The transformative power of knowledge is the path that can facilitate economic growth and development while maintaining a social and environmental balance. In this scenario, Embrapa Tropical Agroindustry operates in the generation of technologies that aim to increase productivity and competitiveness of agribusiness. The challenge is not simply to obtain finished products, but to enable the development of processes that will help Embrapa clients to acquire products and services that meet the needs of the people and their markets.

Embrapa Tropical Agroindustry has 170 employees. This includes 64 scientists that direct their Research and Development Programming towards scientific and technological advances that aggregate value to crops that are of interest to the tropical agroindustry. To do this, it is divided into six thematic areas: breeding and plant biology, plant production systems, crop protection, post harvest, agroindustrial processes, and socio-environmental management.

In terms of international cooperation, Embrapa Tropical Agroindustry has an intense and strategic exchange of knowledge with other countries through technical and scientific cooperation missions, consulting and training courses.

Vitor Hugo de Oliveira
Head of the National Research Center for Tropical Agroindustry
History

Embrapa Tropical Agroindustry originated at the National Research Center for Cashew (CNPCa), created in 1987, to meet the demands of cashew agribusiness in Brazil.

In 1993, the Center had its mission expanded to work with products and processes demanded by agribusiness, changing its name to National Research Center for Tropical Agroindustry, with the synthesis signature “Embrapa Tropical Agroindustry”.

Mission Statement

To facilitate, through research, development and innovation, solutions to the sustainability of production chains in tropical agroindustry in benefit of the Brazilian society.

Vision

Being a reference in research, knowledge, technology and innovation for sustainable development of productive chains of interest in the tropical agroindustry.
Embrapa Tropical Agroindustry has

18 laboratories and 2 experimental units.

The laboratories are:

- Soil, water and plant physiology
- Entomology
- Phytopathology
- Soil microbiology
- Plant physiology
- Breeding and genetic plant resources
- Plant tissue culture
- Physiology and postharvest technology
- Molecular biology
- Postharvest pathology
- Chemistry of natural products
- Environmental management
- Food microbiology
- Agroindustrial processes
- Bioprocesses
- Food analysis
- Sensory analysis of foods
- Food packaging technology
Pacaju Experimental Field

The Pacaju Experimental field is home to the world’s largest active Germplasm Bank of the Dwarf Cashew. The 200-ha field is located in the town of Pacaju, Ceará, Brazil, which sits 50 km outside of Fortaleza.

It houses research in the areas of plant breeding, plant propagation and phytosanitary management of the cashew tree; in addition to a nursery to produce seedlings of fruit trees. The experimental field has an Instructional Unit for the processing of tropical fruit, in order to train technicians, growers and producers.

2 experimental
that give support to its research activities

Curu Experimental Field

Located in the town of Paraipaba (Ceará, Brazil), 90 km away from Fortaleza, with a total area of 113 ha, the field houses agronomic experiments with irrigated crops such as cashew, coconut, melon, papaya, soursop, sapodilla, and tropical flowers.
Embrapa Tropical Agroindustry works in the development of new processes and products from plant raw materials. One of these products is yellow food coloring, which is produced from the remaining residue from the processing of cashew apple juice. This yellow natural coloring can replace artificial products used in the industry.

Another innovation is edible film made from fruit pulp. This film improves food protection, therefore increasing shelf life.

The coconut water storage technology, developed by Embrapa Tropical Agroindustry, through combined methods, provided the bottling and increased product life of the coconut water. The technology consists of a set of techniques applied simultaneously seeking the biochemical and the microbiological stabilization of the product on an industrial scale. The taste of bottled coconut water is very close to the natural taste and its shelf life can reach six months if refrigerated, while the shelf life of the fresh fruit is only eight days. The technology has been used by Brazilian companies that process nearly eight million liters of coconut water per year.
Adding value to traditional products is a line of action of Embrapa Tropical Agroindustry, which includes improvement of production processes, certification of traditional products and obtaining a geographical indication label.

Cajuina, a traditional northeastern Brazilian cashew juice, without preservatives, is one such product. Obtained by pressing the apple of a freshly picked, ripe cashew, the juice is produced without adding sugar and has good flavor and is high in vitamin C. Embrapa has developed a methodology for the production of cajuina with simple and modern techniques of clarification and a less prolonged heat treatment. This allows for the obtaining of a product superior to the craftsman version and within the Standards of Identity and Quality required by the market. Besides adding value, the cajuina transforms a highly perishable material into a stable and widely consumed product in the Northeastern and Southeastern regions of Brazil.

