Brazilian Agricultural Research Corporation

Maurício Antônio Lopes, PhD
President

GLOBAL RESEARCH ALLIANCE
ON AGRICULTURAL GREENHOUSE GASES

Croplands Research Group Meeting
11-12 July 2015
Embrapa Headquarters, Brasília, DF - Brasil

Features and Challenges

Brazil is the world's 5th biggest country (8,514,000 km²);

Population: 203 million (5th biggest population);

Brazil shares a border with ten countries in South America - and has lived in peace with all of them for almost 140 years;

The largest economy in South America;

The 7th biggest economy in the world.

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Image credit: http://en.wikipedia.org/wiki/Brazil

Features and Challenges

Technology, Innovation, Development, Competitiveness

Strong Emphasis in Science-based Development

10,000 doctors trained every year
100,000 Brazilians will be trained abroad until 2015
The country ranks 13th in scientific publications - 43,000 papers/yr
A growing intensity of industry R&D

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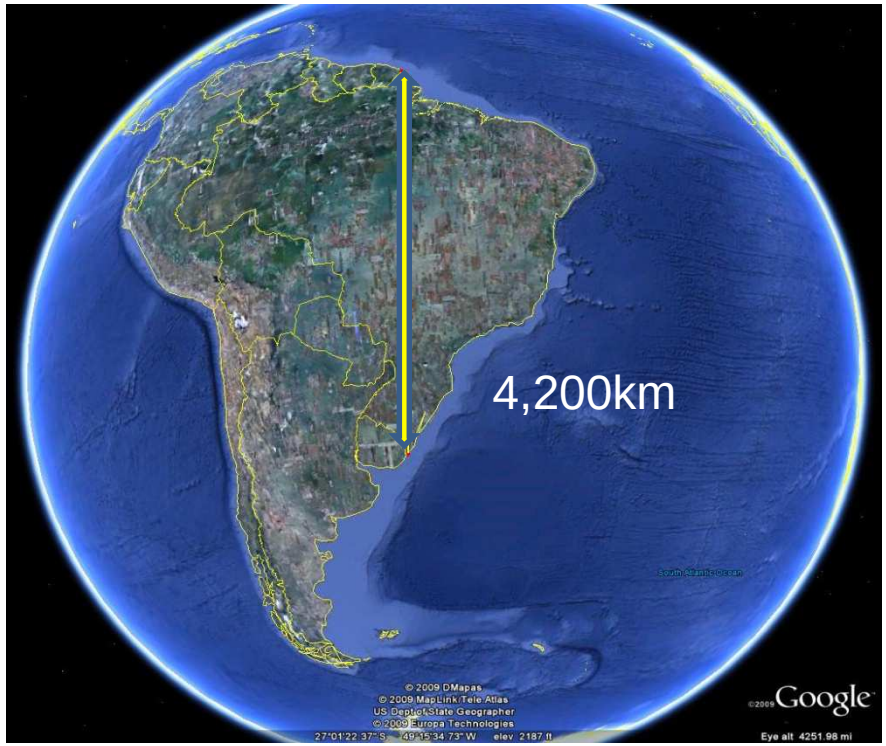
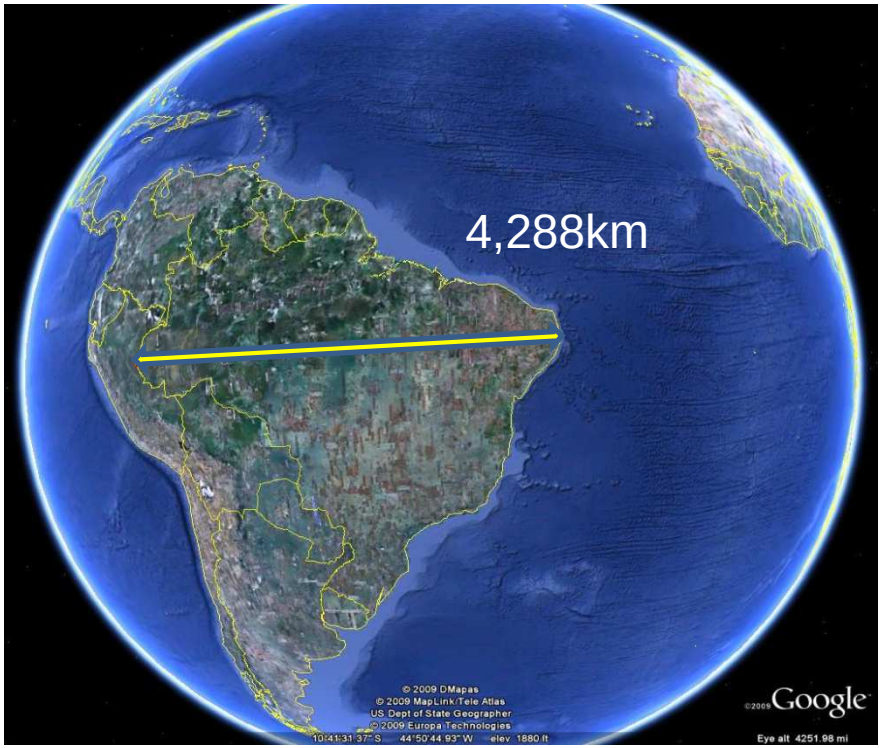
Features and Challenges

Environmental Diversity





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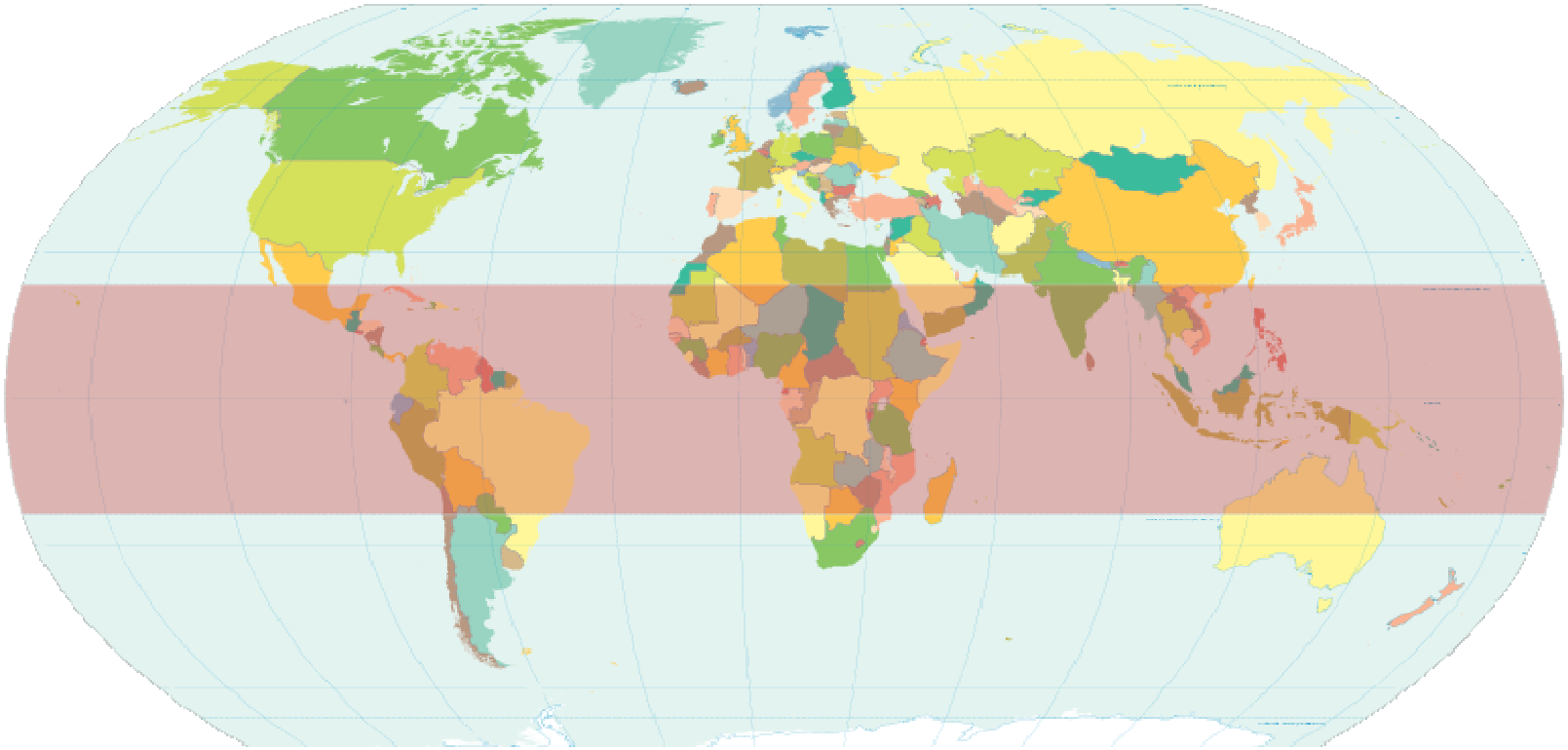
Features and Challenges



Most of the Brazilian Territory is Located in the Tropical Belt of the World

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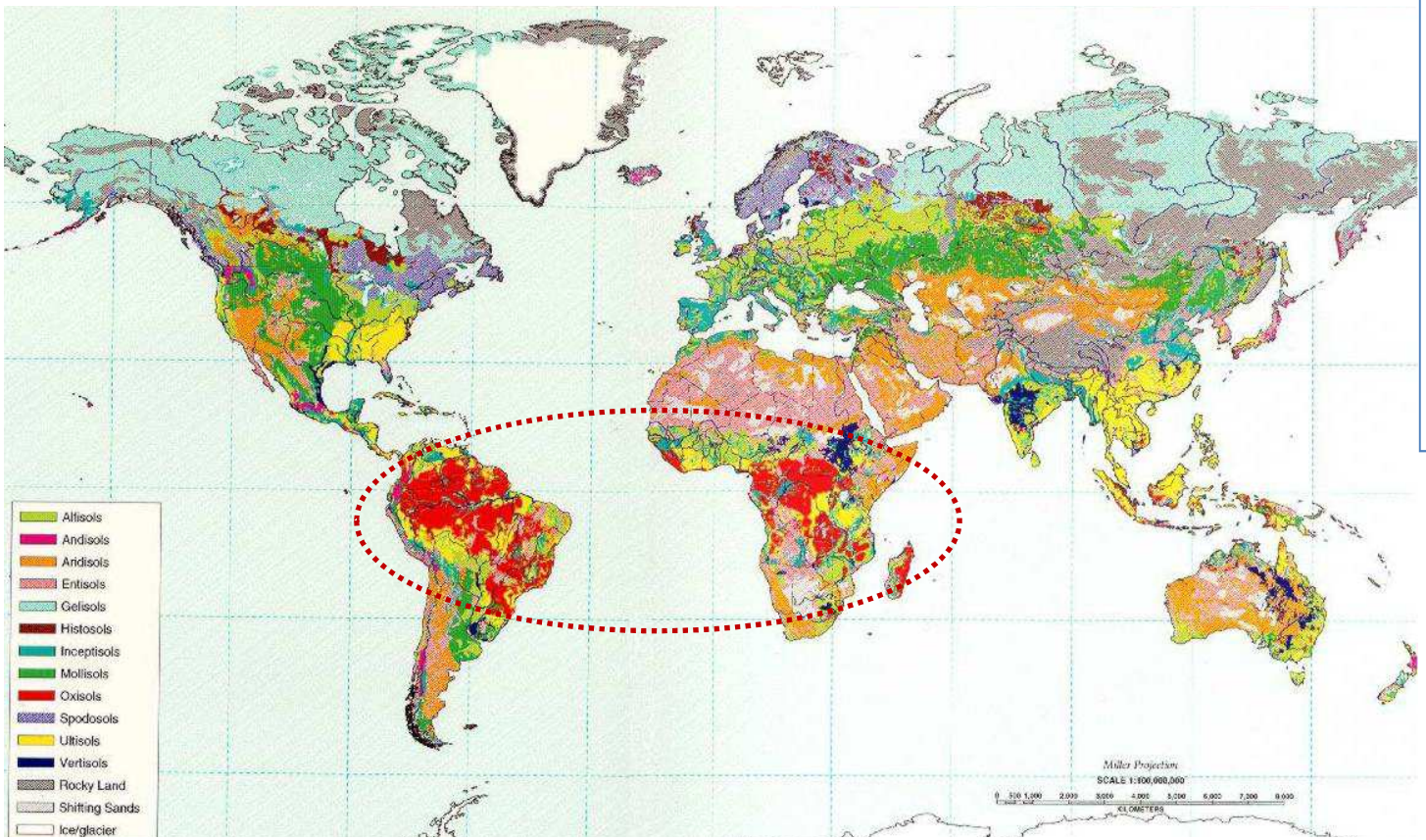
Features and Challenges

