Agricultural Mechanization Promotion Group (IAM-BRAIN)

Institute of Agricultural Machinery (IAM)
URL: http://brain.naro.affrc.go.jp/iam/

Bio-oriented Technology Research Advancement Institution (BRAIN)
Incorporated Administrative Agency
National Agriculture and Food Research Organization (NARO)
Introduction

Agricultural Mechanization Promotion Group of BRAIN is known by the name of Institute of Agricultural Machinery (IAM).

History of IAM-BRAIN

- Oct. 1962 Institute of Agricultural Machinery (IAM) was founded as a semi-governmental corporation specializing research and development as well as testing of farm machinery for promotion of agricultural mechanization in Japan.
- Oct. 1986 Bio-oriented Technology Research Advancement Institution (BRAIN) was founded as a legally approved corporation, inheriting the whole properties and activities of former IAM. The objective of BRAIN is to conduct research, development and testing on agricultural machinery, and newly to promote research and development on biosciences and bio-technology in the field of agriculture, which is not only conducted by IAM-BRAIN itself, but also by private sectors.
- Apr. 2006 Reorganized as IAM-BRAIN, National Agriculture and Food Research Organization (NARO).

Outline of Activities

IAM-BRAIN conducts its main assigned roles in the field of research, development and testing of agricultural machinery as a sole and competent organization in our country. The activities of IAM-BRAIN are currently focused on the followings:

- Testing and Evaluation
  - Testing and evaluation of agricultural machinery based upon the requests of manufacturer or importer on aspects such as performance, safety, environmental effects etc. in order to help spreading high quality agricultural machinery.

- Research & Development of Agricultural Machinery
  - Fundamental and initiative research and development of agricultural machinery, putting stress on performance, safety, durability etc. to realize the high productivity agriculture.

- Urgent Research & Development of Agricultural Machinery
  - Research and development of agricultural machinery for renovation of farm management such as epochal elimination or reduction of labor, a high advancement of production management, an effective utilization of natural resources and so on under close cooperation with different stakeholders such as manufacturers, end users, research institutions including those of different fields.

- Publication and Service
  - Publicity service on research, development and testing results, technical advice to manufacturers and other private as well as public sectors, permission of using patents to industries, contracted research/investigations and others.

- Other activities
  - Survey on agricultural mechanization, collection and provision of technical information, technical training, international cooperation, opening of subject library, display of old and new agricultural machinery etc. are also a part of our activities.
This department takes charge of fundamental as well as initiative research and development being common to the whole agricultural machinery.

This department takes charge of research and development on paddy field as well as dry field crop machinery to increase the yield and work efficiency.

This department takes charge of research and development on horticultural machinery and equipment.

This department takes charge of research and development on animal industry machinery and equipment.

This team conducts special research activities on the energy-related agricultural machinery.

This team conducts special research activities on the robotic technology applicable to agricultural machinery.

This team conducts special research activities and provides information on the agricultural machinery and farm work safety.
Fundamental Technology Department

This department takes charge of fundamental as well as initiative research and development being common to the whole agricultural machinery.

Agricultural Automation Laboratory

- Sensing Technology, Automation Technology, Agricultural Robot
- Unmanned Seeding Operation by Tilling Robot
- Steering-Assist System for Agricultural Vehicle
- Operation Navigator

Agricultural Automation Laboratory

- Unmanned Seeding Operation by Tilling Robot
  - Robot tractor executing unmanned operations such as tillage, soil puddling and seeding.
- Steering-Assist System for Agricultural Vehicle
  - This is a hands-free system for operation, capable of traveling along crop rows, ridges and borders in fields, or toward a lamp putted in the direction. (Under development)
- Operation Navigator
  - "Farm Vehicle Navigator" useful for wide implement operation and variable rate fertilizer application for precision farming

Biotechnology Engineering Laboratory

- Measurement of Plant Growth Response, Mass Production of Seedling, Biotechnology-related Equipment
- Grafted seeding
- Grafting Robot for Cucurbits
  - A machine that can graft cucurbits automatically. (Commercialized)
- Full-Automated Grafting Robot for Cucurbits
  - A machine that processes automatically not only grafting work but feeding of seedlings
- Aligning Seeder for Big and Elliptical Seeds
  - A seeder capable of arranging the direction of seed, which is big and flat such as pumpkin. The bottom right of the picture is state after seeding (Commercialized)
**Ergonomics Laboratory**

**Safety and Comfort of Farm Work**

**Low Vibration Bush Cutter**

The bush cutter with 30-40% lower hand-transmitted vibration was developed for the purpose of preventing vibration disorders.

