Embrapa

Ministry of Agriculture,
Livestock and Food Supply

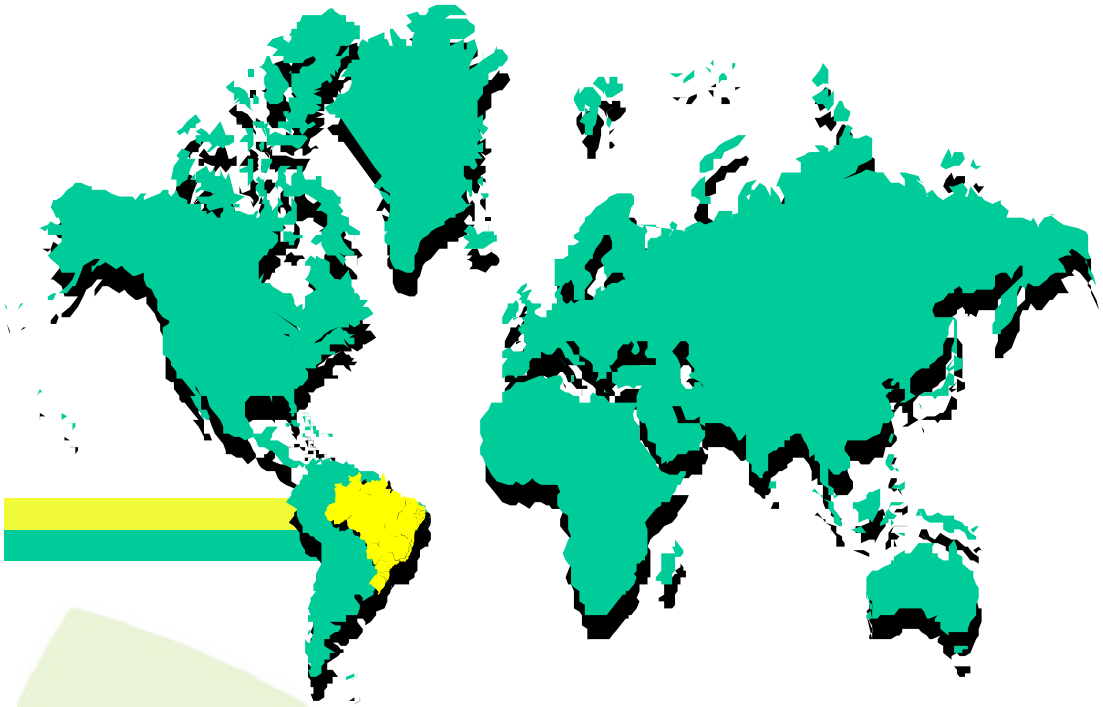
BRASIL
BRAZILIAN GOVERNMENT

The Brazilian Agricultural Research Corporation - Embrapa
- Innovation Capacity and International Cooperation -

Mauricio Antonio Lopes, PhD
Embrapa Labex Korea
Rural Development Administration – RDA
Suwon - Republic of Korea

Rural Development Administration - RDA
International Agricultural R&D – October 26th 2010
Suwon – Republic of Korea

Summary



About Brazil

ARD system in Brazil

About Embrapa

International Cooperation

Labex Korea

There is a Brazil that most people know

Amazon forest

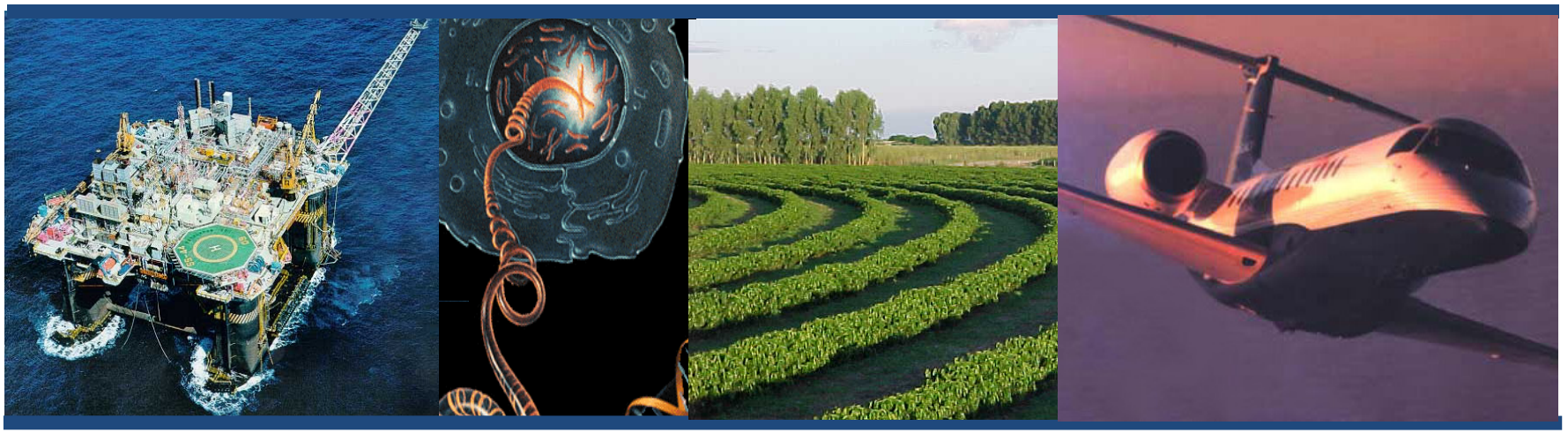
Soccer

Carnival

Coffee

It keeps being successful, but there is still more to know

The Brazil you must know



Technology, Innovation, Competitiveness

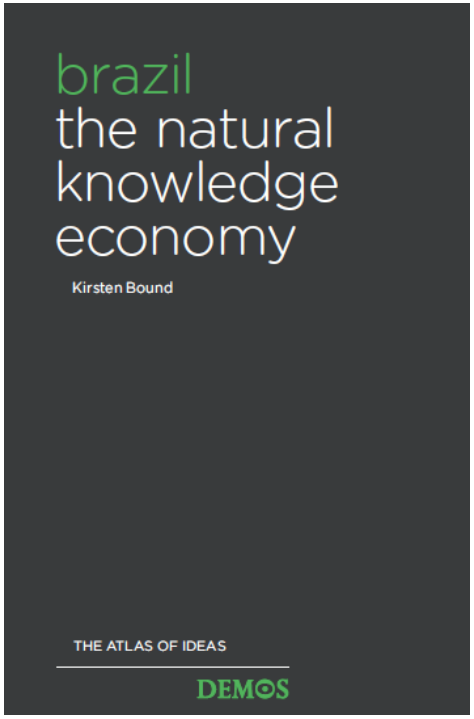
A strong academic base

10,000 doctors trained every year
16,000 scientific papers
Rank 13 in scientific publications
A growing intensity of industry R&D

The Brazil you must know

The Economist - Nov. 14-20, 2009

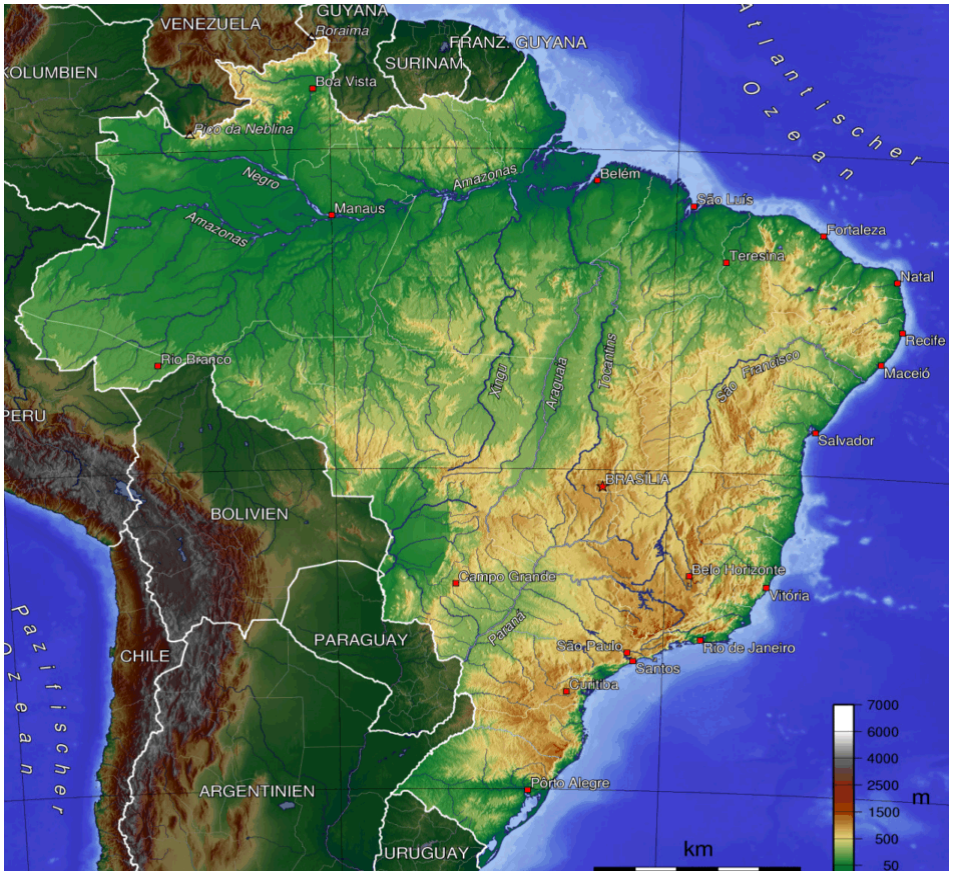
"A country with the world's largest freshwater supplies, the largest tropical forests, fertile land that in some places allows up to three harvests a year, and huge mineral and hydrocarbon wealth."



The Atlas of Ideas – Demos Institute, 2008

"It is helpful to think of Brazil as a 'natural knowledge-economy'… its innovation system is in large part built upon its natural and environmental resources, endowments and assets."

About Brazil



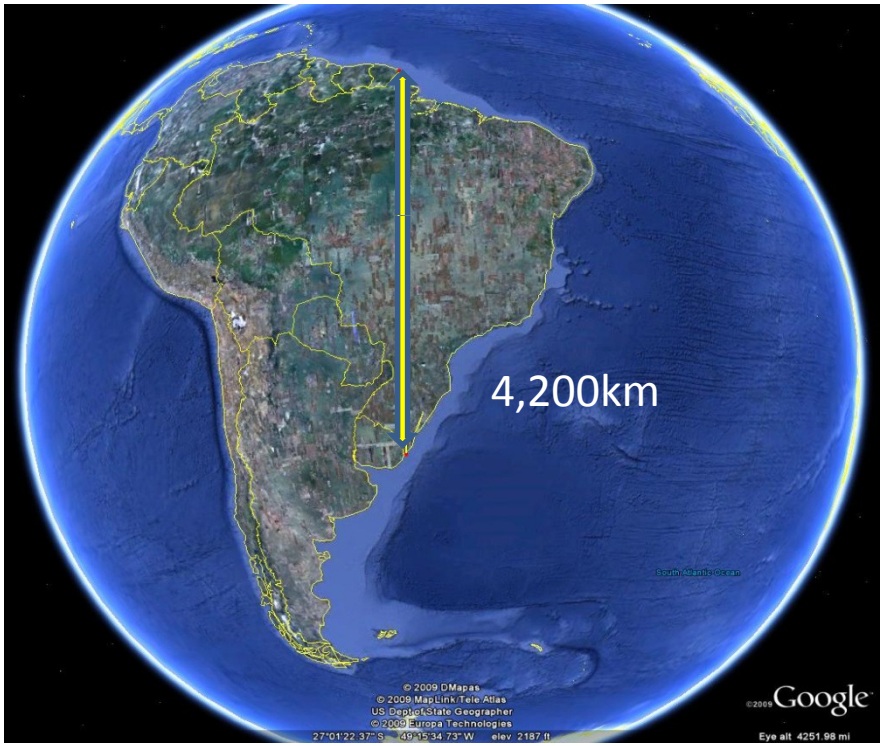
The largest economy in South America and the 10th largest in the world;