World Distribution of Soils



Tropical Soils

Acid – 84%

Saline – 2%

Shallow – 7%

Flooded – 16%

No problem – 9%

Concentration of acidic and nutrient-poor soils in the tropics

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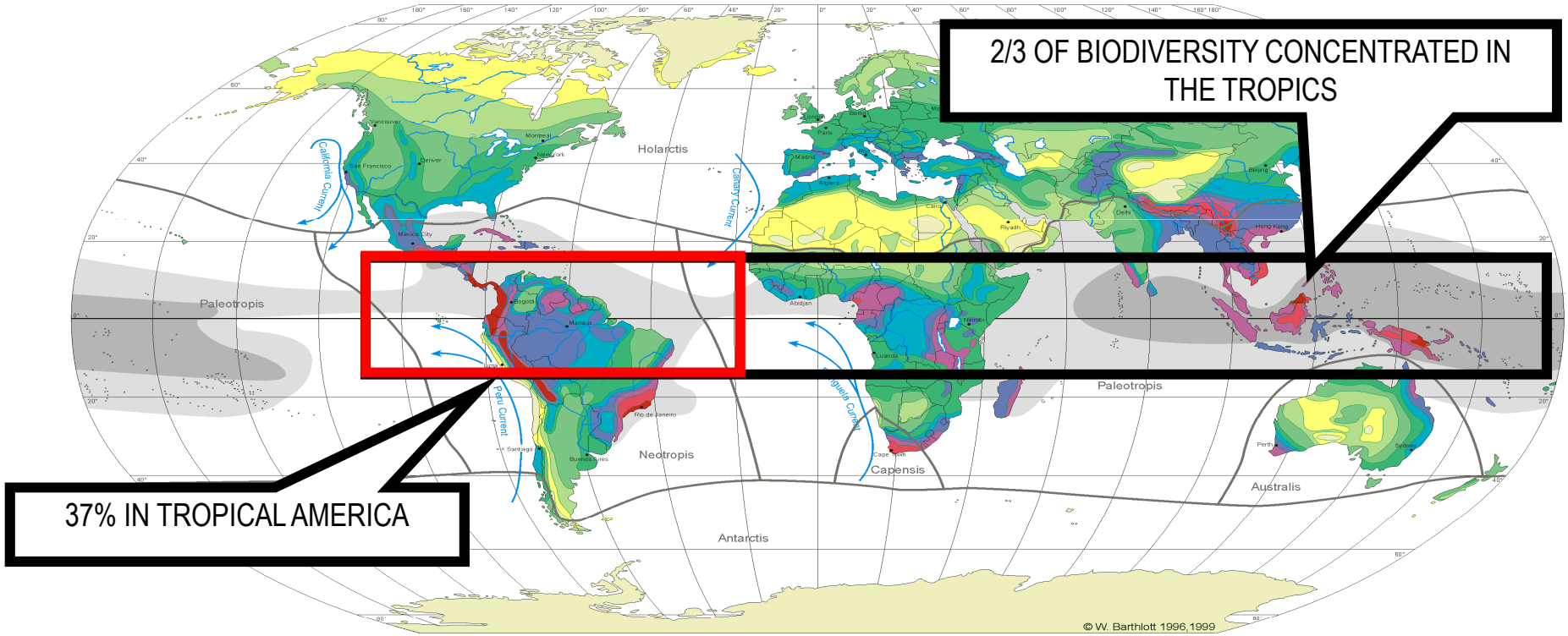
http://www.nhq.nrcs.usda.gov/WSR/mapindx/metadata/Maps/ORDERS.JPG

Features and Challenges

A Mega-diverse Country

It is estimated that Brazil contains greater biodiversity than any other country on Earth.



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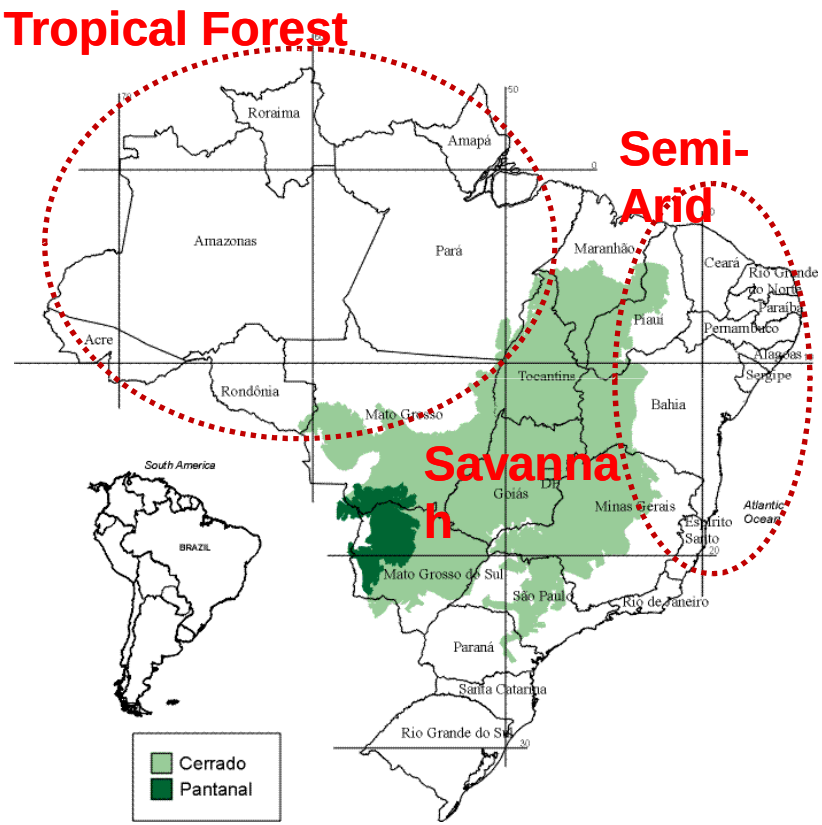
Barthlott, W., Biedinger, N., Braun, G., Feig, F., Kier, G. & J. Mutke (1999): Terminological and methodological aspects of the mapping and analysis of global biodiversity. In: Acta Botanica Fennica 162: 103-110.

Features and Challenges



Before the 1970´s Brazil was not a food secure country.

- Low agricultural production and low yields;
- Production concentrated in the South and Southeast Regions;
- Constant food supply crisis and rural poverty;
- Lack of specific knowledge in Tropical Agriculture;
- Lack of adequate agricultural development policies;
- Brazil known as coffee and sugar producer.

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In 40 Years Brazil Developed a Science-Based, Advanced Tropical Agriculture

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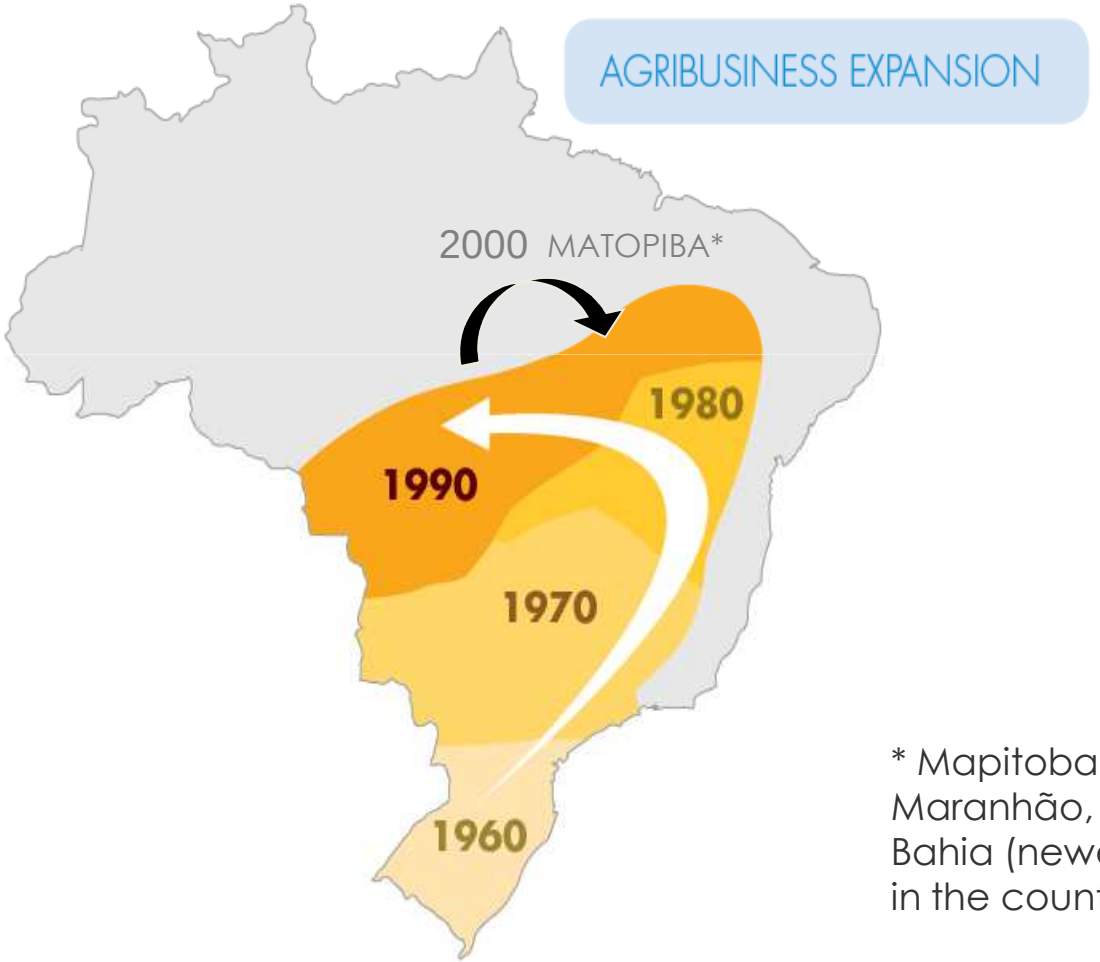
Evolution of Agriculture in Brazil



* Mapitoba: Brazilian states of Maranhão, Tocantins, Piauí and Bahia (newest agricultural frontier in the country).

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Key Drivers of Agricultural Innovation in Brazil

Government commitment and public policies;

Development of science-based tropical agriculture;

Availability of basic infrastructure;

Large extension of arable land and adequate climatic conditions;

Landscape suitable for mechanization;

Availability of mineral resources (limestone and phosphate);

Entrepreneurship of farmers.

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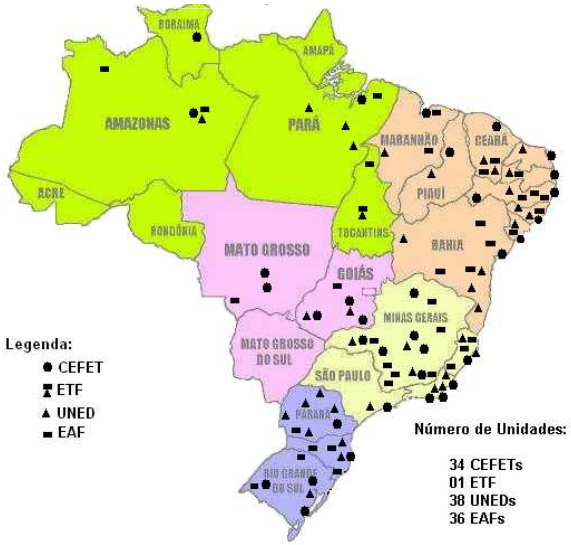
Institutional Building and Strengthening

Brazil has created a large research and education system for agriculture

17 State Ag Research Centers

Large network of experimental stations

Federal Network of Professional Education



Agricultural Universities

Ag Technical Schools

The Brazilian Agricultural Research Corporation

47 Embrapa Centers Dedicated to Technology Development

Private Sector

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

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Brazilian Agricultural Research Corporation

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Largest Agricultural Research Organization in Latin America

Employees: 9,843
Total Scientists: 2,415
Researchers with PhD/DSc: 2,182
Budget: US$ 1.2 billion

47 Centers and Services

- 11 National Thematic Centers
- 14 National Product Centers
- 17 Ecorregional/Agroforestry Centers
- 05 Service Centers

Operations in the US, Europe, Asia, Africa and Latin America

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Brazilian Agricultural Research Corporation

Embrapa – A Network of 47 R&D Units

Ecoregional Centers

- Embrapa Acre
- Embrapa Agropecuária Oeste
- Embrapa Agrossilvipastoril
- Embrapa Amapá
- Embrapa Amazônia Ocidental
- Embrapa Amazônia Oriental
- Embrapa Cerrados
- Embrapa Clima Temperado
- Embrapa Cocais
- Embrapa Meio-Norte
- Embrapa Pantanal
- Embrapa Pecuária Sudeste
- Embrapa Pecuária Sul
- Embrapa Rondônia
- Embrapa Roraima
- Embrapa Semiárido
- Embrapa Tabuleiros Costeiros

