Research Institutions for promoting Agricultural Mechanization in Pakistan

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FARM MACHINERY RESEARCH AND DEVELOPMENT PROCESS

1. Issue/problem statement
2. Issue/problem synthesis/need assessment
3. Technology search
   - Technology available in other countries
     - Acquisition, modification to local condition and test & trial
       - Adaptation
         - No
   - Technology not accessible
     - Design parameter
     - Prototype development
     - Testing & evaluation
       - No
       - Economically and technically acceptable?
         - No
           - Field demonstration
             - Manufacturer’s selection
               - Local manufacturing
                 - Adoption by farmers
               - Yes
         - Yes
           - Yes
RESEARCH & DEVELOPMENT (R&D)

- Confined in public sector
- Non-existent in private sector

R&D Institutes in Public Sector

- Agricultural and Biological Engineering Institute (ABEI), Islamabad
- Agricultural Mechanization Research Institute (AMRI), Multan
- Faculties of Agricultural Engineering, Universities of Agriculture, Faisalabad and Tandojam
- Agricultural Engineering Department, University of Engineering & Technology, Peshawar
## SALIENT ACHIEVEMENTS OF R&D INSTITUTIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Agricultural &amp; Biological Engineering Institute (ABEI), NARC, Islamabad</th>
<th>Agricultural Mechanization Research Institute (AMRI), Multan</th>
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<tbody>
<tr>
<td><strong>Mechanization technologies developed and commercialized</strong></td>
<td>Tractor front mounted reaper-windrower, groundnut digger, groundnut thresher, sunflower thresher, paddy thresher, pneumatic row crop planter, zero-till drill, fertilizer band placement wheat drill, canola thresher, wheat straw chopper-cum-blower, hand operated groundnut shellers, ABEI olive oil extractor, wood shredder, and Mobile seed processing unit.</td>
<td>Seed drills, planters, ridger, bed shaper, weeders, wheat thresher, rotary slasher, potato planter, groundnut digger, maize sheller, rotary tiller, boom sprayer, fertilizer spreader, axial flow pump, seed cleaner grader, hand dibbler, furrow bed/shaper planter, soil hard pan tester, bullock drawn implements, and mobile bhoosa chopper and baler.</td>
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<tr>
<td><strong>Mechanization technologies being Commercialized</strong></td>
<td>Pak seeder, PTO disk plough, vegetable planter, turmeric dryer, solar-cum- gas fired dryer, mini seed cleaner cum grader, flat bed dryer for canola, sunflower &amp; maize, date dryer, mango picking &amp; pre-cooling technology harvester and nursery raising plant, hot-water treatment plant for eradicating mango fruit fly infestation.</td>
<td>Power tiller, chain trencher, fodder cutter bar, sugarcane base cutter, pneumatic drill, rotary ditcher, ejector pump, maize cob harvester, cheaper biogas planter, vegetable nursery transplanter, groundnut sheller, rice thresher, seed-bed finisher, stubble shaver, and orchard sprayer.</td>
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RESEARCH INSTITUTIONS

Agricultural and Biological Engineering Institute (ABEI)

Former

Farm Machinery Institute (FMI)
Mission

Contribute to

- food security
- poverty reduction
- environment protection

by fostering sustainable enhancement in productivity of agricultural production resources through farm machinery

- Development/adaptation
- testing & standardization
- commercialization
MACHINE SYSTEMS ENGINEERING PROGRAM

• To design, develop and evaluate agricultural mechanization technologies especially for small holder mechanization

• To provide technical assistance to local agro-industry in commercialization and quality enhancement of agricultural mechanization technologies

• To develop precision farming technologies for optimal utilization of crop production inputs

• To undertake development activities related with agricultural machinery testing, standardization, mechanization informatics and capacity building
To develop and evaluate agro-processing technologies for cereals, legumes, and medicinal plants

To develop and evaluate technologies for processing of bio-wastes into useful products