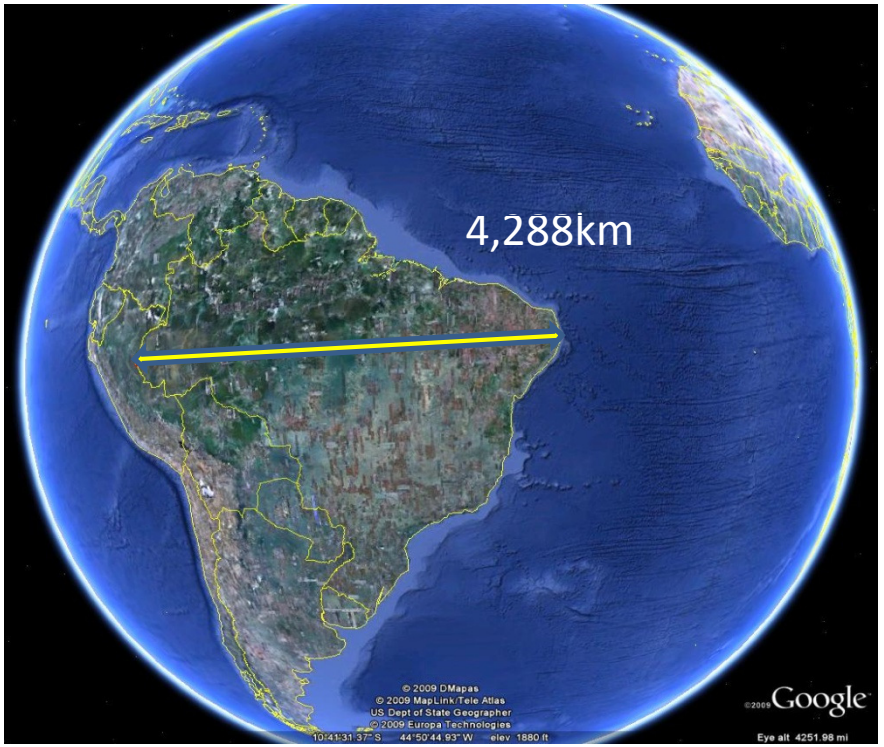
5th largest country in the world in area;

192 million inhabitants (5th after China, India, USA and Indonesia);

About Brazil

Great Environmental Diversity

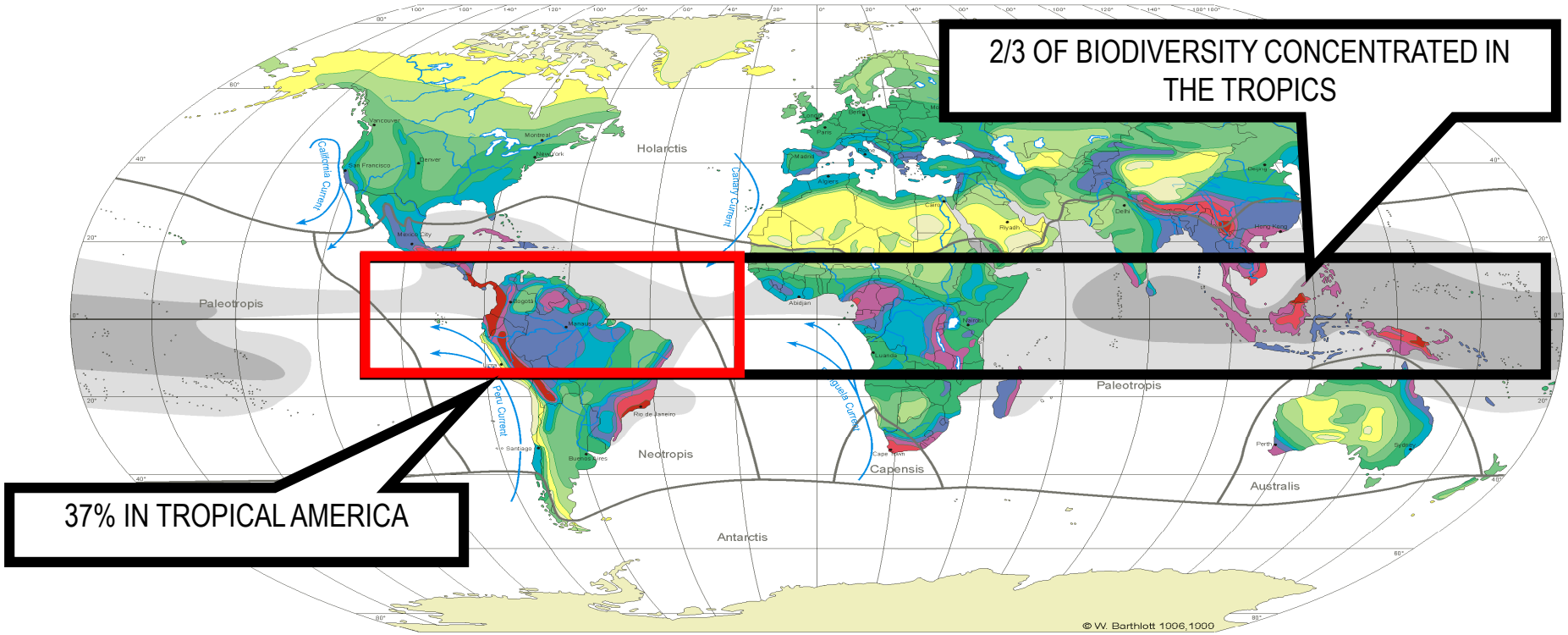




Embrapa

About Brazil

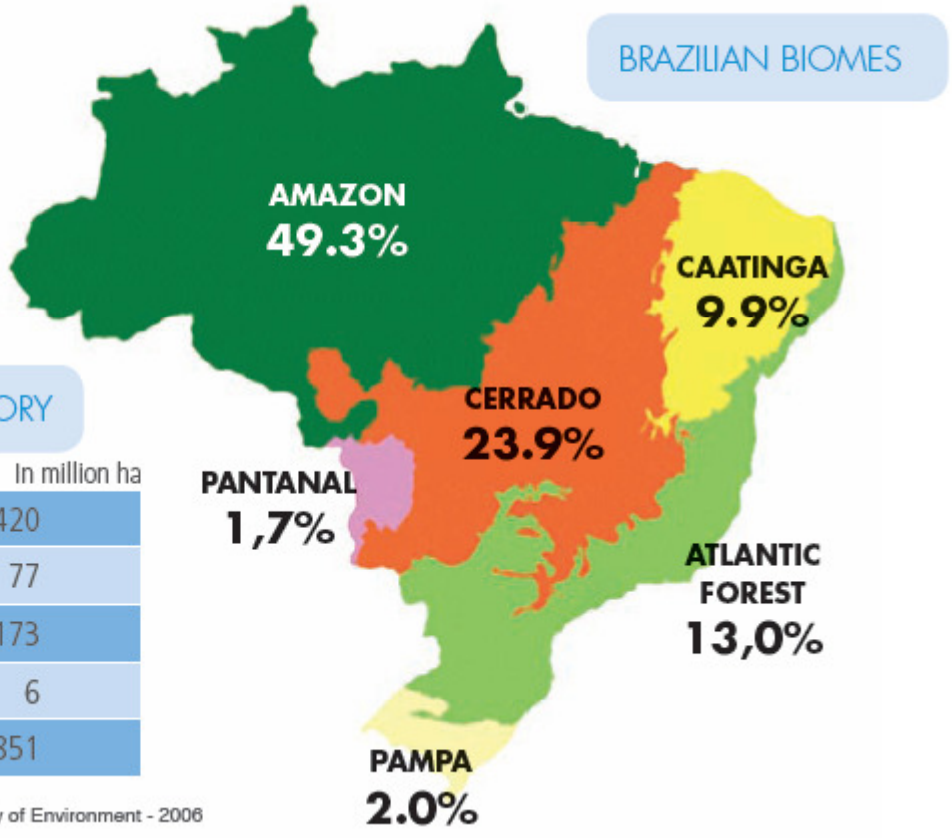
A Mega-diverse Country



Barthlott, W., Biedinger, N., Braun, G., Feig, F., Kier, G. & J. Mutke (1999): Terminological and methodological aspects of the mapping and analysis of global biodiversity. In: Acta Botanica Fennica 162: 103-110.

About Brazil

BRAZILIAN BIOMES



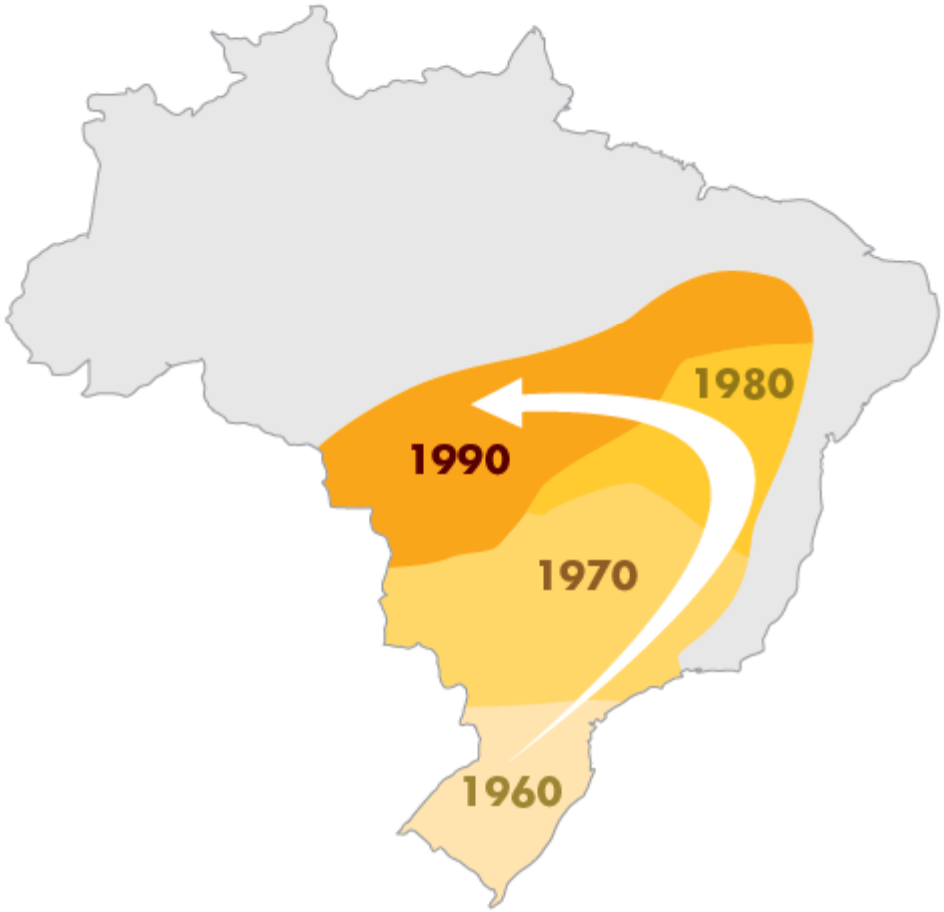
BRAZILIAN TERRITORY

In million ha

Amazon Biome	420
Crops	77
Pastures	173
Planted Forests	6
Brazil	851

Sources: Ministry of Agriculture; Ministry of Environment - 2006

About Brazil



Evolution of Agriculture in Brazil

From the 1960´s to the 1990´s

Embrapa

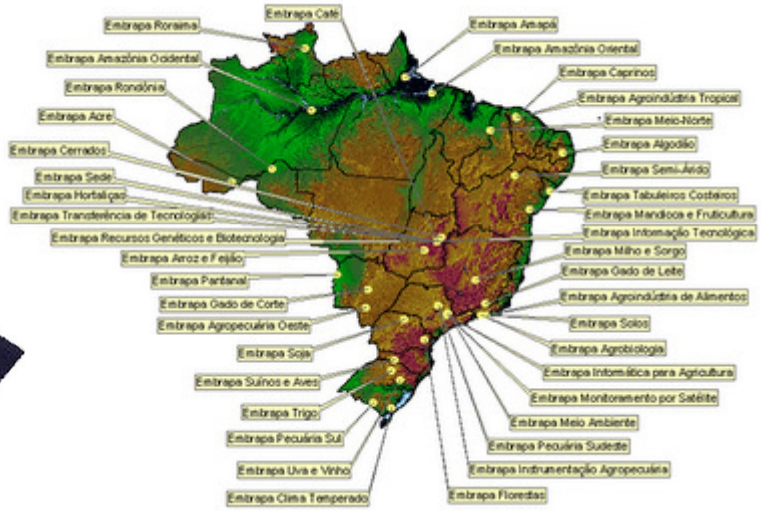
The Brazilian Agricultural Research System

