The Brazilian Agricultural Research Corporation - Embrapa

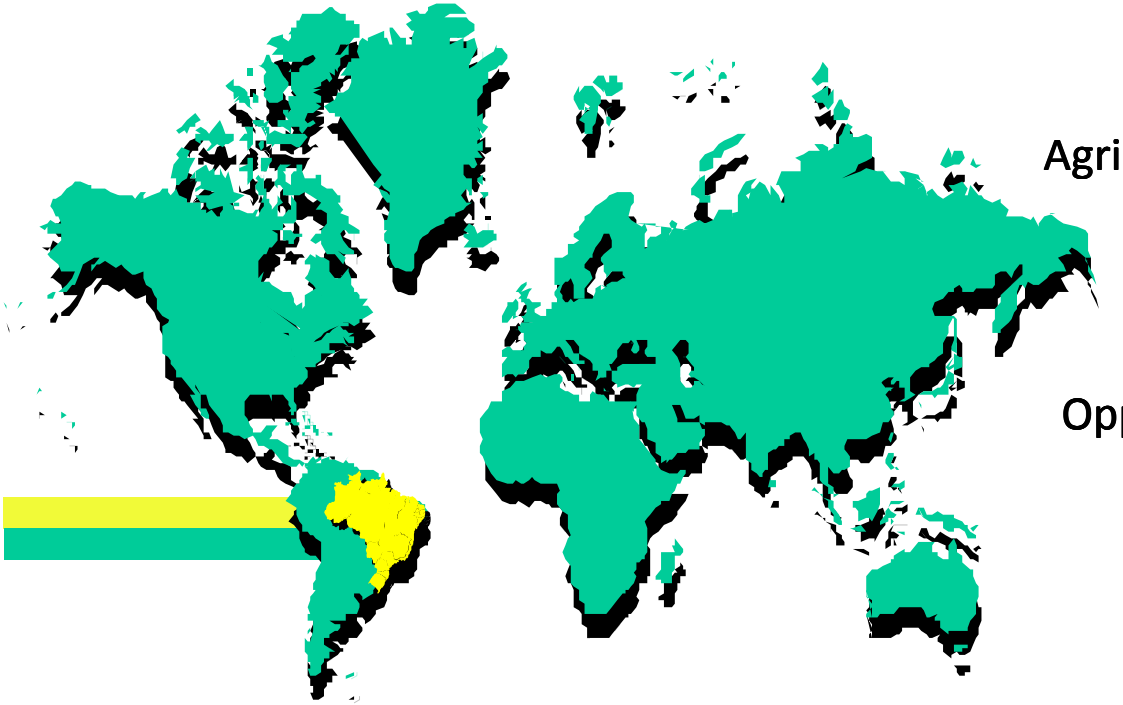
Possibilities of Cooperation with RDA in Strawberry R&D

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

Visit to the National Institute of Horticultural & Herbal Science
Protected Horticulture Research Station - (NIHHS), RDA
Busan, Kyungsangnam-do Province, August 31st, 2010

The Brazilian Agricultural Research Corporation - Embrapa

Possibilities of Cooperation with RDA in Strawberry R&D



Agriculture and Agricultural R&D in Brazil

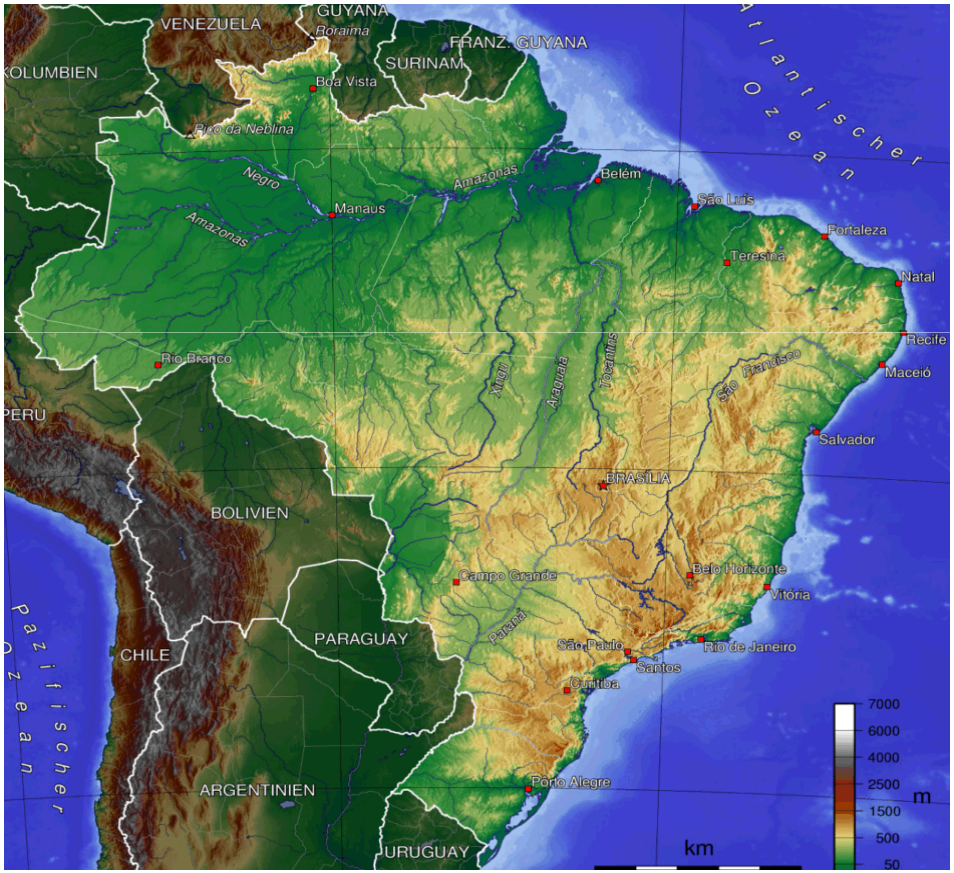
The Embrapa Labex Program

Strawberry Research in Brazil

Opportunities of Technical Cooperation

Discussion

About Brazil



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

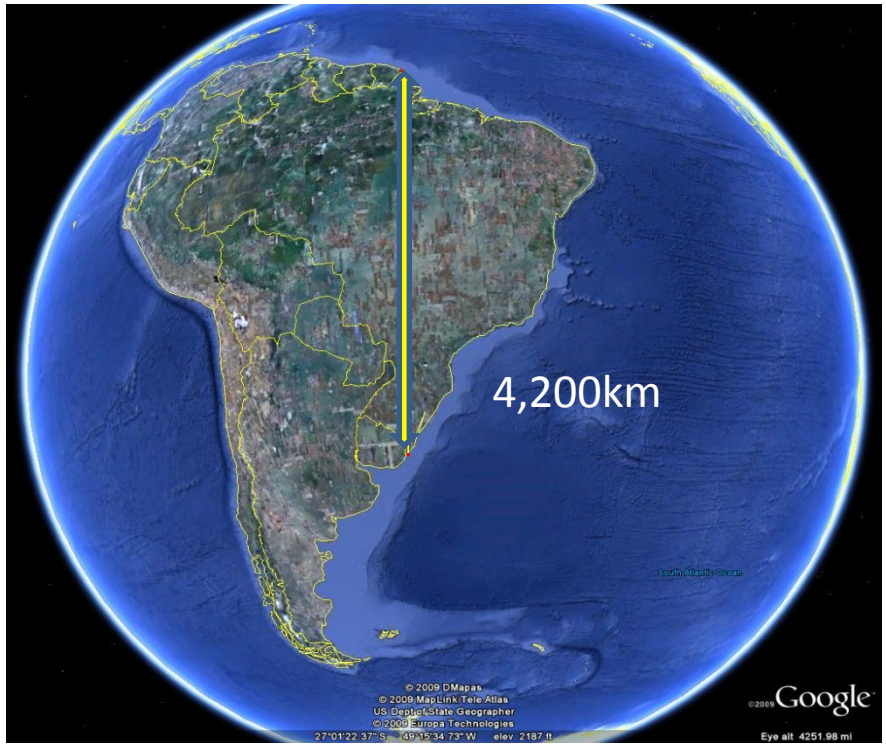
5th largest country in the world in area;

