

# ICAR-Central Institute of Agricultural Engineering: At a Glance

## ICAR-CIAE, Bhopal

The ICAR - Central Institute of Agricultural Engineering (CIAE), Bhopal was established on 15<sup>th</sup> February 1976 to increase the role of engineering interventions in agriculture and allied areas and accordingly it has been instrumental in mechanization of Indian agriculture since inception. Engineering interventions in production and post-production agricultural activities have contributed in enhancing productivity, reduction in cost of production, timeliness in farm operations and reduction in drudgery and thus the modernization of Indian agriculture. Precision farming, automation of unit operations, applications of sensors, machine learning, artificial intelligence, internet of things and robotics in agriculture, autonomous farm vehicles, smart packaging, mobile based applications for agriculture machinery, smart irrigation and storage management are some of the areas that CIAE aspire to put its thrust in the development of indigenous, cost effective, faster and reliable tools, machinery and applications for the prosperity of farmers and agri-businesses.



## Contribution of CIAE in Agricultural Mechanization

The Institute is mainly engaged in R&D and extension activities, for accelerating the pace of agricultural mechanization, with the objective of increasing productivity, per unit time and per unit input for all farm operations ranging from land preparation to harvesting, threshing and post-harvest management. During nearly 5 decades of its existence, more than 500 farm tools, gadgets, implements, equipment and machinery of varying capacity, from manual to animal and power operated have been developed of which more than 180 have been commercialized. The major objective of developing these equipment and machinery has been to introduce and promote mechanization in Indian agriculture which was mainly primitive and using inefficient manual and bullock operated tools and implements. These improved farm machines have contributed in enhancing farm mechanization level in the country to 47%. Many of the developed equipment have been multiplied by the Institute's Prototype Manufacturing unit and more than 40,000 prototypes have been supplied for prototype feasibility testing and frontline demonstration. The CIAE has a strong linkage with State Development, agricultural engineering and farm machinery industries for commercial exploitation of developed technologies. More than 5,000 entrepreneurs and 1,00,000 farmers have directly availed training and technology from the CIAE. State Agro-Industries Development Corporation of Madhya Pradesh, Maharashtra, Rajasthan, Odisha, Gujarat and Uttar Pradesh are already manufacturing machinery developed by CIAE.

The development of improved tools, equipment and machines for mechanization of pre and post-production operations and their large-scale adoption by farmers/producers has brought a sea change in their economic status through saving of time and inputs, larger coverage area, efficient timely operations for next crop and add value to farm produce. Also, mechanization has helped to diversify into fruits and vegetable production, dairying and in many cases fishery. Many equipment designed and developed by the Institute and AICRPs have helped in utilizing bio-waste (animal dung, crop residues etc.) for producing bio-energy and helping in clean and green energy. It has been observed that wherever mechanization has been adopted, the farmers have gained economically. The input cost in production agriculture has been reduced by 20-30% with proven improved farm machinery.

## Major outputs of the Institute during last 10 years

Particulars of Output	Achievements	Particulars of Output	Achievements
Technologies Developed (machinery, process technology)	156	Skill Development programmes under PMKVY	10 (210*)
Technology commercialized	120 (103*)	Patents filed	59
Technology Incubation	11	Patents granted	18
Start Ups promoted	125	Copyright registration granted	11
Research articles in peer reviewed Journals	702	Memorandum of Understanding (MOU)	41
Entrepreneurship Development Programmes Organized (beneficiaries)	128 (2532*)	Commercial Testing of Agricultural Machinery (test reports released)	1481



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Particulars of Output	Achievements	Particulars of Output	Achievements
International Training Programmes organized (beneficiaries)	7 (61*)	Prototype supplied	42,893
ICAR sponsored Summer School/ Winter School/ Short Course/ CAFT organized	32 (514*)	Awards received	28
Model Training Courses, sponsored by DoAC & FW, Government of India	6 (118*)	Revenue generation (Rs. in lakh)	1481

(\* No. of Beneficiaries)

### CIAE can offer

In order to foster strong links with academia, industry and other stakeholders for collaborative research, technology transfer, and specialized human resource development, services offered to industrial partners, government organizations, and other agencies in niche areas are:

- Design, development, testing and commercialization of farm equipment for different crops, farm sizes and agro-climatic conditions; processing technologies for different crops and scale of operation; solar and bio-energy based gadgets, rainwater harvesting and on-farm water management practices.
- AI, IoT, Robotics, sensors and mechatronics based technologies for pre and post-harvest precision agriculture
- Man-machine-environment concept including gender issues in development of agricultural machines leading to increased efficiency, human comfort and safety in agricultural operations.
- Manufacturing technology and large scale prototype production to make quality machines available for demonstration and feedback for refinement.
- Application of computers in design, simulation, analysis and presentation of data for increased efficacy of research in the field of agriculture in general and agricultural engineering in particular.
- Improved hand tools, animal, power tiller, tractor drawn and self-propelled agricultural machinery.
- Post-harvest technology, agro-processing and food technology package for promotion of agri-business.
- Technology for Integrated energy management and renewable energy appliances.
- Technology refinement, up-scaling and commercialization.
- Skill up-gradation and support for manufacturers/entrepreneurs in CAD/CAM and manufacturing technology.
- Scientific support to manufacturers/entrepreneurs in technology development based on their own novel ideas.
- Sharing R & D facilities for research collaborations.
- Quality evaluation and testing of equipment (machineries)/products.
- Consultancy and contractual research/IPR issues.
- Training in design, testing, manufacturing, operation and management of agricultural machinery.
- Vocational training to farmers, farm women, rural youths and village artisans for self-employment.
- Training to Researchers Extension Functionaries and Subject Matter Specialists on various aspects of mechanization.
- International Training programmes for foreign nationals in the area of agricultural engineering.



### Strengths of CIAE

- Highly qualified and experienced scientists from various disciplines to address inter-disciplinary research
- Well-developed laboratories for high quality research in the field of agricultural mechanization for crop production, processing & value-addition, renewable energy and irrigation water management.
- Computer Aided Design facilities for design of agricultural machinery.
- Training facilities for manufacturers and village artisans for manufacturing promotion.
- Liaisoning with manufacturers and allied agro-industries
- Experience in consultancy projects.
- Network of 54 cooperating centres of AICRPs in all agro-climatic regions of the country.
- Prototype Production Centre with modern workshop machine tools to undertake manufacturing of proven agricultural machines for multi-location evaluation.
- Well-equipped Instrumentation cell.
- Experimental farm of 40 ha area with 4 water harvesting ponds.
- The Soybean Processing Unit is the only centre of its kind in Asia with specialized facilities for soybean processing.
- Centre of Excellence on Agri-electronics and Automation in Agriculture for promoting Robotics, UMV etc.
- Close linkages with Agro-Industries, Machinery Manufacturers, other R & D organizations, International Organizations, States Departments, DOAC & FW (M&T) and other associated ministries.
- State of the art Library with over 131 Journals, 4721 bounded journals and 12,000 books.