17 State Research Networks

CONSEPA
Conselho Nacional dos Sistemas Estaduais de Pesquisa Agropecuária

70 Agricultural Universities

The Brazilian Agricultural Research Corporation
45 Embrapa Centers



Private Sector

Brazil has also an active and growing private sector, which supplies technologies and technical assistance mainly in farm inputs and food processing

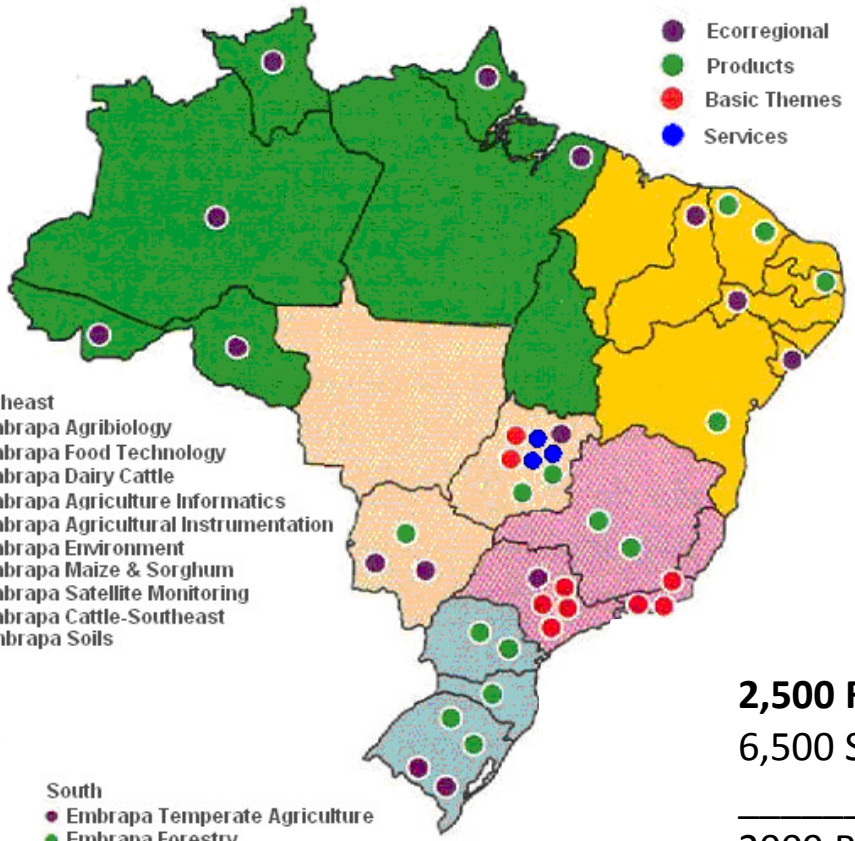
Embrapa

The Brazilian Agricultural Research Corporation – Embrapa

The largest Agricultural R&D System in Latin America

Embrapa Network for R,D&I

- ✓ 41 Research Centres and Services Units
- ✓ 3 Virtual Laboratories Abroad (Labex)
- ✓ Offices for Technology Transfer: 14 in Brazil and 2 abroad (Africa and Venezuela)



North
- Embrapa Acre
- Embrapa Amapa
- Embrapa Western Amazon
- Embrapa Eastern Amazon
- Embrapa Rondonia
- Embrapa Roraima

Northeast
- Embrapa Mid-North
- Embrapa Tropical Semi-Arid
- Embrapa Coastal Tablelands
- Embrapa Goat and Sheep
- Embrapa Cassava &Tropical Fruits
- Embrapa Cotton
- Embrapa Tropical Agroindustry

Mid-West
- Embrapa Agrienergy
- Embrapa Western Region Agriculture and Livestock
- Embrapa Rice & Beans
- Embrapa Coffee
- Embrapa Cerrados
- Embrapa Beef Cattle
- Embrapa Vegetables
- Embrapa Technological Information
- Embrapa Pantanal
- Embrapa Genetic Resources & Biotechnology
- Embrapa Technology Transfer

Southeast
- Embrapa Agribiology
- Embrapa Food Technology
- Embrapa Dairy Cattle
- Embrapa Agriculture Informatics
- Embrapa Agricultural Instrumentation
- Embrapa Environment
- Embrapa Maize & Sorghum
- Embrapa Satellite Monitoring
- Embrapa Cattle-Southeast
- Embrapa Soils

South
- Embrapa Temperate Agriculture
- Embrapa Forestry
- Embrapa South Animal Husbandry & Sheep
- Embrapa Soybean
- Embrapa Swine and Poultry
- Embrapa Wheat
- Embrapa Grape & Wine

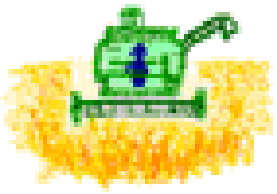
2,500 Researchers

6,500 Staff

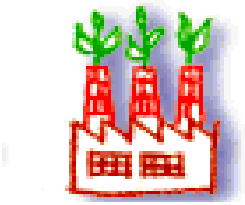
2009 Budget: US$ 1 Billion

The Brazilian Agricultural Research Corporation

Contributions of Embrapa



Advanced Production Systems



Agroindustry

Environment

Regional Development

The Brazilian Agricultural Research Corporation

A comprehensive portfolio to meet the needs of the users

Products

- Varieties
- Hybrids
- Animal clones
- Germplasm
- Bioinsecticides
- GMOs
- Agricultural Machinery
- Equipaments
- Kits for diagnostics
- Vaccines

Information

- Cultivar Evaluation Networks
- Traceability and Certification
- Forecasting and Future Analysis
- Biological Security Networks
- Genomics and Biological Functions
- System´s Automation
- Monitoring – IPM
- Monitoring – Environmental Quality
- Monitoring – Food Chains
- GMOs & Biosafety

Processes

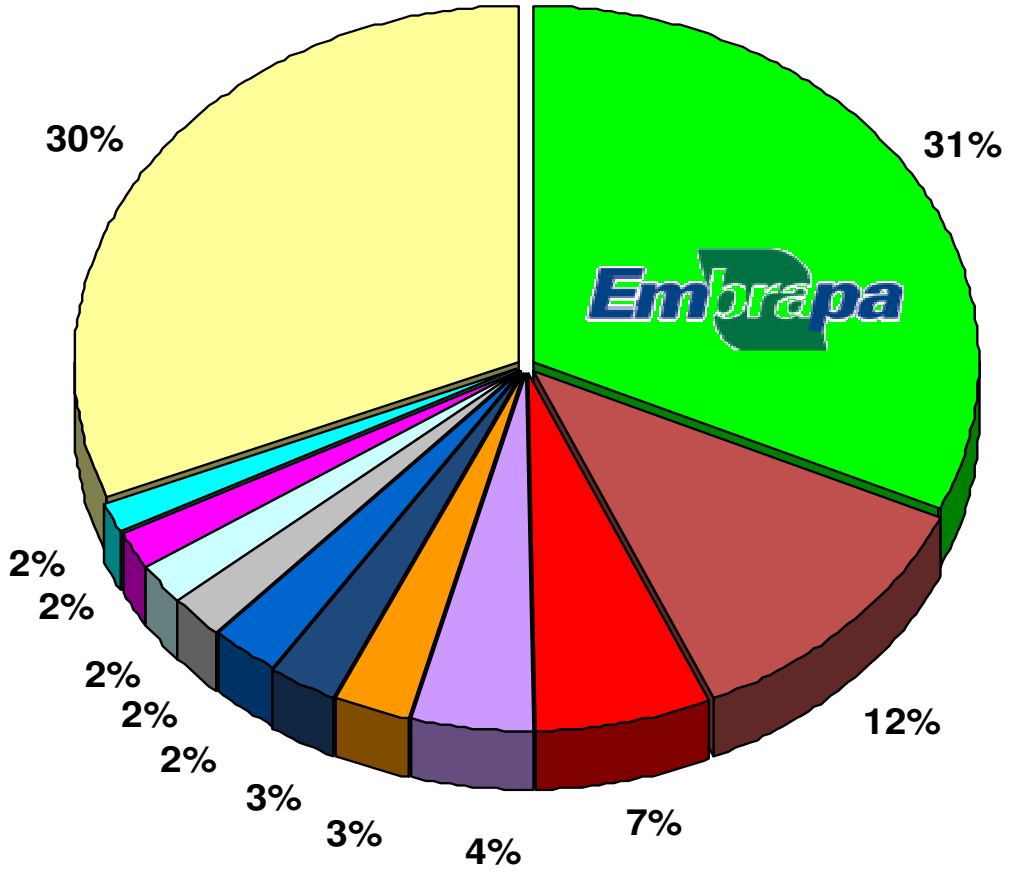
- Crop Management Systems
- Crop Adaptation Processes
- Food Processing Methodology
- Plant & Animal Transformation
- Gene Prospection Methodology
- Integrated Pest Management
- Fingerprinting
- Agroecological Zoning
- Traceability & Certification

Services

- Germplasm Exchange
- Quarentine Analysis
- Information Networks
- Franchising
- Quality Control
- Consultancy
- Training
- Business Incubation

The Brazilian Agricultural Research Corporation

Embrapa´s Share in Crop Variety Protection in Brazil (em %)

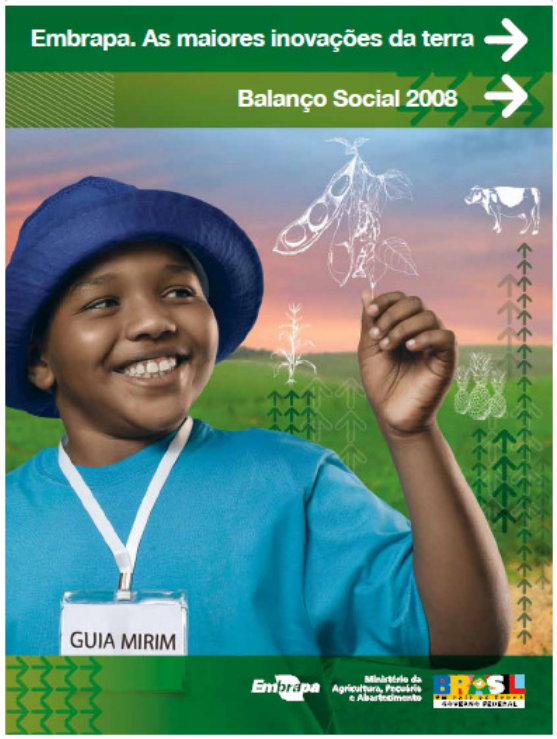


- Embrapa (219)
- MONSOY (81)
- COODETEC (46)
- COPERSUCAR (29)
- FECOTRIGO (20)
- UFV (18)
- Naturalle Agromercantil (16)
- Fundação Mato Grosso (14)
- IAPAR (13)
- BRETAGNE-PLANTS (12)
- OR MELHORAMENTO (11)
- Outros 68 (<11 cultivares cada)

(August 2005)

Total protected cultivars: 699

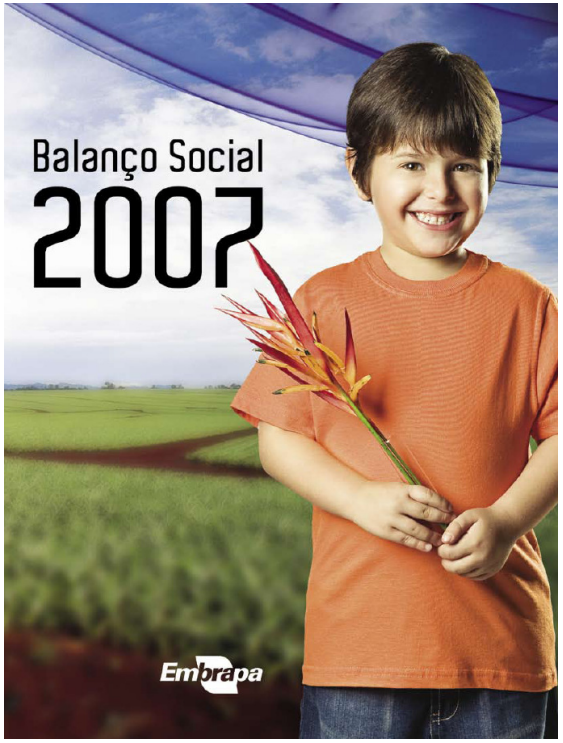
The Brazilian Agricultural Research Corporation



Embrapa publishes regularly its social balance

Every Brazilian Real (R$) invested in Embrapa returns between R$ 12 and R$14 to the Brazilian society (US$ 1.00 = R$ 1.77).