(Commercialized)

**Universal Design Guidance for Agricultural Machinery**

The universal design guidance for agricultural machinery was developed based on the research on the usability for farmers including elder and women.

**Rural Resources Management Laboratory**

**Application of Unutilized Resources, Energy Saving, Environmental Protection**

**Soil Crusher-sieve**

A machine that crushes and sieves the dried sample soil for soil analysis.

(Commercialized)

**Operational Condition Indicator of Tractor for Energy Saving**

An apparatus that indicates fuel saving operational condition of a tractor.

**Disk-type Cultivator-Ridger**

A disk-type cultivator-ridger that suits to wet soil.

(Commercialized)

**Cost Engineering Laboratory**

**Life Cycle Costing, Materials Expense Reduction and Recycling Technology**

**Recovery of Core Metal in Scrapped Rubber Tracklayer**

Easy and inexpensive recycling technology aiming at the promotion of effective utilization of iron resources.
Crop Production Machinery and System Department

Research Activities

This department works for research and development on paddy field as well as dry field crop machinery to increase the yield and work efficiency.

Soil Management Machinery Laboratory

Agricultural Vehicle, Tillage, Fertilizer Application and Seeding

High-speed Rotary Cultivator

This rotary cultivator is capable of cultivating at higher speed, and with better working precision level than a conventional machine. (Commercialized)

Paddy Field Mechanization System Laboratory

Direct Seeding, Fertilizer Application, Material Handling

High Accuracy Direct Seeder for Rice on Wet Field

This seeder is developed to improve the germination rate by covering the seeds with stable thickness of soil. It can be mounted on riding type rice transplanters and paddy-management-vehicles. (Commercialized)

Variable Rate Fertilizer Applicator

The feeding rate of fertilizer can be precisely and easily adjusted during operations responding to the growing crop growth and soil fertilities. (Commercialized)

Precision Fertilizer Spreader

The metering device of this fertilizer spreader is controlled by using a new index value called "FR index" that indicates the physical property of fertilizers. The feeding rate of fertilizer is also adjusted in accordance with traveling speed of the spreader measured by a GPS receiver. (Under development)

Ultra Lightweight Rice Transplanter

Handling of this machine in small scale paddy field is easy, and can be transported by hand. (Under development)
Practical Application Project for a Precision Rice Production System in Japan

This project is introducing all the devices developed in IAM-BRAIN for paddy crop measurement, fertilizer application, processing and so on, and thereby is aiming at establishment of a new farming system in which higher quality, higher profitability, and environmental friendliness can be realized.

**Crop Production Machinery and System Department**

- Crop Tending Machinery Laboratory
- Harvesting System Laboratory
- Drying and Processing Equipment Laboratory

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**Crop Tending Machinery Laboratory**

- Pest Control, Weed Control, Crop Tending

**Detailed Information**

- **Recirculating Batch Grain Dryer using Far Infrared Radiation**
  - This type of dryer uses thermal energy which arises by heating of the FIR body, together with exhaust heat from coming out it, and has been rapidly spread now from viewpoint of energy saving and palatability performance. (Commercialized)

- **Grain Protein Sensor using Near Infrared Reflectance Spectroscopy**
  - This sensor can measure protein contents of grain even in high moisture content or rough rice. Moreover it can be portable. (Under development)

- **Rice Seed Disinfection System using Super Heated Steam**
  - This device can have high performance disinfection system applying Super Heated Steam. (Under development)

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**Harvesting System Laboratory**

- **Multi-crop Combine Harvester**
  - This combine harvester is applicable for various crops such as rice, wheat, soybean, etc. by introducing screw threshing mechanism. (Commercialized)

- **Head-feeding Combine for Hilly and Mountainous Area**
  - This small-scale combine harvester can work on a garden terrace paddy field in mountain areas. (Commercialized)

- **Yield Monitoring Combine**
  - This combine harvester can measure crop data such as grain mass, moisture content, and yield while harvesting. (Commercialized)

