14th Meeting of COMSATS Coordinating Council,
Bogotá, Colombia (26th – 27th May 2011)

Eduardo Campello
(Embrapa Agrobiologia)
Brazil’s Profile

- Area: 8,514,000 km² (5th largest)
- Population: 191.3 million (5th biggest population)
- GDP: US$ 1.6 trillion (8th biggest economy)
- Per capita income: US$ 8 thousand
- 2009 exports: US$159 billion
- 2009 imports: US$136 billion

[Map of the world with Brazil highlighted]
Evolution of Agriculture in Brazil

Evolution of grain and oilseed production (million metric tons), yields (Kg/ha) and farmed area (million hectares) in Brazil from 1975 to 2010.
# 2009 Ranking: Brazilian Production and Exports

<table>
<thead>
<tr>
<th>Main Products</th>
<th>Production</th>
<th>Exports</th>
<th>Number of Markets</th>
<th>Exports US$ Billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>1st</td>
<td>1st</td>
<td>124</td>
<td>8.378</td>
</tr>
<tr>
<td>Coffee</td>
<td>1st</td>
<td>1st</td>
<td>81</td>
<td>3.762</td>
</tr>
<tr>
<td>Orange Juice</td>
<td>1st</td>
<td>1st</td>
<td>75</td>
<td>1.619</td>
</tr>
<tr>
<td>Soybean</td>
<td>2nd</td>
<td>2nd</td>
<td>46</td>
<td>11.413</td>
</tr>
<tr>
<td>Beef</td>
<td>2nd</td>
<td>1st</td>
<td>142</td>
<td>4.118</td>
</tr>
<tr>
<td>Tobacco</td>
<td>2nd</td>
<td>1st</td>
<td>100</td>
<td>2.992</td>
</tr>
<tr>
<td>Ethanol</td>
<td>2nd</td>
<td>1st</td>
<td>48</td>
<td>1.338</td>
</tr>
<tr>
<td>Broiler</td>
<td>3rd</td>
<td>1st</td>
<td>146</td>
<td>5.307</td>
</tr>
<tr>
<td>Corn</td>
<td>4th</td>
<td>3rd</td>
<td>49</td>
<td>1.259</td>
</tr>
<tr>
<td>Pork</td>
<td>4th</td>
<td>4th</td>
<td>81</td>
<td>1.225</td>
</tr>
</tbody>
</table>

Sources: USDA, Ministry of Agriculture
Brazilian Agribusiness Exports
Main Destinations

Total: US$ 64.8 billion

Elaboration: Ministry of Agriculture
Leadership in Tropical Agriculture Technology

- Continuous & persistent public and private investments on R&D;
- Opened partnerships with other countries;
- Expressive results on productivity;
- Efficient use of natural resources.
Investment in S&T in Brazil

Investment in S&T X total GDP

Agricultural Research: 11.8% of 1.61%
Embrapa – General Information

The Brazilian Agricultural Research Corporation
A Network of 46 Research Centers

Established in 1973
Employees: 9,284
Total Scientists: 2,253
PhD/DSc: 1,941
Budget: US$ 1 billion

Research Centers

National Thematic
National Product
Ecorregional/Agroforestry Services
“Agricultural intensification and expansion with mitigation of environmental impact”
Oil Palm Sustainable Production Program

Agroecological zoning for sustainable production
Restrict production expansion to areas that have been deforested
Prohibit the felling of native vegetation
Direct the expansion of production to the recovery of degraded areas

Common interest Corpoica / Embrapa, an example
International Cooperation

Scientific Cooperation
Technical Cooperation
Business

Contact us: Secretariat for International Affairs
chefia.sri@embrapa.br
Scientific Cooperation
Open to New Partnerships

Labex

Bilateral Cooperation

Multilateral Agreements

Virtual laboratories
Projects abroad
Embrapa Agrobiology’s Mission

“To generate knowledge, technologies and innovation supported by agrobiological processes in benefit of a sustainable agriculture for the society”
Competences and Research Lines

Biochemistry and Genetics
1. Microbial Diversity
2. Functional Genomic
3. Plants and microorganisms characterization of gene expression
4. Bacteria-plant Interaction

Plant growth promoting microorganisms
1. Selection of plant growth promoters
2. Use and management of soil organisms in agricultural systems
3. Development of technologies for inoculation of microorganisms for agricultural use

Nutrients Cycling
1. BNF quantification
2. N using efficiency by plants
3. C and N Balance in agricultural systems
4. Emission of greenhouse gases and SOM accumulation
5. Energy balance and Modeling agricultural processes

Organic Agriculture
1. Participatory research methods for improving technological transference
2. Biological control for pests on cultivation systems
3. Management of M B for organic, green manuring and composting strategies
4. Technologies for growing vegetables and coffee
5. Impacts of agroecological systems in forest fragments

Reclamation of degraded areas
1. Physical, chemical and biological indicators to evaluate the environmental services
2. Survey and selection of efficient interactions among plants, bacteria and mycorrhizas
3. RDA of mining and agricultural areas
4. Forest and Agroforestry systems
5. Selection of biological indicators
Research activities by EMBRAPA on greenhouse gas emissions of Brazilian agriculture

- Changes in soil organic carbon stocks
- Methane emissions in rice fields
- Enteric methane emission by cattle
- \( \text{N}_2\text{O} \) emissions from agricultural soils