The Social balance of Embrapa in the past 10 years amounts to US$ 49.7 billion



http://bs.sede.embrapa.br/2006/

Agribusiness in Brazil – Food, Feed, Fiber

Exports

In 2008 Brazil exported more than 1500 types of agricultural products to foreign markets

Commercial partners

Around 79% of the Brazilian food production is consumed domestically and 21% is shipped to over 212 foreign markets

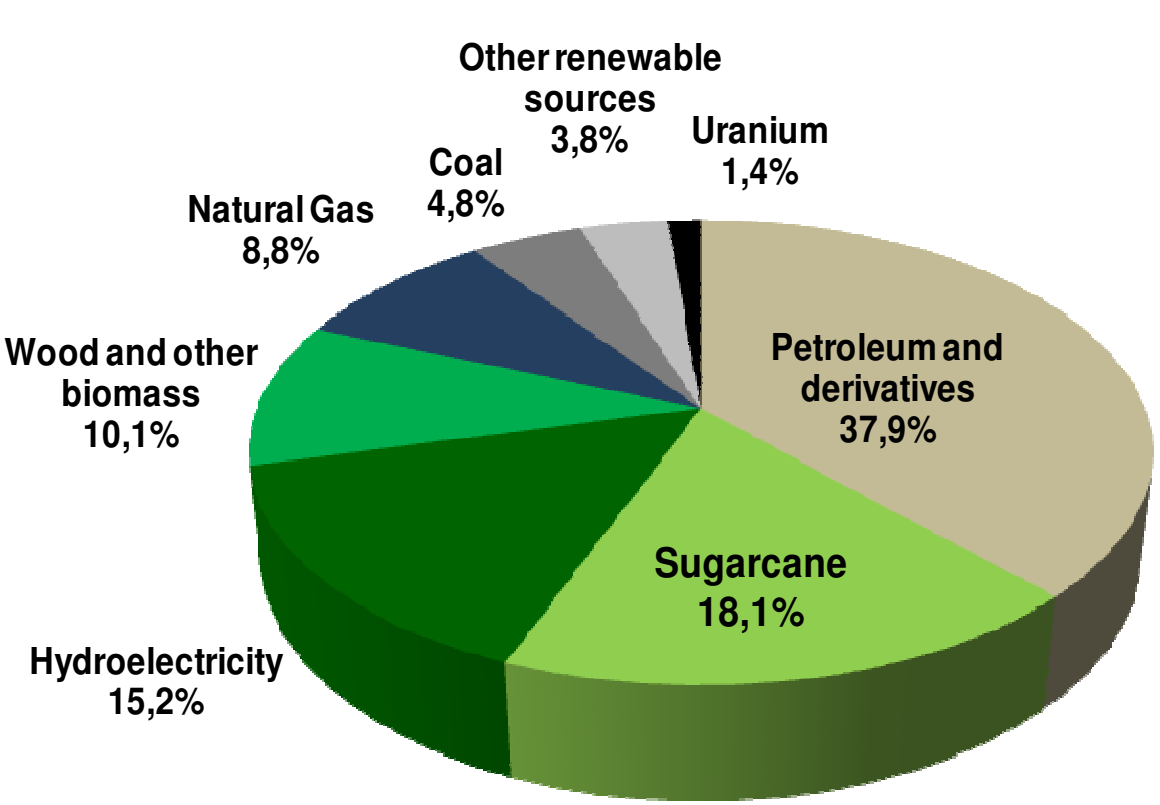
Product	Production	Exports
Sugar	1st	1st
Orange juice	1st	1st
Coffee	1st	1st
Beef	2nd	1st
Soybean	2nd	1st
Tobacco	3rd	1st
Broiler	3rd	2nd
Corn	3rd	4th

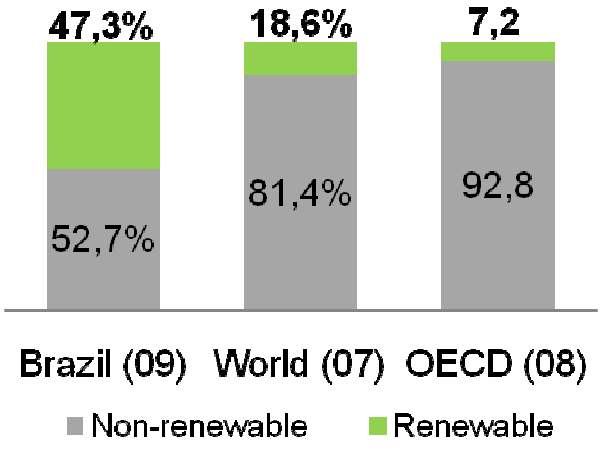
Source: SPA/MAPA (Agricultura Brasileira em Números)

Embrapa

Agribusiness in Brazil – Food, Feed, Fiber, Fuel

Brazilian Energy Matrix





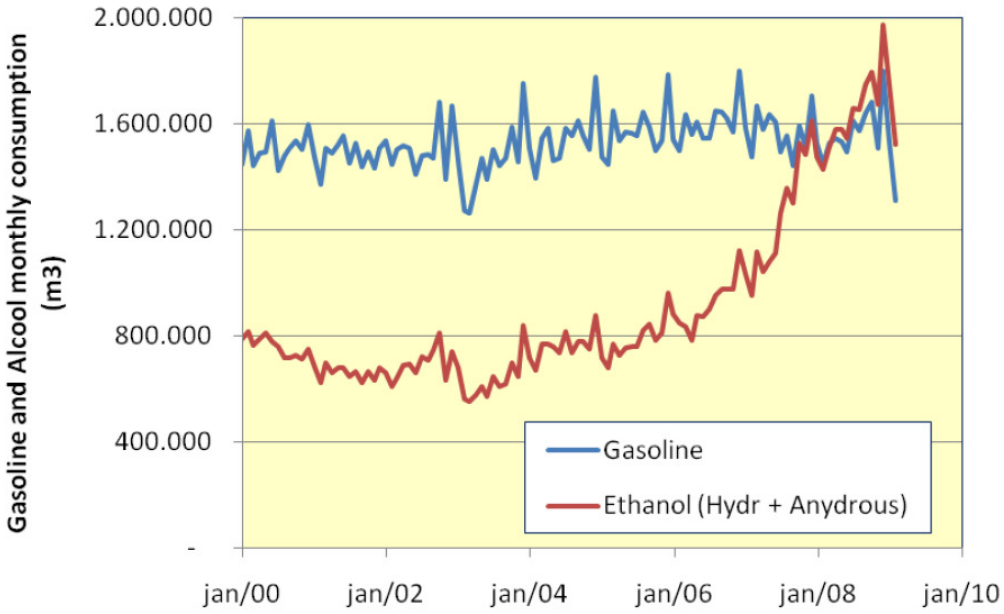
Source: BEN (2010). Elaboration: UNICA

Agribusiness in Brazil – Food, Feed, Fiber, Fuel

Agriculture and Green Energy in Brazil

`Gasoline is Becoming the Alternative Fuel in Brazil`

Changes in Ethanol and Gasoline use in Brazil



Source: ANP, 2009 and Brito Cruz, 2009

Agribusiness in Brazil – Food, Feed, Fiber, Fuel

The Economist

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Brazil's agricultural miracle

How to feed the world

The emerging conventional wisdom about world farming is gloomy. There is an alternative

Aug 26th 2010

http://www.economist.com/node/16889019

The Economist

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Brazilian agriculture

The miracle of the cerrado

Brazil has revolutionised its own farms. Can it do the same for others?

Aug 26th 2010 | CREMAQ, PIAUÍ

http://www.economist.com/node/16886442

Embrapa

International Cooperation is Key to Brazil

Our Belief

As the world becomes more interconnected and challenges become more complex, it will be increasingly necessary to work through intense cooperation.

President Lula: "The Internationalization of Embrapa is a State Policy"

September 11, 2009 · Leave a Comment

Source: Embrapa

The Brazilian President Luiz Inácio Lula da Silva welcomed the new President of Embrapa during the inauguration ceremony, last July. He said that "the mark of Embrapa has always to be the technical expertise, no other" and that "Brazil is a plural country and Embrapa has to be plural and capable to attend many, as well as to increase its contribution to the world." President Lula spoke about the expectations for the new management and one of his most emphatic remarks was that "the internationalization of Embrapa is not only a desire for the government, but a state policy, which will be a constant in the future." Read more (in Portuguese) here.

http://labexkorea.wordpress.com/

International Cooperation at Embrapa

Multiple Strategies

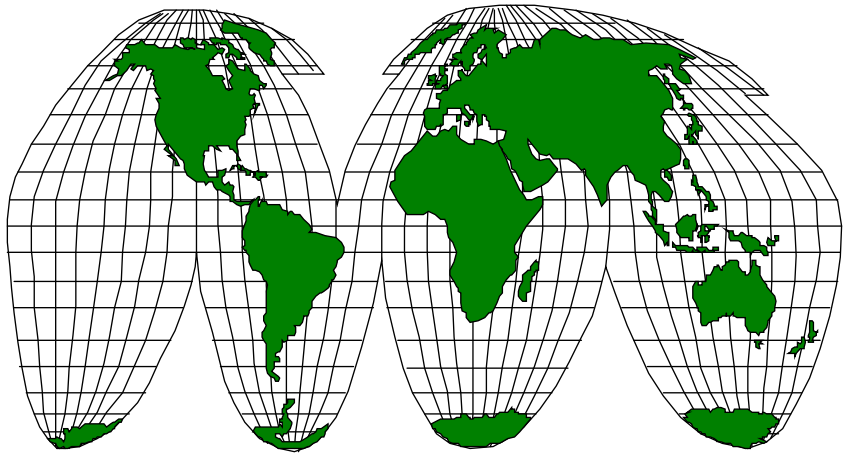
Multilateral Cooperation

Technology Transfer Offices

Virtual Laboratories Abroad- Labex

Public-Private Cooperation

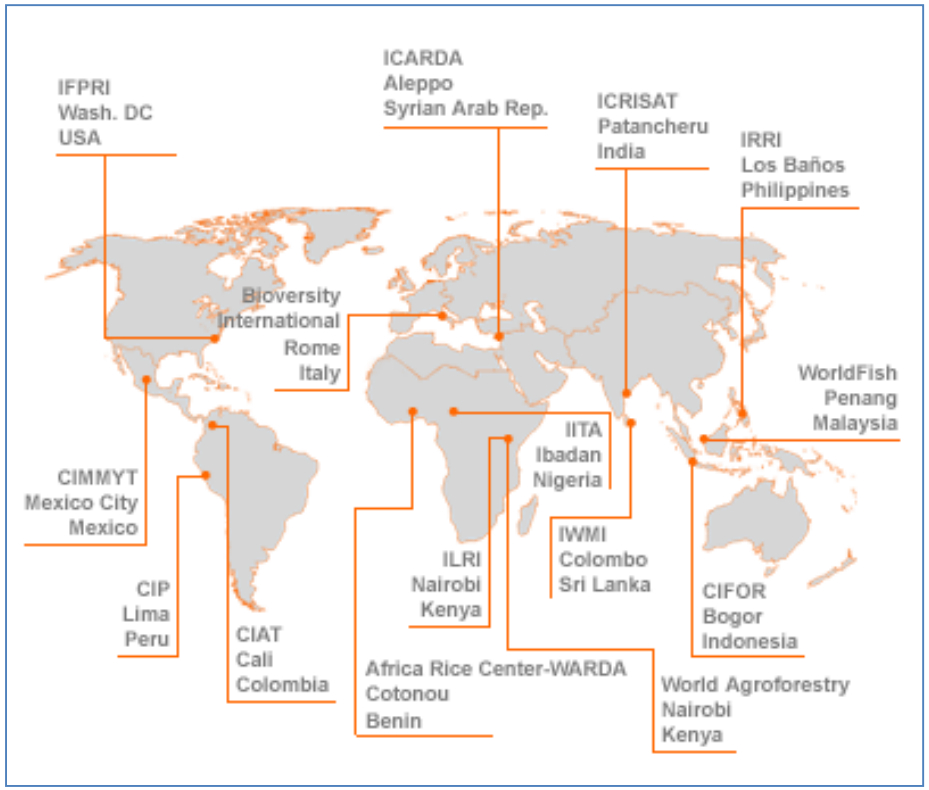
International Cooperation is Key to Embrapa