## Divisions and their Activities

Divisions	Activities
<b>AMD</b> -Agricultural Mechanization Division	Technology and machinery development for tillage, seeding, interculture, plant protection, harvesting and threshing operations for cereals, oilseeds, pulses, horticultural crops and also on specialized technologies for conservation agriculture, precision farming.
<b>APPD</b> -Agricultural Produce Processing Division	R&D on post-harvest operations by evolving technologies and development of appropriate machinery for processing, value addition and loss reduction for major crop commodities.
<b>AEP</b> -Agricultural Energy and Power	R&D on various issues of efficient utilization of energy, crop residue management, bio-fuels, application of renewable energy technologies for rural Industries and households for various environment friendly on-farm and off-farm uses.
<b>IDED</b> -Irrigation and Drainage Engineering	Undertakes studies on development of technologies for efficient irrigation and drainage, testing and evaluation of sprinkler and drippers. It also undertakes hydrological studies to recharge ground water, soil and water conservation.
<b>CESPU</b> -Centre of Excellence for Soybean Processing & Utilization	Dedicated to promote and develop equipment and technologies for processing and value addition of soybean. The use of by-products as well as microbes through genome editing for development of food products is being attempted at the center, for tapping its true potential as a source of protein.
<b>CEAAA</b> -Centre of Excellence on Agri-Electronics and Automation in Agriculture	This focuses on developing and promoting advanced technologies such as IoT, sensors, robotics, and automation for enhancing productivity and efficiency in farming. It serves as a hub for research, innovation, and skill development in smart and precision agriculture.
<b>TTD</b> -Technology Transfer Centre	The main focus of the centre is popularization and commercialization of ICAR-CIAE developed technologies, through industrial liasioning, capacity building of stakeholders including entrepreneurship development, business incubation and IPR management.
<b>KVK</b> -Krishi Vigyan Kendra, Bhopal	The KVK is committed to bridge the gap between the technology developed at the research institutions and its adoption at the field level by the farmers through on farm research, technology assessment, refinement and transfer through demonstration of technology/products etc. It also conducts training of farmers, rural youths and extension personnel and thus, serving as the light house for overall rural development in the district.
<b>RS</b> -Regional Station, Coimbatore (TN)	Regional Station (RS), located at Coimbatore has been carrying out R & D agro industrial extension activities for the past three decades and successfully fulfilling refinement and adoption of mechanization technologies, product improvement and transfer of technology to manufacturers in the southern states of India.

### All India Coordinated Research Projects (AICRPs) and their Activities

Four All India Coordinated Research Projects are being coordinated from CIAE.

#### **AICRP on Farm Implements & Machinery (FIM)**

The mandate of this AICRP is to conduct research and development on farm implements and machinery for different agro-climatic regions of the country, prototype production, feasibility testing and promotion of manufacturing through industrial extension and introduction and popularization of improved farm equipment.

#### **AICRP on Energy for Agriculture and Agro-based Industries (EAAI)**

This AICRP is mandated for coordinating research, development and pilot level field trials in appropriate technology of renewable energy source viz., solar energy and biomass based gaseous, liquid and solid fuels for their appropriate applications for production agriculture, post-harvest operations, animal raising and rural living, singly or in combination with conventional and other new and renewable energy sources.

#### **AICRP on Mechanization of Animal Husbandry (MAH)**

This AICRP is coordinating research and development addressing different aspects of animal energy utilization which includes use of various breeds of animals for operating machinery for crop production, processing, electricity generation and water lifting etc.

#### **AICRP on Ergonomics and Safety in Agriculture and Allied Sector (ESA)**

The mandate of this AICRP is to create database on ergonomical parameters of Indian agricultural workers and to develop/adapt the equipment/technology/work system for increasing production, reducing drudgery and minimizing accidents in agricultural and allied activities through application of ergonomics. This AICRP also addresses the gender related technological issues.

#### **CRP on Engineering Intervention in Precision Farming (PF) and Micro Irrigation Systems**

The mandates of this CRP are

- Engineering interventions for precise application of agricultural inputs for sustainable agricultural production system under open and protected cultivation.
- Mechanized installation and trouble free operation of micro-irrigation systems with higher production and productivity through engineering interventions in agriculture and horticulture crops under the open and protected cultivation.

## CRP on Energy from Agriculture

The mandate of this CRP is to facilitate basic and strategic research on cutting edge renewable energy technologies for generation, conversion, utilization and promotion of bio-based and solar photo-voltaic energy.

### **Laboratories & Research Facilities**

ICAR-CIAE has built great wealth of modern scientific research facilities and equipment for scientists and researchers of the Institute and those from other R & D Institutes and universities. Hi-tech analytical equipment and instrumentation systems are integral part of the state-of-the-art scientific research facilities as these help in accurate measurement, analysis and processing. All Laboratories are well equipped with a broad range of instruments to provide precision measurement capabilities.

Laboratory	Facilities available	
<b>Tillage and Soil Dynamics Laboratory</b>	A state-of-the-art soil bin system is available for R&D studies on soil-tool interaction, tool-design optimization and research on soil-tillage. This facility will help Industries and researchers for testing of their products under controlled conditions for design improvements. Performance parameters are measured by high accuracy sensors and the universal data acquisition system.	
<b>Seeding and Planting Laboratory</b>	Instrumented sticky belt system to study seed metering mechanisms for design optimization of metering mechanism of seed drills, seed cum fertilizer drill and planters to assist researchers and manufacturers for development and testing of their prototypes under simulated conditions.	
<b>Plant Protection Equipment Laboratory</b>	This facility is equipped with test rig for testing of nozzles and their spray pattern under simulated conditions. The laboratory is used for design optimization of components of sprayers and laboratory studies on efficiency of commercial designs of sprayers for their design refinement.	
<b>Precision Farming Laboratory</b>	Advance facilities to support applied research in the field of precision farming. Sophisticated sensors, high performance computation power and software programs, as well as various radiometers, calibration equipment, ecosystem measurement instrumentation and controllers etc. are available to facilitate research leading to smart automation in agriculture. The laboratory also has imaging set ups for normal RGB imaging, microscope equipped with digital imaging capabilities and hyperspectral cameras of different range of wavelengths (400 to 1000 nm and 900 to 1700 nm).	
<b>Ergonomics Laboratory</b>	It helps to conduct scientific studies on man-machine compatibility, ergonomic design of agricultural equipment for their safe and comfortable operation, development of safety gadgets for minimization of agricultural accidents and collection of anthropometric data of Indian male and female workers.	
<b>Drone Systems Laboratory</b>	The laboratory is equipped with cutting edge instruments, simulation platform, patternator and drone system with spraying, broadcasting, and RGB-multi spectral camera to conduct basic studies, design, and testing of drone technologies, to enhance the capabilities and potential of drones for applications in agriculture.	
<b>Fruit and Vegetable Processing Laboratory</b>	The laboratory is equipped with the system for processing of horticultural crops. It has plant/machinery for washing, disinfection treatment (ozone treatment, UV-C treatment), sorting/grading (physical as well as machine vision-based), cutting, peeling, carbonation, drying, packaging and storage of fruits and vegetables, and fruit ripening chamber.	