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**Drying and Processing Equipment Laboratory**

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**Walking-type Ridge Mower**

- The mower can weed both top and slope surface of a ridge simultaneously and stably. Its mowing width of top surface is 30 cm and that of slope surface is adjustable from 30 to 70 cm. (Commercialized)

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**Riding-type Mechanical Weeder for Paddy Field**

- It has the weeding devices of inter-row and intra-row space of paddy field and it can weed precisely and efficiently. (Commercialized)

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**Low volume Sprayer mounted on Paddy-Management-Vehicle**

- The sprayer is capable of low volume application (the application rate is 250 L/ha) precisely and efficiently.
Horticultural Engineering Department

This department takes charge of research and development on horticultural machinery and equipment.

- Orchard Machinery Laboratory
- Pre-harvest Technology Laboratory
- Vegetable Harvest Technology Laboratory
- Protected Cultivation Engineering Laboratory
- Post-harvest Technology Laboratory

**Research Activities**

**Orchard Machinery Laboratory**

- Fruit Tree, Tea Plant

- **Multipurpose Monorail for Hillside Orchard**
  - The multipurpose monorail consists of the main monorail of hill slope direction and the sub monorail of contour direction. By using the multipurpose monorail, farmers can reduce labor and work effectively to carry harvested fruit, spray chemical, and apply fertilizer. (Commercialized)

**Pre-harvest Technology Laboratory**

- Seeding, Transplanting, Crop Tending, Pest Control

- **Clod and Stone Separator**
  - The separator removes clods and stones from the sowing beds before potato planting. It is developed to form a soil conditioning system for potato production in Japan. (Under development)

- **High Accuracy Seeder for Sugar Beet**
  - The seeder can sow sugar beet with high accuracy up to operating speed of 1.5m/s and simultaneously creates sowing beds that shelter young seedlings from strong wind. (Under development)

**Protected Cultivation Engineering Laboratory**

- Protected Cultivation for Vegetables and Flowers

- **Movable Bench System for High-density Cultivation of Strawberry**
  - Planting density of the developed system is about twice as high as conventional cultivation. (Under development)

- **Movable Benches**

- **Planting Machine for Chrysanthemum Cuttings**
  - This machine assists the cutting supply task of an operator to plant accurately into plug trays. (Commercialized)
Vegetable Harvest Technology Laboratory

**Welsh Onion Harvester**
This machine can dig, convey and hold welsh onions grown on a ridged fields. (Commercialized)

**Cabbage Harvester**
This machine can draw a cabbage out of the ridge, cut off external leaves as well as a stem, and convey the head of a cabbage alone. (Commercialized)

**Small-size Sugarcane Harvester with High Chopping Performance**
This machine can harvest sugarcane for biofuels with high efficiency. (Under development)

**Automatic Follow-type Transport Vehicle**
This machine can follow a vegetable harvester automatically and transport the harvests. (Commercialized)

Post-harvest Technology Laboratory

**Welsh Onion Trimmer**
This machine can cut the root, peel and leaves of welsh onion automatically. (Commercialized)

**Automatic Strawberry Packer**
This machine can automatically place some strawberries on the special tray and cover it by lid. (Under development)

**Automatic Cabbage Packer**
This machine can automatically pack some cabbages up into a cardboard box at the packing house. (Under development)
Animal industry Engineering Department

Forage Crop Producing Machinery Laboratory  Livestock Management Machinery Laboratory  Raising and Environmental Machinery Laboratory

Research Activities
This department takes charge of research and development on animal industry machinery and equipment.

Livestock Management Machinery Laboratory

Milking of Cows, Feeding and Individual management of Livestock

Automation of Milking in Stall Barn

Precise monitoring of individual livestock and security of food safety by using IT/Robot Technology

Hygiene Management for High Quality Milk

Milking Unit Carrier System

The automatic carriers combined with pairs of milking units make a drastic reduction of labor force. (Commercialized)

Idea of Individual Cow Monitoring System

(Commercialized)

Teat Cleaning Device

Automatic cleaning/disinfection of teat surface before milking (Commercialized)
Forage Crop Producing Machinery Laboratory

- **Labor Saving Production of High Quality Corn/Maize Silage**
- **Roll Baler for chopped materials**
- **Bale Wrapper**