A strong post-graduation program sent hundreds of young professionals abroad, to the United States and Europe, and to a lesser extent to the United Kingdom, Canada, Spain, Holland, Germany and Australia.

Projects financed by the World Bank, Inter-American Development Bank and the Japanese government have been very important to finance this human development program and also to equip the research units.

International Cooperation is Key to Embrapa



http://www.cgiar.org/index.html

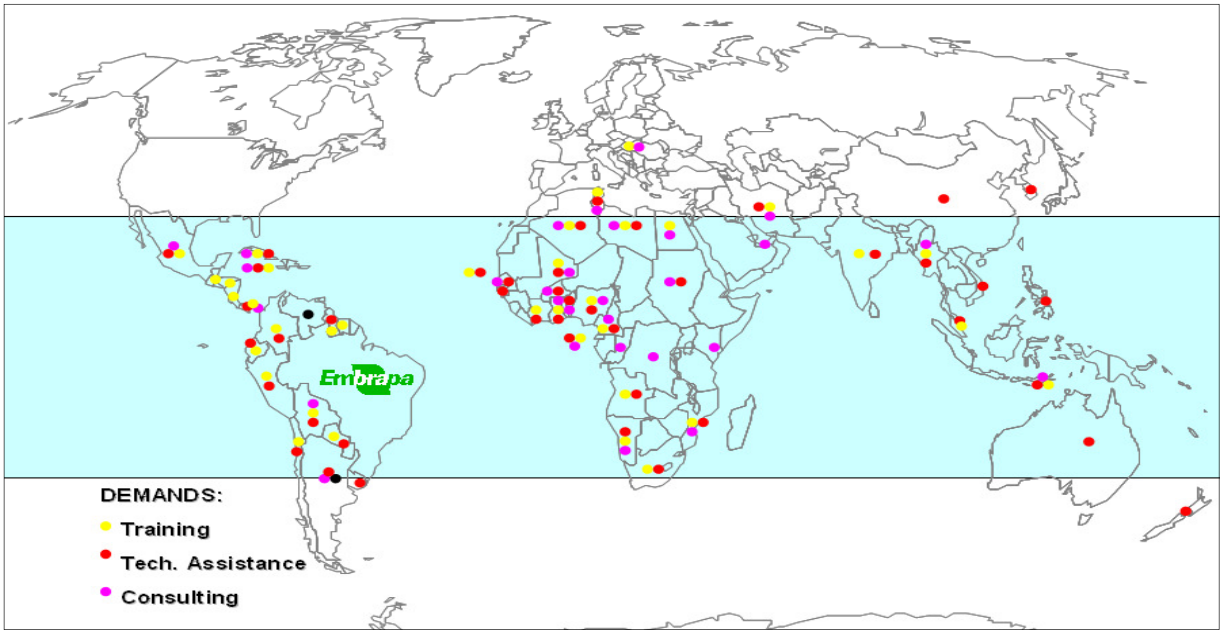
Embrapa collaborates with the CGIAR system since its origin;

This relationship, especially at the beginning of Embrapa, was very important to set directions for research and for training scientists;

Embrapa recognizes that important shares of the Brazilian seed market of wheat, maize, beans and rice is held by varieties that were improved using genetic material received from CGIAR centers.

International Cooperation is Key to Embrapa

The success of Brazilian tropical agriculture motivates countries with similar problems and challenges to seek information and partnership with Embrapa.



Today Embrapa has:

78 bi-lateral agreements with 89 institutions in 56 countries;

Multilateral Agreements with 20 International Organizations;

At project level, there are numerous agreements involving several countries, organizations and research networks.

International Cooperation is Key to Embrapa

Links with the private sector to quickly bring innovations to the market

Example: More than 10 years of successful cooperation between Embrapa and BASF allowed the development of Cultivance® the first genetically modified crop developed in Brazil, from laboratory to commercialization.

BASF The Chemical Company

Embrapa

Ministério da Agricultura, Pecuária e Abastecimento

BRASIL UM PAÍS DE TODOS GOVERNO FEDERAL

Joint Press Release

February 5, 2010

BASF and Embrapa's Cultivance® soybeans receive approval for commercial cultivation in Brazil

- *First genetically modified crop developed in Brazil to reach commercialization stage*
- *Market launch to take place after regulatory approval in key export markets*

http://www.basf.com/group/pressrelease/P-10-148

Embrapa

International Technology Transfer Programs

Embrapa Africa

Technology transfer office in Accra, Ghana since November 2006

- **11 agreements and ongoing projects in several African Countries**

- **8 agreements and projects being negotiated**

International Technology Transfer Programs

Embrapa Latin America

Technology transfer office in Caracas, Venezuela, since May 2008

- **11 Agreements and ongoing projects in Latin American countries**

Embrapa Americas opened in 2010 its Central America Office – in Panama

International Cooperation at Embrapa

Technology Transfer Offices

Embrapa Latin America

Technology transfer office in Caracas, Venezuela, since May 2008

11 Agreements and ongoing projects in Latin American countries

Embrapa Americas opened in 2010 in Central America - Panama

Embrapa Africa

Technology transfer office in Accra, Ghana since November 2006

11 agreements and ongoing projects in several African Countries

8 agreements and projects being negotiated

International Cooperation at Embrapa

R&D Platforms

The Africa-Brazil Agricultural Innovation Marketplace is Launched

Posted on June 28, 2010 | Leave a comment

The **Africa-Brazil Agricultural Innovation Marketplace** is a multiparty international initiative involving the Forum for Agricultural Research in Africa (FARA), the Brazilian Agricultural Research Corporation (Embrapa), the United Kingdom Department for International Development (DFID), the International Fund for Agricultural Development (IFAD), the World Bank (WB) and the Brazilian Cooperation Agency (ABC).

The initiative aims to promote South-South partnerships to enhance agricultural research and development in the African continent, focusing on small holders. Agricultural innovation will be the major emphasis of this cooperation program and proposals will be accepted in the following thematic areas:

1. Productivity Enhancing Technologies
2. Natural Resource Management Improvement
3. Policy, Institutional and Market Strengthening and Knowledge Management
4. Smallholder and Poverty-Alleviation Targeted Technologies

The **Africa-Brazil Agricultural Innovation Marketplace** is a multiparty international initiative

International Cooperation at Embrapa

Training and Capacity Building

Embrapa Inaugurates a New Unit Dedicated to Strategic Studies and Training

Posted on May 9, 2010 | Leave a comment

Photo by Leonardo Carvalho

On May 10, 2010 President Luiz Inacio Lula da Silva will inaugurate a new Embrapa Unit, as part of the agenda of the Brazil-Africa dialogue on food security, hunger and rural development, which occurs in Brasilia. The event, organized by the Brazilian Ministry of Foreign Affairs, will be attended by more than 70 delegations from African countries.

Embrapa Strategic Studies and Training will be a Unit dedicated to promote and to coordinate studies on strategic issues that contribute to the enhancement of institutional and programmatic objectives of Embrapa, as well as to capacity building and training of local and foreign professionals in tropical agriculture.

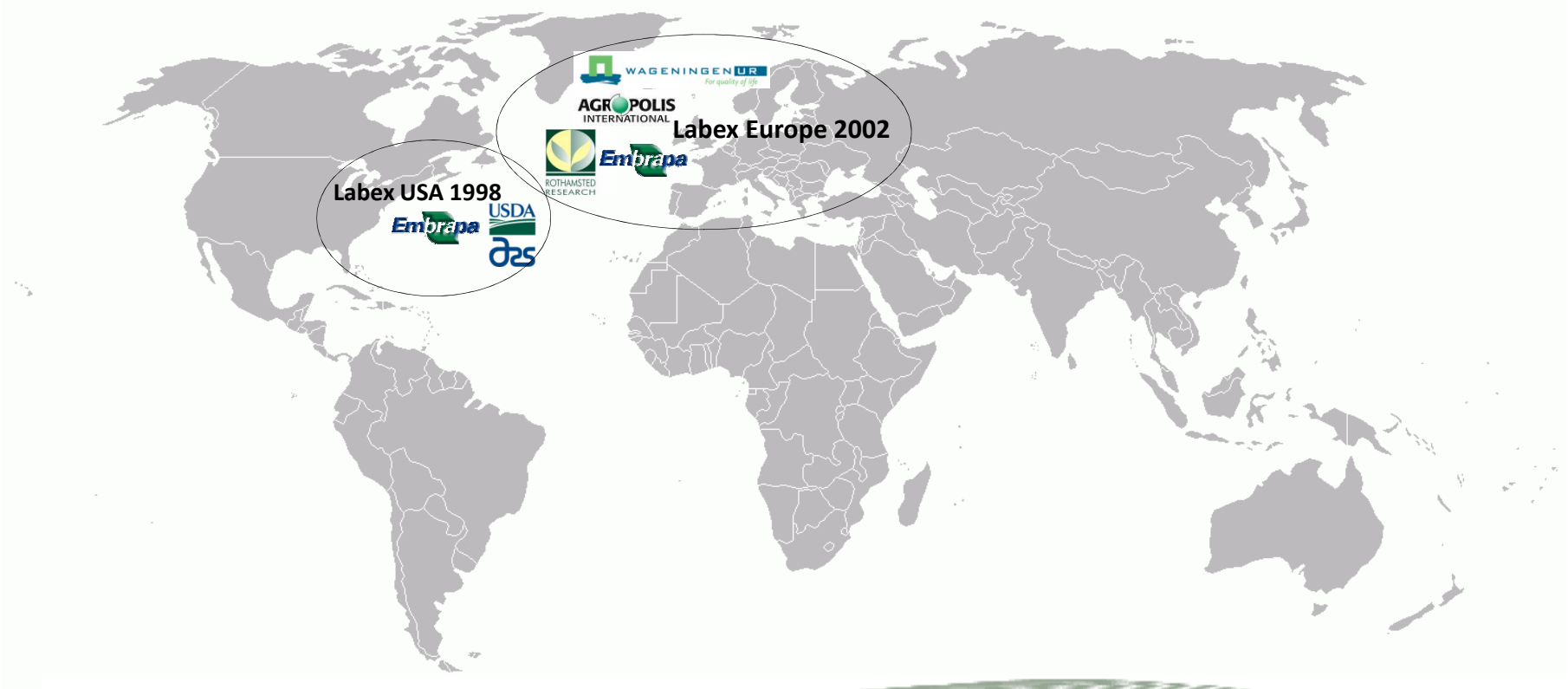
It will also contribute to empower new talents, employed by Embrapa or by other technical organizations, public and private. The Unit will start in 2010 capacity building activities in the framework of technical cooperation projects between Brazil and African countries, especially those with which Embrapa develops cooperation projects in different areas of agricultural research and development.