## Laboratory

## Facilities available

### Grain Processing Laboratory

There are laboratory scale facilities for cleaning and grading of food-grains, different types of drying, dehulling and polishing of rice, decortication of groundnut, milling and flaking of millets, dal mills, oil expellers (mustard, peanut, soybean etc.), grinders and miscellaneous primary processing equipment for various agricultural commodities.



### Engineering Properties Laboratory

For determination of various engineering properties of food material from plant or animal origin. The laboratory has the state of the art instrumentation capable of generating data of internationally accepted standards. Major instruments available in this laboratory are Hunter lab colorimeter/spectrophotometer, Texture analyzer, Instron UTM, Rheometer and Particle size analyzer.



### Storage Engineering Laboratory

It has been developed for augmenting the post-graduate and faculty research in the area of storage of biological materials. Equipment/instruments are available for shelf life evaluation, oxidative stability, microbial (bacteria, fungi), insect growth and other similar studies includes autoclave, sonicator, homogenizer, double distillation unit, micro balances, sensors and e-nose etc.



### Food Engineering Laboratory

This laboratory has the facilities for different food engineering operations. Instruments/setup such as spray dryer, freeze dryer, membrane separation unit, ball mill, head space analyzer, ultrasonication probe unit, moisture meter and water bath are available for research work.



### Microbiology Laboratory

Nutritional quality, quantity and the health benefits of cereals, pulses, oilseeds, millets, fruits, vegetables, medicinal plants and their food products are assessed and estimated in this laboratory, through micro-biological analysis.



### Biochemistry Laboratory

It facilitates bio chemical analysis of food samples, including nutritional and anti-nutritional profiling. Instruments such as gas chromatograph, UV-VIS spectro photometer, kjeldhal apparatus, soxhlet apparatus, fiber analysis apparatus, trans-illuminator, orbital shaker, centrifuges, electro phoresis units, hot air ovens, gel dryer, water bath, etc. are installed in the lab.



### Soybean Processing Pilot Plant

Production and demonstration of soy milk, TOFU and various other soybean products such as soybean full-fat flour, soy ice cream, and soy biscuits are offered to various training groups. Other soybean processing machinery like vacuum packaging units, hot air dryers, soybean dehuller, heavy duty centrifuge, extrusion expelling unit, enrobing machine etc. are available in the pilot plant.



### Farm Power cum Solar Energy Lab

It has facilities of solar photovoltaic systems, testing of solar panels efficiency, solar power plant and characterization of solar panel/cell and maintenance of the system.



Laboratory	Facilities available	
<b>Bio-Fuel Laboratory</b>	It facilitates the study of various biomass based solid, liquid and gaseous fuels as a sustainable and green source of energy. The lab has a batch production facility for bio-diesel @ 50 l/batch, an in-house development.	
<b>Energy Enclave</b>	Live demonstration and outdoor experimentation on biomass gasification, charring and briquetting technology, biogas generation, solid state biodigester, water scrubber for removal of CO <sub>2</sub> from biogas/producer gas, PV system, solar dryer, solar cookers and solar cold storage and water heating system.	
<b>Irrigation &amp; Drainage Laboratory</b>	Test set up for hydraulic performance evaluation, Indoor testing set up for micro sprinklers, Pressure plate extractors (5 & 15 bar), Outdoor pump test rig for testing non-electric mono-bloc centrifugal pump sets, SSD systems with automated water measuring and pumping system.	
<b>Food Testing Laboratory</b>	The Food Testing Laboratory (FTL) of ICAR-CIAE, Bhopal, is a multidisciplinary facility accredited by NABL (Certificate No. TC-12647) as per ISO/IEC 17025:2017 for chemical testing of food samples. This accreditation affirms the laboratory's adherence to international quality and technical standards, ensuring accurate, reliable, and credible results in food testing.	

## Central Units

Unit	Activities
<b>Agricultural Knowledge Management Unit</b>	The unit helps in research activities related to IT, development of software applications to meet the requirements of the Institute, management of database on different disciplines of agricultural engineering and training to CIAE staff and students on Computer Applications and IT related subjects. Training and support on use and softwares for statistical data analysis, word processing, preparation of presentations, etc are also provided by the unit.
<b>CAD Cell</b>	The Computer Aided Design Cell of the Institute is equipped with Design and Analysis facilities and experienced faculty for imparting training. Customized training programmes are organized for scientists, research engineers and students on use of CAD in designing agricultural machinery. Large format plotter and printers are available for creation of high quality design documentation.
<b>PG Cell</b>	An outreach centre graduate school, IARI, New Delhi conducts post graduate studies in Agricultural Engineering. Presently 46 PG scholars of Agricultural Engineering under different disciplines are registered at ICAR-CIAE, Bhopal completing their course and research work.
<b>Research Workshop and Prototype Production Centre</b>	Two workshops; one for Research and other for Prototype Production. The RW is for fabrication of new designs of research prototypes and setups and the PPC is meant for batch production of prototypes for multi-location trials, pilot introduction and to meet the demand of users to a limited extent. Both workshops are well equipped with modern machines for machining, welding, grinding, press work, cutting and shearing, tools and die making, heat treatment and painting for fabrication and training of manufacturers and artisans.