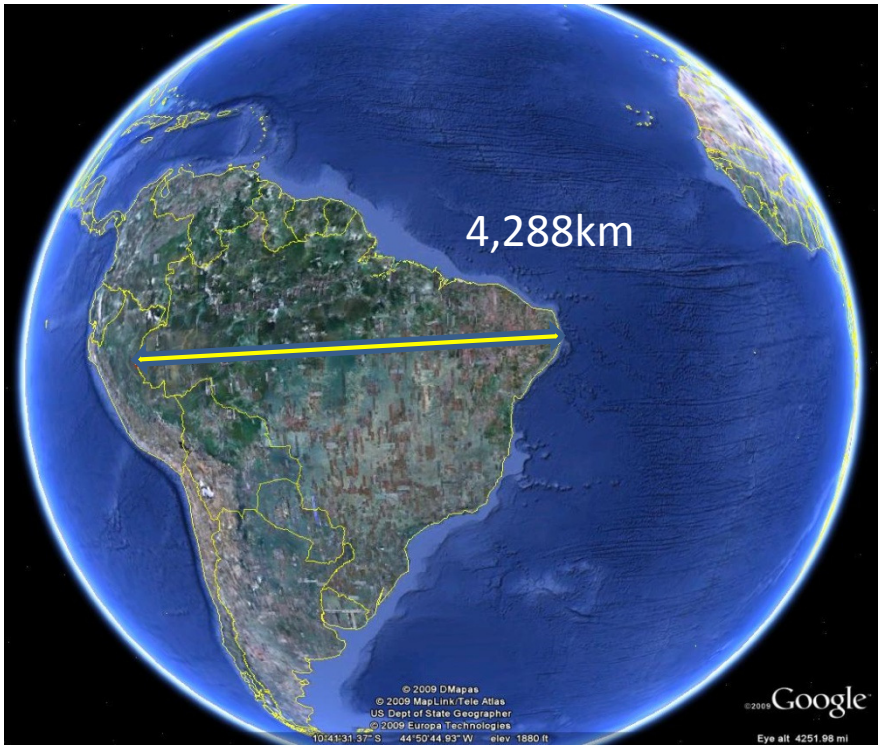
192 million inhabitants (5th after China, India, USA and Indonesia);