Embrapa Strategic Studies and Training

Establish training programs focused on technology transfer and sharing of knowledge. Its team have the responsibility to plan, coordinate, implement and monitor training as means of supporting knowledge and technology transfer in tropical agriculture.

Labex – cooperation in cutting-edge agricultural R&D

Embrapa has developed more than a decade ago the concept of "Virtual Laboratories Abroad" – Labex, as means of increasing its scientific and technological ties with advanced research organizations around the world.



Embrapa

The Embrapa Labex Program

“Labex Mission and Objectives”

To bring the international dimension to the Embrapa network

Monitoring trends in S&T and opportunities of cooperation

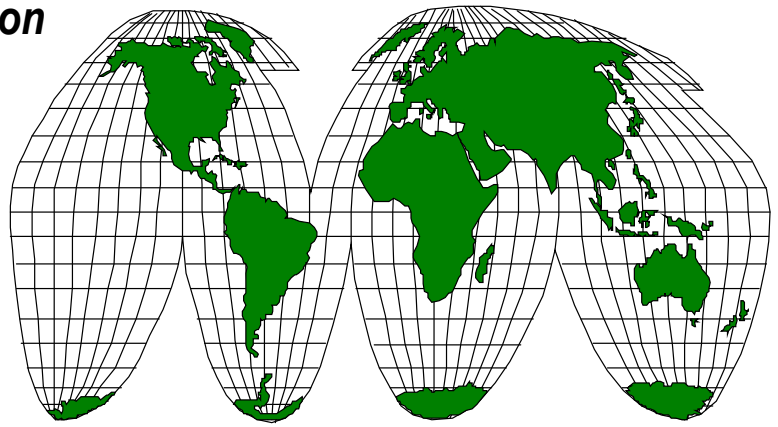
Promoting collaborative projects in strategic areas

Facilitating exchanges of scientists

Identifying training opportunities

Promoting technical meetings and scientific exchange

Follow-up on joint research projects



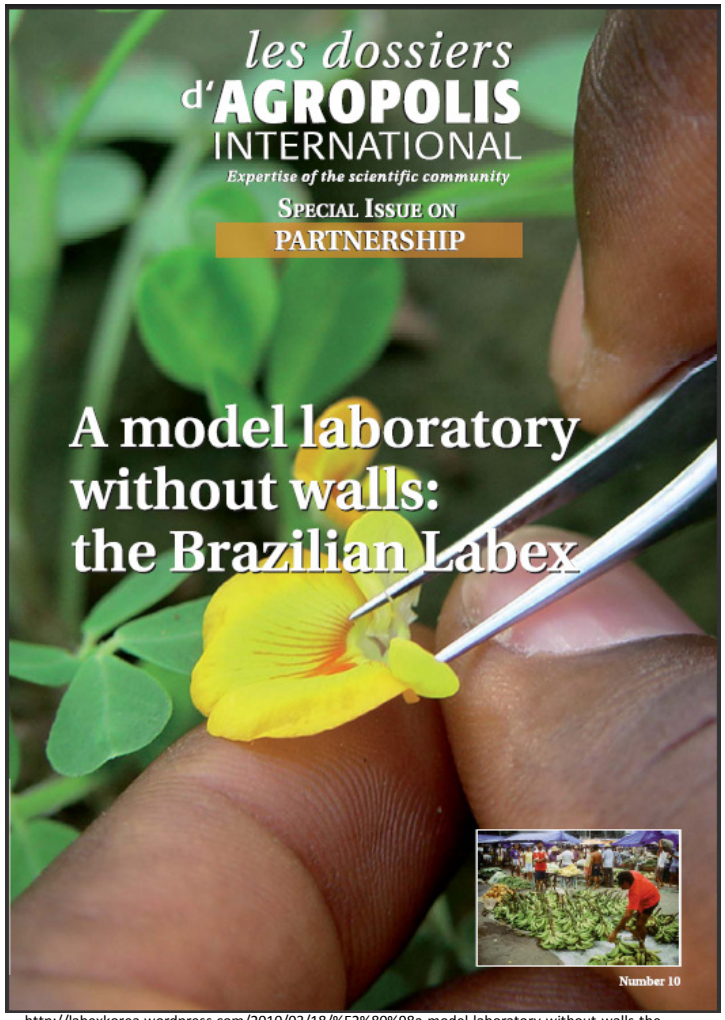
The Embrapa Labex Program

"The Labex Impact"

International networking - cutting-edge research - capacity building - access knowledge access new funds and tools - increased visibility - dialogue in international fora, etc,etc...

"Advanced Biology"
"Applied Nanotechnology"
"Food Safety"
"Genetic Resources"
"Agro-energy"
"Animal Health"
"Climate Change"
"Natural Resource Management"
"Precision Agriculture"
"Food Processing"
"Forestry"
"Intellectual Property"
"Functional Foods"

The Embrapa Labex Program



http://labexkorea.wordpress.com/2010/03/18/%E2%80%98a-model-laboratory-without-walls-the-brazilian-labex%E2%80%99/

United States and Brazil Sow Seeds for **Germplasm Exchange**

What effect does temperature have on long-term seed storage?

Christina Walters, a plant physiologist at the ARS National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, Colorado, and visiting scientist Luciano Nass, from Brazil, are trying to find out. They're using germplasm—the genetic material of a plant—from maize, which is an important crop in both nations.

"NCGRP has a lot of data on maize storage, dating back to 1977, which makes it an ideal crop for a comparison study like this," Walters says.

She and Nass plan to clarify how maize grains respond to both extremely cold cryogenic storage and conventional storage over time. Previous NCGRP research suggests that maize deteriorates faster in the frigid temperatures of cryogenic storage (about –238°F) than in those of conventional storage (about 0°F). Walters and Nass want to know why.

They'll use this information to determine the most economical and efficient method for storing maize germplasm. They may be able to extrapolate the results to other crops as well. This will aid both countries in evaluating the cost efficiency of their respective genebanking systems and could guide future investment decisions.

"This research will show us how to use taxpayers' money to the greatest advantage," Walters says. "We want to know which method gives them the most bang for their buck and how we can increase the efficiency and effectiveness of germplasm storage."

The Virtual Laboratory

This research is one aspect of an ongoing collaborative effort between ARS and its Brazilian counterpart, EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária).

Despite differences in climate, native flora and fauna, and agricultural management practices, the United States and Brazil have a lot in common. Both are large nations with diverse topographies. Both count corn and soybeans among their principal crops. The two nations even face similar agricultural challenges.

In 1998, ARS and EMBRAPA decided to capitalize on the nations' similarities and the unique perspectives that arise from their differences by organizing a formal agricultural collaboration. The resulting program is Labex, from a Portuguese term meaning "virtual laboratory," so called because it lacks any physical laboratory buildings of its own.

ARS's Office of International Research Programs coordinates the Labex program, through which the United States and Brazil share equipment, researchers, and expertise. ARS provides offices, laboratory space, equipment, and supplies to visiting senior scientists from Brazil. EMBRAPA funds the salaries and expenses of the scientists, who are among the most respected and experienced ones in their country.

The program often expands its focus, but previous projects emphasized precision agriculture, animal health, integrated pest management, new uses of commodities, genomics, proteomics, bioinformatics, and global change. Current projects focus on genetic resources, nanotechnology, and food security.

In December 2005, Nass and visiting scientist Arthur Mariante arrived from B… effectiv… niques … germpl… Labex … resourc… ordinat…

Updati…

While … NCGRP … tion Re… months … the National Animal Germplasm … U.S. and Brazilian livestock gene… with livestock breeders from ar… with ARS animal geneticist Harv… for evaluating the genetic diversi… and cattle populations.

Blackburn and several EMBR… for a Brazilian computer progra… Cajueiro, to work with U.S. progra… to develop a new version of the ar… ARS's Genetic Resources Inform… Brazilian programmers are expe…

"Currently, Brazil does not ha… animals, so this collaboration wi…

Brazilian geneticist Luciano Nass (left) and ARS animal geneticist Harvey Blackburn prepare to cryopreserve germplasm in a computerized programmable freezer as part of the Labex exchange program.

12

http://www.ars.usda.gov/is/AR/archive/feb07/seeds0207.pdf

Expanding the Labex Program to Korea

Inauguration of Labex Korea (12.2009)

Korea-Brazil Summit (11.2008)