### **Vision**

*The vision of ICAR-CIAE, Bhopal is "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**

*The institute is mandated to undertake*

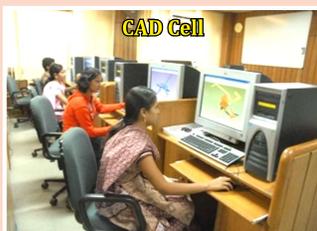
- Basic, adaptive and applied research on farm mechanisation, post-harvest food processing & value addition, irrigation & drainage engineering and energy management in agriculture.*
- Human resource development and capacity building through outreach and training programs, commercialization and utilization of agricultural engineering technologies.*

## Central units

Unit	Activities
Agro Processing Centre (APC)	It is a model set-up which can be emulated at village level for primary and secondary processing of farm produces. It has graders, cleaners, flour mill, flour sifter, dal mill, pulverisers, packaging machines, storage silos, etc. Hands-on training is provided to the interested stakeholders for a live experience of running a processing centre.
Meteorological Observatory	Agro meteorological observatory of the Institute is located at 77°24'10"E longitude and 23°18'35"N latitude at an elevation of 498.7 m from mean sea level. Rainfall, min and max temperature, relative humidity, pan evaporation, wind velocity and Bright Sun Shine (BSS) are measured on regular basis and used in various studies.
Library	A state-of-art Library having a collection of books on Agricultural Engineering and its allied subjects, to serve the needs of Scientists and other research personnel and students. The foreign and national periodicals are subscribed to keep track of the current scientific/ technical developments. Besides, volumes of bound journals, bulletins, thesis, BIS Standards, CD-ROMs, and reprints, database/literature search facility is available.
Research Farm	Total land area of the Institute is 94 ha, having crop cultivation in 27 ha, Orchards in 11.5 ha and Water harvesting ponds in 10.5 ha area. The farm is managed by Farm Production & Field Research Management Section.
International Training Centre (ITC)	The ITC has 12 air conditioned double bedded rooms with in-built wardrobes. Each room has multi channel TV and Internet connectivity. Exclusive conference hall and dining hall in the centre provide an excellent ambience for the conduct of international conference and training with all basic comforts and service.
Guest House	The Institute has a well-furnished Guest House and a Trainees Hostel. The guest house has 8 VIP and 20 double bedded rooms to accommodate 48 guests. Every room has attached bathroom. A 24x7 broadband internet facility is also available to the Guests.



Library



CAD Cell



Agro Processing Centre



Prototype Production Centre



Guest House



ITC



Research Workshop



Research Farm

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## 1. Tillage & Sowing-Planting-Transplanting

### T/O Trencher For Laying Sub-surface Drainage Pipe

Suitable for making trenches and laying drainage pipe simultaneously to address waterlogging and salinity issues in vertisols and salt-affected lands.

**Capacity of pipe laying : 250-350 m/h**  
**Trench Depth, m : 1-1.1,**  
**Trench Width, mm: 150-160**  
**Power Source : Tractor (60-75 hp)**



### T/O Mole Plough

It is used for making moles at depth of about 60 cm. These moles function as pipeless drains to drain water in water logged soils.

**Capacity : 0.14-0.42 ha/h holes/h**  
**Power Source : Tractor (60-75 hp)**



### T/O Peg Type Puddler

Useful for breaking the soil clods into soil particles in order to prepare homogenized puddle tilth for mechanized paddy transplanting. Improves puddling in combination with cage wheels.

**Capacity : 0.40 ha/h**  
**Power Source : Tractor (35-45 hp)**



### Power Tiller Drawn Auger Digger

To dig holes of 45-60 cm depth and 30 cm diameter for planting saplings.

**Capacity: 40-50 holes/h**  
**Power Source: Power Tiller (8-10 hp)**



### T/O Drum Type Pneumatic Planter

Suitable for precision planting of seeds of crops such as cotton, maize, groundnut, grams, pigeon pea, soybean, rice and other small seeds.

**Field Capacity – 0.4 ha/h**  
**Power Source : Tractor (35-45 hp)**



### T/O Drip Lateral And Plastic Mulch Layer Cum-Planter

It performs raised bed formation, drip lateral and plastic mulch laying, and planting of metered seed in plastic mulch in a single pass of the tractor.

**Field capacity: 0.2 ha/h**  
**Power Source : Tractor (35-45 hp)**



### T/O Pre-emergence Herbicide Strip Applicator-Cum-Planter

This tractor drawn machine is equipped with pre-emergence herbicide applicator. It plants seed, drills fertilizer and sprays herbicide strip across the planted rows simultaneously.

**Field capacity- 0.4 ha / h,**  
**Power Source : Tractor (35-45 hp)**



### T/O Raised Bed Former Cum Onion Bulb Planter Multiplier Onion

Suitable to make raised beds, lay drip irrigation lines, and plant onion bulbs simultaneously, streamlining the onion cultivation process.

**Field Capacity – 0.4 ha/h**  
**Power Source : Tractor (35-45 hp)**



### T/O Garlic Dibbler For Raised Beds

Suitable for dibbling of garlic cloves on broad raised beds, with precise seed placement at uniform depth. Integrated with levelling and depth control systems to ensure consistent sowing quality.

**Field capacity: 0.2 ha/h**  
**Power Source : Tractor (35-45 hp)**



### T/O Planter With Fertilizer Drill (Inclined Plate Type/Vertical Plate Type)

It is a light weight power tiller operated six row planter with fertilizer drill Low ground clearance for effective sowing of millets/multi-crop such as sorghum, wheat, maize etc. and (vertical plate type).

**Field capacity – 0.42 ha / h**  
**Power Source : Power Tiller or Tractor**



### T/O Transplanter for Sugarcane Bud Seedlings

It is two row transplanter for sugarcane bud seedlings raised in portrays. Bud chip/single bud technology to save cost towards seed material. Only 1-1.5 t/ha seed material and the remaining cane can be sent for milling/jiggery making.

**Field capacity – 0.15-0.20 ha/h.**  
**Power Source : 35-40 HP Tractor**



### T/O Pneumatic Planter

To plant single seed at predetermined seed to seed and row to row spacing. Suitable for mustard, sorghum, soybean, cotton pea, groundnut, okra etc.

**Field Capacity : 0.5-1.0 ha/h**  
**Power Source : Tractor (35-45 hp)**



# 1. Tillage & Sowing-Planting-Transplanting

## T/O Inclined Plate Planter

For planting maize, groundnut, gram, soybean, mustard etc. Row to row distance can be varied and planting of different seeds in different rows is possible.

**Field Capacity : 0.45-0.65 ha/h**

**Power Source : Tractor (35 hp or above)**



## T/O Precision Plot Drill

Designed for Bio-Scientist for research trials. It is used for precision drilling of seeds in experimental plot. Prevents interplot material mixing and seed damage.

