The Challenge of Achieving Sustainable Food Production in the Tropical Belt of the World
- The Case of Brazil -

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Session 5:

Assuring Access to Clean Water, Sanitation, and Adequate Food for All

Food Security
Access and Use of Natural Resources
Sustainable Development
The Tropical Belt of the World

Area bound by the Tropics of Cancer and Capricorn
Most persistent and serious problems of poverty and inequality
- Severe Impacts of Climate Change and Stress Intensification -

Intense biotic (pests) and abiotic (drought, soil acidity, low nutrients, etc) stresses.

Higher frequency of extreme events, flooding and waterlogging, heat waves, etc.

Map Source: https://content.meteoblue.com/nl/meteoscool/general-climate-zones
The Tropical Belt of the World

World Soil Type Distribution

Distribution of acidic and nutrient-poor soils in the tropics

Tropical Soils
- Acid – 84%
- Saline – 2%
- Shallow – 7%
- Flooded – 16%

Source: http://www.nho.nrcs.usda.gov/WSR/manindx/metadata/Maps/ORDERS.JPG
The Tropical Belt of the World

A Mega-diverse Region
Brazil – contains greater biodiversity than any other country on Earth.

Source: https://earthobservatory.nasa.gov/
The Tropical Belt of the World

- Brazil -
A Mega-diverse Country

It is estimated that Brazil contains greater biodiversity than any other country on Earth.
Before the 1970’s Brazil was not a food secure country.  

Limited Understanding of our Biomes;  

Low agricultural production and low yields;  

Constant food supply crisis;  

Widespread rural poverty;  

Brazil known as coffee and sugar producer.
In 40 Years Brazil Developed a Science-based, Advanced Tropical Agriculture
Path of Agricultural Innovation in Brazil

EXPANSION

COMPETITIVITY

SUSTAINABILITY

MULTIFUNCTIONALITY

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Path of Agricultural Innovation in Brazil

Agricultural Expansion from 1960’s to 1990’s
Education, Research and Innovation System

Federal Research
Embrapa

Regional, State
Research

Universities

Private Sector
Basis for Agricultural Modernization in Brazil

Transformation of acidic, poor soils into fertile land

“Tropicalization” of crops and animal production systems

Conservation Practices
Zoning of Agricultural Risks

Contributions of Agricultural R&D
Basis for Agricultural Modernization in Brazil

“Building” soil fertility

Soil fertility built

Natural Soil

Source: Embrapa
Basis for Agricultural Modernization in Brazil

Managing crop nutrition

Natural Soil
Low Phosphorus

+ Phosphorus

Source: Embrapa
Basis for Agricultural Modernization in Brazil

Biological Nitrogen Fixation

No Biological Nitrogen Fixation

Source: Embrapa
Thanks to biological fixation of nitrogen, with Rhizobia, soybeans cultivated in 35 M ha in Brazil do not require any commercial nitrogen fertilizer

The economy to farmers (and the country) is U$ 13 billion/year + 62 million ton of CO$_2$-equivalent/year

Source: Embrapa
A Platform of Conservation Practices

No-Till Systems protect the soil, increase carbon and save water

Source: Embrapa
Tropicalization of Cropping Systems

Corn

Temperate

Tropical

Wheat

Temperate

Tropical

Source: IBGE/Nexo
Zoning of Agricultural Risks

Source: Embrapa
Zoning of Agricultural Risks

Source: Embrapa
The huge growth in Brazilian agricultural production resulted in reduced prices to consumer. This alleviated inflationary pressures and generated an “income-effect” that benefited mostly the poor.

Source: Prices for SP-Brazil. Data from Dieese (2018). The inflation deflator is the IGP-DI (Jan.2018). Calculations and elaboration by G.Martha,
Path of Agricultural Innovation in Brazil

Food Security – Production of Surplus

1
EXPANSION

2
COMPETITIVITY
Key Results and Impacts

Sources: MAPA, Conab and ÚNICA
The miracle of the cerrado

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

Aug 26th 2010 | CREMAQ, PIÁUL | From the print edition

Bloomberg

IN a remote corner of Bahia state, in north-eastern Brazil, a vast new farm is springing out of the dry bush. Thirty years ago eucalyptus and pine were planted in this part of the cerrado (Brazil's savannah). Native shrubs later reclaimed some of it. Now every field tells the story of a transformation. Some have been cut to a litter of tree stumps and scrub; on others, fucose the rootballs to fuel; next, other fields have been tillised; and some have already been turned into white m at Jatobá will plant and harvest cotton, soybeans...
Land Use – Biodiversity – Climate