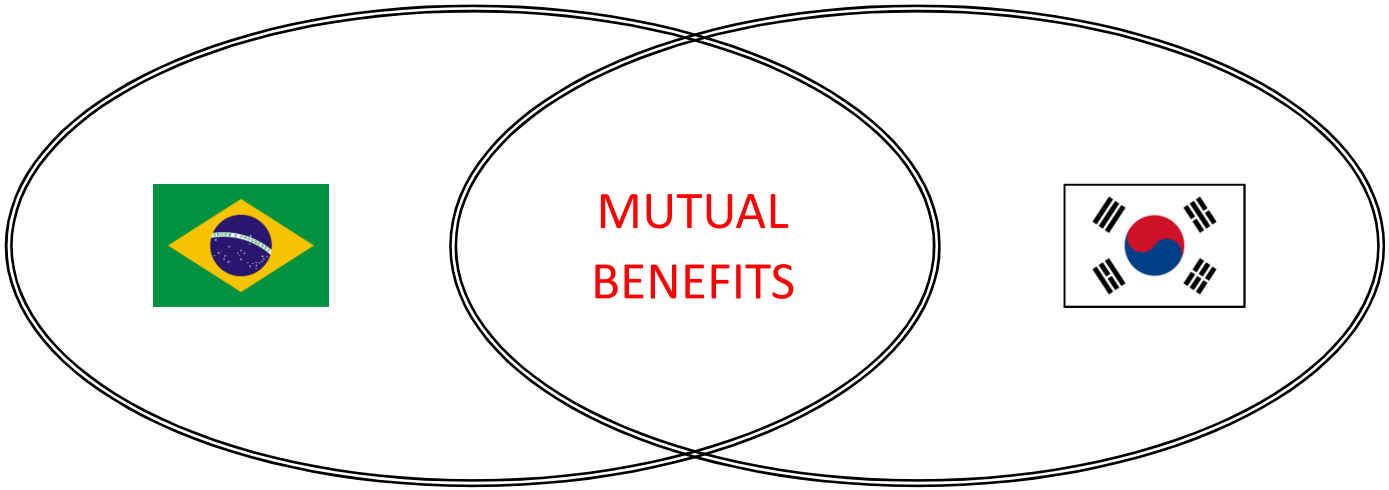
Embrapa

RDA

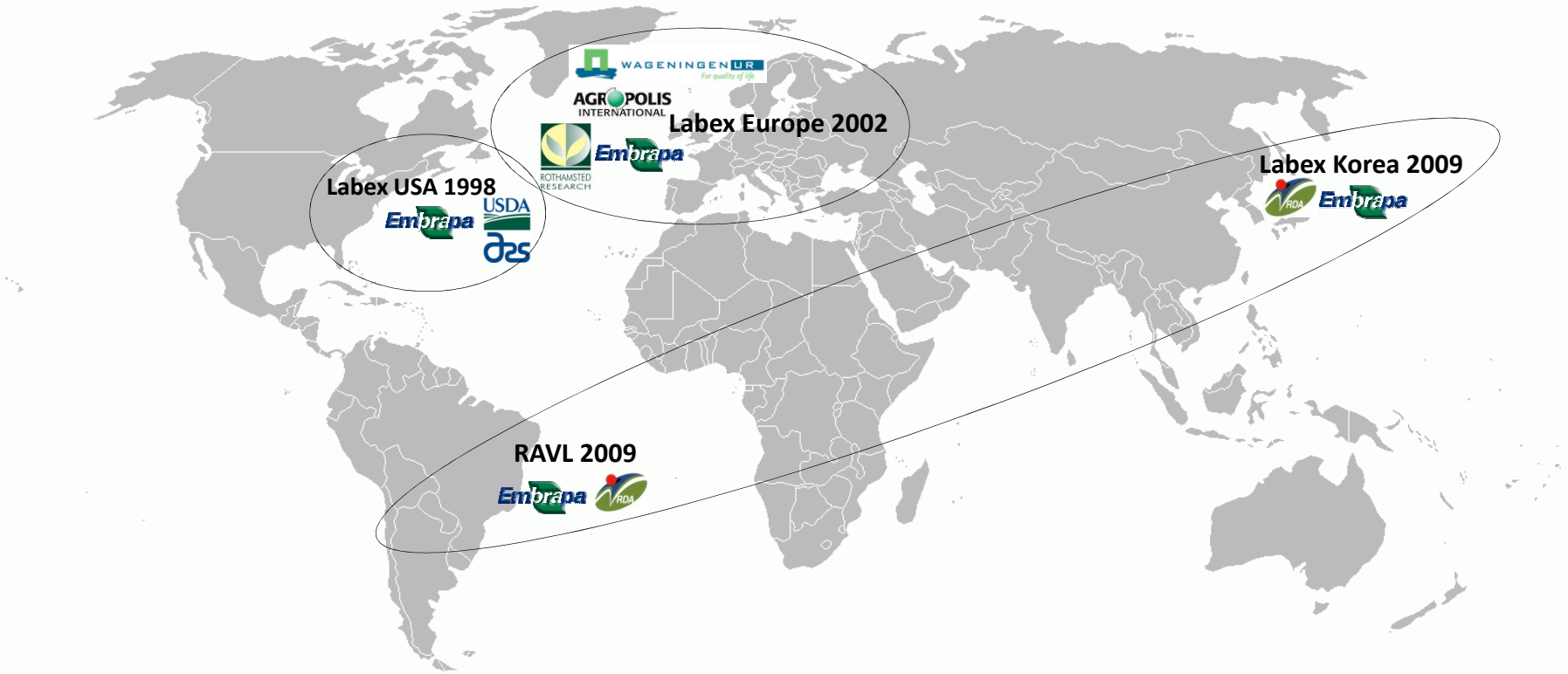
Expanding the Labex Program to Korea

It is feasible to think about a strong collaboration between two knowledge-driven countries such as Brazil and Korea

Brazil – "natural knowledge" driven + Korea - innovation-driven



Labex – cooperation in cutting-edge agricultural R&D



Labex Korea – Agenda of Priorities

1. Bioenergy
2. Genetic resources
3. Biotechnology (Plant & Animal)
4. Plant breeding (Crop & Horticulture)
5. Agro-ecosystem and environment
6. Agricultural engineering

Labex Korea – Agenda of Priorities

The Labex Korea Research Project

"Comparative analysis of Korean and Brazilian regulations affecting access, exchange and use of biological resources for food, agriculture and bioindustry".

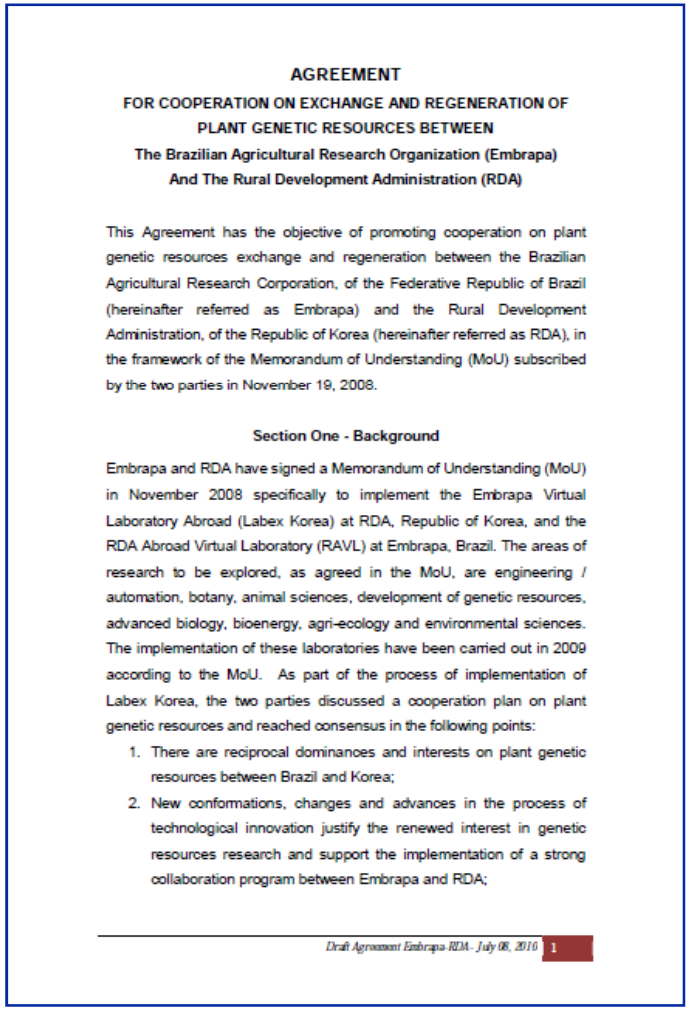
The objective of this ongoing research project is to develop an information and decision support process to facilitate the exchange and use of biological resources between Brazil, and Korea in the context of food, agriculture and bioindustry research and development.

The weblog of the project is located at:

http://bioresourcespolicy.wordpress.com/

Embrapa

Labex Korea – Agenda of Priorities



AGREEMENT

FOR COOPERATION ON EXCHANGE AND REGENERATION OF PLANT GENETIC RESOURCES BETWEEN

The Brazilian Agricultural Research Organization (Embrapa)

And The Rural Development Administration (RDA)

This Agreement has the objective of promoting cooperation on plant genetic resources exchange and regeneration between the Brazilian Agricultural Research Corporation, of the Federative Republic of Brazil (hereinafter referred as Embrapa) and the Rural Development Administration, of the Republic of Korea (hereinafter referred as RDA), in the framework of the Memorandum of Understanding (MoU) subscribed by the two parties in November 19, 2008.

Section One - Background

Embrapa and RDA have signed a Memorandum of Understanding (MoU) in November 2008 specifically to implement the Embrapa Virtual Laboratory Abroad (Labex Korea) at RDA, Republic of Korea, and the RDA Abroad Virtual Laboratory (RAVL) at Embrapa, Brazil. The areas of research to be explored, as agreed in the MoU, are engineering / automation, botany, animal sciences, development of genetic resources, advanced biology, bioenergy, agri-ecology and environmental sciences. The implementation of these laboratories have been carried out in 2009 according to the MoU. As part of the process of implementation of Labex Korea, the two parties discussed a cooperation plan on plant genetic resources and reached consensus in the following points:

1. There are reciprocal dominances and interests on plant genetic resources between Brazil and Korea;
2. New conformations, changes and advances in the process of technological innovation justify the renewed interest in genetic resources research and support the implementation of a strong collaboration program between Embrapa and RDA;

Draft Agreement Embrapa-RDA - July 08, 2010 1

Embrapa-RDA Agreement For cooperation in Exchange and Regeneration of Plant Genetic Resources

Promotion of continuous exchange and regeneration of plant genetic resources and sharing of information of interest to both parties;

Creation of a stable channel for exchanges of experts and dialogues between scientists of the two parties, for further cooperation.

In final phase of negotiation

Embrapa

Labex Korea – Agenda of Priorities

PROPOSAL

EMBRAPA-RDA RESEARCH PLATFORM FOR FIRST AND SECOND GENERATION BIOFUEL PRODUCTION FROM SWEET SORGHUM FEEDSTOCK

INTRODUCTION

Biofuels promote a series of environmental gains (carbon sequestration, lower level of emissions), are renewable (short production cycle, with entire process controlled by man) and generate positive socio-economic impacts, such as generation of new jobs, better income distribution and sustainable response to the growing global energy demand.

A common view of the international trend in the development of biofuels shared by many indicates that the first generation biofuels (ethanol from sucrose or starch; biodiesel produced by transesterification of oils and fats with methanol or ethanol) currently available will be followed by the so-called second generation biofuels, that include diesel produced from synthesis gas by thermo chemical processes and ethanol from lignocellulose by chemical and enzymatic processes. Next, integrated biorefineries will be built to produce energy, biofuels and a wide range of chemical and biochemical products from biomass.

The environmental sustainability of lignocellulosic biomass as feedstock for bioethanol production is very attractive. Each hectare of land can produce far greater yields of lignocellulosic biomass than grain or sugar with lower inputs. This vastly improves the GHG savings arising from use of biofuels as well as reducing their land-use impacts. Lignocellulosic residues from crops such as sugar cane and sweet sorghum are potential bioethanol feedstock. Despite the clear environmental benefits of moving to lignocellulosic bioethanol production, the current inefficiency of this process makes it economically uncompetitive. Lignocellulosic plant biomass is mainly composed of secondary plant cell walls, which are comprised of roughly 75% polysaccharides and 25% lignin. Bioethanol can be produced by fermentation of the sugars locked up in the polysaccharides of the cell walls, but these first have to be released as simple sugars.

Sweet sorghum (*Sorghum bicolor*) is a high-energy crop that produces high energy starchy grains and also stalks rich in sugar. The grain can be use as food or feed. The sugar in juice of stalk can be used to produce sugar, syrup, wine or bioethanol. The fiber from the stalks can be used to make pulp or paper. Also, the whole plant is an excellent alternative for silage. Of all such uses, recent interest in sweet sorghum is directed to its potential as a bioenergy crop. In general, it can produce 45-75 t/ha of sugar rich stalks, with Brix ranging from 15-23%. According to Dajue (1997) sweet sorghum can be divided into saccharin-types and syrup-types. Saccharin-type sweet sorghum, which mainly contains sucrose, can be used for refining crystal sugar. Syrup-type sweet sorghum, which mainly contains glucose, can be used for producing syrup. Syrup-type sweet sorghum is also a material of quality for making drinking wine and alcohol.

Sweet sorghum is also becoming attractive as an energy crop due to its wide adaptability, drought resistance, waterlodging tolerance, saline alkali resistance, and high capacity of biomass accumulation. With growing interest in development of new alternatives for biomass and bioenergy production, it is expected an increase of sweet sorghum research and development efforts towards popularization of its use as a highly efficient bioenergy source in many parts of the world.

PROJECT OBJECTIVE AND RATIONALE

This project has the objective of integrating efforts from research teams of Embrapa (the Brazilian Agricultural Research Corporation) and RDA (Rural Development Administration, of South Korea) for development of first and second generation biofuel production processes from sweet sorghum feedstocks.

The proposed cooperation is sustained on a Memorandum of Understanding (MoU) signed by the two organizations in November 2008 that allowed the implementation, in 2009, of the Embrapa Virtual Laboratory Abroad (Labex Korea) at RDA, in Suwon, and the RDA Abroad Virtual Laboratory (RAVL) at Embrapa, in Brasília. One of the areas of research to be explored in this partnership is bioenergy, an innovation field for which there are reciprocal dominances and interests between Brazil and Korea.

Brazil is the acknowledged world leader in the generation and implementation of modern, tropical agricultural technology, with strong emphasis to production of sustainable bioenergy sources. A series of advantages, such as climate, advanced innovation capabilities and the availability of land to energy farming without having to reduce food-crop area or impose environmental impact beyond what is socially acceptable, have enabled Brazil to become a world leader in green energy production. A striking example of the country success in this area is the ethanol production chain (Goldemberg, 2006, 2007).