This baler can form corn/maize, which was chopped by a forage harvester, into high density roll bale. (Commercialized)

Multi-Crop and Self-propelled Harvesting Roll Baler

This machine is available for various forage crops by changing the attachments. (Commercialized)

Raising and Environmental Machinery Laboratory

- **Easy Treatment of High-moisture Animal Waste**
- **Screw Press Type Soil-liquid Separator**
- **Offensive Odor Control**

This low cost device separates animal waste into cake (75% and under of moisture content) and liquid content. (Commercialized)

Animal Waste Treatment/Utilization, Environment Pollution Control

- **Rock Wool-type Deodorization Facility for Cold Climate**

This facility decomposes of and removes odors generated from composting facilities at high concentration by microbiological actions. (Commercialized)
Testing and Evaluation Department

Tests and Appraisal Activities

This department takes charge of the National Test, Safety Test, OECD Test, IAM Test (Groupe 1 and 2), together with research on testing procedure and apparatus.

Large Tractor Testing Division

- Large Tractor, Farm Vehicle, etc.
- Tractor Power Take Off (PTO) Performance Test
  Available power, torque, etc. of PTO shaft for driving implements shall be measured.
- Tractor Drawbar Performance Test
  Available power, force, etc. for drawing implements shall be measured.

Small Tractor Testing Division

- Small Tractor, Farm Transport Vehicle, etc.
- Exhaust Gas Emission Test
  Amount of NOx, Particulate Matter (PM), etc. in exhaust gas from diesel engines shall be measured.
- Safety Test of Monorail Transporter
  Safety equipment, brake performance, etc. shall be investigated.

ROPS Testing Division

- Roll-over Protective Structure, Brush Cutter, etc.
- Static Strength Test of Roll-over Protective Structure
  Zone of clearance for protecting the operator in the case of tractor’s overturning accident shall be checked.
- Safety Test of Brush Cutter (Cutting Attachment Impact Test)
  A fixed steel bar shall be impacted by the rotating cutting attachment.
Outline of Testing and Appraisal Activities

<table>
<thead>
<tr>
<th>Kind of Test</th>
<th>Targeted machinery</th>
<th>Major test items</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Test</td>
<td>Agricultural Tractor (riding type), Rice transplanter (riding type), Vegetable transplanter, Power Sprayer (boom type), Air-blast sprayer, Combine harvester (head feeding type), Combine harvester (conventional type), Potato harvester, Sugar beet harvester</td>
<td>Performance (including exhaust gas level), durability, ease of operation, safety equipments</td>
</tr>
<tr>
<td>Safety Test</td>
<td>Most agricultural machinery</td>
<td>Safety equipment, ease of operation</td>
</tr>
<tr>
<td>OECD Test</td>
<td>Agricultural tractor (riding type)</td>
<td>Performance, noise level</td>
</tr>
<tr>
<td>ROPS for agricultural tractor (riding type)</td>
<td>Strength</td>
<td></td>
</tr>
<tr>
<td>IAM Test (group 1)</td>
<td>Soybean thresher, Soybean grader, Head feeding type combine harvester for seed crop, Oil heater for green house, Low volume sprayer for green house, Driving disk type plow, Trencher, Manure spreader, Side row fertilizer applicator attachment for rice transplanter</td>
<td>Performance, ease of operation, safety equipment</td>
</tr>
<tr>
<td>IAM Test (group 2)</td>
<td>Most agricultural machinery and their parts. Test under code(s) of respective country(ies) and areas. English test report is available.</td>
<td>Decide based on the request of applicant upon agreement with IAM-BRAIN</td>
</tr>
<tr>
<td>Functional Check for road travelling agricultural motor vehicle</td>
<td>Agricultural tractor, Rice transplanter, Air-blast sprayer, Combine harvester</td>
<td>Functions required by an official notice by the Ministry of Agriculture, Forestry and Fisheries</td>
</tr>
</tbody>
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Transplanter, Sprayer and Harvester Testing Division

- **Field Performance Test of Rice Transplanter**
  - Accuracy of transplanting, efficiency of operating, etc. shall be measured.

- **Wind Speed Distribution Test of Air Blast Sprayer**
  - Wind speed distribution blown off at air outlet shall be measured.