In the same line of action, Embrapa has been working to ensure quality to the coalho cheese - a typical product of Northeastern Brazil that is widely consumed by the local population. The goal is the implementation of the Geographical Indication label, which involves the organization of producers, the use of Good Agricultural Practices, Good Manufacturing Practices and fulfillment of existing legislation.
Embrapa has developed studies to improve the post-harvest quality of various horticulture products, with an emphasis on adding value to non-traditional tropical fruits, native and exotic fruits and flowers/ornamental plants for export.

Among the post-harvest technologies developed or adapted by the Center are:

- Establishment of ideal harvest time of tropical fruits like acerola (Malpighia emarginata), cashew, caja (Spondias mombin), coconut, mango, sapodilla) and tropical flowers (heliconia and others).

- Postharvest conservation under refrigeration, with or without modified atmosphere and other complementary techniques (pineapple, acerola, atemoya, cashew, caja, coconut, soursop, papaya, mango, melon, pine, sapodilla, heliconia).

- Fresh-cut fruits and vegetables (pineapple, mango, watermelon, melon, etc.).

- Characterization of functional and nutritional properties of traditional tropical fruits (pineapple, citrus, acerola, guava, papaya, mango, melon, watermelon, grapes) and non-traditional native fruits.

An important outcome of the post-harvest cashew research carried out by Embrapa was the increase of the shelf life of the cashew apple from three to 20 days under refrigeration. This technology enabled the creation of a market for the cashew apple in natura, which in 2008 presented a trading volume of over three thousand tons per year in Brazil.
Embrapa Tropical Agroindustry has been developing technologies to make use of waste from agroindustrial productive chains, aimed at environmental and economic sustainability of these chains.

An example of this technology is the processing of the green coconut husk. Through it, the waste discarded after consumption of the coconut water are turned into powder and fiber - the raw materials used in developing a series of high-value products such as agricultural substrates, blankets, carpets, automotive accessories, vases, handicrafts, etc.

The use of the coconut shell reduces the negative environmental impact generated by the consumption of the fresh fruit and offers a new alternative for adding value to the chain. In Brazil, until the year 2010, more than twenty industries used the technology for the processing of the green coconut shell, with capacity of processing up to 220 tons of shells per day.
Embrapa Tropical Agroindustry has, among its key developments, several technologies for the cashew cultivation and processing. Clones of dwarf and common cashew trees were developed that are more productive, resistant to diseases and with better cashew nut and apple quality.

Modern propagation techniques, top working (canopy replacement), crop management and control of pests and diseases of cashew tree provided for yields higher than 1200 kg of cashew nuts/ha in rainfed crops and better use of the cashew nut and apple.

The clones of dwarf cashew, launched by Embrapa, already represent 15% of cultivated area and account for 24% of the production of cashew in the state of Ceara.

Embrapa Tropical Agroindustry developed the Agroindustrial Multiple Cashew Nut Processing Module in a mini-factory system. This allowed the insertion of small and medium producers in agribusiness, through associations and cooperatives, creating jobs for the communities at all stages of the process. The processing of cashew nuts in mini-factories allows for the obtaining of a higher proportion of whole, white cashew nuts with better quality. Up until the year 2010, 40 cashew nut mini-factories were implemented and revitalized in the Brazilian Northeast, with a processing capacity of 8,000 tons of cashew nuts per year.
Among the technologies developed by Embrapa Tropical Agroindustry for tropical flower agribusiness are protocols for plant micropropagation, substrates, integrated production of flowers and post harvest technology.

In the case of plant micropropagation, the seedlings are produced in vitro under aseptic and controlled conditions. The micropropagated seedlings show genetic and development uniformity, which enable the uniformity of planted crops and the synchronization of the harvest, present a higher survival rate when transplanted to the field, and grow faster in the early stages of development than conventional plants.

Another advantage is that the plants from in vitro multiplication produce more than conventional ones, because they were obtained from selected trees and are free of systemic diseases.

The technology allows the production of seedlings on a large scale, at any time of year, with the economy of time period and space in relation to seedling production by conventional methods. The use of micropropagated plants in commercial plantations reduces the production costs, since due to the excellent phytosanitary state of plant seedlings, the use of products to control pests and diseases is significantly reduced.
The interactions with public and private institutions, national and foreign occur through the implementation of research projects and through consulting services, courses and lectures. Key actions taken:

**Haiti**
Technology transfer in cashew cultivation and the processing of cashew nuts
Partners: United Nations Development Program (PNUD), Haitian Ministry of Agriculture, Brazilian Cooperation Agency (ABC)

**Jamaica**
Cultivation and processing techniques for the crop diversification and improvement of tropical fruit production
Partners: United Nations Development Program (PNUD), Brazilian Cooperation Agency (ABC)