Embrapa

About Brazil

Great Environmental Diversity

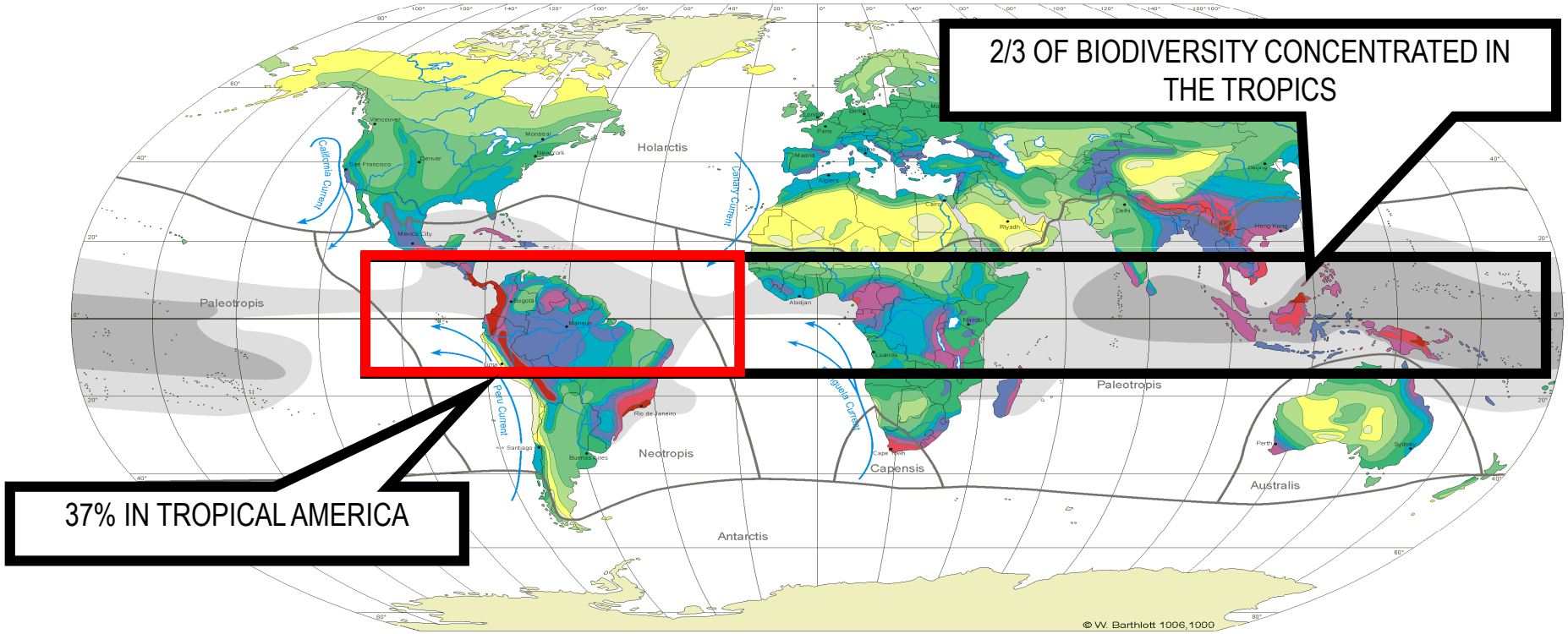




Embrapa

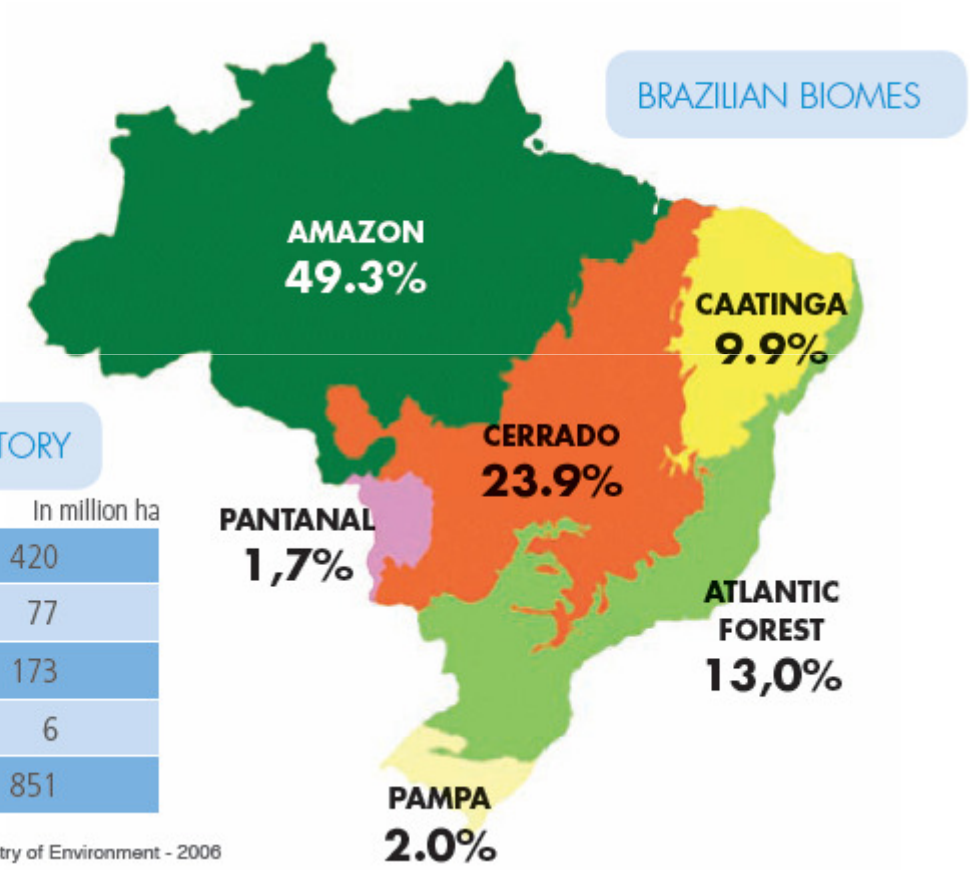
About Brazil

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



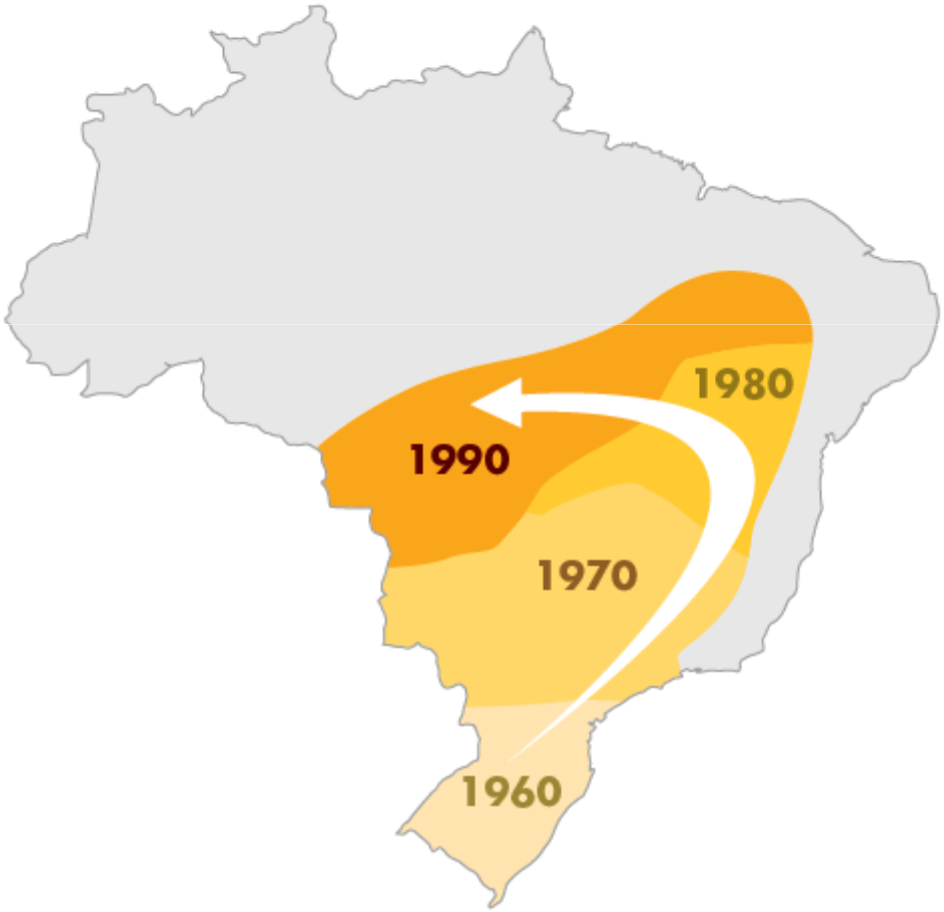
BRAZILIAN TERRITORY

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

About Brazil

Exports

In 2009 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

About Brazil

Agribusiness in Brazil

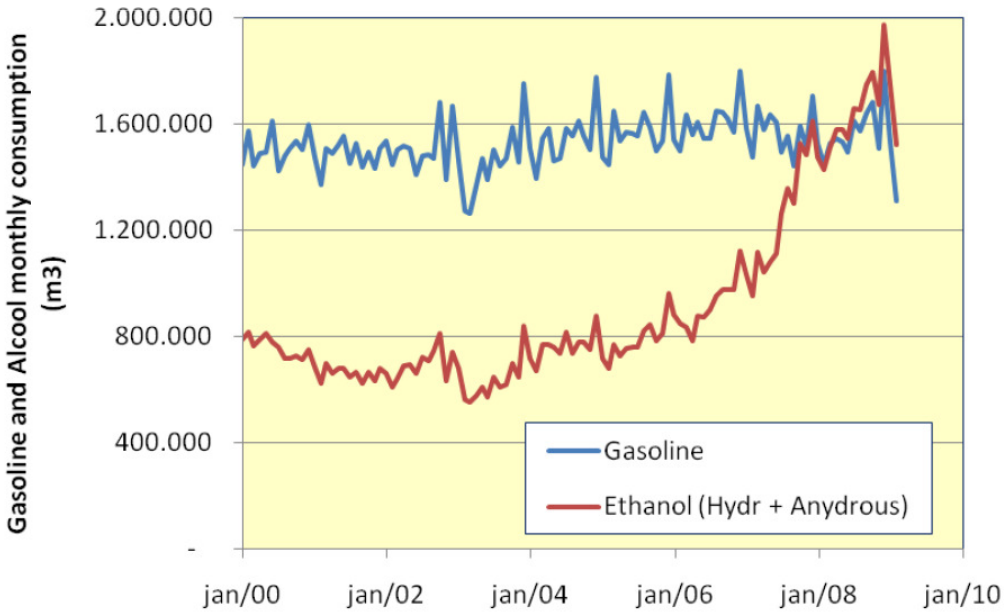
Source: The Economist, August 2010

About Brazil

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

The Brazilian Agricultural Research System

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

"Brazil is strong in areas related to animal and plant biology, agriculture and veterinary science, with greater than 5% share of world publications …"

Global Research Report – Brazil, Research and collaboration in the new geography of science
Thomson-Reuters - http://researchanalytics.thomsonreuters.com/grr/

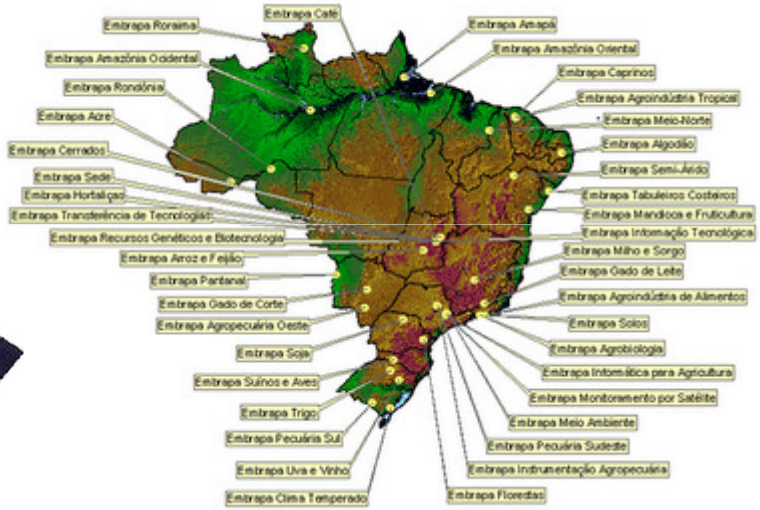
The Brazilian Agricultural Research System

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

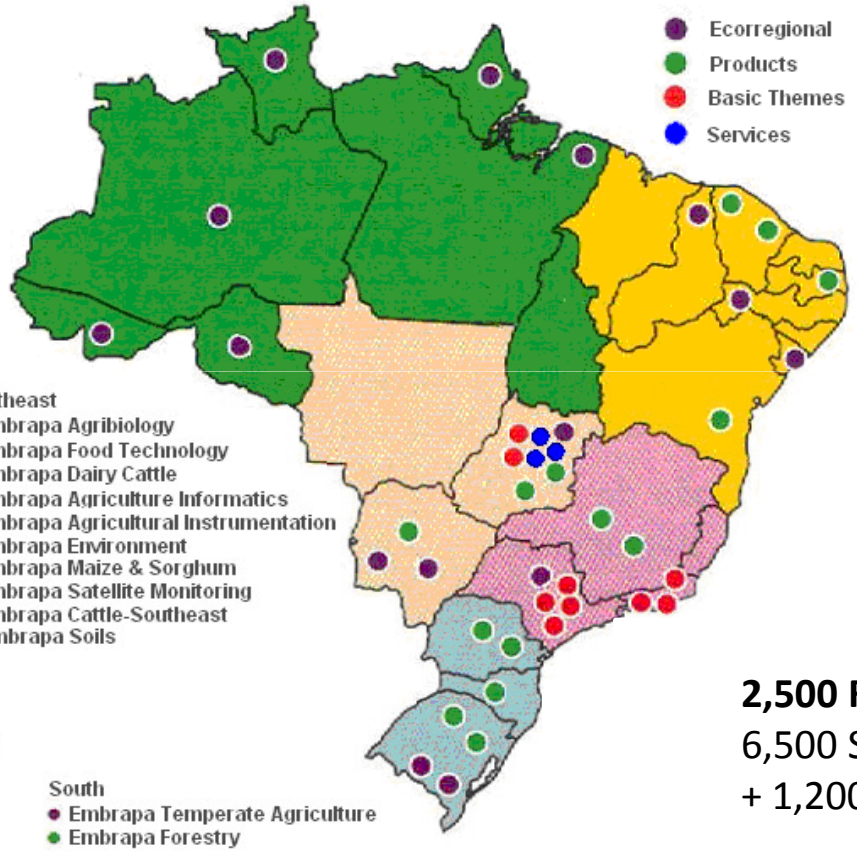
Brazil has also an active and growing private sector, which supplies technologies and technical assistance mainly in farm inputs and food processing