Product Centers

- Embrapa Algodão
- Embrapa Arroz e Feijão
- Embrapa Caprinos e Ovinos
- Embrapa Florestas
- Embrapa Gado de Corte
- Embrapa Gado de Leite
- Embrapa Hortaliças
- Embrapa Mandioca e Fruticultura
- Embrapa Milho e Sorgo
- Embrapa Pesca e Aquicultura
- Embrapa Soja
- Embrapa Suínos e Aves
- Embrapa Trigo
- Embrapa Uva e Vinho

Thematic Centers

- Embrapa Agrobiologia
- Embrapa Agroenergia
- Embrapa Agroindústria de Alimentos
- Embrapa Agroindústria Tropical
- Embrapa Estudos e Capacitação
- Embrapa Informática Agropecuária
- Embrapa Instrumentação
- Embrapa Meio Ambiente
- Embrapa Monitoramento por Satélite
- Embrapa Recursos Genéticos e Biotecnologia
- Embrapa Solos

Service Centers

- Embrapa Café
- Embrapa Gestão Territorial
- Embrapa Informação Tecnológica
- Embrapa Produtos e Mercado
- Embrapa Quarentena Vegetal

International Cooperation Units – USA, Europe, Asia, Africa, LAC

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Institutional Building and Strengthening

Brazil has built one of the largest ag research systems in the world

State-of-the-art Infrastructure + Strong Training and Capacity Building

Embrapa Soybean Center

Source: Embrapa Soybean

Brazilian Agricultural Research Corporation

Embrapa Soybean

Embrapa

Brazilian Agricultural Research Corporation

Embrapa Agroenergy

Brazilian Agricultural Research Corporation

Embrapa Agrossilvipastoril

Embrapa

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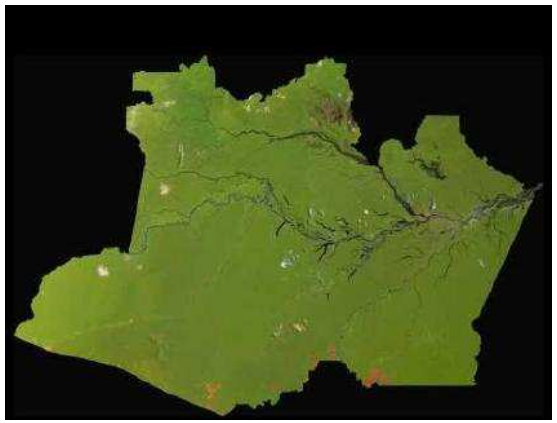
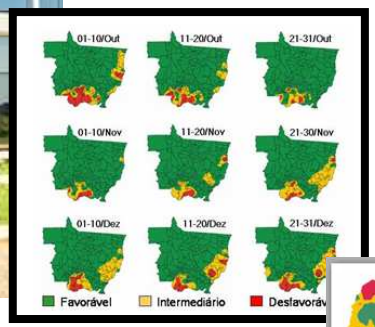
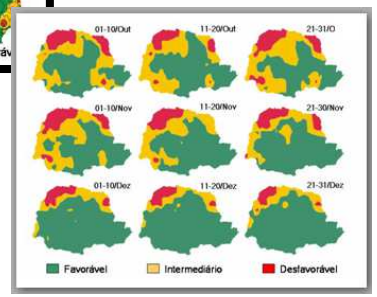
Embrapa Genetic Resources and Biotechnology

Brazilian Agricultural Research Corporation

Embrapa Satellite Monitoring

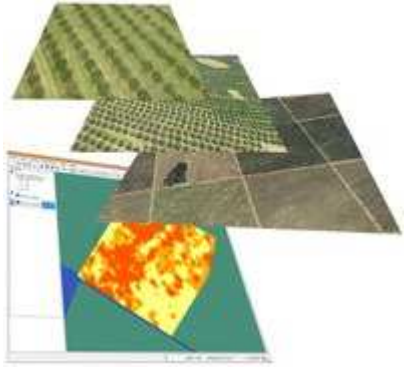


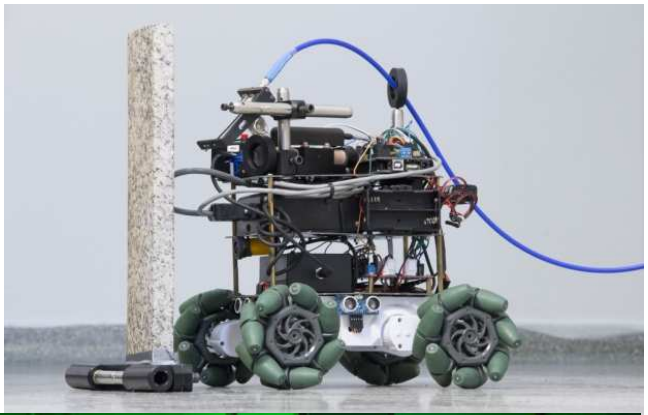


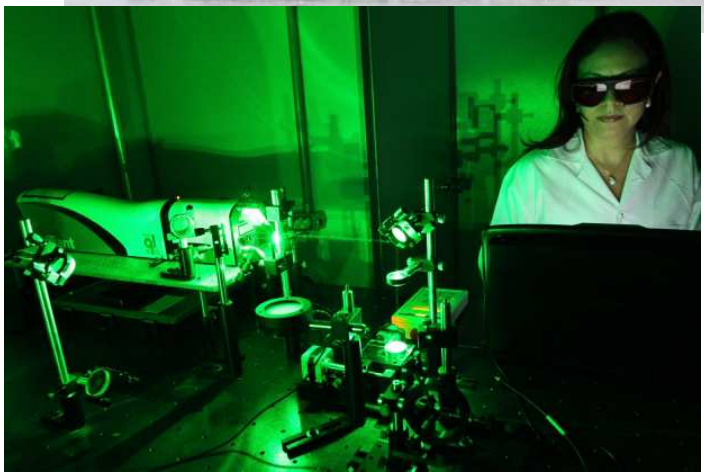


Brazilian Agricultural Research Corporation

National Precision Ag Laboratory







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Strong Emphasis in Partnerships

Currently Embrapa has 162 partnership agreements – Public-Private

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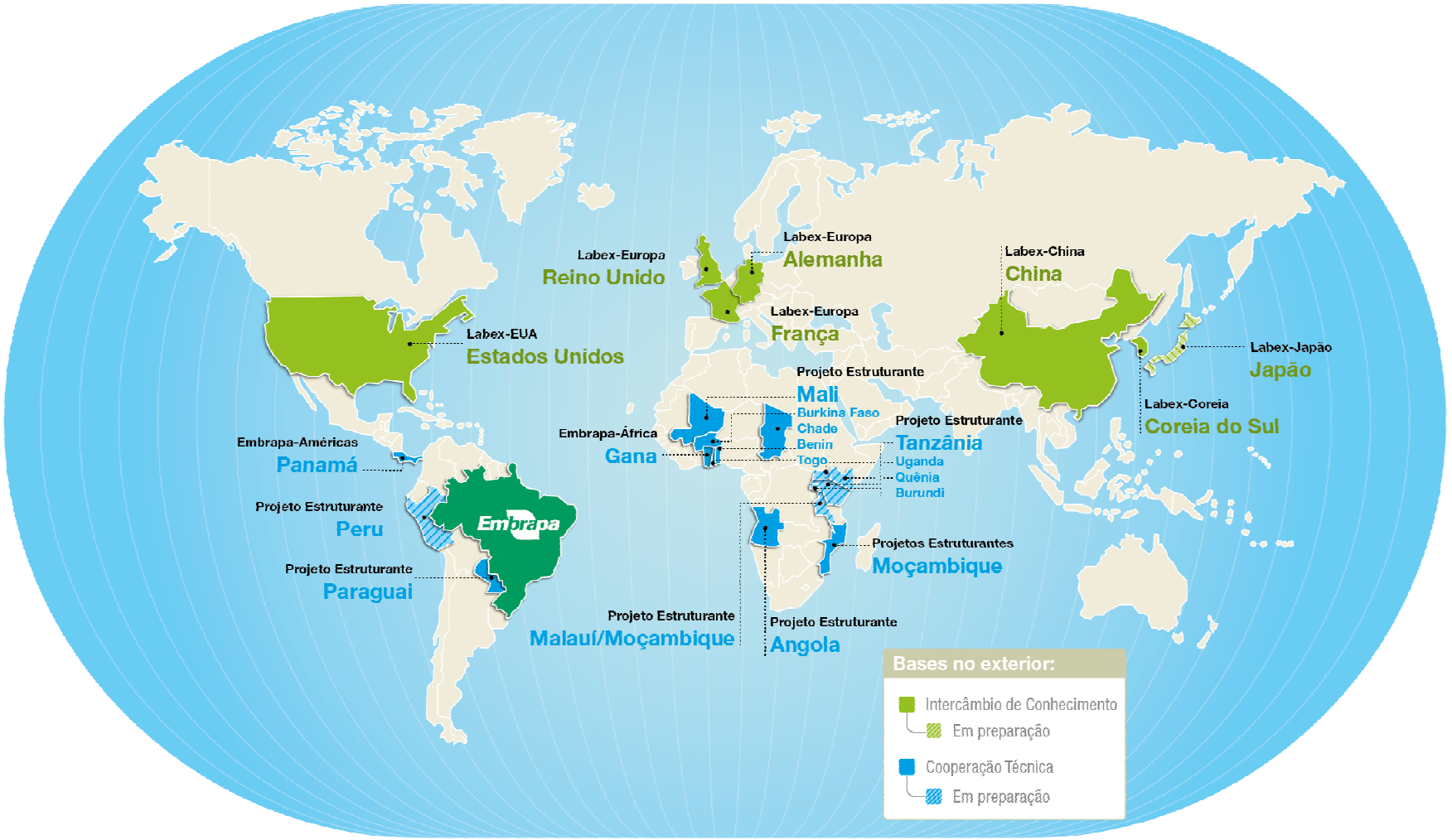
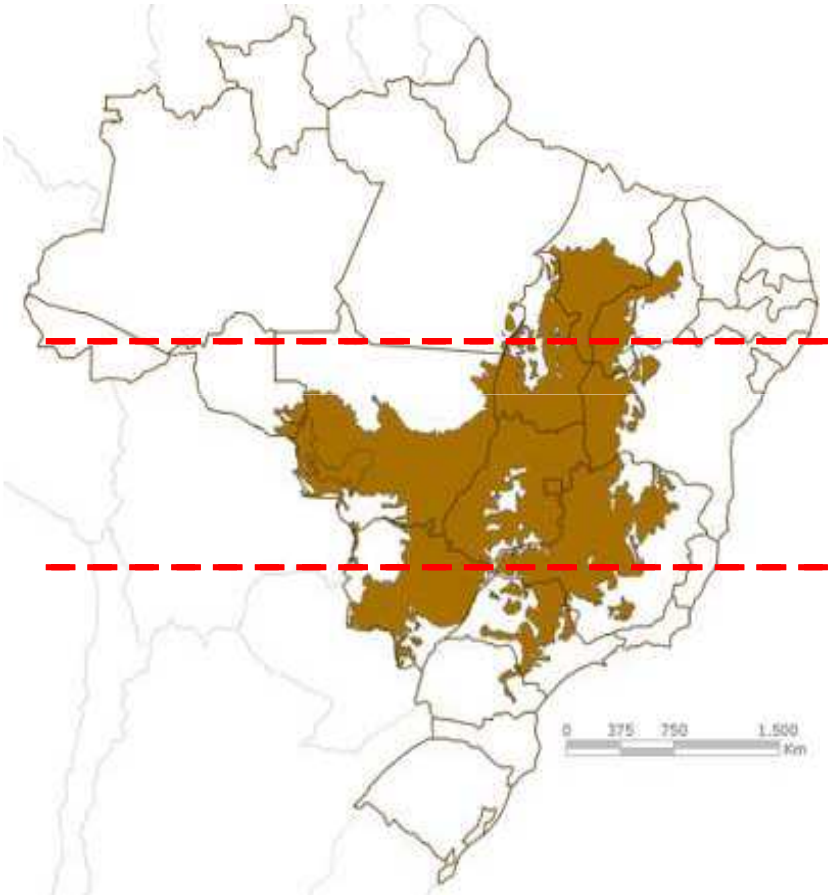
Embrapa – International Cooperation



Sharing Knowledge in Tropical Agriculture



Pro-Savannah Project - Mozambique

Corridor to Port of Nacala -14 million hectares

Brazilian Cooperation Agency (ABC), Japan International Cooperation Agency (JICA), the Brazilian Agricultural Research Corporation (Embrapa) and the Ministry of Agriculture of the Republic of Mozambique.