**Suriname and Guyana**
Training in modern techniques of cashew nut production
Partners: United Nations Development Program (PNUD), Brazilian Cooperation Agency (ABC)

**Mozambique**
Cashew Processing
Partners: National Council for Scientific and Technological Development (CNPq), Industrial Development Organization (UNIDO) and Japan International Cooperation Agency (JICA)

**Guinea Bissau**
Restructuring program for cashew cultivation
Partners: World Bank, Brazilian Cooperation Agency (ABC), Guinean Foundation for Enterprise Development Industrial (Fundei)

**Europe and Latin America**
Scientific cooperation
Research Project: Adding value to tropical fruits
Partners: France (Agricultural Research for Development - CIRAD), England (University of Southampton), Germany (Bonn University), Belgium (Ghent University), Mexico (National Institute of Forest, Agriculture and Livestock Research - INIFAP and the University of Celaya), Ecuador (National Polytechnic School), Costa Rica (National Center for Research in Food Technology - CITA)
Areas of Competence for international cooperation

1. Processing of tropical fruits
2. Breeding of tropical fruit trees and ornamental plants
3. Micro and macro propagation of tropical fruit trees, ornamental plants and flowers
4. Improving the production system of tropical fruits, with emphasis on organic production and soil quality indicators
5. Plant protection: phytosanitary diagnosis and recommendations for the control of pests and diseases that affect the cashew tree and other species of agroindustrial interest.
6. Quality control of agroindustrial products and processes
7. Improvement of agroindustrial processes
8. Training of technicians and producers in the production and processing of fruits and products of the tropical agroindustry
9. Postharvest of tropical fruit and flowers
10. Use of agroindustrial residues
Demands

From Brazil:
- Consulting on cashew crop (agronomic and industrial processing);
- Consulting for processing of tropical fruits (juices, pulps, jellies, jams, dried fruit, and fresh-cut);
- Consulting for micro and macro plant propagation of tropical fruits and ornamental plants;
- Consulting for the processing of the coconut shell;
- Consulting for processing of coconut water;

From Abroad:
- Technical consulting on the cashew crop: Agricultural (clones, crop management, pest and disease control), cashew nut processing, production of cajuina and other beverages and the use of by-products;
- Consulting for the processing of tropical fruits (juices, pulps, jellies, jams, dried fruit and fresh-cut).
Books:
- Science and Technology Tools for Food Safety
- Fundamentals of Food Stability
- Tropical Flowers
- Integrated Fruit Production (PIF) - Melon
- Integrated Fruit Production (PIF) - Cashew
- Cashews - 500 Questions - 500 Answers

Technical Bulletins:
- Applications of biosensors in the analysis of food quality
- Methods for the control of ethylene in the quality and postharvest conservation of fruits
- Mycotoxins: importance in the nourishment and health of humans and animals
- Minimally processed fruits: aspects of quality and safety
- Methods for determination of moisture in aromatic plants
- Volatile flavor compounds from pseudofruits of the dwarf cashew (Anacardium occidentale L.) CCP-76
- Harvest and postharvest of the dwarf cashew nut in the integrated production of fruits (IPM)
- Irrigation management in integrated production of the dwarf cashew
- Weed control in cashew orchards
- Cultivation of dwarf cashew: fertilization and irrigation
- Monitoring of diseases in cashew crops
- Monitoring of pests in cashew crops
- Epidemiology of black mold in cashew production
- Production of dwarf cashew nut under different water regimes
- Good practices in the processing of cashew nuts
- Cajuína: how to produce with quality
- Cashew clones: breeding, characteristics and prospects
- Genetic resources of cashew: collection, conservation, characterization and utilization
- Classification and selection of raw materials: vital activities to advance the competitiveness of the Brazilian cashew nut productive chain
- The cultivation of sapodilla
- Operational manual for survey, detection, monitoring and control of fruit flies
- Monitoring of pests in integrated production of melon
- Manual of Good Agricultural Practices and the APPCC system for melons
- Bioindicators of environmental impact on organic agricultural systems
- Treatment of the green coconut for export with an emphasis on control of basal postharvest decay

Embrapa publishes books and technical bulletins on various topics related to its work. See some examples below. The complete list, with more than 500 publications, can be found at: http://www.cnpat.embrapa.br
Embrapa Tropical Agroindustry Headquarters - Fortaleza - Ceará - Brazil

Research offices and laboratories

Embrapa Tropical Agroindustry
Contact Information | Email: chgeral@cnpat.embrapa.br | twitter: @embrapacnpat
website: www.cnpat.embrapa.br | telephone: 011-55-3391-7106 Street address: Dr. Sara Mesquita
2270 Pici | CEP 60511-110 | Fortaleza - CE - Brazil