation
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Technology Development Process of CIAE

1. Interaction with farmers through ORP, FLD, Kisan Melas etc.
2. Interaction with machinery manufacturers/processors
3. Inputs of Regional Committees, DoAC-ICAR interface
4. Interaction with developmental agencies, KVK, NGOs
5. Commodity based and other ICAR Institutes/universities

- Identification of Problems
- Design / development or adaptation of hardware/process/technology
- Field evaluation / testing
- Pilot introduction through ORP, on-farm trials, FLD, KVKs
- Technology & information dissemination through Trainings, Manufacturers’ days, exhibitions, kisan melas, MoA/ MoU, Mera Gaon Mera Gaurav
  - Farmers, fabricators, processors
  - Entrepreneurs
  - Personnel of developmental agencies

Users of developed hardware/Process/technology
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Thrust Areas

• Small Farm Mechanization
• Conservation Agriculture and Climate Resilient Technologies
• Hill Agriculture
• Horticulture Mechanization
• Precision Agriculture
• Developing value chains for food grains
• Food quality and safety
• Energy management in agriculture for enhanced efficiency;
• Technology for second and third generation biofuels;
• Mechanized on-farm water management practices to produce more crop per drop;
• Technology management and capacity building for stakeholders.
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<thead>
<tr>
<th>Sl. No.</th>
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<th>Salient Features</th>
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</table>
| 1      | Planters for millets/small seeds | • Field capacity of machine is 0.4-0.5 ha/h  
• Use of these planters can save upto 90% seeds as compared to broadcasting and 70% seeds as compared to drilling by traditional methods in case of millets. |
| 2      | Package of machinery for sugarcane bud chip technology | Reduce the seed cane requirement by about 90% in comparison to conventional method |
| 3      | Seed-cum-fertilizer drill for two stage placement of fertilizer | • Field capacity of the machine is 0.5 ha/h at forward speed of 3.5 km/h with the cost of operation of Rs 600/h.  
• An estimated saving of 5-7% in phosphorus and potash fertilizers can be achieved.  
• a farmer can get additional income of Rs. 8000/- per ha in wheat and Rs. 7000/- per ha in soybean crop |
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### (Some recent technological developments)

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| 4      | Pre-emergence herbicide strip applicator-cum-planter           | • Helps in reduced use of herbicide by applying the chemical at the time of sowing  
• Field capacity of the developed system is 0.4 ha/h with an operating cost Rs 1,350/- per ha saving 40-50% herbicide. |
| 5      | Bullock drawn garlic planter                                   | • It is used to carry out sowing at depth of 25-40 mm.  
• The seed damage was found between 2-4% in all case.  
• The operational cost is calculated Rs 725/- per hectare. |
| 6      | Spectral reflectance based variable rate top dress urea application system | • For top dressing of urea in rice and wheat crops, integrated with spectral reflectance based sensor (Green seeker)  
• can be mounted on back of operator (weight 5.5 kg without urea) and covers swath width of 4 m.  
• An estimated 8-15% savings in urea fertilizer can be achieved with use of NDVI based variable rate fertilizer applicator in wheat and rice crops in areas with spatial nitrogen variation. |
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<td>7</td>
<td>Colour sensor based herbicide applicator</td>
<td>• Developed to spray herbicide on site-specific weeds in between rows. Laser sensor acts as “eye” to the equipment, which sprays liquid only on the weed patches&lt;br&gt;• This system is an automatic on-off type unit enabling chemical application on the area where weeds exist.&lt;br&gt;• It can save herbicide to the tune of 40-60% depending upon level of weed infestation</td>
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<td>8</td>
<td>Multi-millet thresher</td>
<td>• Suitable for cleaning and grading of millets seeds&lt;br&gt;• Threshing capacity of the equipment is 80-150 kg/h&lt;br&gt;• About one million farmers of India, especially in the tribal areas are likely to get benefit of the equipment by saving about 30 man-h/ha of operation time</td>
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<td>9</td>
<td>Rotary assisted broad bed former-cum-seeder</td>
<td>• Developed for seeding of soybean and wheat crops on raised beds.&lt;br&gt;• The field capacity of this machine for making fresh bed and sowing is 0.35 ha/h and for reshaping of bed and sowing is 0.56 ha/h.</td>
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| 10     | Arecanut Sheath Shredder                           | • Compact and energy efficient.  
• The capacity of the machine was found to be 130 kg/h.                                                                                                                   |
| 11     | Low cost SPAD meter                                | • Developed using principal of spectrophotometer  
• It can be used in estimating SPAD values for N dose recommendation                                                   |
| 12     | Tractor operated cassava planter                   | • Field capacity of the planter is 0.18 ha h⁻¹  
• Cost of operation of cassava planter is Rs. 3125/ha and it saves 60.40% in cost when compared to manual planting.                                                   |
| 13     | Tractor front mounted hydraulically operated 3-row sorghum harvester | • Field capacity and field efficiency of the machine was observed in the range of 0.20 -0.23 ha/h and 80-83%.  
• Operating cost : Rs. 2500/ha                                             |
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| 14      | Millet Mill | • Developed for dehusking minor millets viz., foxtail millet, little millet, kodo millet, proso millet and barnyard millet  
• Capacity of dehusking : 100 kg/h (at 95% efficiency) |
| 15      | Pneumatic Conveyor-cum dryer, Flaking machine & belt conveyor assembly | • Produces flakes from pre-treated whole sorghum grains  
• Process was also developed for preparation of sorghum flakes by fermenting the grains with suitable cultures, steaming and then mechanically pressing into flakes |
<p>| 16      | Processing of Garcinia combogia Juice | Package of equipment (capacity 40-45 kg/h) consists of juicer/grinder, juice squeezer and juice concentration |</p>
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| 17     | **Machine vision based on-line non-destructive quality assessment** | • A set up for on-line non-destructive quality assessment using X-ray imaging of mango has been developed.  
• It is expected that with advent of more economic hardware and more concern for food safety, field deployable units could be made available. |
| 18     | **Innovative products for high nutrition**  | • **Soy-butter** (high protein content of 39 % )  
• **Probiotic soy cheese spread** (made from soy milk with addition of soybean oil, dry okara powder, sugar, and specific probiotic starter cultures)  
• **Nutribar** (rich in protein (10g/40g), iron (6mg/40g) and anti-oxidants)  
• Multi-nutrient biscuits [protein content of the biscuits was 23% with high fibre (2%)] |

