



Cooperation Mechanism for HRD on Sustainable Agricultural Mechanization

Dr. Krishna Kumar Singh

Director

ICAR-CENTRAL INSTITUTE OF AGRICULTURAL ENGINEERING, BHOPAL

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**



Department of Agricultural Research and Education , Ministry of Agriculture

Indian Council of Agricultural Research

Research Advisory Committee

**Director,
ICAR-CIAE**

Institute Management Committee

PME

Divisions

- Agricultural Mechanization**
- Agricultural Energy and Power**
- Agro Produce Processing**
- Technology Transfer**
- Irrigation and Drainage Engineering**
- CESPU**

Administration

- Establishment
- Purchase
- Stores
- Bill and cash

Centres

- Farm Science Centre (KVK)**
- Regional Centre, Coimbatore**

Audit and accounts

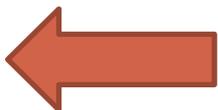
AICRP

- Farm Implements and Machinery (25)**
- Utilization of Animal Energy (12)**
- Energy in Agriculture and Agro Based Industries (17)**
- Ergonomics and Safety in Agriculture (10)**

Post Graduation Cell

Central Facilities

- | | |
|------------------------------------|--------------------------------|
| Research Workshop | Library |
| Prototype Production Centre | Estate Management |
| AKMU | Vehicle Management |
| CAD Cell | Women Cell |
| Instrumentation Cell | Guest House/ Hostel/ITC |
| ATIC | Hindi Cell |
| Farm Section | Dispensary |
| Security | Staff Canteen |



ICAR-CIAE INFRASTRUCTURE



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

- Agricultural Mechanization Division
- Research Workshop
- AICRP on FIM
- AICRP on UAE