The Brazilian Legal Amazon
- Forest
- Non-forest
- Deforestation up to 2012
- Hidrography

Source: Inpe/Embrapa
Path of Agricultural Innovation in Brazil

1. EXPANSION

2. COMPETITIVITY

3. SUSTAINABILITY
Science and Public Policies Promoting the Sustainability of Agricultural Systems
Forestry Code
Limit Expansion of Agricultural Land
Conserve Water and Biodiversity in Private Land

Low Carbon Agricultural Plan
Conservation Practices – Lower GHG Emissions
Forestry Code and Land Occupation in Brazil

AREAS OF PERMANENT PROTECTION (APP)

APP de margem de rios, ribeirões e riachos

- Menos de 10 m
- De 10 a 50 m
- De 50 a 200 m
- De 200 m a 600 m
- > 600 m
Forestry Code and Land Occupation in Brazil

AREAS OF LEGAL RESERVATION (RL)

Source: WWF Brasil
Brazilian Forestry Code

RURAL ENVIRONMENTAL REGISTRY - CAR
A REQUIREMENT UNDER THE NEW FOREST CODE
Forestry Code and Land Occupation in Brazil

Source: Embrapa Territorial
Forestry Code and Land Occupation in Brazil

Source: Embrapa Territorial
Forestry Code and Land Occupation in Brazil

Source: Embrapa Territorial
The Extent of Land Protection in Brazil

AREAS PRESERVED BY BRAZILIAN FARMERS

MORE THAN 20% OF BRAZIL
MORE THAN 200 M HA

Source: Embrapa Territorial
The Extent of Land Protection in Brazil

...PLUS INDIGENOUS AND PROTECTED LAND AND OTHER UNAVAILABLE AREAS (STATE OWNED, MILITARY ETC.)

66,3% OF BRAZIL
563,736,030 HA

Source: Embrapa Territorial
The Extent of Land Protection in Brazil

THE TOTAL PROTECTED AREA OF BRAZIL IS THE EQUIVALENT OF THE ENTIRE TERRITORY OF 48 COUNTRIES IN EUROPE

Source: Embrapa Territorial
Forestry Code
Limit Expansion of Agricultural Land
Conserve Water and Biodiversity

Low Carbon Agricultural Plan
Conservation Practices – Lower GHG Emissions
Recovery of Degraded Pasture Land

The next frontier of agricultural expansion, 50 M ha

Source: Embrapa
Sustainable Intensification of Land Use

Double Cropping Systems – Early Cycle Soybean + Corn
Sustainable Intensification of Land Use

Cycling crops and livestock – and adding trees...

Source: Embrapa
Sustainable Intensification of Land Use

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Cycling crops and livestock – and adding trees…

Source: Embrapa
Path of Agricultural Innovation in Brazil

1. EXPANSION
2. COMPETITIVITY
3. SUSTAINABILITY
4. MULTIFUNCTIONALITY
Food and Agriculture in the UN 2030 Agenda
Food and Agriculture in the Emerging Bioeconomy

**Multifunctionality**

- **Agriculture... Food – Fiber – Bioenergy ...**
- **Agriculture... Food – Nutrition – Health ...**
- **Agriculture... Environmental and Ecosystem Services**
- **Agriculture... Biomass – Biomaterials – Green Chemistry...**
- **Agriculture... Organic – Agroecology – Agroforestry ...**
- **Agriculture... Food – Culture – Tradition – Gastronomy – Tourism**

[Images of the UN Sustainable Development Goals (SDGs) 1 to 13]

*Embrapa*
Food and Agriculture in the Emerging Bioeconomy

Multifunctionality

Agriculture... Food – Fiber – Bioenergy ...  
Agriculture... Food – Nutrition – Health ...  
Agriculture... Environmental and Ecosystem Services  
Agriculture... Biomass – Biomaterials – Green Chemistry...  
Agriculture... Organic – Agroecology – Agroforestry ...  
Agriculture... Food – Culture – Tradition – Gastronomy – Tourism
Growing demand for culturally diverse foods

Food as an Experience

Flavors
Tastes
Textures
Sensations

Image Source: Agronomie Environment & Sociétés, June 2017.
Conclusion
Many Challenges in the 2050 Horizon...

Source: Modified from J. Lokrantz/Azote
Brazil can help the world face the challenges ahead... 

Enhancing its Capacity as Food Producer and Supplier

Consolidating Capacity in Conservation Agriculture and Sustainable Intensification

Sharing Knowledge and Experiences in Tropical Agricultural Systems

Source: Modified from J. Lokrantz/Azote
Thank You!

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