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*(Some recent technological developments)*
### ICAR-CIAE

**Some recent technological developments**

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| 19     | **Biomass based decentralized electricity generation plant** | • Plant generates the electrical energy of 1 kWh from 1.2-1.5 kg of crop residues with estimated cost of Rs. 7 per kWh  
   • Two units of 100 kVA installed at 2 villages of Madhya Pradesh (India)  
   • Technology was found suitable for electricity generation and its use for operation of agro-industries (water pumping system and dal mill) at decentralized mode in the areas where the biomass burning is being practiced |
| 20     | **Biochar production technology**                      | • Calorific value of charred pigeon pea stalk was found to be 24.8 MJ/kg and was 26.8 percent  
   • Vapour produced during the production of bio char was composed of 5.63 % carbon monoxide, 10.35% carbon dioxide, 20% methane, 17.5% hydrogen |
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| 21     | **Solar powered knapsack sprayer (3 nozzle)**   | • Developed for spraying in field and vegetable crops  
• Field capacity is 0.3 ha/h as compared to conventional knapsack sprayer 0.11 ha/h |
| 22     | **Solar assisted dehumidifier based heat pump dryer** | • Developed for drying of high valued crops  
• Thermal efficiency of the heat pump dryer was 24-30% as compared to 15-22% of conventional electrical dryer |
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<td>23</td>
<td>Drip irrigation approaches</td>
<td>• Using drip irrigation along with plastic mulch yield of rice could be increased by 33 per cent in rice and 23 per cent in wheat over conventional system of cultivation</td>
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International Training Programmes Offered by CIAE
(Experienced scientific and technical expertise is available)

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<tr>
<th>Sl. No.</th>
<th>Training on</th>
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<tbody>
<tr>
<td>1</td>
<td>Production Technology of Agricultural Equipment for quality up-gradation and standardization</td>
<td>3-Weeks</td>
<td>Designers, researchers and manufacturers of agricultural machinery</td>
<td>For quality product manufacturing through modern manufacturing technology</td>
</tr>
<tr>
<td>2</td>
<td>Computer Aided Design (CAD) of Agricultural Machinery</td>
<td>2-weeks</td>
<td>Research scientists, design engineers and faculty members involved in the field of agricultural machinery</td>
<td>Extensive knowledge of CAD techniques and intensive hands on working in use of CAD software.</td>
</tr>
<tr>
<td>3</td>
<td>Testing and Evaluation of Agricultural Machinery</td>
<td>3-Weeks</td>
<td>Agricultural Engineers, Research Engineers, University Teachers, Entrepreneurs</td>
<td>Persons engaged in selection of test procedures and instrumentation, field evaluation of equipment and adoption of the test standards that address the needs of national conditions</td>
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**ICAR-CIAE, Bhopal**