To develop and evaluate food processing technologies in order to add value to agricultural produce

To develop image processing technologies and controls for applications in food processing

To disseminate innovative bio-processing technologies among the end users
ENERGY SYSTEMS ENGINEERING

• To design, develop and evaluate innovative energy systems engineering technologies for drying and cooling of agricultural produce

• To develop technologies for on-farm production and utilization of biomass and bio-fuels energy, and solar energy

• To conduct energy conservation studies in order to optimize energy consumption for crop production

• To disseminate innovative energy and post-harvest technologies among the end users
Agricultural and Biological Engineering Institute

History

1976  IRRI-PAK Agricultural Machinery Program
1979  Agricultural Machinery Division (Dev.)
1982  Renamed as Farm Machinery Institute
1985  Converted to Non-Development side

Facilities

- Design Office
- Machinery Testing Lab
- Prototype Workshop
ACHIEVEMENTS

Testing & Evaluation - Machines Tested

- Prototypes 25
- Commercial/Local 27
- Imported
  - Tractors 20
  - Others 35

Standardization - Standards Developed

- Farm machinery 53
- Plant protection equipment 10
- Earth moving machinery 18
ACHIEVEMENTS

**Trainings Organized for:**
- Engineers in testing & evaluation of farm machinery
- Extension Officers and farmers in operation, repair and maintenance of farm machinery

**Technical Assistance:**
- Provided to manufacturers in manufacture of FMI developed technologies

**Policy Input:**
- Input provided to Government in formulation of farm mechanization strategies for the country
Testing & Evaluation – Machines Tested

- Prototypes: 25
- Commercial/Local: 27
- Imported
  - Tractors: 20
  - Others: 35

Standardization – Standards Developed

- Farm Machinery: 53
- Plant Protection Equipment: 10
- Earth Moving Machinery: 18
RECENTLY COMPLETED RESEARCH PROJECTS

- Development of picking and pre-cooling technology for mangoes
- Adaptation and commercialization of a small scale olive oil extraction unit
- Interventions for the management of mycotoxins in maize and groundnut (Component-I: Adaptation of mobile flat-bed dryer for maize and groundnut)
- Development of milking machine for water buffaloes and indigenization of milking machine for cows
- Post Harvest process and Value Addition of Dates in Khairpur, Sindh
- Investigation of Factors Causing Low Head Rice Recovery
- Development and evaluation of a turmeric curing and drying technology
- Development of small Mango Hot Water Treatment Plant
RECENTLY COMPLETED PROJECTS

• Development and Evaluation of Power-Take-Off (PTO) Driven Disk Plow

• Up-gradation and rehabilitation of existing solar dates dryer in Khairpur, Sindh

• Development and Evaluation of a In-Bin Seed Drying, Aeration and Storage Technology

• Adaptation and commercialization of a Tractor PTO Operated Wood Chipper Shredder

• Development and Evaluation of Vegetable Planter and Transplanter

• Introduction of “Onion Autumn Crop through sets plantation” in Punjab

• Commercialization of wheat straw chopper in combine harvested wheat fields in southern Punjab
COMMERCIALIZED TECHNOLOGIES
Reaper
Units: 51000
Benefit: 103 billion

Zero tillage drill
Units: 7000
Benefit: 43 billion

Wheat straw chopper
Units: 3000
Benefit: 9 billion

Rice thresher
Units: 7000
Benefit: 33 billion

Seed processor
Units: 50
Benefit: 1.3 billion

Groundnut digger
Units: 2200
Benefit: 6 billion

Ground nut thresher
Units: 2200
Benefit: 7 billion

Planter
Units: 300
Benefit: 1 billion

Seed drill
Units: 8000
Benefit: 30 billion
Technologies Commercialized

1985: Reaper-windrower: 35,000 units
1995: Zero-till Drill: 7,000 units
2002: Wheat Straw Chopper: 5,000 units
2002: Paddy Thresher: 6,000 units
Technologies Commercialized