Embrapa

The Brazilian Agricultural Research System

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
+ 1,200 new staff (2013)

2009 Budget: US$ 1 Billion

Embrapa

International Cooperation at Embrapa

Two Distinct Strategies

Technology Transfer Offices

Virtual Laboratories Abroad- Labex

International Cooperation at Embrapa

“The Embrapa Labex Program”

To bring the “international dimension” to the Embrapa network

Trends in S&T and opportunities of cooperation

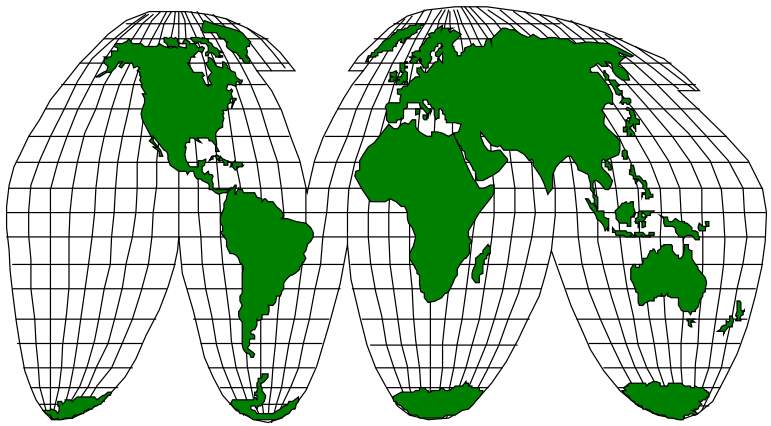
Promoting collaborative projects in strategic areas

Facilitating exchanges of scientists

Identifying training opportunities

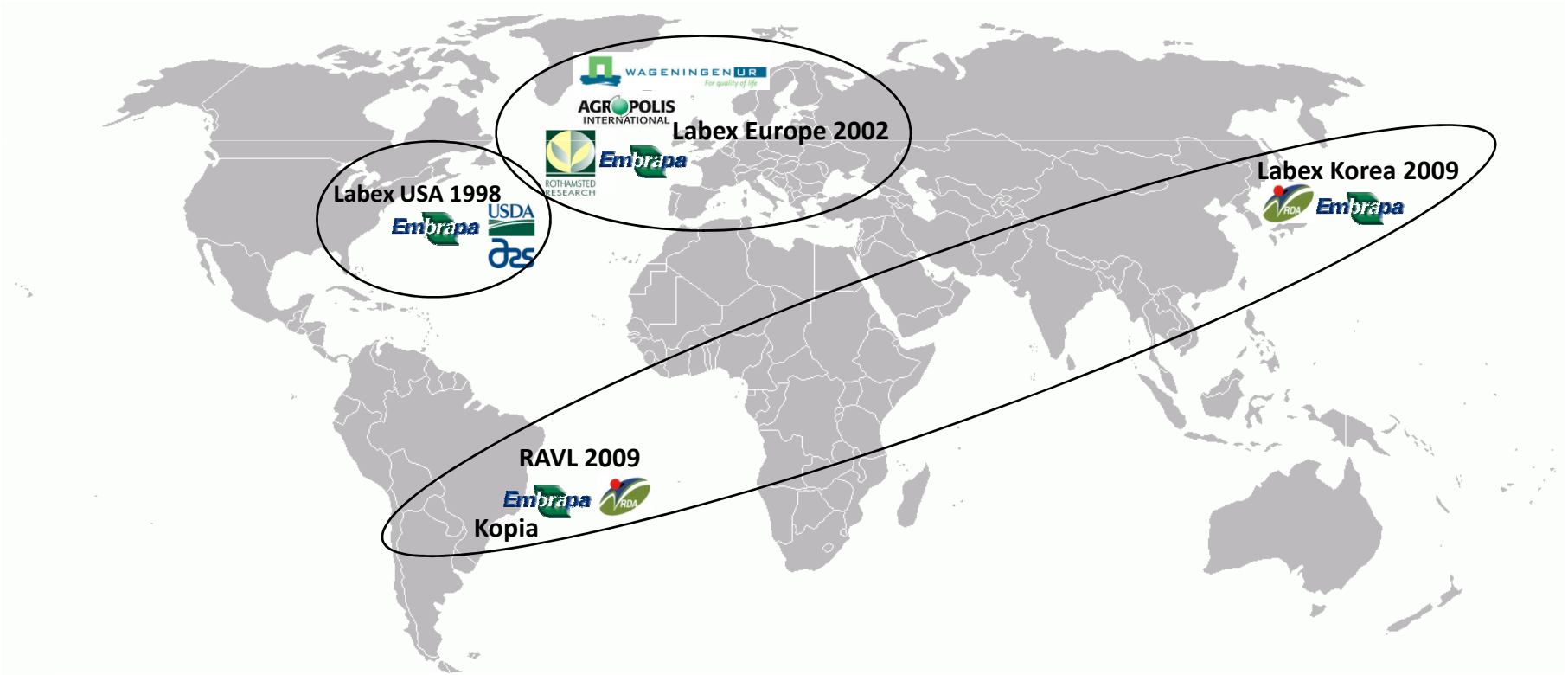
Promoting technical meetings and scientific exchange

Follow-up on joint research projects



International Cooperation at Embrapa

Labex – cooperation in cutting-edge agricultural R&D



Expanding the Labex Program to Korea

Inauguration of Labex Korea (12.2009)

Korea-Brazil Summit (11.2008)

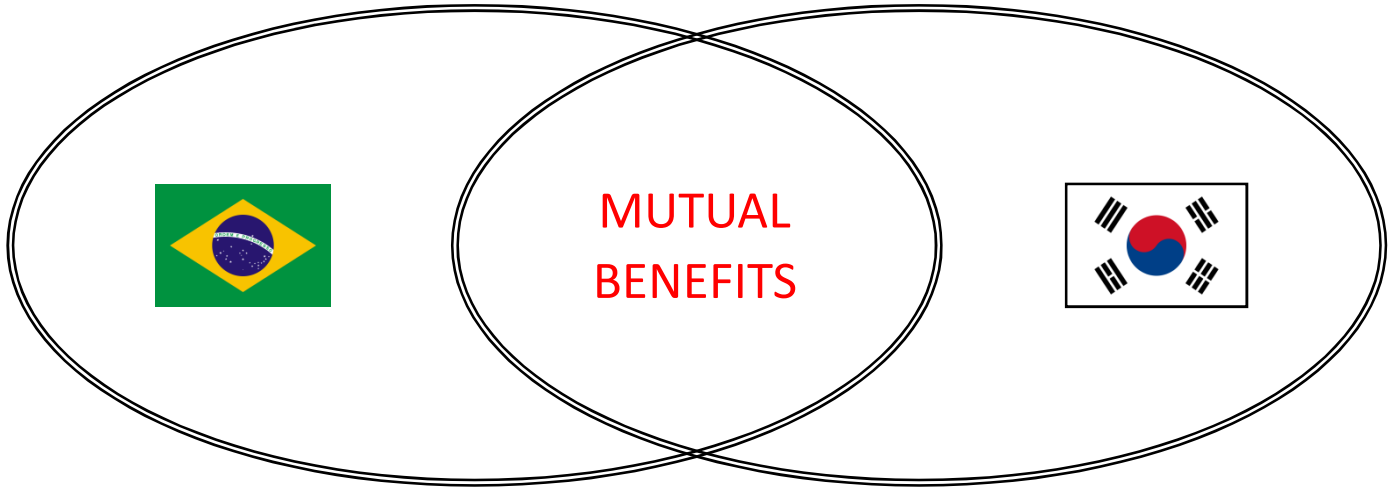
Embrapa

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



Some Results of Labex Korea

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".