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Key Contributions of Public Research in Brazil

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Key Contributions of Public R&D in Brazil

Public R&D operated like a "*Track Cleaning Train*",
opening the way for a fast moving private sector

Transformation of acidic, poor soils into fertile land

"Tropicalization" of crops and animal production systems

Development of a Platform of Sustainable Practices

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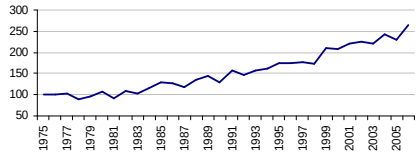
Rising Agricultural Productivity

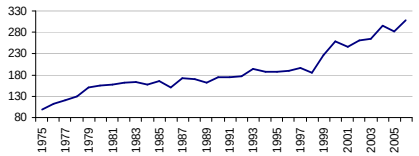
Yield increase (1975 to 2009): from 60% to over 200%

Rice



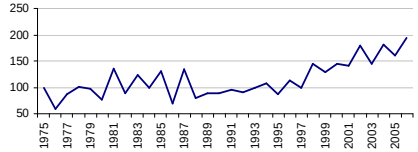
Fonte: IBGE

Onions



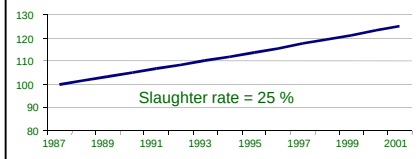
Fonte: IBGE

Coffee

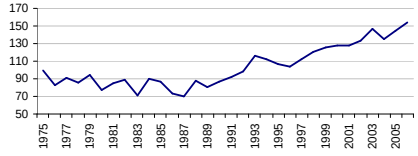


Fonte: IBGE

Beef cattle

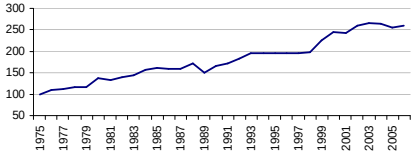


Beans



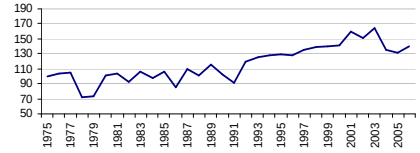
Fonte: IBGE

Tomatoes



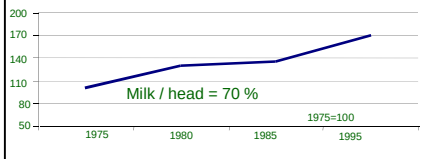
Fonte: IBGE

Soybeans

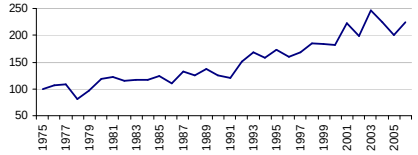


Fonte: IBGE

Dairy cattle

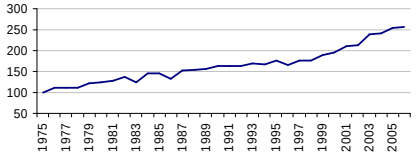


Corn



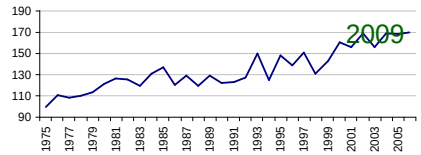
Fonte: IBGE

Potatoes



Fonte: IBGE

Oranges



Fonte: IBGE

2009

1.7

Poultry

	1970	
Days to slaughter	50	39
Weight kg	1.8	2.2
Food conversion (wtwt)	1.4	

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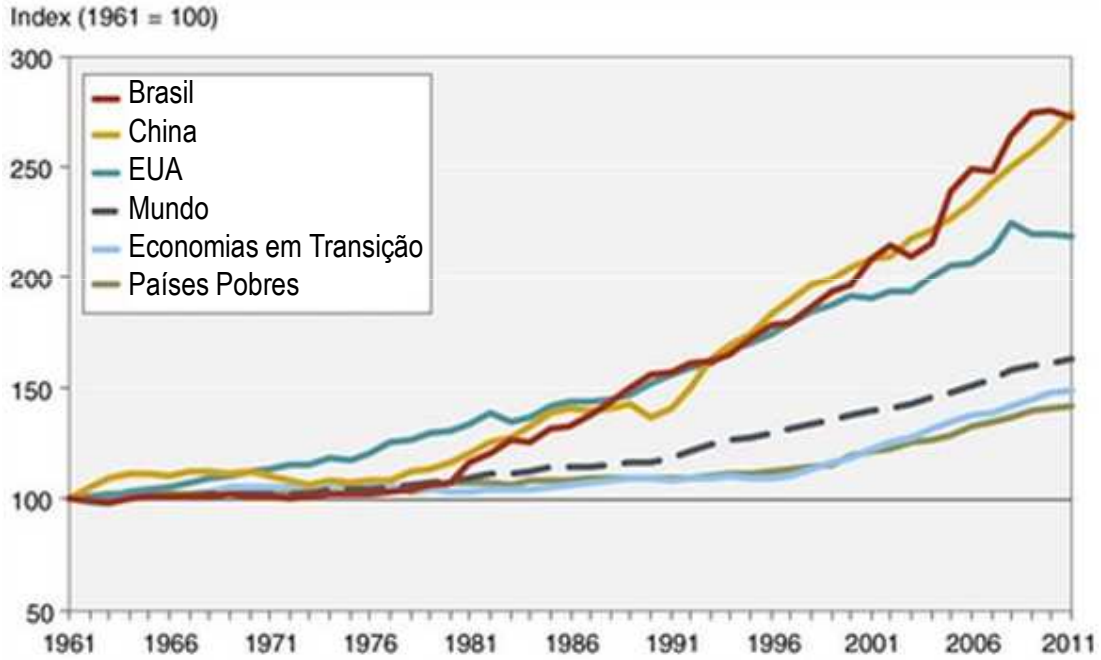
Rising Agricultural Productivity

Produtividade da agricultura medida pela produtividade total dos fatores (PTF) – 1961-2011

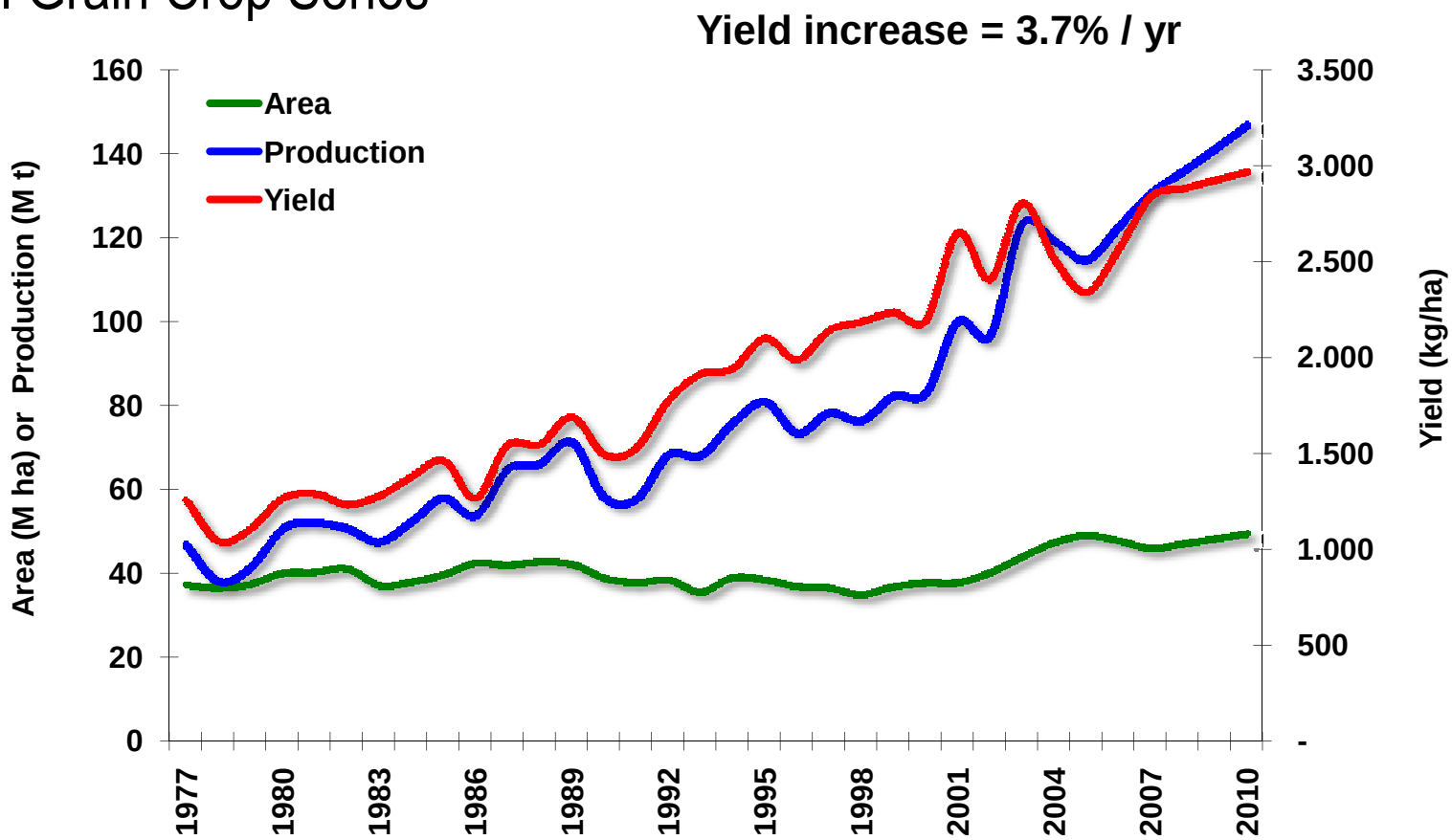


Produtividade total dos fatores (PTF) leva em conta terra, trabalho, capital e todos os recursos materiais empregados na produção e os compara com o resultado final. Se a produção final cresce mais rápidamente que o total de recursos materiais empregados, nós temos uma melhoria em PTF.

Fonte: USDA – Economic Research Service.

Rising Agricultural Productivity

Annual Grain Crop Series

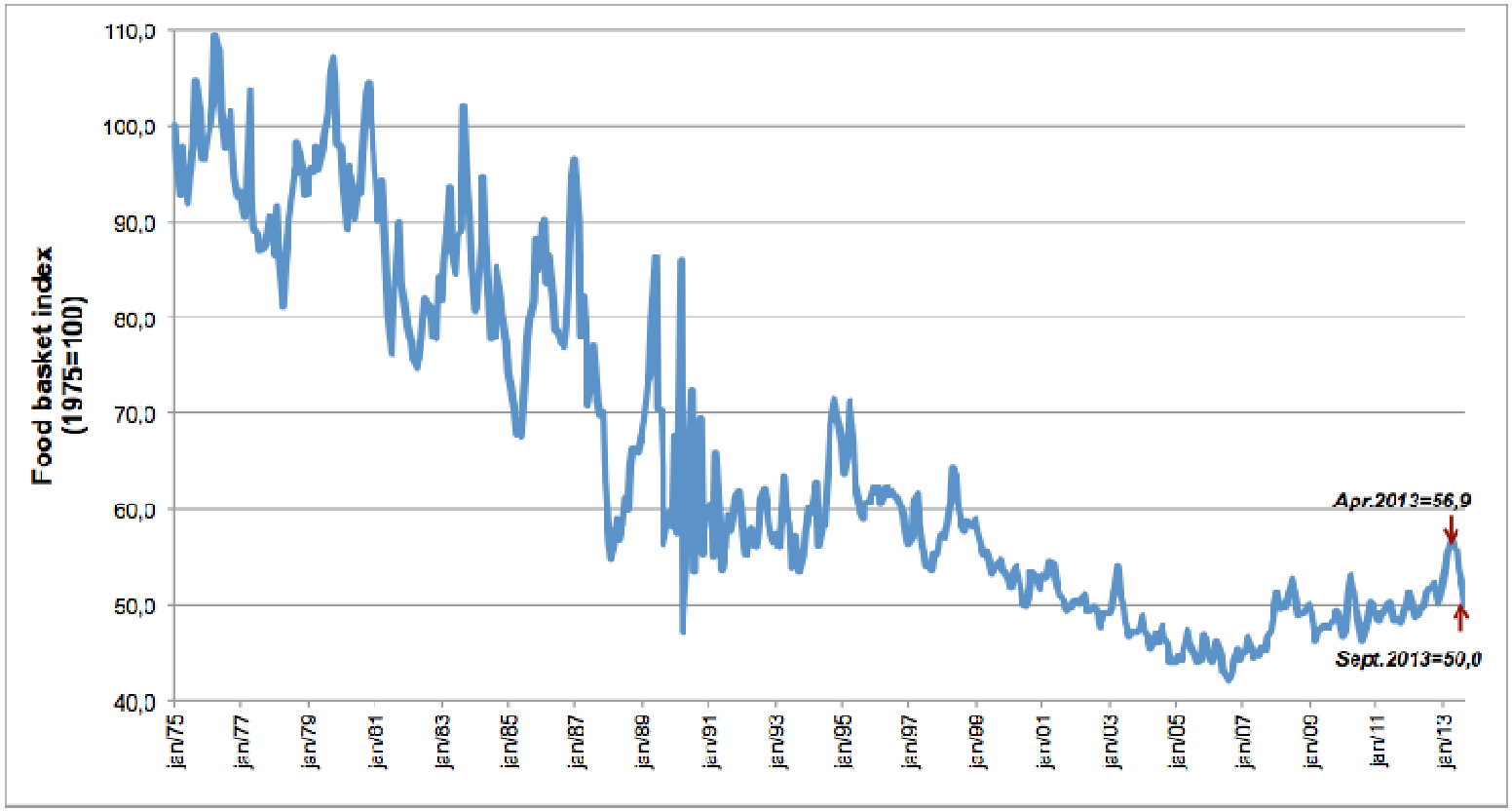


Source: MAPA (Brazilian Ministry of Agriculture, Livestock and Food Supply)

Brazil Became Food Secure in a Short Period of Time

Evolution of food basket prices in São Paulo, Brazil

(1975=100, real prices, Sept.2013)



Data from DIEESE, deflator IGP-DI (FGV), calculations and elaboration by G.B. Martha (2013).