**Field Capacity: 1.0 plot/min (5mx18m)**

**Power Source : Tractor (35 hp or above)**



## Power Tiller Seed cum Fertilizer Drill

For sowing seeds of wheat soybean, bengal gram, sorghum etc. in medium and heavy soil.

**Field Capacity : 0.20-0.25 ha/h**

**Power Source : Power Tiller (8-10 hp)**



## B/D Planter With Fertilizer Drill (inclined Plate Type & Vertical Plate Type)

A 3-row inclined plate type planter with fertilizer drill. Low ground clearance and suitable for planting of multi- crops such as millets, jute, carrot, gram etc and drills fertilizer simultaneously.

**Field Capacity - 0.12 ha / h,**

**Power Source : A pair of Bullocks**



## Animal Drawn Puddlers

Patela Puddler and Lug Wheel Puddler for shallow puddling with higher mechanical dispersion of soil.

**Field Capacity : 0.10 ha/h**

**Power Source : A pair of Bullocks**



## 3-Row Seed cum Fertilizer Drill

For sowing crops like wheat, gram, sorghum, lentil, pea, sunflower etc. and drilling fertilizer in black soil under rainfed conditions for medium size bullocks.

**Field Capacity : 0.08-0.12 ha/h**

**Power Source : A pair of Bullocks**



## Paddy Drum Seeder

For sowing pre-germinated paddy seeds in puddled field. Light in weight and hence can be easily operated. Available in 4 and 8-row sizes.

**Field Capacity : Upto 0.1 ha/h**

**Power Source : One Person**



## Vegetable Transplanter (Single and Two Row)

It is a hand held single or two row device for transplanting of plug/pot type seedlings on ridges / raised beds/plastic mulch.

Capacity - Single Row: 12-15 seeding/min, 2-

**Row: 20-22 seeding/min**

**Power Source : One Person**



## 2. Weeding / Plant Protection

### T/O Garlic Weeder for Raised Beds

Suitable for mechanical weed control in garlic crop cultivated on raised beds.

**Field capacity: 0.18 ha/h**

**Power Source : Tractor (35-45 hp)**



### Self-Propelled Onion Weeder

Suitable for weeding in closely spaced onion crop. This self-propelled weeder features four spring-tyne weeding units spaced at 150 mm and powered by a 1.5 hp petrol engine.

**Field capacity: 0.06 ha/h**

**Power Source : 1.5 hp Petrol Engine**



### T/O Side Trencher for Grape Orchards

Suitable for trench making near grapevines in two grapevine rows simultaneously. Features adjustable trench width and depth to suit various plant row spacing.

**Field Capacity: 0.2 ha/h**

**Power Source : Tractor (35-45 hp)**



### Self-Propelled Power Weeder

For weeding in crops sown in rows. Sweeps can be adjusted as per crops spacing.

**Field Capacity : 0.1-0.15 ha/h**

**Power Source : 3.5 hp petrol engine**



## 2. Weeding / Plant Protection

### Small T/O Boom Sprayer for Field and Orchard Crops

Suitable for pesticide spraying in diverse crop protection applications, using hollow cone nozzles to deliver controlled droplet sizes for effective weed and pest management.

**Field capacity: 1.45 ha/h**  
**Power Source : Tractor (15-20 hp)**



### Induction Based Air Assisted Electrostatic Sprayer

This machine enhances pesticide application efficiency and thereby minimizes pesticide use, pollution, and fuel consumption.

**Field capacity : 0.084 ha/h**  
**Power Source : 1 hp petrol engine**



### Small T/O EPN Applicator for Sugarcane Whitegrub Management

Suitable for precise field application of entomopathogenic nematodes in sugarcane, enabling effective white grub control, uniform coverage, and reduced reliance on chemical pesticides.

**Field capacity: 0.18 ha**  
**Power Source : Tractor (15-20 hp)**



### T/O Side Trencher-cum-FYM Applicator for Grapes Orchard

A side trencher-cum-FYM applicator having one tonne capacity can do trenching and place FYM on either side of plant rows, simultaneously.

**Field Efficiency, %: 80**  
**Power Source : Tractor (35-45 hp)**



### Twin Wheel Weeder

For weeding and interculture operations between crop rows in dry fields.

**Field Capacity : 0.01 ha/h**  
**Power Source : One Person**



### Cono Weeder

For weeding and interculture operations between crop rows in paddy fields.

**Field Capacity : 0.01 ha/h**  
**Power Source : One Person**



## 3. Harvesting & Threshing

### T/O Bunch Field Crop Harvester

Suitable for harvesting of bunch-type crops (Soybean, Gram etc), integrating cutting and conveying to reduce losses, save straw, and improve efficiency.

**Field capacity – 0.25 ha/h**  
**Power Source : Tractor (35-45 hp)**



### T/O Garlic Harvester For Raised Beds

Suitable for harvesting garlic crops grown on raised beds (150 mm height, 1200 mm top width, and 300 mm furrow width).

**Field capacity: 0.21 ha/h**  
**Power Source : Tractor (35-45 hp)**



### Small Tractor Mounted Hydraulic Pruner

Small tractor-mounted hydraulic pruner to overcome limitations of manual and small power tools in orchard pruning, enhancing efficiency and reducing labour. For canopies up to 3.5 m height.

**Field Capacity: 0.24 ha/h**  
**Power Source : Tractor (35-45 hp)**



### Multipurpose Hydraulic Platform For Orchard Operations

A self-propelled machine for harvesting, pruning, spraying and canopy management operations in orchards, for trees up to a height of 6m.

**Load carrying capacity: 200 kg.**  
**Power Source : 12 hp petrol engine**



### 3. Harvesting & Threshing

#### T/O Cotton Stalk Puller

Facilitates efficient uprooting and disposing of deep-rooted cotton stalks after harvest, across different planting systems.



**Field capacity: 0.08 - 0.12 ha/h**  
**Power Source : Tractor (35-45 hp)**



#### Self-Propelled Vertical Conveyor Reaper (Walk behind type)

The self-propelled vertical conveyor reaper, also known as walk behind type reaper is suitable for harvesting and windrowing, wheat, paddy and soybean.



**Field Capacity : 0.20-0.25 ha/h**  
**Power Source : 5 hp diesel engine**



#### T/O Groundnut Digger

For digging out groundnut plants from the soil specially in black soil. Groundnut pods along with plants are exposed over the soil by operation of this machine.



**Field Capacity : 0.40 ha/h**  
**Power Source : Tractor (35 hp or above)**



#### B/D Groundnut-cum-Potato Digger

For digging groundnut and potato and exposing them on soil surface. Can also be used for secondary tillage operation (harrowing).