Special interest on improving soil fertility, mitigation practices of GHG emissions, and to develop emission factors for the IPCC guidelines for the National GHG inventory
Survey of N\textsubscript{2}O emission rate from Brazilian agriculture: Studies in development and programmed by Embrapa Agrobiologia

- Crop rotation (soybean and wheat, ZT and CT)
- Crop rotation (maize, soybean and wheat, ZT and CT)
- Integration: cropping-pasture
- Maize and soybean crops
- Pasture and cattle excreta
- Residues
- Sugar cane
- Flooded rice
- High land rice, ZT
- Irrigated maize and bean, ZT
- Pig slurry and chicken manure
- Evaluation of N sources and Residues
- Forest, eucalyptus and pasture
- Crop rotation (maize, soybean and wheat, ZT and CT)
- Crop rotation (soybean and wheat, ZT and CT)
- Pig slurry

Ministry of Agriculture, Livestock and Food Supply

Brazilian Government
N$_2$O emissions derived from cattle excreta in pastures

IPCC: 2% of N-excreta is lost as N$_2$O


$N_2O$ derived from cattle urine in *Brachiaria brizantha* Marandu pasture at Santo Antonio farm, Goiás, Brazil. 2009-2010.

\[
\begin{align*}
\text{EF}_{\text{urine}} &= 2.57 \text{ e } 1.61 \% \\
\text{EF}_{\text{feces}} &= 0.14 \text{ e } 0.29 \%
\end{align*}
\]

(Lessa, Madari, Urquiaga, Boddey e Alves - in preparation)

EF$_{\text{urine}}$ = 0.01%
EF$_{\text{feces}}$ = 0.00%
Bacteriocin production and Phosphate solubilization in Gluconacetobacter diazotrophicus PAL5 strain

Antagonism of wild type and mutant of *G. diazotrophicus* against *X. albilineans*.
Drechsell et al, 2010

Phosphate solubilization – in vitro assay
Galvão et al, 2010
Functional genomic analysis of the endophytic diazotrophic *Gluconacetobacter diazotrophicus* strain PAL5

1. **Exopolyssaccharide (gumD)** gene is involved in the initial steps of root colonization

Adsorption and anchoring colonization phases of *G. diazotrophicus* strain PAL5, mutant MGD and restored strain in roots of rice seedlings

Effect of EPS addition (from the wild-type PAL5 strain) on the colonization of rice roots by the MGD mutant of *G. diazotrophicus*

Adhesion of the rice root surface by the *gfp* labeled strains of *G. diazotrophicus* (wild-type, EPS mutant and restored strain).

Meneses et al, 2010
Functional genomic studies: effect of *G. diazotrophicus* indol (auxin) minus strain inoculation on micropropagated sugarcane root growth

Galvão et al, 2010
Inoculant for maize application

- Strain selected by Embrapa Agrobiologia
- *Herbaspirillum seropedicae* BR 11417
- Tested in four different places in Brazil: Embrapa Agrobiologia (RJ), Embrapa Milho e Sorgo (MG), Embrapa Cerrados (GO) and Embrapa Roraima (RO);
- Tested hybrids and varieties planted in rain season (safra) and dry season (safrinha)
Inoculant for sugarcane

5 packs containing 1250 g of peat + bacteria = mix with clean water
Sugarcane in Brazil 2008 - 2009

Harvested area 2008 – 8.2 million ha (Mha)
• Planted area 2009 – 9.7 Mha
• Total Cane production 2008 = 649 Million tonnes (Tg)
• Mean yield – 79.7 tonne/ha
• Ethanol production - 27 Billion litres (5.4 bi exported)
• Production of ethanol per ha - 6500 litres
Maize

RB 52-454
Bacteria used in the inoculant:

- **Burkholderia tropica**
- **H. rubrisubalbicans**
- **Herbaspirillum seropedicae**
- **Azospirillum amazonense**
- **Gluconacetobacter diazotrophicus**

**BRASIL**

Ministry of Agriculture, Livestock and Food Supply
Better growth

Increment of the root system

Contribution to N nutrition
Ratoon Field inoculation
A New International Project: Inoculant for cowpea in África

– Project: Cooperation Program for Developing Agricultural at Tropical Savannah - Mozambique
  • Country: Mozambique
  • Partnership: Agriculture Research Institute of Mozambique

– Project: Africa-Brazil Agricultural Innovation Marketplace
  • Country: Ghana
  • Partnership: Savanna Agricultural Research Institute (SARI)
AGROFORESTRY SYSTEM
CONNECTING FOREST FRAGMENTS

To allow the flow of animals and ensuring the maintenance of biodiversity.
AFS ESTABLISHMENT

3 years
• Technology for the establishment of the consortium lettuce-onion.

• Vegetable cultivation in Alley cropping
Infrastructure – laboratories (18)

- Nitrogen and Isotopes (15N e 13C)
- Soil-Multi-user
- Organic Agriculture
- Organic matter
- Enzymes
- Biological control
- Soil fauna
- BNF Leguminous Trees
- Collection of cultures
- Microbial Ecology
- Microscopy
- Micorrizas
- BNF Grasses
- Genetics/Biochemistry
- Genome
- Molecular Techniques – Multi-user
- Inoculant Development
- Inoculant Production
Embrapa Agrobiology Staff

Total: 148 employees
- 40 researchers (most of all PhDs)
- 35 analysts (graduated)
- 73 support
Thank you!