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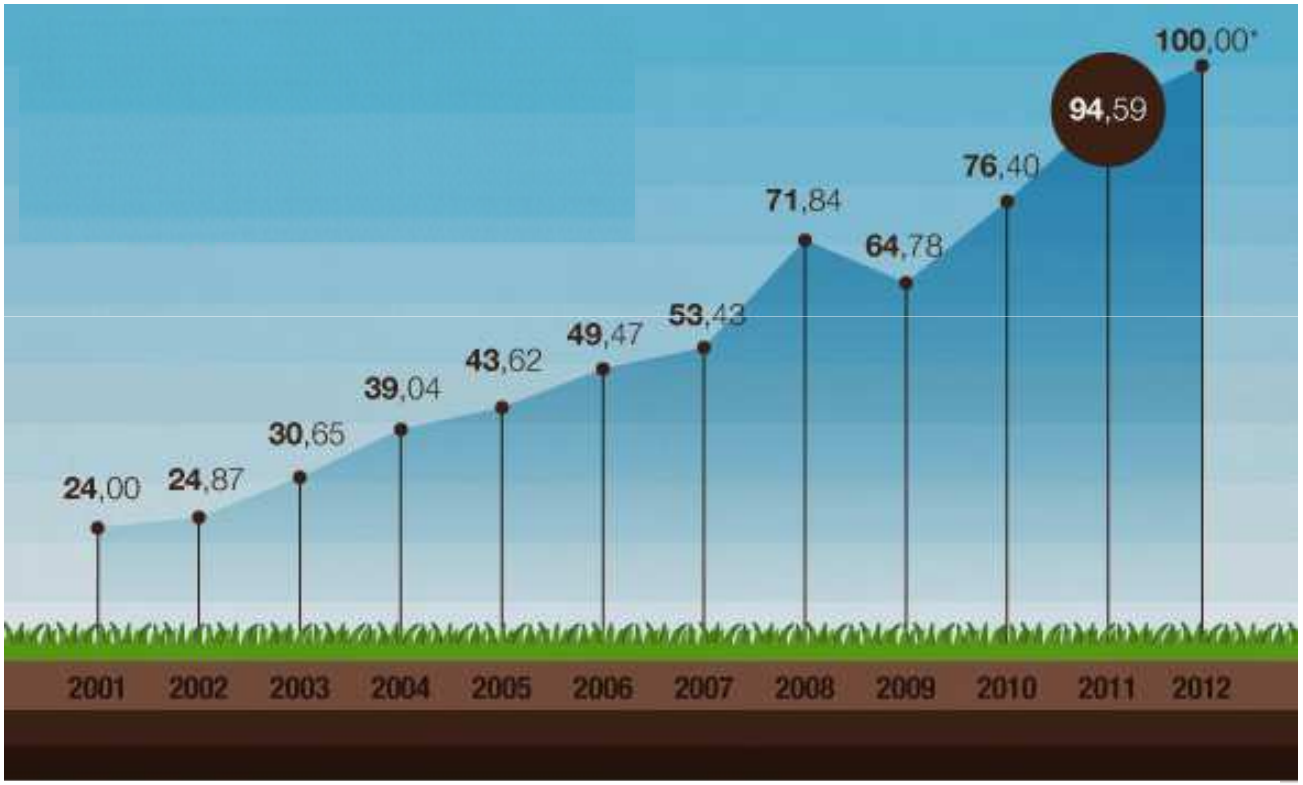
Brazil Became an Important Food Exporter

Brazilian Agricultural Exports (US$ billions) – From 2001 to 2011



Source: MAPA, 2012 - with data from Secex

* Expected

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Agricultural Inovation Driving Development

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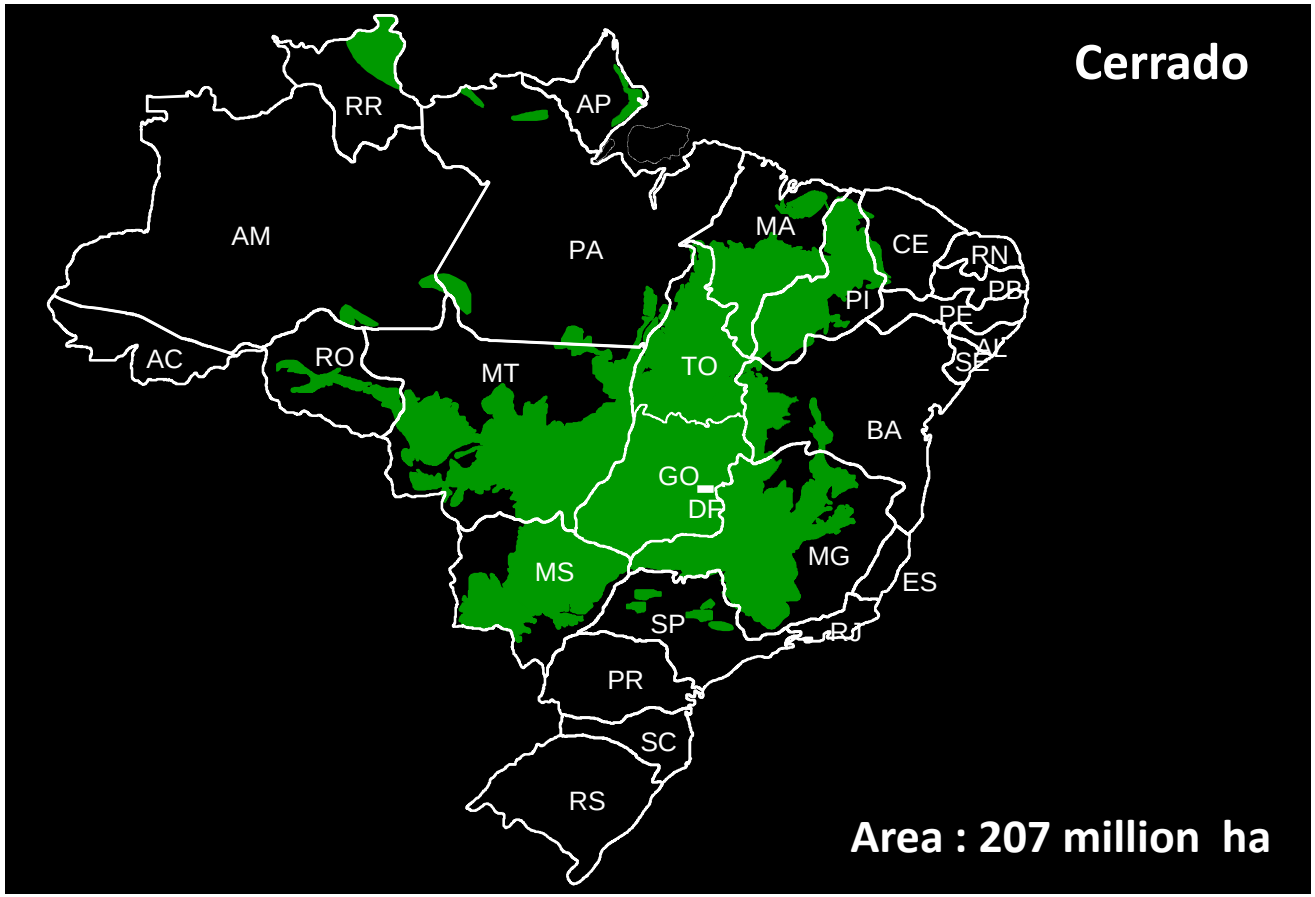
Agriculture in the Brazilian Savannah - Cerrado



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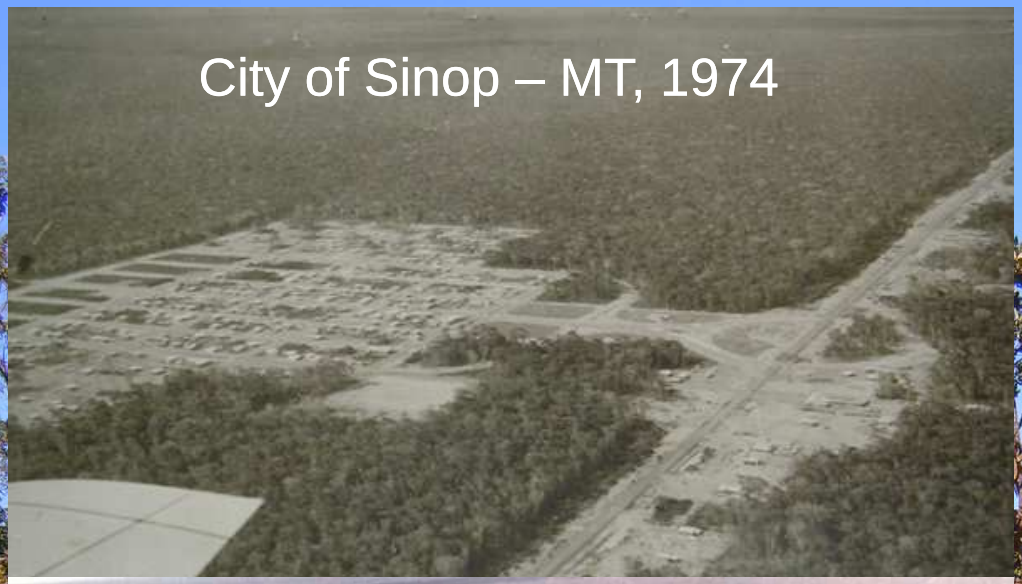
City of Sinop – MT, 1974




Cidade de Sinop – MT, 2015


Sinop e Lucas do Rio Verde – MT, 2015

Development of Tropical Agriculture in Brazil

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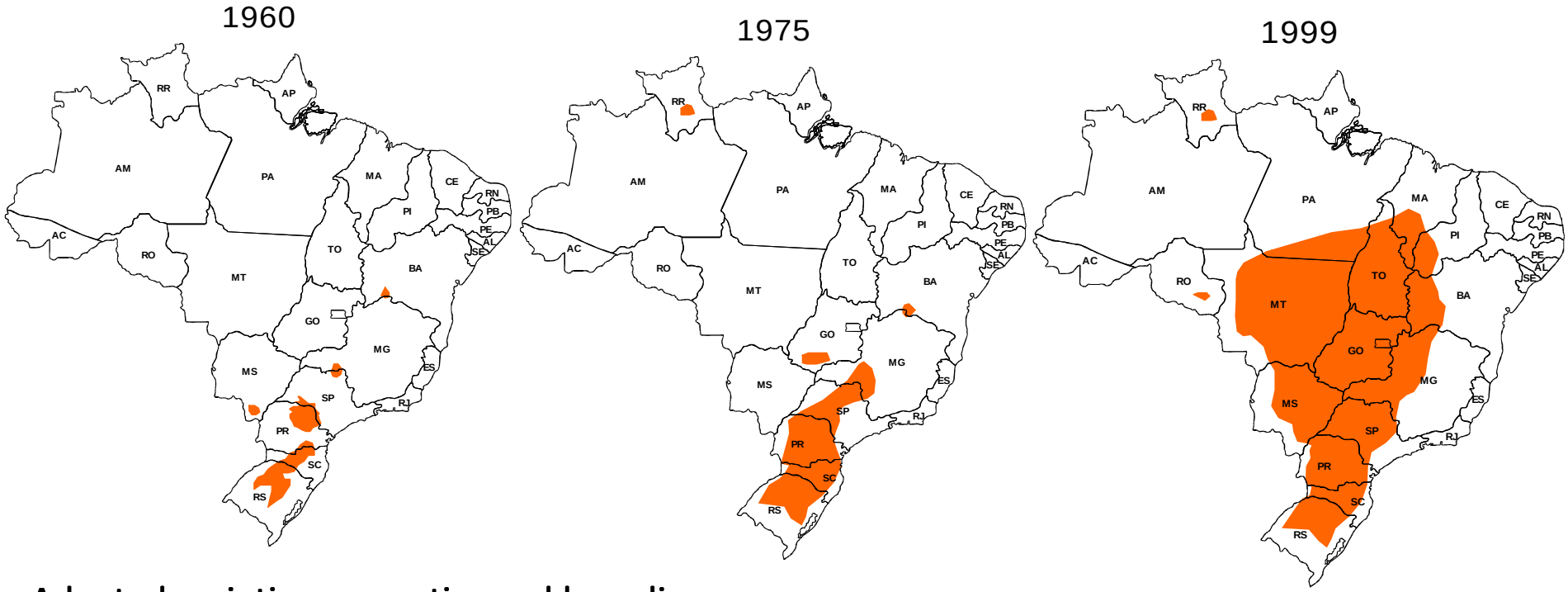
Development of Tropical Agriculture in Brazil