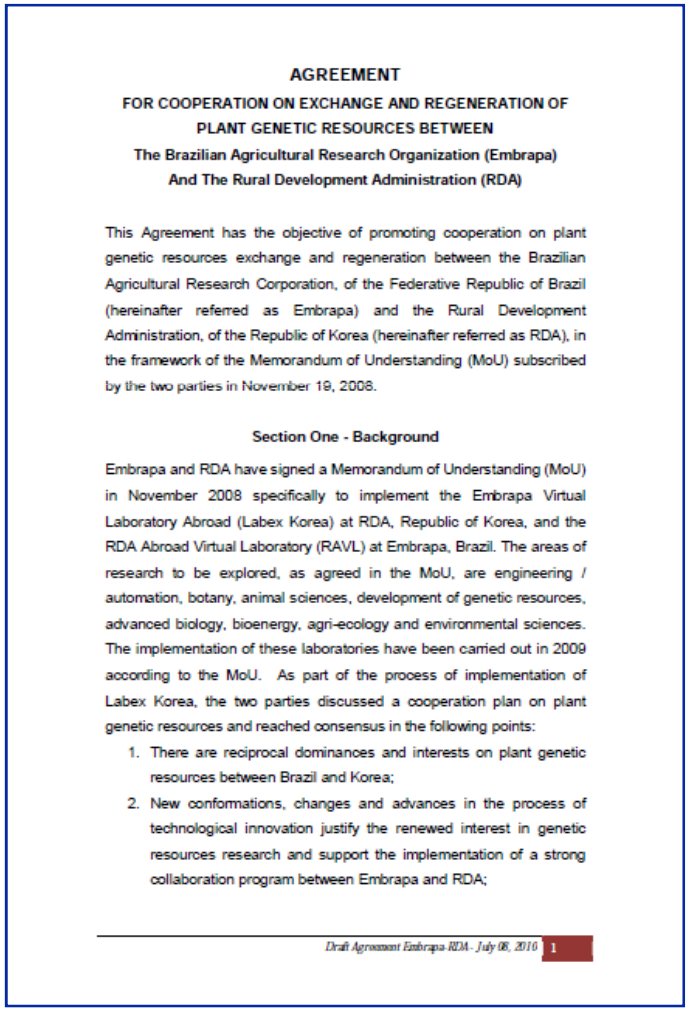
The objective of this ongoing research project is to develop an information and decision support process to facilitate the exchange and use of biological resources between Brazil, and Korea in the context of food, agriculture and bioindustry research and development.

The weblog of the project is located at:

http://bioresourcespolicy.wordpress.com/

Embrapa

Some Results of Labex Korea



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

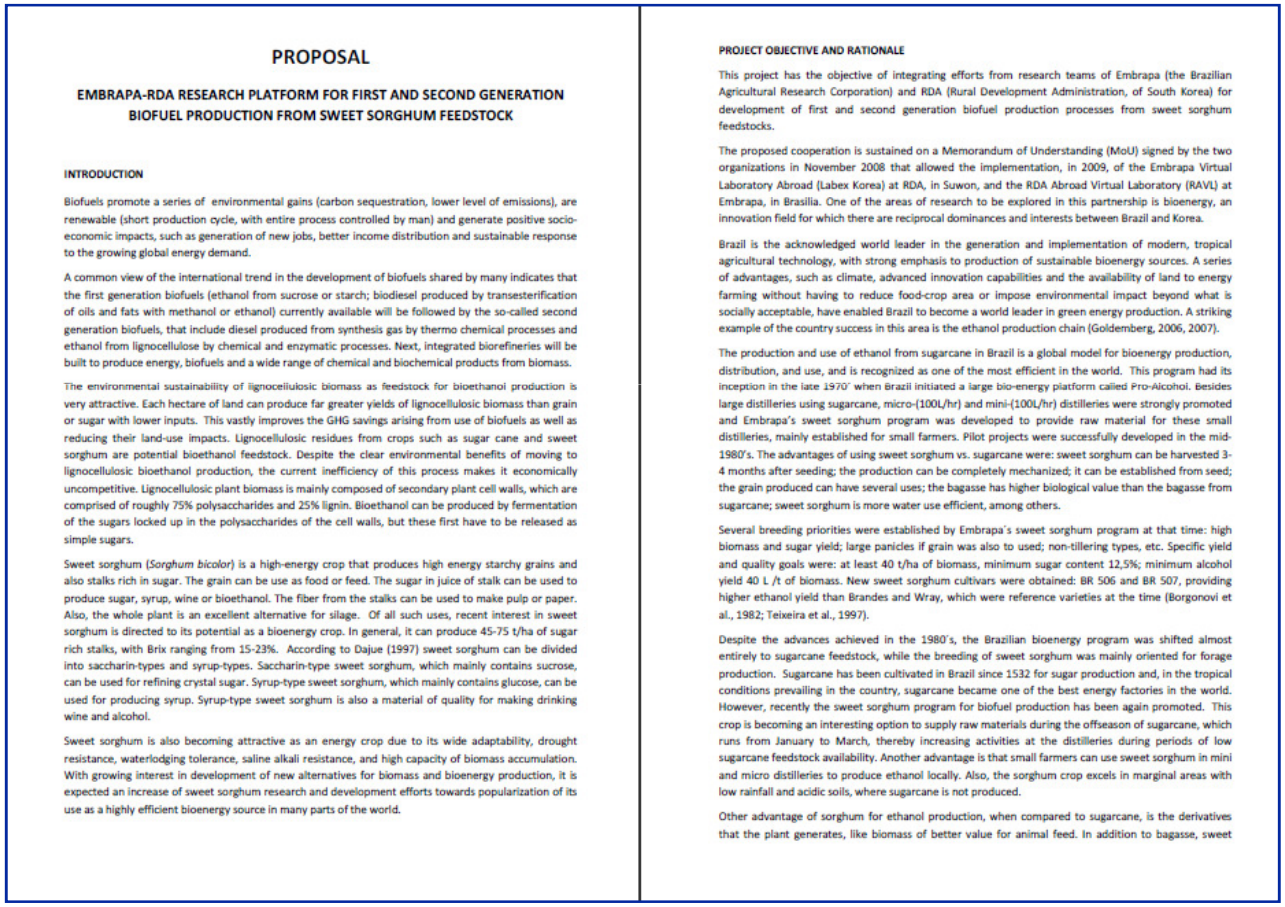
Promotion of continuous exchange and regeneration of plant genetic resources and sharing of information of interest to both parties;

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

Some Results of Labex Korea



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 Brasilia. 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

Some Results of Labex Korea

- 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.

[1] Edmundo Sussumu Fujita is the Ambassador of Brazil in Seoul, Republic of Korea.

[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

1

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.

http://www.gggi.org/

Embrapa

Some Results of Labex Korea

TEACHING

Collaboration with the Associate Professor of KAIST – Korea Advanced Institute of Science and Technology, teaching

Special Lectures on Agricultural Biotechnology

At the
Graduate School of Innovation and Technology Management

Some Results of Labex Korea

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 will participate 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

Some Results of Labex Korea

Labex Korea was a partner in the organization of the UK-Brazil-Thailand Joint Seminar on Agricultural Biotechnology
22-24 February 2010

UK-THAILAND
partners in science

UK-Brazil-Thailand Joint Seminar on Agricultural Biotechnology
22-24 February 2010

Brazil:

18. Dr. Elisabeth Fontes	Embrapa – Brazilian Agricultural Research Corporation		plant-pest interactions
19. Dr. Miguel Borges	Embrapa - Brazilian Agricultural Research Corporation	Genetic Resources and Biotechnology Center	Chemical ecology for development of innovative strategies of biological control of agricultural pests. Also a Labex scientist, working with the ARS/USDA in biological control
20. Dr. Jurandir Vieira de Magalhaes	Embrapa, - Maize and Sorghum Centre	Senior Researcher	Soil acidity & drought tolerance

Embrapa

Some Results of Labex Korea

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.