**Field Capacity : 0.05-0.08 ha/h**  
**Power Source : A pair of Bullocks**



#### Motorized Multi Millet Thresher

A electric motor operated thresher for threshing and dehulling of all minor millets viz., foxtail millet, millet, kodo millet, proso millet and barnyard millet.



Threshing capacity- 80-120 kg/h, Dehulling Capacity- 15-40 kg/h  
**Power Source : 3 hp electric motor**



#### Plot Thresher

Designed for breeder scientists to thresh samples of research plots of wheat, gram, soybean etc. for precise calculation of plot yield. Can be used for seed purpose too, as injury to seed is almost nil.



**Capacity: 10-25 kg/h**  
**Power Source : 1 hp electric motor**



#### Motorized Sugarcane Single Bud Cutting Machine

Designed for precise cutting of uniform single-bud sugarcane setts, enhancing seed health and multiplication efficiency. It facilitates uniform plant population establishment, leading to improved and sustainable crop yields.

**Capacity (single bud setts)- 7,200 per hour, Power Source-1.5 kW electric motor**



The banner features a central text 'ICAR-CIAE Mechanizing Every Stage of Farming' in a stylized font. Above the text are icons for a combine harvester, a laboratory flask with a thermometer, a tractor, a sun, and a drone. The background is a lush green field of crops under a blue sky.

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## 3 in 1 Cashewnut Separator, Pulp Extractor and Fibrous Material Separating Machine

This machine facilitates separation of raw cashew nuts from the cashew apple, extraction of juice and pulp along with separation of fibrous material, and high-capacity continuous feeding for enhanced output.

**Capacity: 275-300 kg/h, Separation efficiency > 99 %**  
**Power Source: 7.5 hp electric motor**



## Equipment and Chemical Free Process Technology for Production of Grape Raisin

It includes a grape de-bunching machine to separate intact grape berries, abrasive pre-treatment equipment to remove waxy layer from grape surface, drying protocol for grapes, packing and storage of raisins.

**Capacity: 150 kg/h (de-bunching machine) : 135-150 kg/h (abrasive pre-treatment equipment)**  
**Power Source: 1 hp electric motor**



## Tobacco Leaves Stringing Machine

It is FCV tobacco leaves stringing machine suitable for uniform and secure stitching of tobacco leaves.

**Capacity : 100 leaves/stick (4kg)**  
**Stitching time: 20s/stick**  
**Power Source: 0..5 hp electric motor**



## Soy Paneer Plant

To cook and grind soybean to make soy milk and soy paneer.

**Capacity : 300 Lt milk or 50 kg paneer per day (8h)**  
**Power Source : Cooking Gas/Kerosene Stove and 2 hp Electric Motor**



## Dal Mill

For making dal from tur/arhar (Pigeon Pea) at cottage level. Can also be used for other pulses such as black gram, green gram and lentil.

**Capacity : 100 kg/h**  
**Power Source : Electric Motor 2 hp three phase**



## Millet Mill

Efficient for dehulling of all small millets like foxtail millet, little millet, kodo millet, proso millet, barnyard millet in a single machine.

**Capacity : 100 kg/h, Dehulling efficiency: > 90%**  
**Power Source: 1 hp electric motor**



## Continuous Feed Banana Fibre Extraction Equipment

It is a power-operated machine that extracts fibre from banana pseudostems by removing non- fibrous tissues using a controlled mechanical process.

**Capacity: 175-200 kg/h (Throughput)**  
**Power Source: 5 hp electric motor**



## Multiple Feed Banana Fibre Extraction Equipment

Suitable for extracting fibre from stems of banana.

**Capacity: 23 kg/h on wet basis & 3.5 kg/h on dry weight basis.**  
**Power Source: 2 hp electric motor**



## Pedal cum Power Grain Cleaner cum Grader

Can be operated manually or with electric motor, for cleaning and grading of selected grains using suitable matching sieves with high capacity and reduced drudgery.

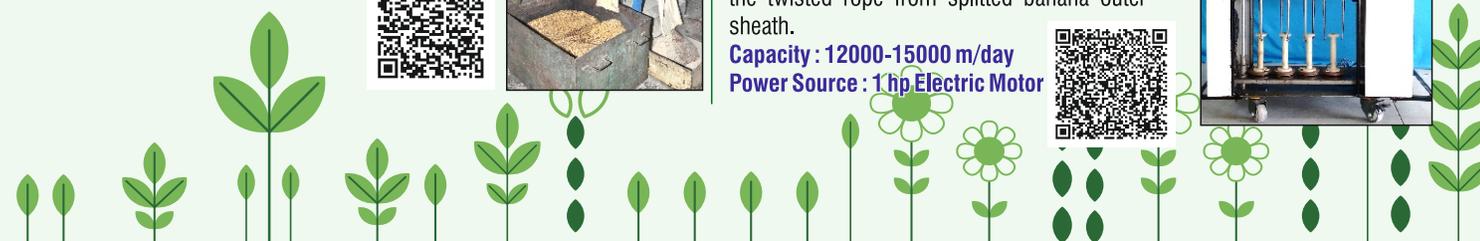
**Capacity : 180-900 kg/h**  
**Power Source : Manual or 0.5 hp Electric Motor**



## Package for Rope Making from Outer Sheath of Banana Pseudo Stem

Ropes from outer sheath of banana pseudostem are in high demand for different applications. The package of equipment consists of equipment for splitting the outer sheath and a twisting equipment for obtaining the twisted rope from splitted banana outer sheath.

**Capacity : 12000-15000 m/day**  
**Power Source : 1 hp Electric Motor**



## Motorized Soybean Dehuller

To remove outer hull of soybean to make soy splits.

**Capacity : 80 kg/h**

**Power Source : 1 hp Electric Motor**



## Arecanut Sheath Shredder

For converting dry arecanut sheath into small pieces which has been found to be a good alternative as fodder for the cattle.

**Capacity : 130 kg/h**

**Power Source : 3 hp electric motor**



## Double Screen Grain Cleaner with Sack Holder

For cleaning and grading of selected grains using suitable matching sieves and sack holder to hold sack while transferring clean grain with reduced drudgery.

**Capacity : 150-225 kg/h**

**Power Source : One Person**



## Fruit Ripening Chamber

Suitable for ripening of fruits like banana, mango and papaya using ethylene gas under controlled conditions of temperature and relative humidity.