Brazilian Scientists had to "Tropicalize" Soybeans and Other Species



Adapted varieties – genetics and breeding

Biological nitrogen fixation

Pest and disease control

Minimum tillage - mechanization

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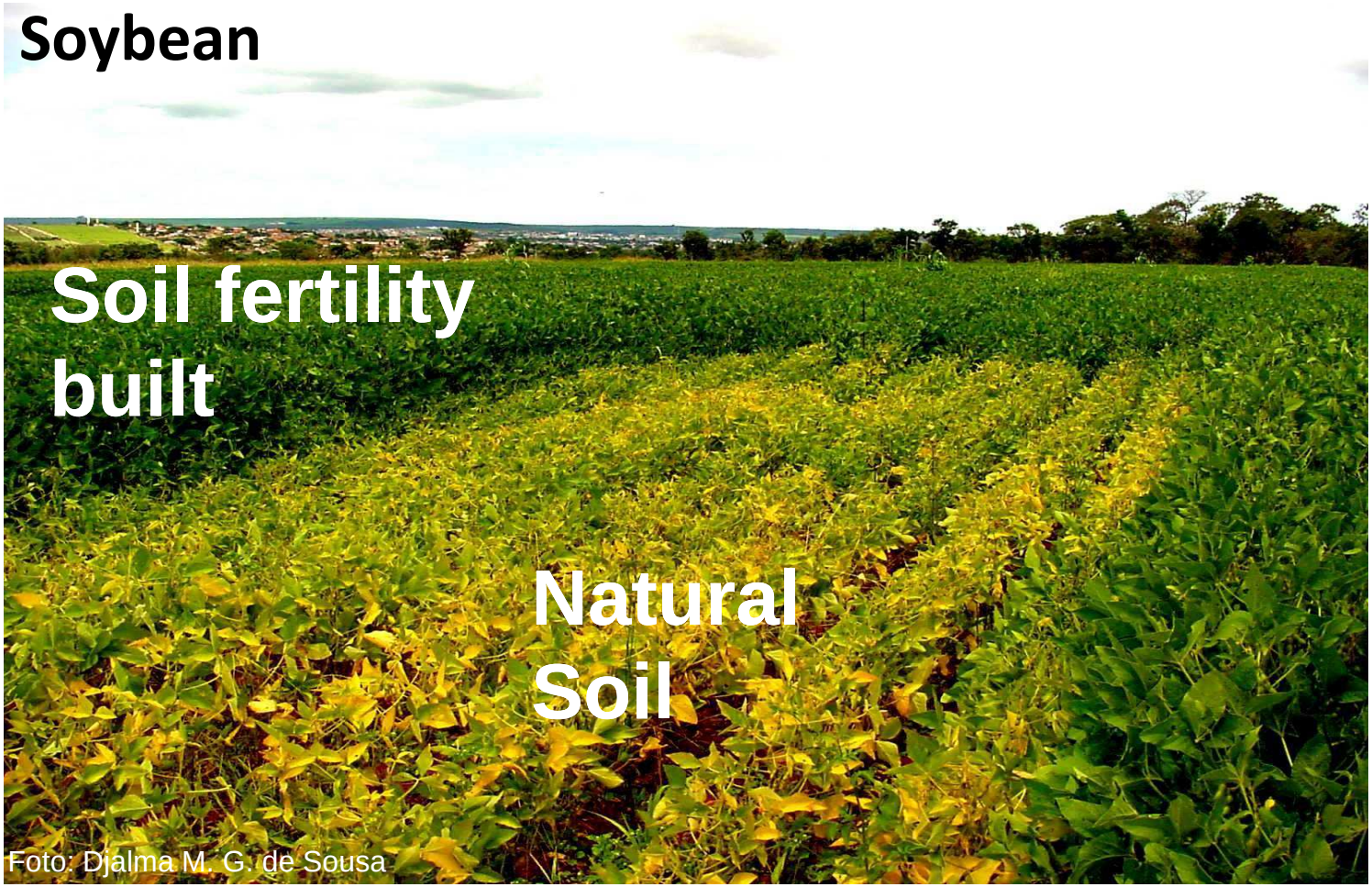
Source: Embrapa Soybean

Development of Tropical Agriculture in Brazil



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Development of Tropical Agriculture in Brazil

More Sustainable Cropping Systems in the Tropics

Biological Nitrogen Fixation with *Bradyrhizobium* strains

N savings in 2014/2015:
~ US$ 4.1 billion

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Development of Tropical Beef Cattle Production Systems

More than 30 years of Tropical Cattle Breeding Programmes
Genetic Resources, Breeding and Development of Tropical Grasses

High performance tropical cattle

High yielding tropical grasses

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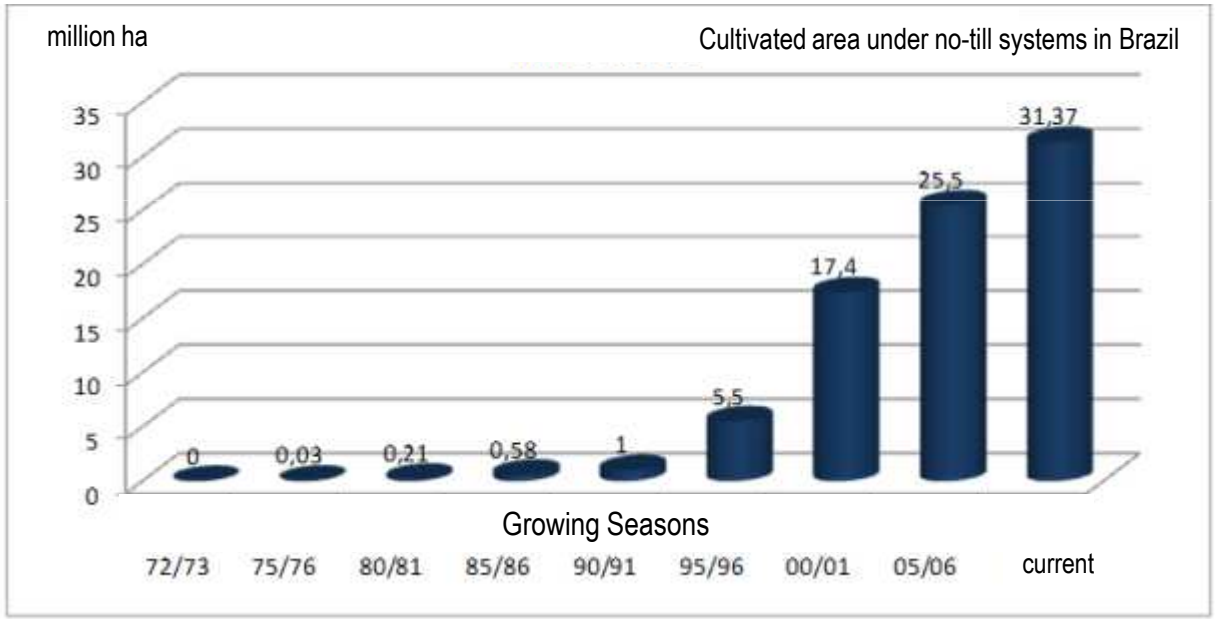
Strong Emphasis in Conservation Agriculture

Brazil's agriculture has been significantly impacted by the transformation of farming from the old intensive tillage systems to new no-till systems.



Brazilian farmers have been the pioneers in no-till farming, maximizing the productivity benefits from Embrapa and other organizations´ R&D.

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Sources: Emater-RS, Epagri-SC, Emater-PR, Cati-SP, Fundação MS, Apdc (cerrado) / Bigma Consultoria (http://www.bigma.com.br/artigos.asp?id=96)

Conservation Agriculture in Brazil

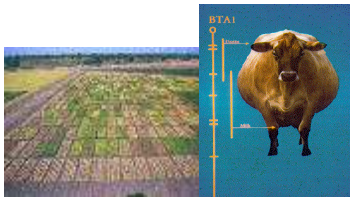
Integrated Pest Management

High Impact Agricultural Sciences

Embrapa

High Impact Sciences in Agriculture

Substantial Advances in Recent Years...



MOLECULAR TOOLS

MOLECULAR BREEDING

Molecular Markers/Maps
Genetic Resources Charc.
Gene/Trait Mapping
Function Characterization

GENETIC ENGINEERING

TRANSGENIC TECHNOLOGY

Biotic Stress Tolerance
Abiotic Stress Tolerance
Quality/Functionality
New Bioproducts

GENOMIC SCIENCES

GENOMICS PROTEOMICS

Coffee
Eucalyptus
Banana/Rice
Bovine & Others

ADVANCED REPRODUCTION

CLONING IN-VITRO FERTILIZATION

Animal Breeding
GR Conservation
Germplasm Enhancement
Biofactories

BIOSAFETY, BIOINFORMATICS, PROTEOMICS, METABOLIC ENGINEERING, ETC...

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High Impact Sciences in Agriculture

Open Innovation

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

2010-02-05
P-10-148

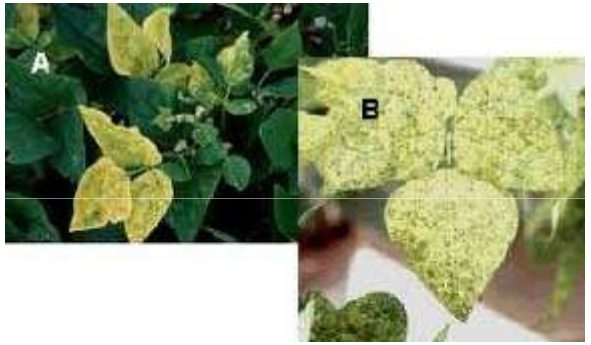
- First genetically modified crop developed in Brazil to reach commercialization stage
- Market launch to take place after regulatory approval in key export markets

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

Cultivance® is the first genetically modified crop developed in Brazil, from laboratory to commercialization. The approval is the result of more than 10 years of successful cooperation between Embrapa and BASF, a global leader in providing agricultural solutions. The Cultivance® Production System combines herbicide-tolerant soybean varieties with BASF's broad spectrum imidazolinone class of herbicides, tailored to regional conditions. Photo: BASF - The Chemical Company, 2010

High Impact Sciences in Agriculture

Transgenic commom bean resistant to golden mosaic virus



http://www.iapar.br/modules/noticias/print.php?storyid=318

RNA interference to silence a gene that is essential for virus replication (*rep*).
It confers immunity to the virus.

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High Impact Sciences in Agriculture

Genomic Selection in *Eucalyptus*

nature International weekly journal of science

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Archive > Volume 510 > Issue 7505 > Articles > Article

NATURE | ARTICLE OPEN

日本語要約

The genome of *Eucalyptus grandis*

Alexander A. Myburg, Dario Grattapaglia, Gerald A. Tuskan, Uffe Hellsten, Richard D. Hayes, Jane Grimwood, Jerry Jenkins, Erika Lindquist, Hope Tice, Diane Bauer, David M. Goodstein, Inna Dubchak, Alexandre Poliakov, Eshchar Mizrachi, Anand R. K. Kullan, Steven G. Hussey, Desre Pinard, Karen van der Merwe, Pooja Singh, Ida van Jaarsveld, Orzenil B. Silva-Junior, Roberto C. Togawa, Marilia R. Pappas, Danielle A. Faria, Carolina P. Sansaloni + *et al.*

Affiliations | Contributions | Corresponding author

Nature **510**, 356–362 (19 June 2014) | doi:10.1038/nature13308

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Genomic Selection in *Eucalyptus*

Participating companies that have genotyped samples and are currently at different stages of assessing, validating or adopting Genomic Selection

High Impact Sciences in Agriculture

Bioengineering synthetic fibers from recombinant proteins

Source: Embrapa Genetic Resources and Biotecnology

High Impact Sciences in Agriculture

Embrapa develops transgenic lettuce powered by folic acid

Source: http://revistaepoca.globo.com/Saude-e-bem-estar/noticia/2012/12/nova-cara-dos-transgenicos.html

Embrapa has started field tests of what can be an important ally to public health: lettuce enriched with folic acid.