Some Results of Labex Korea

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

Some Results of Labex Korea

Prospecting New Embrapa-RDA Cooperation Opportunities

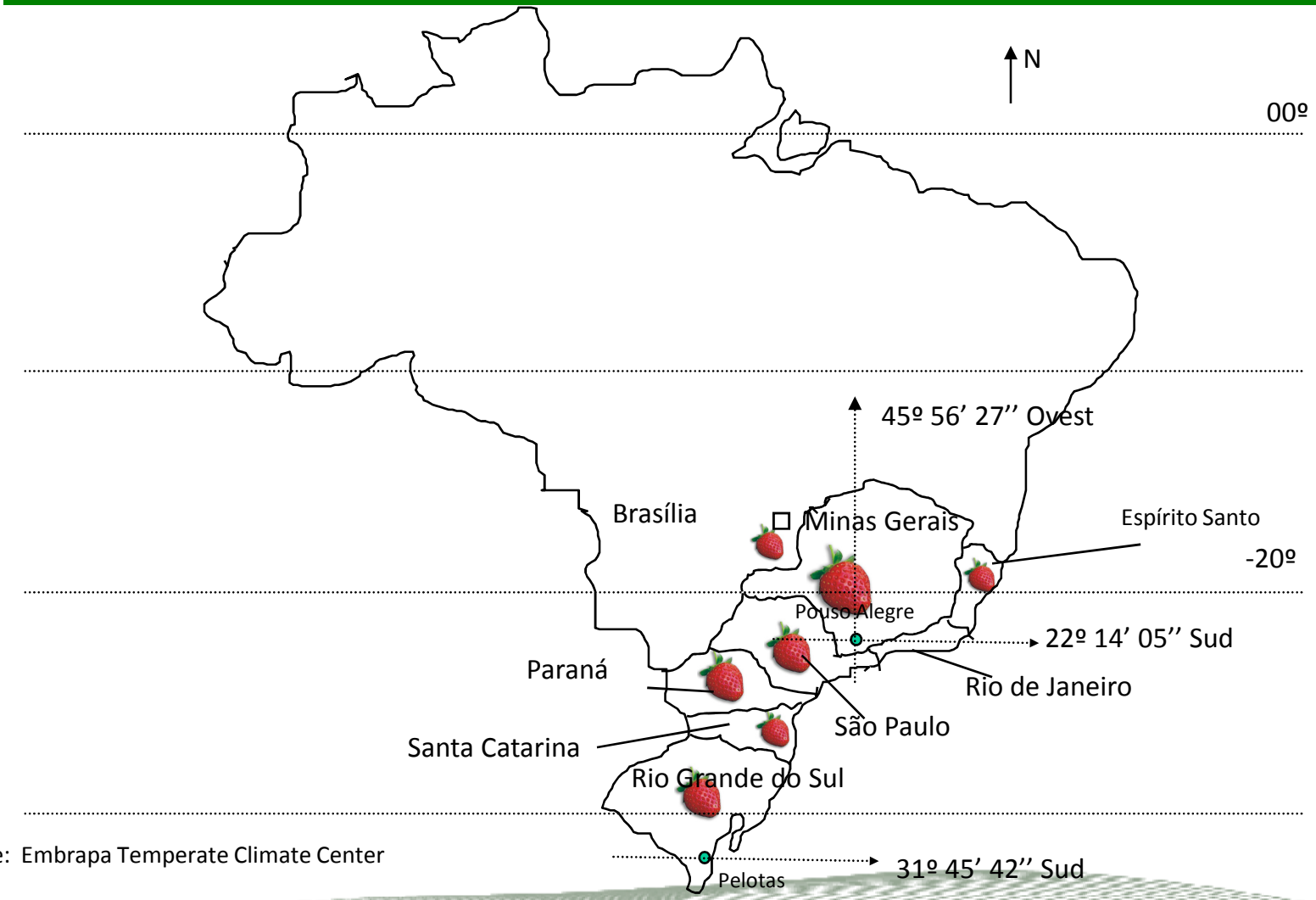
GERMPLASM EXCHANGE AND BREEDING of Capsicum spp.

SUBTROPICAL APPLE GERMPLASM EXCHANGE AND BREEDING

Possibilities of Embrapa-RDA Cooperation in Strawberry R&D

Source: Embrapa Temperate Climate Center

Strawberry Production in Brazil



Source: Embrapa Temperate Climate Center

Embrapa

Strawberry Production in Brazil

Strawberry production is important in Brazil – but localized...
***Bom Principio* County, Caí Valley - RS**

Source: Embrapa Temperate Climate Center

Strawberry Production in Brazil

Strawberry production is important in Brazil – but localized...

State	Area	Main Variety
Rio Grande do Sul	650	Camarosa, Aromas, Albion
Minas Gerais	1,700	Oso Grande, Camarosa, Camino Real, Florida Festival, Campinas (IAC2712),
São Paulo	980	Oso Grande, Toyonoka, CampiDover Aleluia
Paraná	270	Camarosa, Aromas, Albion
Santa Catarina	160	Camarosa, Aromas, Albion
Espirito Santo	150	Camarosa, Aromas, Diamante

Source: Embrapa Temperate Climate Center

Strawberry Production in Brazil

Features of strawberry production systems in Brazil

Small properties – average 0,2 a 0,5 ha

Short day varieties

Brazilian market still not well developed

Production is concentrated

Availability of planting material (seedlings)

Technological packages provided by buyers and sellers

Production system adapted to Fall-Winter

Fresh planting material (seedlings) – local production x exports

Source: Embrapa Temperate Climate Center

Strawberry Production in Brazil

Characterization of Strawberry Cultivars In Southern Brazil

There is continuous introduction of new cultivars from Chilean and Argentine nurseries. Also, introductions originating from the USA (Florida and California) and Spain.

Embrapa Temperate Climate - Pelotas - RS, evaluated six cultivars ('Camarosa', 'Plarionfre', 'Galexia', 'Festival', 'Earlibrite' and 'Sabrosa'), using plants from Chilean and Argentine nurseries.

Source: Embrapa Temperate Climate Center

Strawberry Production in Brazil

Characterization of Strawberry Cultivars In Southern Brazil

Cultivars	t ha^{-1}	Fresh weight fruit/plant (g)	Average weight/fruit (g)
Earlibrite	36,06 b	722,45 bc	18,95 b
Plarionfre	30,45 b	621,73 c	17,19 cd
Festival	37,36 ab	771,09 ab	16,84 d
Sabrosa	35,81 b	716,43 bc	18,45 b
Camarosa	**43,81 a**	**877,51 a**	**20,02 a**
Galexia	37,41 ab	773,37 ab	17,51 c
Média Geral	36,81	739,50	18,57
CV (%)	4,90	4,75	1,94

Source: Embrapa Temperate Climate Center

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Strawberry Production in Brazil

Characterization of Strawberry Cultivars In Southern Brazil

Cultivares	pH	TSS (ºBrix)	TTA (% cítric ac)	Ratio (SST/TTA)	Antocian (mg 100mL^{-1})
Earlibrite	3,54 a	7,8 ab	0,58 b	13,71 a	28,41 a
Plarionte	3,49 a	8,7 a	0,70 ab	12,41 ab	30,69 a
Festival	3,45 a	7,6 ab	0,74 a	10,83 ab	34,60 a
Sabrosa	3,41 a	8,7 a	0,79 a	10,95 ab	26,64 a
Camarosa	**3,45 a**	**7,6 ab**	**0,76 a**	**9,94 ab**	**38,01 a**
Galexia	3,41 a	6,8 b	0,78 a	8,6 b	22,44 a
Média Geral	3,46	7,9	0,72	10,96	30,04
CV (%)	2,15	7,52	7,65	14,96	23,20