The production and use of ethanol from sugarcane in Brazil is a global model for bioenergy production, distribution, and use, and is recognized as one of the most efficient in the world. This program had its inception in the late 1970' when Brazil initiated a large bio-energy platform called Pro-Alcohol. Besides large distilleries using sugarcane, micro-(100L/hr) and mini-(100L/hr) distilleries were strongly promoted and Embrapa's sweet sorghum program was developed to provide raw material for these small distilleries, mainly established for small farmers. Pilot projects were successfully developed in the mid-1980's. The advantages of using sweet sorghum vs. sugarcane were: sweet sorghum can be harvested 3-4 months after seeding; the production can be completely mechanized; it can be established from seed; the grain produced can have several uses; the bagasse has higher biological value than the bagasse from sugarcane; sweet sorghum is more water use efficient, among others.

Several breeding priorities were established by Embrapa's sweet sorghum program at that time: high biomass and sugar yield; large panicles if grain was also to used; non-tillering types, etc. Specific yield and quality goals were: at least 40 t/ha of biomass, minimum sugar content 12,5%; minimum alcohol yield 40 L /t of biomass. New sweet sorghum cultivars were obtained: BR 506 and BR 507, providing higher ethanol yield than Brandes and Wray, which were reference varieties at the time (Borgonovi et al., 1982; Teixeira et al., 1997).

Despite the advances achieved in the 1980's, the Brazilian bioenergy program was shifted almost entirely to sugarcane feedstock, while the breeding of sweet sorghum was mainly oriented for forage production. Sugarcane has been cultivated in Brazil since 1532 for sugar production and, in the tropical conditions prevailing in the country, sugarcane became one of the best energy factories in the world. However, recently the sweet sorghum program for biofuel production has been again promoted. This crop is becoming an interesting option to supply raw materials during the offseason of sugarcane, which runs from January to March, thereby increasing activities at the distilleries during periods of low sugarcane feedstock availability. Another advantage is that small farmers can use sweet sorghum in mini and micro distilleries to produce ethanol locally. Also, the sorghum crop excels in marginal areas with low rainfall and acidic soils, where sugarcane is not produced.

Other advantage of sorghum for ethanol production, when compared to sugarcane, is the derivatives that the plant generates, like biomass of better value for animal feed. In addition to bagasse, sweet

EMBRAPA-RDA

Research Platform for First and Second Generation Biofuel Production from Sweet Sorghum Feedstock

Proposal in negotiation

Embrapa

Labex Korea – Agenda of Priorities

Mushroom R&D – Capacity Building – KOPIA Program

Embrapa

Labex Korea – Agenda of Priorities

- Brazil and Korea on Green Growth -
Elements for a cooperation agenda based on science, technology and innovation

Edmundo Sussumu Fujita[1], Mauricio Antonio Lopes[2] and Daniel Fink[3]

Abstract

Sustainable development is one of the most challenging goals for mankind and transition towards a greener economy is becoming a major driver on the global development agenda. Climate change requires urgent actions, considering impacts already being felt, with more droughts, floods, strong storms and other climate-related stresses that may draw resources away from development, posing increasingly severe pressures to all nations. Reducing modern society´s carbon footprints without jeopardizing development prospects will depend on intense cooperation, in addition to stable policies and incentives. The trans-boundary nature of these challenges imposes a new vision of interaction and alignment of efforts and no country will be able to face the emerging problems working in isolation. There is already a consensus that strong emphasis on cooperation, coupled with intensive investments in science, technology and innovation will provide the safest route to a lower carbon path to development in the future. Korea is already a leading country among those pursuing a new green growth paradigm. Having adopted a 5 year Green Growth Plan in 2009, the country seeks a new path to development, investing in innovations to decouple economic growth from environmental degradation, extreme dependency on fossil fuels and unsustainable natural resource use. On the other side of the globe, Brazil faces even greater challenges. With an area of 8,511,965 km², Brazil is one of the largest countries in the world, with an extensive surface of continuous land, a large supply of fresh water, abundant solar energy, and a rich biodiversity. In the past five decades the country has used its abundance and diversity of resources to successfully become a world leader in many sectors, including agriculture and green energy production and use. However, Brazil faces many environmental and developmental challenges to fulfill its vision of becoming one of the leading natural knowledge economic powerhouses of the future. Despite the geographical distance, it is feasible to think about a strong scientific and technological collaboration between a resource-rich country, such as Brazil, and an innovation-driven country, such as Korea, to generate, in a synergistic way, new and greener growth engines for the future. In this article we will review the respective development strategies of Brazil and Korea, emphasizing key drivers and pointing out elements for future green growth cooperation between the two countries.

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[2] Mauricio Antonio Lopes - PhD, is Coordinator of Embrapa Labex Korea, in Suwon, Republic of Korea. Email: labexkorea@ymail.com

[3] Daniel Fink is Advisor of Science and Technology at the Embassy of Brazil in Seoul, Republic of Korea. Email: danielfink@brasemb.or.kr

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Labex Korea Analysis and Studies in Partnership with the Brazilian Embassy in Seoul

- Brazil and Korea on Green Growth -
Elements for a cooperation agenda based on science, technology and innovation

By Edmundo Sussumu Fujita, Mauricio Antonio Lopes and Daniel Fink

Study presented at the "International Conference for Environmental Cooperation and Green Growth between Korea, Latin America and the Caribbean" held in July 2010 in Seoul.

Basis for future Brazil-Korea cooperation in the framework of the Global Green Growth Institute.

Global Green Growth Institute

http://www.gggi.org/

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Labex Korea – Agenda of Priorities

2010 KISTEP-ISTIC R&D Management Program

http://www.kistep.re.kr/ksp/eng/main/main.jsp

Labex Korea – Agenda of Priorities

TEACHING

Collaboration with the Associate Professor of KAIST – Korea Advanced Institute of Science and Technology, teaching at the Graduate School of Innovation and Technology Management

Embrapa

Labex Korea – Agenda of Priorities

COMMUNICATION AND INFORMATION SHARING

Labex Korea maintains a web page as means of disseminating information, sharing knowledge and views on issues important for the cooperation.

The link http://labexkorea.wordpress.com/ is listed in the webpages of RDA and Embrapa and serve as source of information on Labex for both organizations and for other users.

Labex Korea – Agenda of Priorities

Ongoing discussions on collaboration in Biomass and Bioenergy with the Korea Research Institute of Chemical Technologies – KRICT and the Korea Research Institute of Energy Research - KIER.
Ongoing discussions on research in botany and phytochemistry with KRIBB

Embrapa

Labex Korea – Agenda of Priorities

Ongoing discussions on R&D cooperation in botany and phytochemistry with KRIBB
Ongoing discussions on R&D cooperation in medicinal plants with KIOM

http://www.kribb.re.kr/

http://www.kiom.re.kr/english/

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Labex Korea – Agenda of Priorities

2010 World Oriental Medicine-Bio EXPO in Jecheon

Come to Jecheon, home of the Korean herbal medicine
And explore the wonderful healing effects of Hanbang.

2010 World Oriental Medicine -Bio EXPO in Jecheon

Rediscovery of traditional Korean medicine – tradition, science, and the world

Since the time of the Joseon Dynasty, Jecheon has been one of the three trade centers for medicinal herbs in the region. Jecheon is also a city of warmhearted, friendly people who are always ready to help visitors in need. Come and see the valuable herbs that only grow around Jecheon.

VISIT THE WEBSITE

Event summary

- Event title : 2010 World Oriental Medicine-Bio EXPO in Jecheon
- Date : September 16 ~ October 5, 2010, (20 days)
- Location : 2nd Bio Valley, Wangam-dong, Jecheon-si
- Host : City Hall of Jecheon, Chungcheongbuk-do

Embrapa have participated in the 2010 World Oriental Medicine-Bio Expo in Jecheon, from 16 September to 16 October, presenting its research and development activities in medicinal and aromatic plants and phytochemistry

Embrapa

Labex Korea – Agenda of Priorities

Prospecting New Embrapa-RDA Cooperation Opportunities

GERMPLASM EXCHANGE AND BREEDING of Capsicum spp.

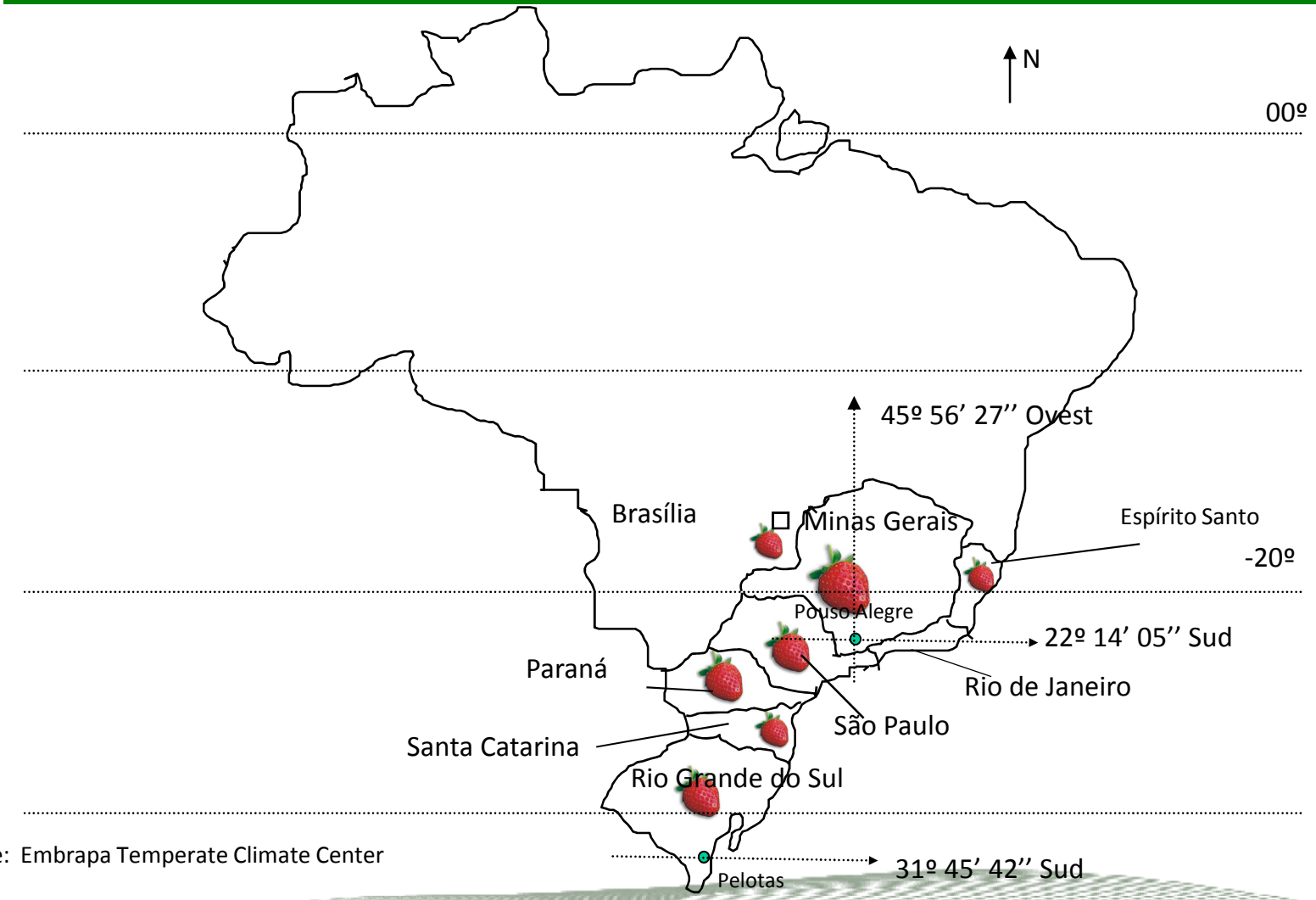
SUBTROPICAL APPLE GERMPLASM EXCHANGE AND BREEDING

Possibilities of Embrapa-RDA Cooperation in Strawberry R&D

Source: Embrapa Temperate Climate Center

Embrapa

Possibilities of Embrapa-RDA Cooperation in Strawberry R&D



Source: Embrapa Temperate Climate Center

Embrapa

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