**Power source : 1.5 kW, Electrical Power**

**Capacity, tonne of fruits/ batch : 1 (in 4-5 days)**



## Modular Onion Storage Structure (Model-II)

Suitable to store the onions during rainy season. The multiple units of the structure needs to be arranged in a array with single air blowing station for scaling-up the system up to any capacity. The unit is rectangular in shape and having two cages of the storage unit each having 1200 mm of height placed one above the other.

**Power source : 1hp, Electrical Power**

**Storage Capacity, tonne : 3**



## Diverging Belt Fruit Grader

For grading of spherical fruits/vegetables such as tomato, onion, apple, guava, amla, citrus etc. in 4 grades.

**Capacity- 1.0-1.5 ton of fruit /h,**

**Power Source-0.5 hp electric motor**

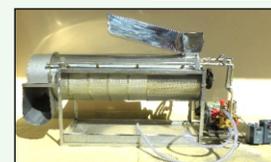


## Abrasive Peeling Machine for Medicinal Tuber Crops

For removal of peels from medicinal tuber crops such as Safed Musli and Shatavari. Peeling efficiency of approximately 95% for Safed Musli and 55% for Shatavari.

**Capacity: 18-20 kg/h**

**Power Source: 3 hp electric motor**



## Groundnut Decorticator (Standing Type & Sitting Type)

For shelling/separating dry groundnut kernels from pods for use as seed/food purpose.

**Capacity : 40-60 kg/h (Standing)**

**30-35 kg/h (Sitting)**

**Power Source : One Person**



## Modular Onion Storage Structure (Model-I)

Suitable to store rabi harvest of the onion during rainy season. It is foldable and modular in nature and made from light weight, corrosion and UV resistant FRP material. The storage unit is equipped with sensor based automated aeration and fumigation system.

**Power source : 1hp, Electrical Power**

**Storage Capacity, tonne : 1**



## Aloevera Whole Gel Extraction Equipment

Suitable for peeling the top and bottom rinds of aloevera leaves and extracting the whole gel in single pass.

**Power source: 1 hp electric motor**

**Capacity (Motorized) : 200-225 kg/h (900-1000 leaves/hour)**

**Capacity (Manual) : 100kg/h (400-450 leaves/hour)**



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# Automated/Remote-controlled Equipment & Technologies

## Remote-controlled Multipurpose Track-type Vehicle

This remote-controlled, track-type vehicle with various attachments is suitable for multiple farming tasks (Tillage, Sowing, Weeding etc) with minimal operator exposure. Good for operations in small fields and compact space.

**Field capacity: 0.16 ha/h**

**Power Source: 11 hp Diesel engine**



## Remote-controller System for Riding Type Transplanter

This remote-controller system for four-wheel rice transplanter facilitates remote operation of transplanter (Start-stop, Steering and seedling tray control)

**Field capacity: 0.27 ha/h**



## Remote-controlled Weeder

A remotely controlled weeder to reduce labor and time in weeding row crops, in both raised and flatbed field conditions.

**Field Capacity: 0.07 ha/h**

**Efficiency: 81.6% (raised bed); 74.9% (flatbed)**



## Automatic Fruit Grader

Suitable for postharvest handling of citrus fruits, performing washing, vision-based sorting, and weight-based grading. Performs weight grading and color sorting, operating at noise levels below 80 dB.

**Capacity: about 1700 fruits per hour with over 90% efficiency**

**Power Source: 5 hp electric motor**



## SPAD- Meter

It can measure chlorophyll content of the plant leaves [up to one mm thickness] to assess nitrogen requirement of the crop and makes recommendation for doze of nitrogen application.

**The accuracy of the instrument is  $\pm 1.5$  SPAD units.**



## Solar-Powered IoT enabled Floating Axial Flow Pump

It ensures portability, remote operation through IoT and wireless control, and reduces manual effort in water lifting, irrigation and farm water management.

**Discharge Capacity: 20,000 litres/day**

**Efficiency: 27-50% under standard condition**



## Automatic Irrigation System for Rice

It is automatic sensor-based irrigation system for rice cultivation under the Alternate Wetting and Drying (AWD) method. Saves up to 35% water.

**Capacity- With one sensor it can cover 1 acre rice field.**



## Abiotic Stress Detection Device

Real time identification of abiotic stress (Nutrient, Water, Temp etc) in field crops with the aim to assist crop breeding and precision crop input management.

**Accuracy: For Nitrogen 81.5% (wheat), 68.3% (maize) and 80.2% (rice)**

**For Water 68.6% (wheat) & 67.5% (maize).**



# Renewable Energy based Technologies & Miscellaneous Equipment

## Multi-utility e-vehicle for small agricultural operations

Battery operated pollution free multi utility vehicle, suitable for agricultural operation such as sowing, weeding, harvesting and transportation.

**Power Source: Battery**

**(60V, 100Ah)**

**Field capacity :0.18 ha/h**



## Solar Assisted Dehumidifier based Heat Pump Dryer

Suitable for drying heat sensitive fruits, medicinal and aromatic crops. The unit retained the quality of the dried with reduced loss of vitamins and essential oils.

**Thermal efficiency: 24-30%**



## Solar Cocoon Dryer

Suitable for drying cocoon by solar air heater based forced convection type dryer.

The drying time of the cocoons (from 61% to 12%) in the solar dryer is 16-20 h during summer and 25-30 h in autumn.



## Gasifier based power generation system

Gasifier based power generation system is a standalone type of power generation system. It consists of mainly gasifier, producer gas scrubber, coarse and fine gas filters, engine and generator set. Producer gas generated from wood is used as fuel to run engine-generator set.

The wood consumption for generating unit power is usually 1.2-1.3 kg/kWh and briquettes consumption is 2-2.5 kg/kWh.



## Charring and Briquetting Technology

Suitable for making bio-char and briquettes from crop residue.

Capacity of charring: 80 kg/day

Capacity of briquetting machine: 40 kg/h



## Briquetting plant for Crop Residues

For producing binderless briquettes from crop residues. The technology can utilize crop residues namely pigeon pea stalk, soybean straw, lantana camara, etc.



## Tubular condenser integrated bio oil unit

An apparatus for Conversion of biomass into bio-oil through slow pyrolysis at controlled temperatures up to 700 °C.

Capacity: 1 kg powdered biomass per batch; bio-oil recovery up to 48 % (tested with pine needle biomass)

Power Source: Electric heating system with nitrogen gas supply for maintaining an inert atmosphere.



## Solar Tunnel Dryer

This tunnel type semi-cylindrical drying chamber provided with windows to allow the ambient air to enter the dryer. Suitable for drying of Fish and fish products, vegetables, fruits and agro-products.