The new variety of the vegetable has 15 times the amount of folic acid compared to conventional lettuce, supplying 80% the daily requirement of an adult.

The transgenic lettuce will be an important alternative to combat the deficiency of folic acid, which generates from malformation in babies to heart problems and, according to some recent studies, depression.

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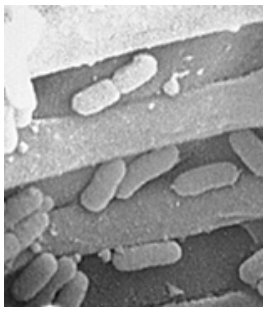
Source: Embrapa Genetic Resources and Biotecnology

High Impact Sciences in Agriculture

Preventive Breeding



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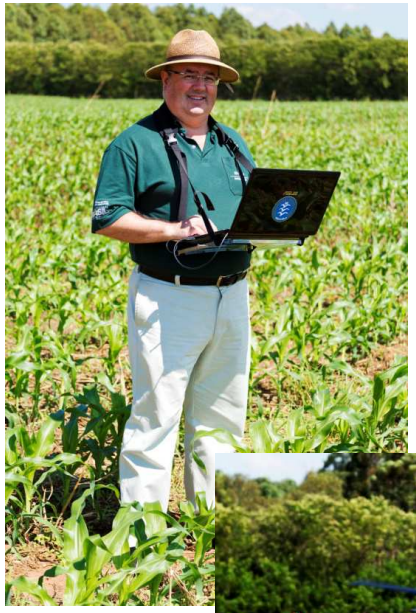
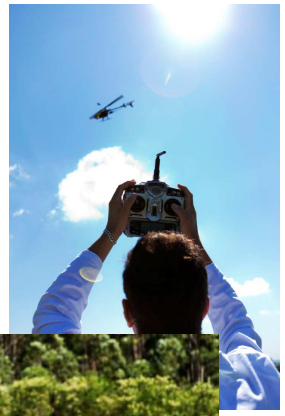
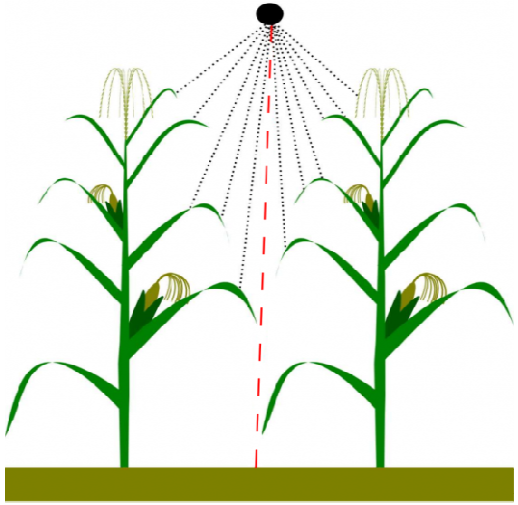
Precision Agriculture







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Science Driving Public Policies

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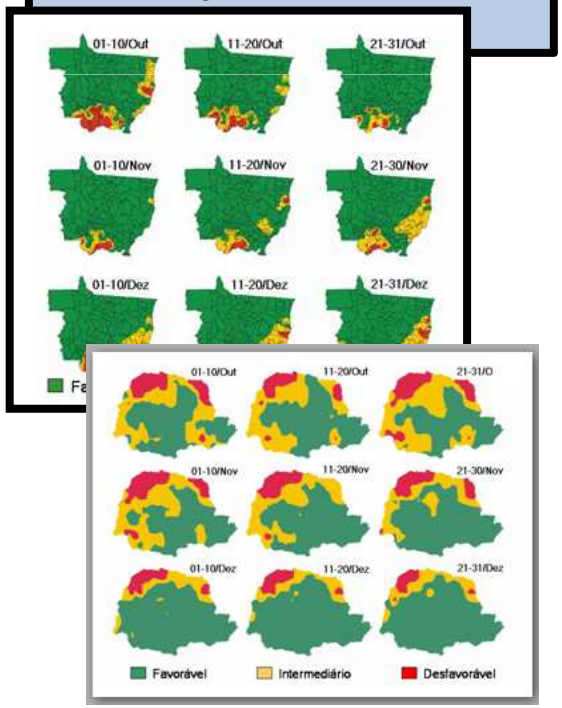
Science Driving Public Policies

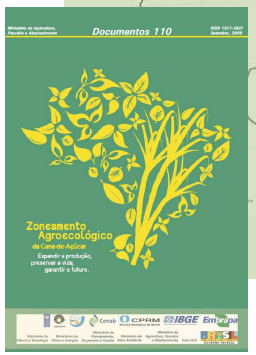
Zoning of Climatic Risks

Regionalização dos sinistros climáticos para minimizar as perdas na produção agrícola, reduzindo os riscos oriundos do regime de chuva.



Agroecological Zoning of Sugarcane

Define áreas aptas e zonas de exclusão para o cultivo da cana-de-açúcar no Brasil. Orienta a política de expansão da cana e da produção de bioetanol



Low Carbon Agriculture ABC Plan

Promove a “descarbonização da agricultura pela incorporação de práticas de baixa emissão de gases de efeiro estufa – plantio direto, fixação de N, iLPF, etc.

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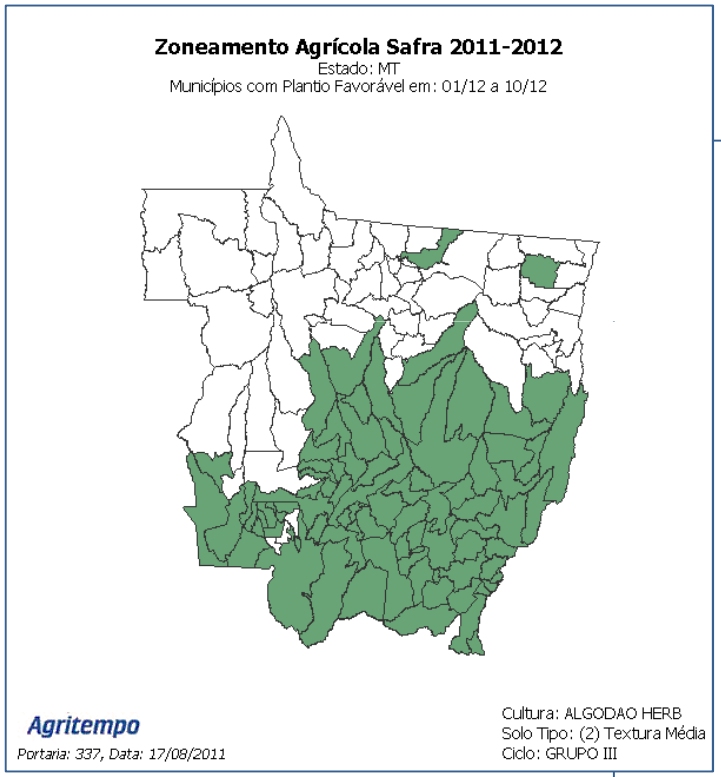
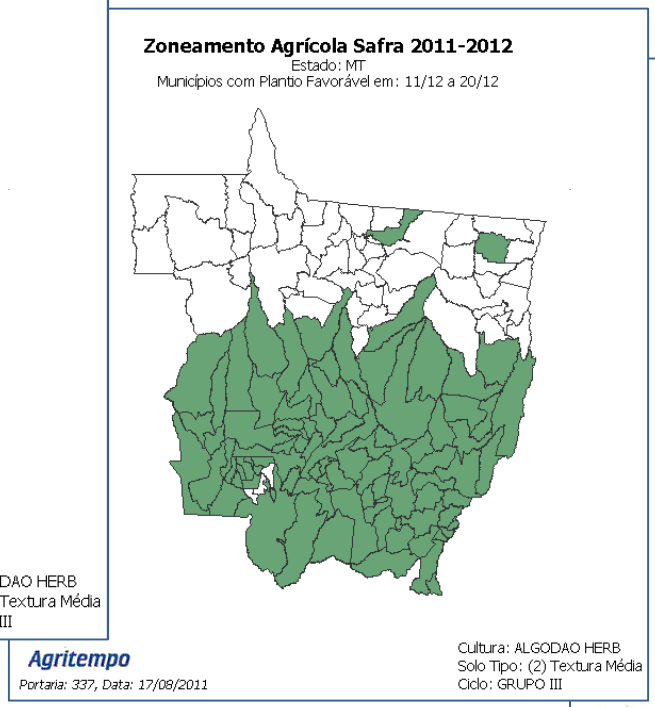
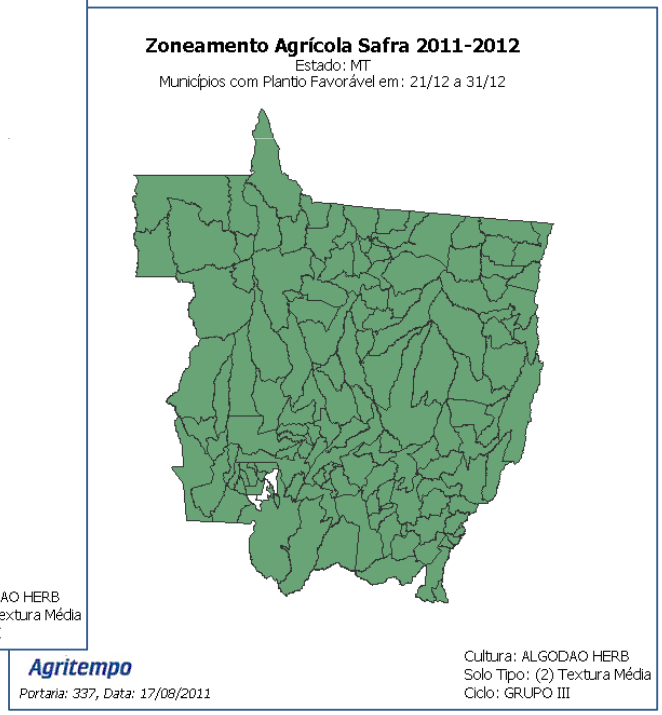
Zoning of Agricultural Risks

Guidance to public policy implementation – Rural credit and insurance







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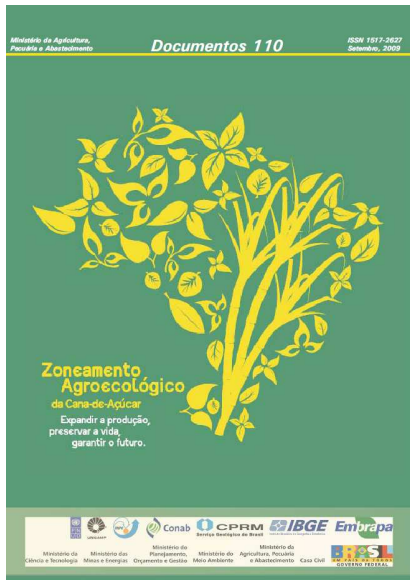
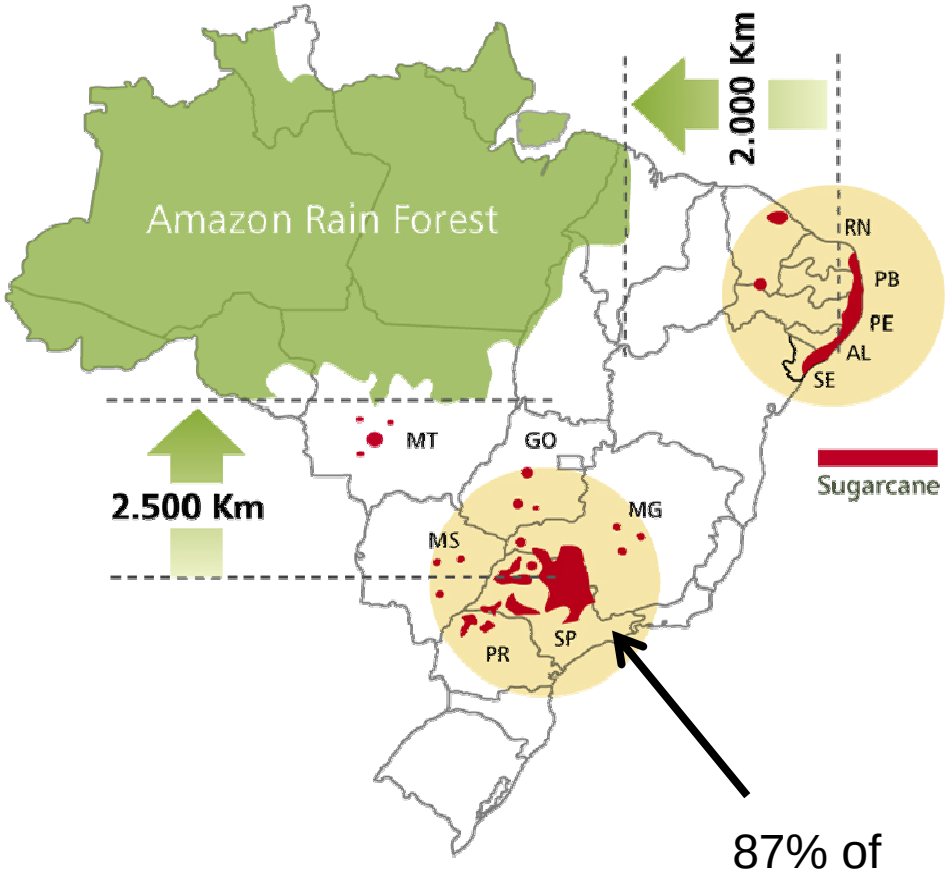
Sustainable Expansion of Agriculture in Brazil

Use of advanced geotechnologies, zoning and management on territory basis

Brazil is using Zoning Technology to Manage Agricultural Expansion

Agroecological Zoning of
Sugarcane for ethanol production





87% of sugarcane production

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http://www.cnps.embrapa.br/zoneamento_cana_de_acucar/ZonCana.pdf

Source: UNICA.