Source: Embrapa Temperate Climate Center

Strawberry Production in Brazil

Field cultivation
Tunnel covered with plastic
Drip irrigation

Strawberry Production in Brazil

Protected cultivation systems

Embrapa

Strawberry Production in Brazil

Protected cultivation systems

Strawberry Production in Brazil

Protected cultivation systems

Photo: Carlos Reisser Junior

Embrapa

Strawberry Production in Brazil

Strawberry Production in Brazil

Embrapa

Strawberry Production in Brazil

Embrapa

Strawberry Production in Brazil

Embrapa

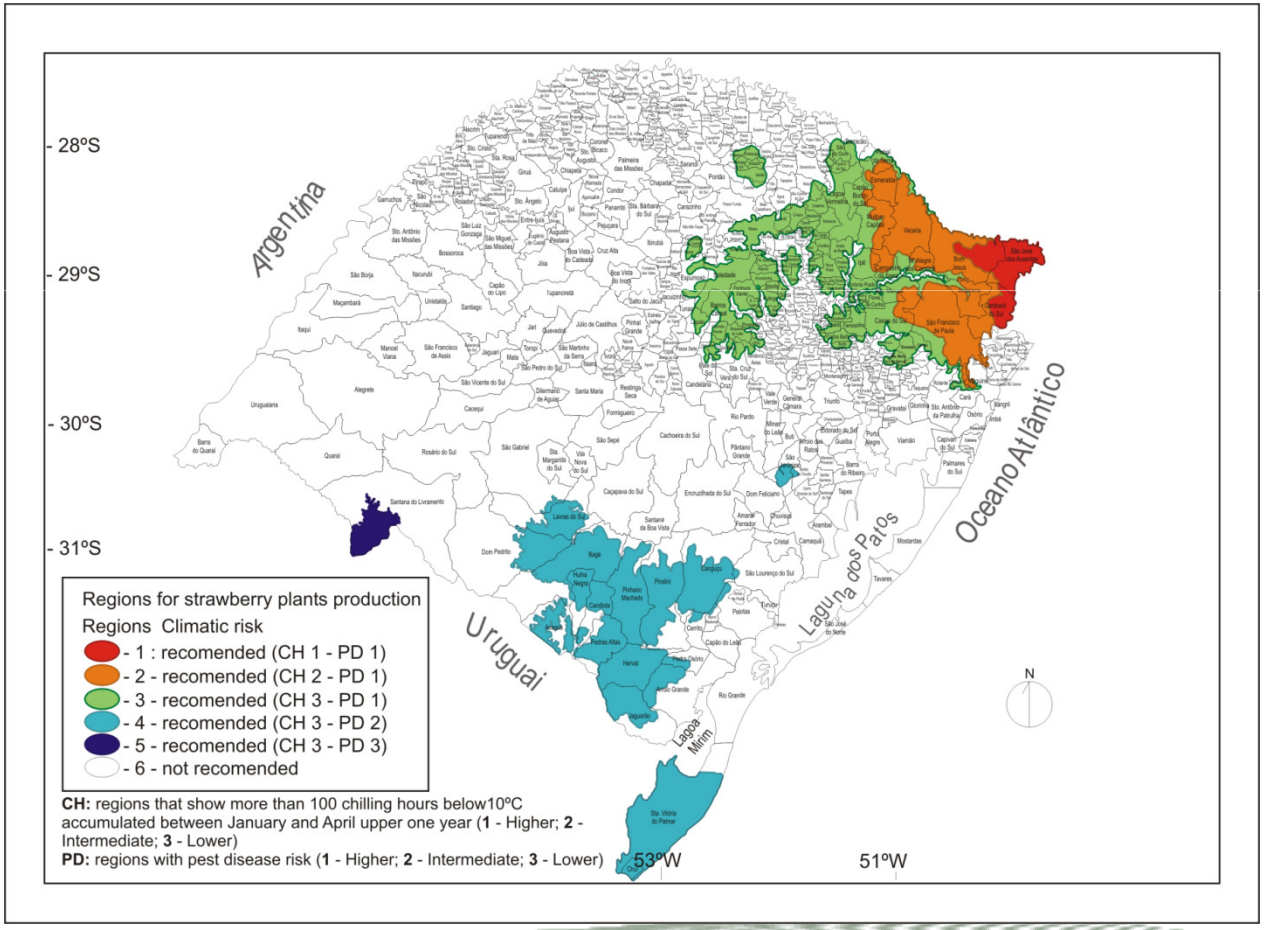
Strawberry Production in Brazil

Strawberry Production in Brazil

Embrapa

Strawberry Production in Brazil

Zoning for seedling production in Southern Brazil



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Strawberry Production in Brazil

Seedling production in Southern Brazil

Strawberry Production in Brazil

Fresh Seedling

Strawberry Production in Brazil

Seedlings imported from Chile and Argentina- Growing Demand

Embrapa

Strawberry Production in Brazil

"Clean" plants from tissue culture – matrix for commercial seedling production

Strawberry Production in Brazil

Commercial Production

Strawberry Production in Brazil

Commercial Production

Embrapa

Strawberry Production in Brazil

Commercial Production

Embrapa

Strawberry Production in Brazil

Commercial Production

Embrapa

Strawberry Production in Brazil

Commercial Production

Embrapa

Strawberry Production in Brazil

Integrated Production – Traceability and Certification

Strawberry Production in Brazil

Integrated Production – Monitoring Pests and Diseases

Strawberry Production in Brazil

Integrated Production – Monitoring Pests and Diseases

Embrapa-RDA Cooperation in Strawberry R&D

Some initial contacts already established.

Dr. Luis Eduardo Corrêa Antunes – Researcher from Embrapa Temperate Climate Center visited RDA in September 2008;

A preliminary proposal discussed with Dr. Il-Rae Roh;

Title:
Germplasm evaluation, selection and development of new populations of strawberry.

Embrapa-RDA Cooperation in Strawberry R&D

Germplasm evaluation, selection and development of new populations of strawberry.

1. Objectives

   a. Exchange, evaluation and selection of germplasm of strawberry;

   b. Development of new populations of strawberry from American and South Korean cultivars;

   c. Selection of improved cultivars using new genetic sources established;

   d. Training and technical exchanges.

Embrapa-RDA Cooperation in Strawberry R&D

Germplasm evaluation, selection and development of new populations of strawberry.

First year

-- Exchange of germplasm, evaluation of Korean germplasm in Brazil; collection and selection of germplasm of strawberry in Brazil (quality of fruit - sugar content, fruit firmness, yield, etc., resistance to diseases - anthracnose, fusarium, mildew, etc.); exchange information about the strawberry industry in both countries;

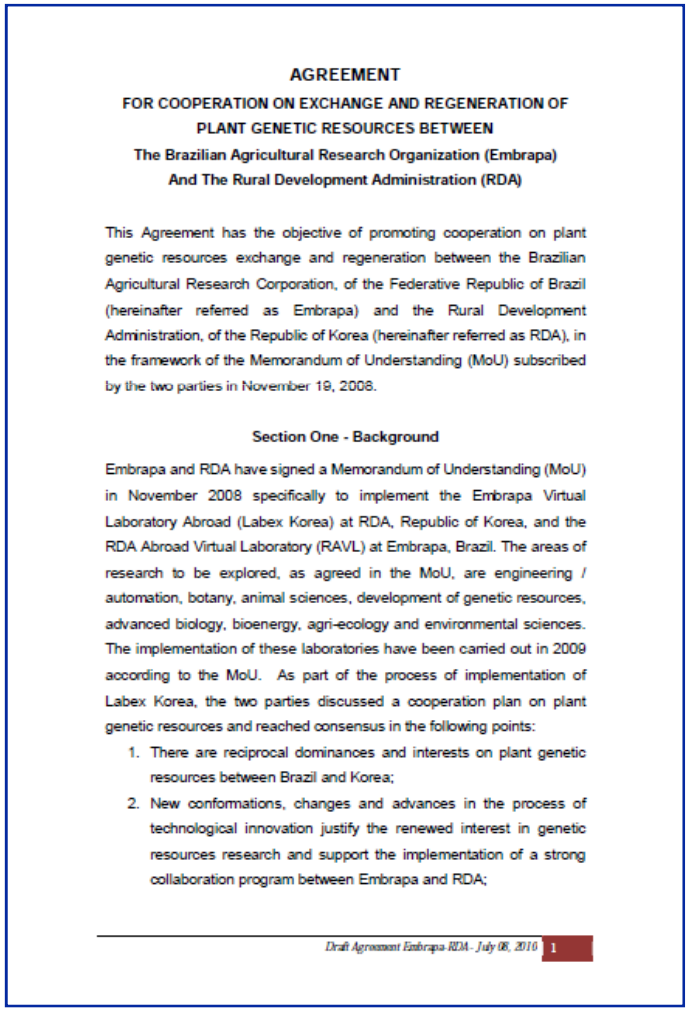
Second year

-- Crosses and establishment of populations between Korean and Brazilian cultivars; selection of promising genetic resources; exchange information about the strawberry industry in both countries;

Third Year

-- Multiplication and establishment of clones of advanced selections; test of clones; exchange information about the strawberry industry in both countries.