**Power source : Solar**  
**Loading capacity, kg : 100**  
**kg/batch**



## Solar Cabinet Dryer

To dry fruits/vegetables. Saves electricity about 1.5-2.0 kWh/kg dried produce over electric dryers. Provides quality drying which fetch higher market price for produce.

**Capacity: 20-25 kg per batch**  
**Drying Time: 3-5 days per batch**



## Animal Lifting Device

A manually operated, low cost and light weight machine suitable for lifting and shifting sick animal weighing up to 900 kg.

**Capacity – 900 kg**



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# WOMEN FRIENDLY EQUIPMENT AND TECHNOLOGIES

## Hand Ridger

To make small ridges in the well prepared field for irrigation, sowing or planting of vegetable crops.

**Capacity: 0.03 ha/h**

**Power source: Two women**



## Rotary Dibbler

For continuous planting of medium or bold seeds in well pulverized small field and for gap filling.

**Capacity: 0.05 ha/h**

**Power Source: One Woman**



## Rice Transplanter 4-Row

To plant rice seedlings in puddled wet field with standing water.

**Capacity : 0.06 ha/h**

**Power Source: One Woman**



## Paddy Thresher

For threshing harvested paddy crop.

**Capacity: 35kg/h**

**Power Source : One Woman**



## Potato Peeler

To remove outer skin of potatoes through scouring.

**Capacity : 50-60 kg/h**

**Power Source: One Woman**



## Groundnut Decorticator (Sitting Type)

For shelling / separating dry groundnut kernels from pods for use as seed/ food purpose.

**Capacity : 30-35 kg/h**

**Power Source : One Woman**



## Soybean Dehuller

To remove outer hull of soybean to make soy dal.

**Capacity: 80kg/h**

**Power Source : 1 hp Motor**



## Paddy Seeder 4 – Row

To plant pre-germinated rice seeds in puddled wet field without standing water.

**Capacity: 0.1 ha/h**

**Power Source: One Woman**



## Serrated Sickle

To harvest thin stem crops such as paddy, wheat, mustard etc.

**Capacity : 0.02 ha/h**

**Power Source: One Woman**



## Maize Sheller

To separate the maize kernels from the cob.

**Capacity : 20-25 kg/h**

**Power Source : One Woman**



## Potato Slicer

To cut slices of potatoes for making wafers / chips.

**Capacity : 40-50 kg/h**

**Power Source : One Woman**



## Double Screen Grain Cleaner (with Sack Holder )

To clean and grade selected grains using suitable matching sieves with reduced drudgery and sack holder to hold sack while transferring clean grain.

**Capacity : 150-225 kg/h, 150 kg/h Wheat, 200kg/h Gram, 225 kg/h Soybean**

**Power Source : One Woman**



## Pedal cum Power Grain Cleaner cum Grader

Purpose: To clean and grade selected grains using suitable matching sieves with high capacity and reduced drudgery.

Capacity: 180 - 900 kg/h

Pedal (kg/h): 180 Linseed, 350 Wheat, 280 Sunflower, 500 Gram, 507 Mustard 274 Safflower, 600 Soybean.

Power (kg/h): 230 Linseed, 500 Wheat, 345 Sunflower, 800 Gram 315 Safflower, 900 Soybean.

**Power Source: Manual or Motor 0.5 hp**



## WOMEN FRIENDLY EQUIPMENT AND TECHNOLOGIES

### Soy Milk and Soy Paneer (Tofu) Plant

To cook and grind soybean to make soy milk and soy paneer.

**Capacity : 300 Lt milk / 50 kg paneer per day (8 h)**  
**Power Source :Cooking Gas/Kerosene Stove and 2 hp Motor**



### Portable Charring Kiln

To partially burn crop residue for charring under controlled air supply to convert it to coal.

**Capacity : 80 kg/h (Char)**  
**Persons required : One Woman to handle biomass**



### Dal Mill

For making dal from tur/arhar (Pigeon Pea) at cottage level. Can also be used for other pulses such as black gram, green gram and lentil.

**Capacity: 100 kg/h**  
**Power Source : 2 hp Electric Motor**



### Multi Fuel Domestic Cook Stove

Preferably to be used as smokeless cooking stove using briquettes made of crop residue.

**Capacity: 1.0 kg briquettes (1.5 h Burning)**  
**0.5 kg (Hopper)**  
**Persons required : One Woman to cook food**



## PROCESSED PRODUCTS & FUNCTIONAL FOODS

### Soy Fortified Nutritious Healthy Noodles

Noodles fortified with Defatted (DFSF) and Full Fat Soy flour (FFSF), in proportion ranging from 10% to 30% with refined wheat flour/whole wheat flour while. It provides about 17% protein, fat 7.5%, carbohydrate 68% and energy 395 Kcal/100 g.



### Gluten Free Eggless Cake

Eggless gluten free multinutrient cake has been made using cereals, millets, pulses and fruits. It is rich in protein, vitamins, minerals and antioxidants sans cholesterol and saturated fat. No added colour and preservatives are added and its high nutritive value is its USP. Suitable for people who are allergic to gluten.



### Soy Butter

Soy-butter is healthy, nutritionally rich; cholesterol and trans- fat free plant based spread with high protein content of 39 % making it ideal for people suffering from protein malnutrition, obesity and hypercholester-olemia. No added flavour and preservatives with a shelf life of 3 months under ambient conditions



### Nutri-bar

Multi-Nutrient Bar is a high nutrient baked product which provide an easy way out of the dilemma of choosing between health and taste. The snack contains ingredients from almost every food group and is sweetened with healthy natural sweeteners like jaggery. It substantially contributes to our daily requirement of energy, protein, minerals and added advantages of phenolics and antioxidants.



### Process Technology for Production of Pro-Biotic Soya Cheese Spread

Process technology is available for production of probiotic soy cheese spread, which is nutritionally rich product having probiotic characteristics. The product contains about 17% protein, 25% fat, high antioxidant activity (53%) and higher probiotic culture viability. It can be utilized as a spread with bread/chapatti/paratha/biscuits as a main meal or a meal supplement.



### Multi Nutrient Ladoo

Multi nutrient Laddoo (contains cereals, sprouted legumes, malted millet, dairy ingredient, fruits oil and jaggery) is a high energy and protein food with good source of minerals, phenolics and antioxidants. These are easy to store and consume and contain protein (24.6g), iron (10.4mg), phosphorus (287.5mg), phenolics (123.0 GAE) mg, flavonoids (6.9 QE) mg and antioxidant activity (62.6% RSA) in 100g.