Low Carbon Agriculture

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Moving Faster Towards Sustainability

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New Frontiers in Conservation Agriculture in Brazil

Intensification of land use with integrated crop-livestock-forest systems

Supported by Brazil´s low carbon emission program for agriculture

Source: MAPA, 2010 – Photos by Votorantin Metais

New Frontiers in Conservation Agriculture in Brazil

Intensification of land use with integrated crop-livestock-forest systems

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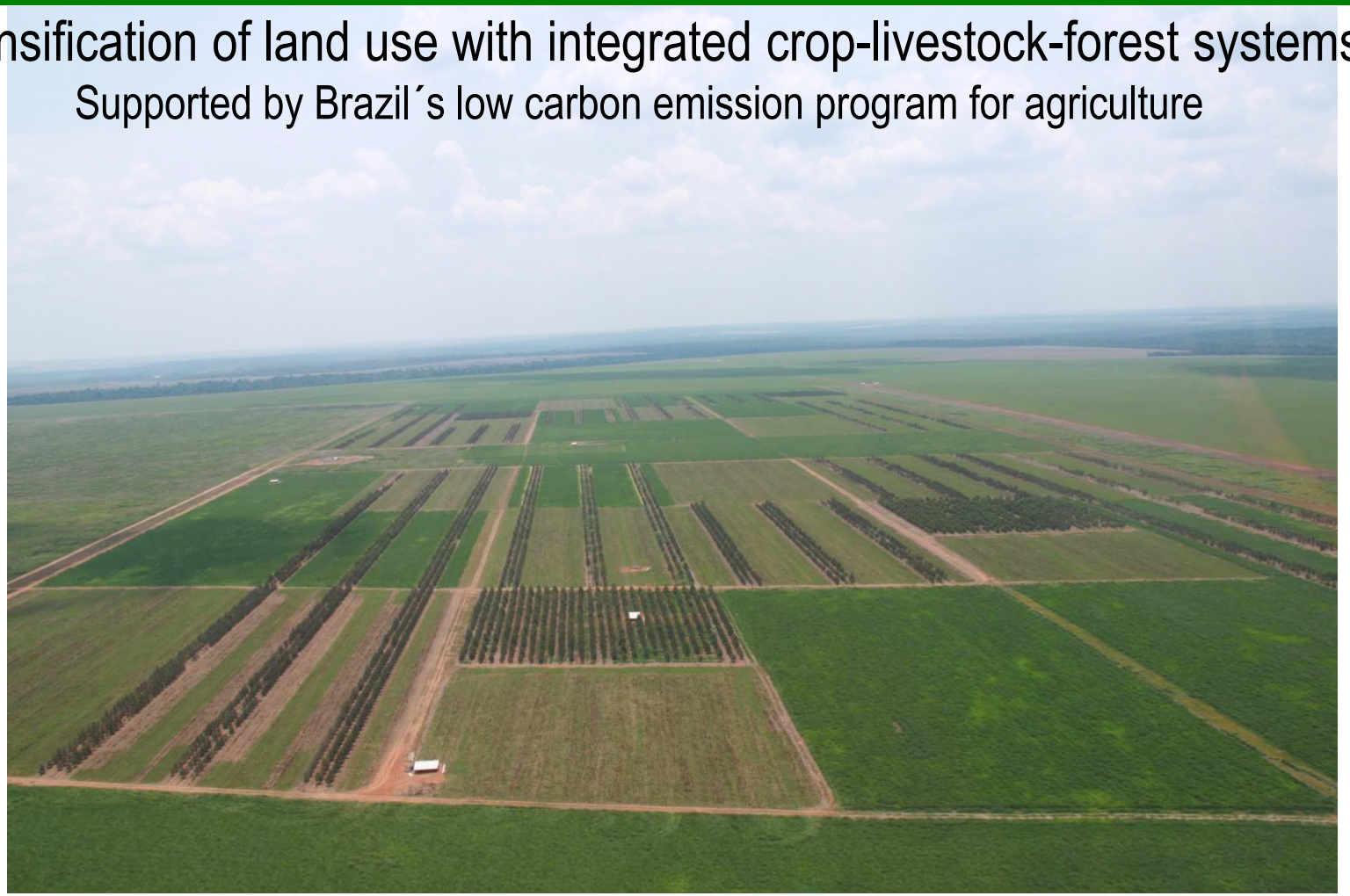

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New Frontiers in Conservation Agriculture in Brazil

Intensification of land use with integrated crop-livestock-forest systems

Supported by Brazil´s low carbon emission program for agriculture

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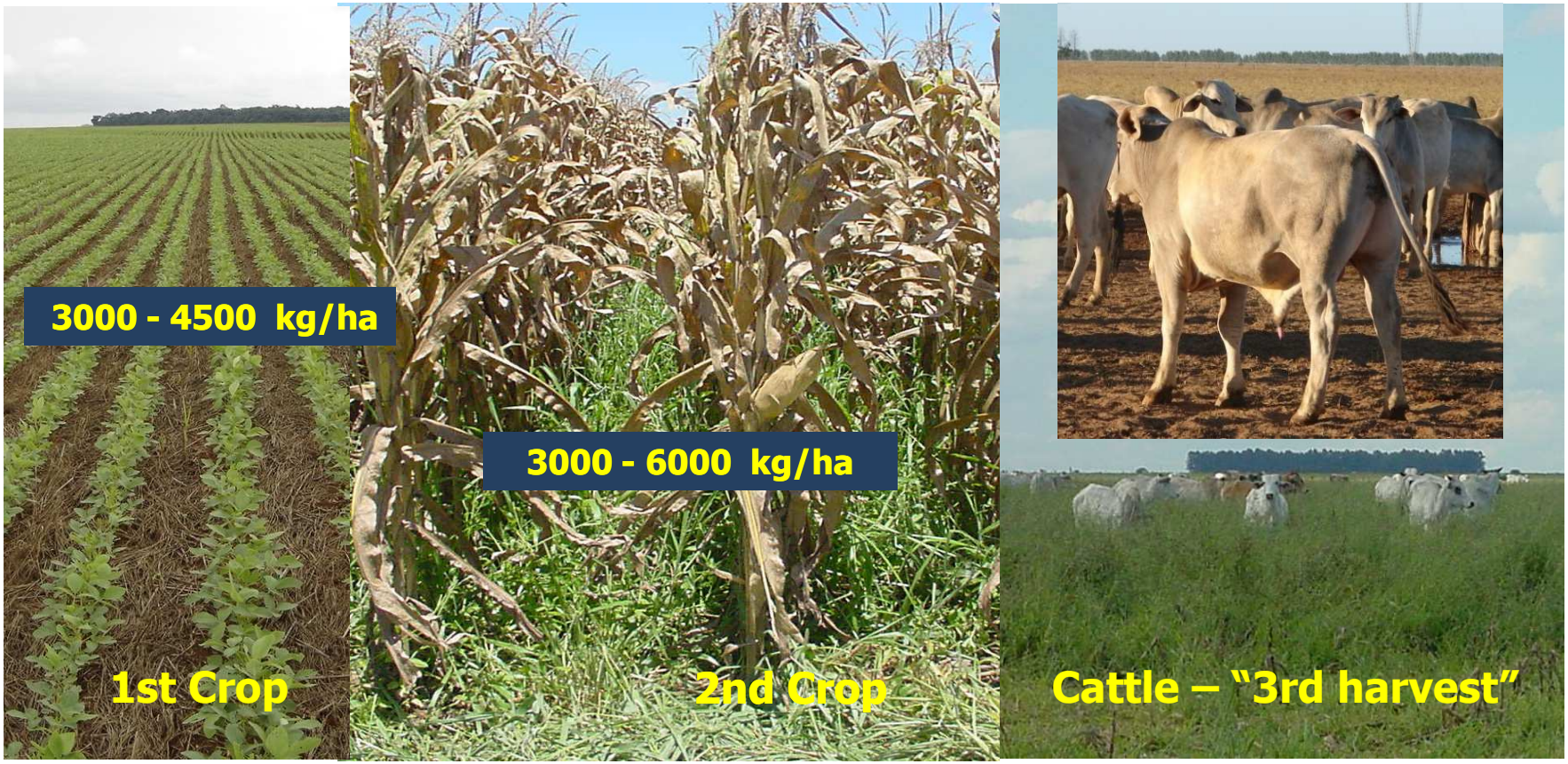
Sustainable Intensification



Source: Embrapa Cerrados

Integrated Crop-Livestock Systems

Corn being harvested and pasture is ready to receive cattle

Integrated Crop-Livestock-Forest Systems

Besides cycling crops, pastures and cattle... bringing trees into the system

Shading - Animal Comfort

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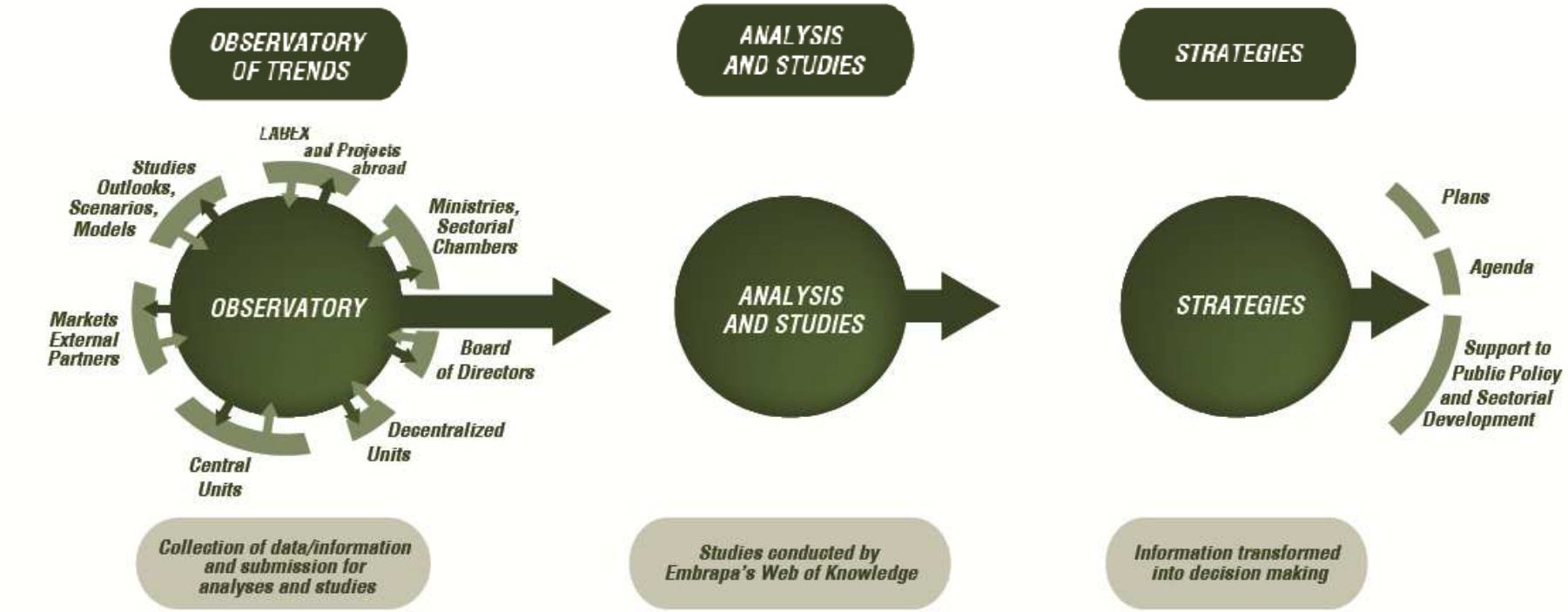
Strategic Intelligence

Strategic Intelligence Unit - Agropensa

Agropensa Components and Operation



Source: Embrapa/Agropensa

Strategic Intelligence Unit - Agropensa

Vision 2014-2034

Brazilian Agriculture

The Future of Technology Development

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Strategic Intelligence Unit - Agropensa

Video

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