- 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



Agricultural Technology Information Centre



**CIAE Guest House
(44)**

**International Training Centre
(18)**





ICAR-CIAE, Bhopal

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

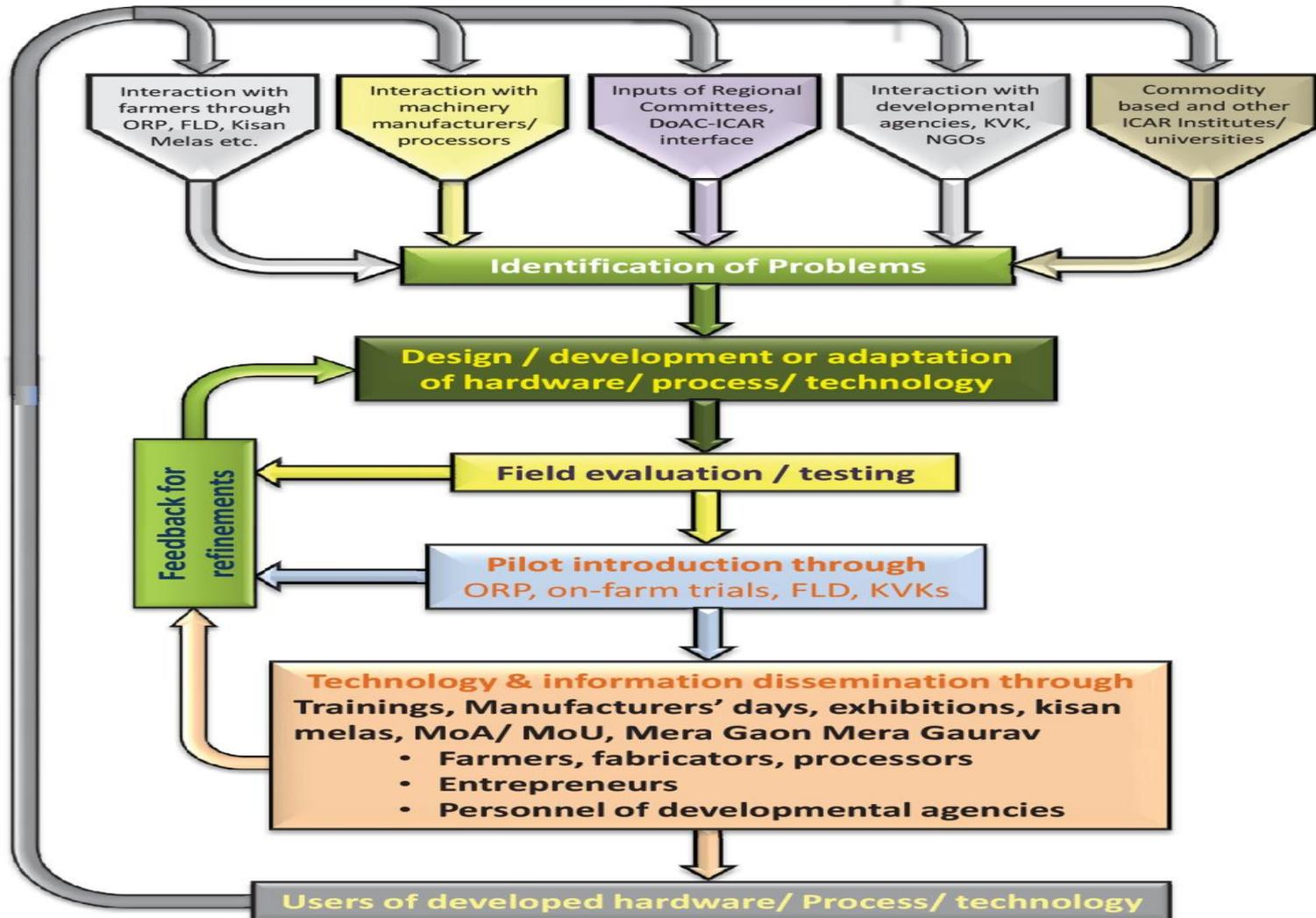
Reducing -

- Cost of Cultivation
- Drudgery

Through

- Enhanced Input use Efficiency
- Timeliness of Operation

Technology Development Process of CIAE





ICAR-CIAE, Bhopal



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.

(Some recent technological developments)

Sl. No.	Technology	Salient Features
1	Planters for millets/small seeds	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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



(Some recent technological developments)

Sl. No.	Technology	Salient Features
4	Pre-emergence herbicide strip applicator-cum-planter	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.



(Some recent technological developments)

Sl. No.	Technology	Salient Features
7	Colour sensor based herbicide applicator	<ul style="list-style-type: none"> 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 This system is an automatic on-off type unit enabling chemical application on the area where weeds exist. It can save herbicide to the tune of 40-60% depending upon level of weed infestation
8	Multi-millet thresher	<ul style="list-style-type: none"> Suitable for cleaning and grading of millets seeds Threshing capacity of the equipment is 80-150 kg/h 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
9	Rotary assisted broad bed former-cum-seeder	<ul style="list-style-type: none"> Developed for seeding of soybean and wheat crops on raised beds. 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.



(Some recent technological development)

Sl. No.	Technology	Salient Features
10	Arecanut Sheath Shredder	<ul style="list-style-type: none"> • Compact and energy efficient. • The capacity of the machine was found to be 130 kg/h.
11	Low cost SPAD meter	<ul style="list-style-type: none"> • Developed using principal of spectrophotometer • It can be used in estimating SPAD values for N dose recommendation
12	Tractor operated cassava planter	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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



(Some recent technological developments)

Sl. No.	Technology	Salient Features
14	Millet Mill	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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
16	Processing of Garcinia combogia Juice	Package of equipment (capacity 40-45 kg/h) consists of juicer/grinder, juice squeezer and juice concentration



(Some recent technological developments)

Sl. No.	Technology	Salient Features
17	Machine vision based on-line non-destructive quality assessment	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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%)]



(Some recent technological developments)

Sl. No.	Technology	Salient Features
19	Biomass based decentralized electricity generation plant	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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



(Some recent technological developments)

Sl. No.	Technology	Salient Features
21	Solar powered knapsack sprayer (3 nozzle)	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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



(Some recent technological developments)

Sl. No.	Technology	Salient Features
23	Drip irrigation approaches	<ul style="list-style-type: none">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



International Training Programmes Offered by CIAE

(Experienced scientific and technical expertise is available)