Embrapa-RDA Cooperation in Strawberry R&D



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;

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

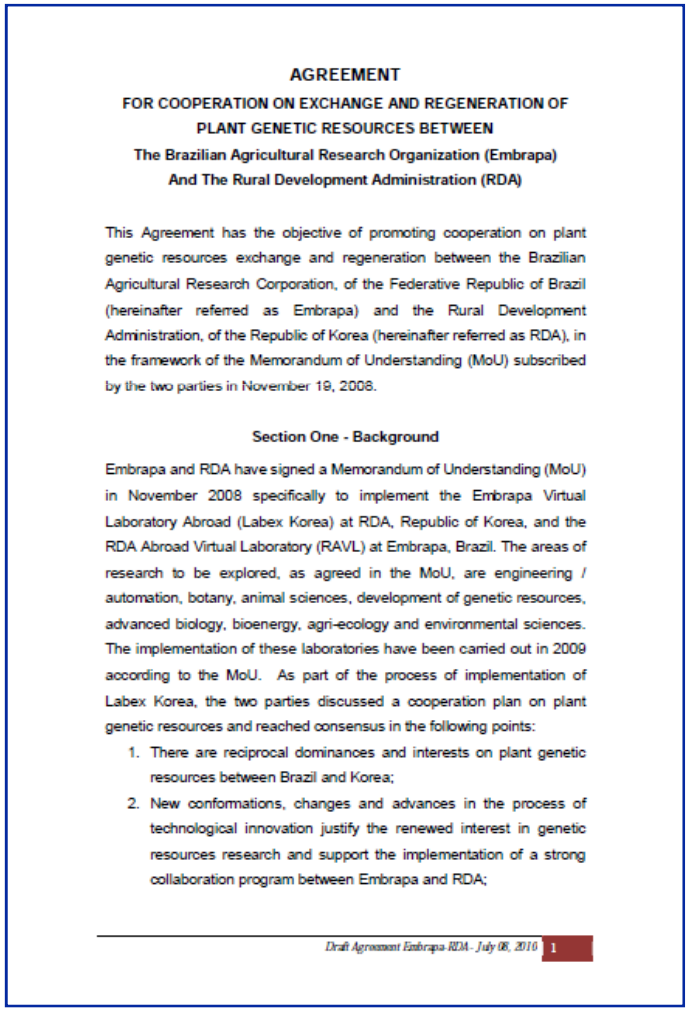
Promotion of continuous exchange and regeneration of plant genetic resources and sharing of information of interest to both parties;

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

Embrapa-RDA Cooperation in Strawberry R&D



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

The objectives of the Agreement are to enhance cooperation between the two parties in the following areas:

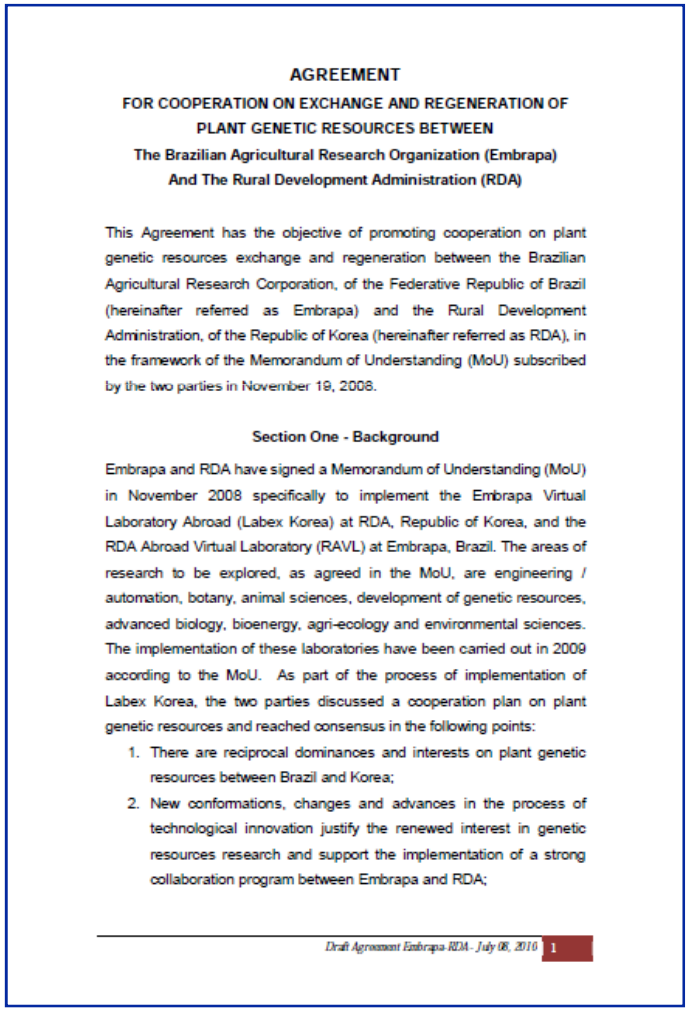
1. Promotion of cooperation between RDA and Embrapa in the area of genetic resources and related technologies, on the basis of national and/or international norms and regulations;

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

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

Embrapa

Embrapa-RDA Cooperation in Strawberry R&D



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

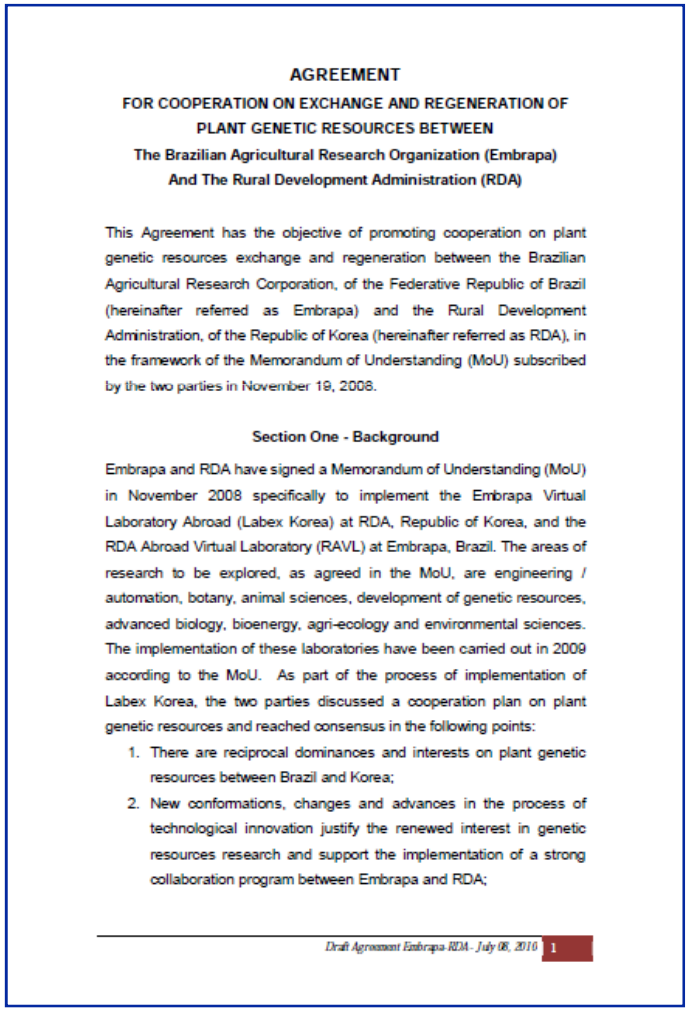
This Agreement will be implemented by the following steps:

1. Lists of accessions of plant genetic resources, including passport data of each accession, and accessions selected from the lists prepared by the two parties should be exchanged annually;

2. Regeneration, characterization and evaluation of the exchanged materials should be conducted by the two parties in their respective countries, and the information of evaluation should be shared;

3. Regeneration of plant species difficult to grow in their own country should be done in a reciprocal and mutually agreed manner and the resulting material should be shared by both parties;

Embrapa-RDA Cooperation in Strawberry R&D



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

This Agreement will be implemented by the following steps:

4. Development of conservation protocols, including cryopreservation, with joint selection of crops to be developed and reciprocal supply of materials to be studied;

5. Exchange of science and technology information on plant genetic resources, pre-breeding and breeding;

6. Development of visiting plan of scientists from both parties shall be initiated as soon as this Agreement is signed.

Embrapa

Embrapa-RDA Cooperation in Strawberry R&D

Embrapa Temperate Climate will organize from 21st to September 23, 2010 the Fifth National Symposium and the IV Meeting on strawberry and small native fruits of Mercosur.

There will be lectures on the latest technologies used on strawberry, blackberry, blueberry, raspberry and native fruits (jabuticaba, jelly palm, among others). Discussions also will occur on the main bottlenecks limiting the development of sustainable crop development and market opportunities.

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Suwon - Republic of Korea

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