Fertilizer Band Placement Drill 2009 onward: 8,000 (Punjab Govt.)
Technologies Commercialized

Mobile Flat-bed Dryer

Olive Oil Extraction Unit

Milking Machine for Buffaloes

Mango Picking Machine
Technologies being Commercialized

Solar-cum-Gas Fired Dates Dryer

Mobile Seed Processing Unit

Solar House Dates Dryer

Seeder For Combined Harvested Paddy Fields
MACHINES BEING COMMERCIALIZED

Olive oil extraction unit

Milking machine
## Current Projects

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<tr>
<td>Development and Adaptation of Ispabghol Processing Technologies</td>
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<tr>
<td>Design and Development of Solar Dryer for Fruits and Vegetables</td>
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<tr>
<td>Design and Development of Sisal Decorticator</td>
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<tr>
<td>Introduction of “Onion Autumn Crop through sets plantation” in Punjab</td>
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<tr>
<td>Design and Development of Vegetables Planter</td>
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<tr>
<td>Design and Development of Kalongi and Onion Thresher</td>
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<tr>
<td>Development and adaptation of farm scale agricultural technologies for sugarcane crushing, maize Stover harvester, maize dryer, and palm oil extractor</td>
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<tr>
<td>Development of Mechanized Multipurpose Nursery Raising Facility at NARC, Islamabad</td>
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<tr>
<td>Commercialization of Dates and Banana Processing Technologies in Sindh- a SARC Funded Project</td>
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ABEI Future Vision

- Mechanization strategy formulation
- National Network of Agricultural Mechanization
- Testing Lab Accreditation
- Grain Drying & Storage
- Agro-Processing Machinery
- Livestock Mechanization
- Energy efficient & environment friendly technologies
- Mechanization Informatics
Future Research Plans:

Olive Oil Extractor
IN-BIN SEED DRYING & STORAGE TECHNOLOGY

ISSUE: A CONSIDERABLE AMOUNT OF SEED OF VARIOUS CROPS IS WASTED DURING STORAGE OF SEED

Design Capacity: **15 tons**
Moisture Content: **from 22% to 12%**
Time: **2-3 days**
Cost of drying sample/ton: **Rs 1,600**

First prototype (storage bin cum seed drying technology) unit was developed under ALP funded project
HOT WATER TREATMENT UNIT

OBJECTIVE: TO KILL FRUIT-FLY LARVAE WITHIN PULP USING HOT WATER TREATMENT 45-48°C FOR 60-75 MINUTES AND PULP TEMPERATURE AT 47.6°C

Capacity: 150 kg/batch

Price (Approx.): Rs 200,000

- Semi automatic unit based on Philippine Design was developed at ABEI, NARC Islamabad
- Demonstrated to mango growers in district Multan
TRACTOR PTO OPERATED WOOD CHIPPER SHREDDER

ISSUE: THE LOW GRADE BIOMASS WAS NOT UTILIZED EFFECTIVELY

- Identified & imported one unit of wood chipper shredder.
- Installation of hydraulic kit on MF-240 tractor for running hydraulic motors of feeding system.

Capacity: 2-3 tons/h
Chip size: 10-30 mm (adjustable)
Power required: 30 hp
Price: Rs 300,000
Developed a vegetable planter particularly for Peas and Okra.
Field evaluated this machine at farmer’s field for sowing of peas and okra.

Capacity: 0.40 ha/h
Operational Cost: Rs 2000/ha
Price (Approx): Rs 120,000
Saving: 60% seed saving
Economic benefits: Rs 30,000/ha
POWERED DISK PLOW
ISSUE: SEED BED PREPARATION FOR WHEAT IN PADDY FIELDS

• Developed powered disk plow first time in the Country.
• Field evaluation refinement is in process.

Capacity: 0.4 ha/h
Operational Cost: Rs 3000/ha
Saving: Rs 3500/ha
Price (Approx): Rs 140,000
SISAL DECORTICATOR
THANKS