Sl. No.	Training on	Duration	For	Purpose
1	Production Technology of Agricultural Equipment for quality up-gradation and standardization	3-Weeks	Designers, researchers and manufacturers of agricultural machinery	For quality product manufacturing through modern manufacturing technology
2	Computer Aided Design (CAD) of Agricultural Machinery	2-weeks	Research scientists, design engineers and faculty members involved in the field of agricultural machinery	Extensive knowledge of CAD techniques and intensive hands on working in use of CAD software.
3	Testing and Evaluation of Agricultural Machinery	3-Weeks	Agricultural Engineers, Research Engineers, University Teachers, Entrepreneurs	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



International Training Programmes Offered by CIAE

(Experienced scientific and technical expertise is available)

Sl. No.	Training on	Duration	For	Purpose
4	Resource Conservation Technologies for Sustainable Agricultural Production	2 Weeks	Researchers, Teachers and Entrepreneurs related with Agricultural mechanization	To address mechanization needs for promotion and adoption of conservation agriculture and climate change mitigation
5	Design Methodology of Ergonomically Sound Agricultural Machinery	6 Weeks	Researchers, teachers and manufacturers related with Agricultural mechanization	For appropriate design of agricultural machinery.
6	Machine vision applications in agriculture and food	2 Weeks	Agricultural Engineers, Research Engineers, University Teachers, Entrepreneurs	Engineers working for mechanization of agriculture



International Training Programmes Offered by CIAE

(Experienced scientific and technical expertise is available)

Sl. No.	Training on	Duration	For	Purpose
7	Equipment and technology for processing and value addition to agro produce at small scale / rural level	2 Weeks	Agricultural Engineers, Extension Officers, Food Professionals, Process Engineers, Research Engineers, University Teachers, Upcoming Entrepreneurs	To gain knowledge and understand about establishing and operating value addition centres
8	Soybean processing for food uses	2 Weeks	Agricultural Engineers, Extension Officers, Process Engineers, Food Professionals, Research Engineers, University Teachers, and Upcoming Entrepreneurs	To train and establish entrepreneurs on soy processing for self employment opportunity in developing world to facilitate availability of nutritious food to population



International Training Programmes Offered by CIAE

(Experienced scientific and technical expertise is available)

Sl. No.	Training on	Duration	For	Purpose
9	Nutritional security through plant & dairy ingredients based function foods	2 weeks	Agriculture and food entrepreneurs, Research fellows, Scientists, University teachers, government officials dealing with agriculture	For improving food and nutritional security
10	Renewable Energy Technology for Production & Post Production Agriculture and Rural Entrepreneurship	2 weeks	Agricultural Engineers, Extension Officers, Research Engineers, University Teachers, Entrepreneurs	Utilization of renewable energy technologies in the production and post-production agriculture





ICAR-CIAE, Bhopal



International Training Programmes Offered by CIAE

(Experienced scientific and technical expertise is available)

Sl. No.	Training on	Duration	For	Purpose
11	Recent advances in irrigation and drainage systems for precision agriculture and sustainable production in semi-arid conditions	2 weeks	Irrigation and Drainage Engineers, Extension Officers, Research Engineers, University Teachers/ faculties	Water management and use of other inputs more efficiently and precisely for sustainable farm productivity
12	Technopreneurship of Engineering Technologies for Agribusiness	3 weeks	Engineers, Agricultural Research Engineers, Entrepreneurs	



International Training Courses Organized by CIAE in the recent past

Sl. No.	Training	Duration
1	Advances in Agricultural Equipment for Productivity Enhancement including Precision Farming” for Association of South East Asian Nations (ASEAN)	23 April to 5 May, 2012
2	AARDO training on “Equipment and Technology for Processing and Value-addition to Agricultural Products at Small Scale/ Rural Level	14-27 December, 2012 10-24 February, 2014
3	Training-cum-Study Tour on Farm Mechanization for the African Stakeholders	29 April to 4 May, 2013
4	Certificate Course in Food Science and Technology for 2 participants from Federal Republic of Nigeria	June to November, 2015





ICAR-CIAE, Bhopal



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



ICAR-CIAE, Bhopal



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

E-mail: KK.Singh@icar.gov.in; singh_ciae@yahoo.com

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