- **Required Power Test of Potato Harvester**
  - Required power of PTO shaft for harvesting, power for drawing harvester, etc. shall be measured.

Grain Harvester Testing Division

- **Field Performance Test of Head Feeding Type Combine Harvester**
  - Quality of work such as harvest loss shall be measured by sampling the materials at all outlets.

- **Durability Test of Combine Harvester**
  - The durability of major parts shall be evaluated through a harvesting operation of a specific area.

- **Specification Check of Head Feeding Type Combine Harvester**
  - Specifications such as equipment, dimensions, structure and material of major parts shall be measured and/or checked.
Specific Project Research Teams are engaged in urgently needed special research calling for immediate solution, and on effective accumulation of future research seeds for R & D of agricultural machinery.

**Specific Project Research Team (on Energy)**

This team conducts a special research activities on the energy-related agricultural machinery.

- **Processing/Drying/Collecting/Storage System of Rice Straw**
  - Research on processing/drying/collecting/storage system of rice straw as raw materials for bioethanol fuels

- **Application of Biodiesel Fuels to Tractors**
  - Investigation of the influence on application of biodiesel fuels to tractors such as its engine power, emission gas, oil and filters.

**Specific Project Research Team (on Robot)**

This team conducts special research activities on the robotic technology applicable to agricultural machinery.

- **Agricultural Vehicle Robot**
  - Development of an auto-steering device, a navigation sensor, communication control interfaces and software, which can be used commonly for agricultural vehicle robots

- **Wearable assist device for farm worker**
  - Development of a wearable device that reduces the physical strain of farm worker in a fixed posture over a prolonged time

**Specific Project Research Team (on Safety)**

- **Harvesting Robot for Strawberry**
  - The harvesting robot currently under development for strawberry, which harvests a red fruit automatically while judging its maturity.
Research on safety of agricultural machinery

Collection and analysis of data which are needed for revising "Safety Test" standards, to help the improvement on safety of agricultural machinery.

Provision of information/data on farm safety

Collection and supply of various information/data on agricultural machinery and farm work safety on our Web site (in Japanese)

Development of safety-supporting techniques on farm work

“Agricultural machinery safety e-learning system”, by which people can learn various knowledge on safe use of agricultural machinery through Internet (in Japanese)

Specific Project Research Team (on Safety)

This team conducts special research activities and provides information/data, on the agricultural machinery and farm work safety.
Planning Department

This department takes charge of planning and administration of research as well as testing activities, manages intellectual property rights, also offers our technical fruits information to public.

Experimental Farm

Fields and crops for research and test activities are provided.

Workshop

Experimental or prototype machinery and measuring apparatus are made, modified or repaired.

Facility Guide

Area: 184,797㎡

Information map
Area Map of IAM-BRAIN and Traffic Guide

Exit JR Omiya station at the West Exit. Take the “Tobu” Bus for “Sanshin-jidosha” or “Cityheights Mihashi” at the No.6, or No. 7 bus stop. Get off the bus at “Jieitai-iriguchi” after approximately 10 minutes riding. The place surrounded by trees, to the direction of bus route, is the campus of IAM-BRAIN. Taxi is also available, say “Seiken-center” or “Jeitai-mae Seiken-center” to the taxi driver.

Area Map of Experimental Farm and Traffic Guide

1389 Sakai, Konosu-city, SAITAMA, 365-0013 JAPAN
Cooperation & Information

1. Research Cooperation
   1) Make joint research
   2) Contracted research or investigation
   3) Entrust of research and survey to outside
   4) Collaborated research by agreement

2. Technical Transfer
   1) Technical advice to industries
   2) Permission of using patents to industries
   3) Provide various technical trainings
   4) Technical consultation

3. Dispatch and Acceptance of Researchers
   1) Dispatch to an official trip by request
   2) Acceptance of students and trainees
   3) Acceptance of researchers
   4) Undertake a member of committee by request

4. Information and Communication
   1) Open Show Room (latest machinery) and Museum (historical machinery) to the public
   2) Open the Library to the public
   3) Publication of research papers, technical reports, annual reports and others
   4) Holding the national meeting of official researchers of agricultural mechanization, research report meetings and others

5. Freedom of Information
   We receive any application to request the indication of our documents, charts and electronic records.

You shall always be welcome to visit our Institute, please contact us in advance.

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