**International Training Programmes Offered by CIAE**

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<td>4</td>
<td>Resource Conservation Technologies for Sustainable Agricultural Production</td>
<td>2 Weeks</td>
<td>Researchers, Teachers and Entrepreneurs related with Agricultural mechanization</td>
<td>To address mechanization needs for promotion and adoption of conservation agriculture and climate change mitigation</td>
</tr>
<tr>
<td>5</td>
<td>Design Methodology of Ergonomically Sound Agricultural Machinery</td>
<td>6 Weeks</td>
<td>Researchers, teachers and manufacturers related with Agricultural mechanization</td>
<td>For appropriate design of agricultural machinery.</td>
</tr>
<tr>
<td>6</td>
<td>Machine vision applications in agriculture and food</td>
<td>2 Weeks</td>
<td>Agricultural Engineers, Research Engineers, University Teachers, Entrepreneurs</td>
<td>Engineers working for mechanization of agriculture</td>
</tr>
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<td>7</td>
<td>Equipment and technology for processing and value addition to agro produce at small scale / rural level</td>
<td>2 Weeks</td>
<td>Agricultural Engineers, Extension Officers, Food Professionals, Process Engineers, Research Engineers, University Teachers, Upcoming Entrepreneurs</td>
<td>To gain knowledge and understand about establishing and operating value addition centres</td>
</tr>
<tr>
<td>8</td>
<td>Soybean processing for food uses</td>
<td>2 Weeks</td>
<td>Agricultural Engineers, Extension Officers, Process Engineers, Food Professionals, Research Engineers, University Teachers, and Upcoming Entrepreneurs</td>
<td>To train and establish entrepreneurs on soy processing for self employment opportunity in developing world to facilitate availability of nutritious food to population</td>
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<td>9</td>
<td>Nutritional security though plant &amp; dairy ingredients based function foods</td>
<td>2 weeks</td>
<td>Agriculture and food entrepreneurs, Research fellows, Scientists, University teachers, government officials dealing with agriculture</td>
<td>For improving food and nutritional security</td>
</tr>
<tr>
<td>10</td>
<td>Renewable Energy Technology for Production &amp; Post Production Agriculture and Rural Entrepreneurship</td>
<td>2 weeks</td>
<td>Agricultural Engineers, Extension Officers, Research Engineers, University Teachers, Entrepreneurs</td>
<td>Utilization of renewable energy technologies in the production and post-production agriculture</td>
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## International Training Programmes Offered by CIAE

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<td>11</td>
<td>Recent advances in irrigation and drainage systems for precision agriculture and sustainable production in semi-arid conditions</td>
<td>2 weeks</td>
<td>Irrigation and Drainage Engineers, Extension Officers, Research Engineers, University Teachers/ faculties</td>
<td>Water management and use of other inputs more efficiently and precisely for sustainable farm productivity</td>
</tr>
<tr>
<td>12</td>
<td>Technopreneurship of Engineering Technologies for Agribusiness</td>
<td>3 weeks</td>
<td>Engineers, Agricultural Research Engineers, Entrepreneurs</td>
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### International Training Courses Organized by CIAE in the recent past

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<tr>
<td>1</td>
<td>Advances in Agricultural Equipment for Productivity Enhancement including Precision Farming” for Association of South East Asian Nations (ASEAN)</td>
<td>23 April to 5 May, 2012</td>
</tr>
<tr>
<td>2</td>
<td>AARDO training on “Equipment and Technology for Processing and Value-addition to Agricultural Products at Small Scale/ Rural Level</td>
<td>14-27 December, 2012 10-24 February, 2014</td>
</tr>
<tr>
<td>3</td>
<td>Training-cum-Study Tour on Farm Mechanization for the African Stakeholders</td>
<td>29 April to 4 May, 2013</td>
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<tr>
<td>4</td>
<td>Certificate Course in Food Science and Technology for 2 participants from Federal Republic of Nigeria</td>
<td>June to November, 2015</td>
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Priority Areas for Cooperation

Research & Development

- Small Farm Mechanization
- Conservation Agriculture
- Horticulture Mechanization
- Precision Agriculture
- Drudgery Reduction in Agriculture
- Women Friendly Machinery
- Post Harvest Technology and Food Processing
- Second and Third Generation Bio-Fuels
- Micro-irrigation Systems
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Priority Areas for Cooperation

Human Resource Development & Capacity Building

- Computer Aided Design (CAD) of Agricultural Machinery
- Design Methodology for Ergonomically Safe Machinery
- Manufacturing Technology for Quality Upgradation
- Testing of Agricultural Machinery
- Machinery for Small Farm Mechanization
- Machinery for Enhancing Input Use Efficiency
- Establishment of Custom Hiring Centre
- Resource Conservation Technologies
- Entrepreneurship Development Programmes in Farm Mechanization and Food Processing
Opportunities that CIAE can contribute

- Offering Services of Technical Experts
- Joint Funding Proposal
- Arranging Study Tours
- Exchange of Scholars/Students
- Hosting Internship or Visiting Research Positions
- Organizing Training and Capacity Building Programmes
- Skill Development Programmes
- Technical Assistance in Establishment of Custom Hiring Centres
- Organizing Seminars, Conferences and Workshops
If We Forget How to Till the Soil and Tender the Earth we will Forget Ourselves

MAHATMA GANDHI

Thank You

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Website: http://www.ciae.nic.in