

The role of technologies on the development of the Brazilian agribusiness

(emphasis on soybean)

FULBRIGHT BRAZIL

São Paulo, 28 July, 2009

Amélio Dall'Agnol, PhD



Ministério da
Agricultura, Pecuária
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The Brazilian agribusiness

- ✓ Brazil may be considered a 3rd World country, but our agribusiness is 1st World.
- ✓ Agribusiness: large superavits in trade balances.
- ✓ Changes occurred during the last 40 yrs.
- ✓ Coincides with Embrapa's existence.



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- ✓ **Embrapa was established in the 70's.**
- ✓ **The “Boom” of agricultural production and productivity, also started in the 70's.**
- ✓ **Thus, media wrongly considers that all good agricultural achievements were and are Embrapa's results.**
- ✓ **Universities, State and private Research corporations also contributes.**



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Productivity of Brazilian agribusiness

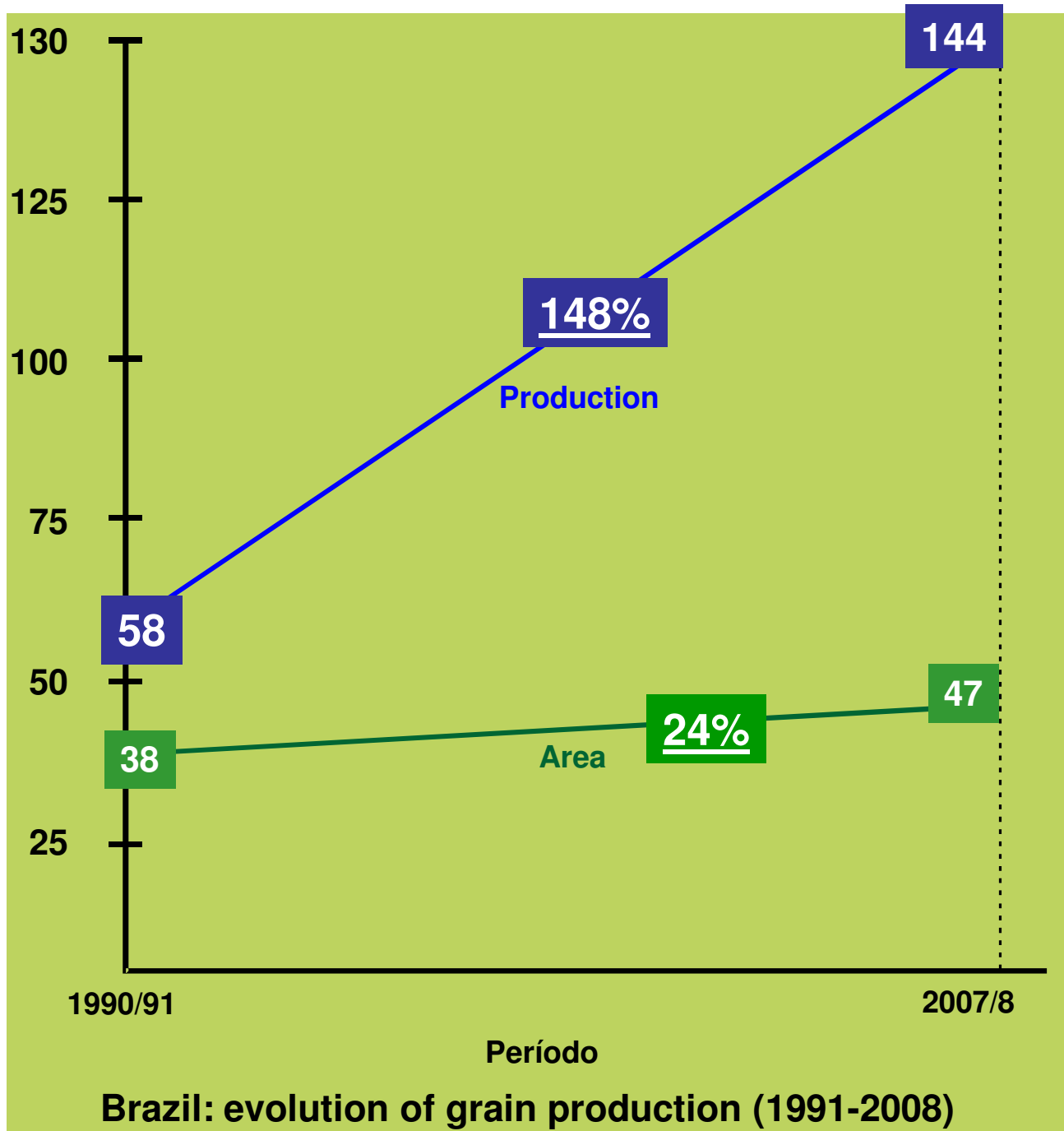
(MAPA's strategic department -1975/2008)

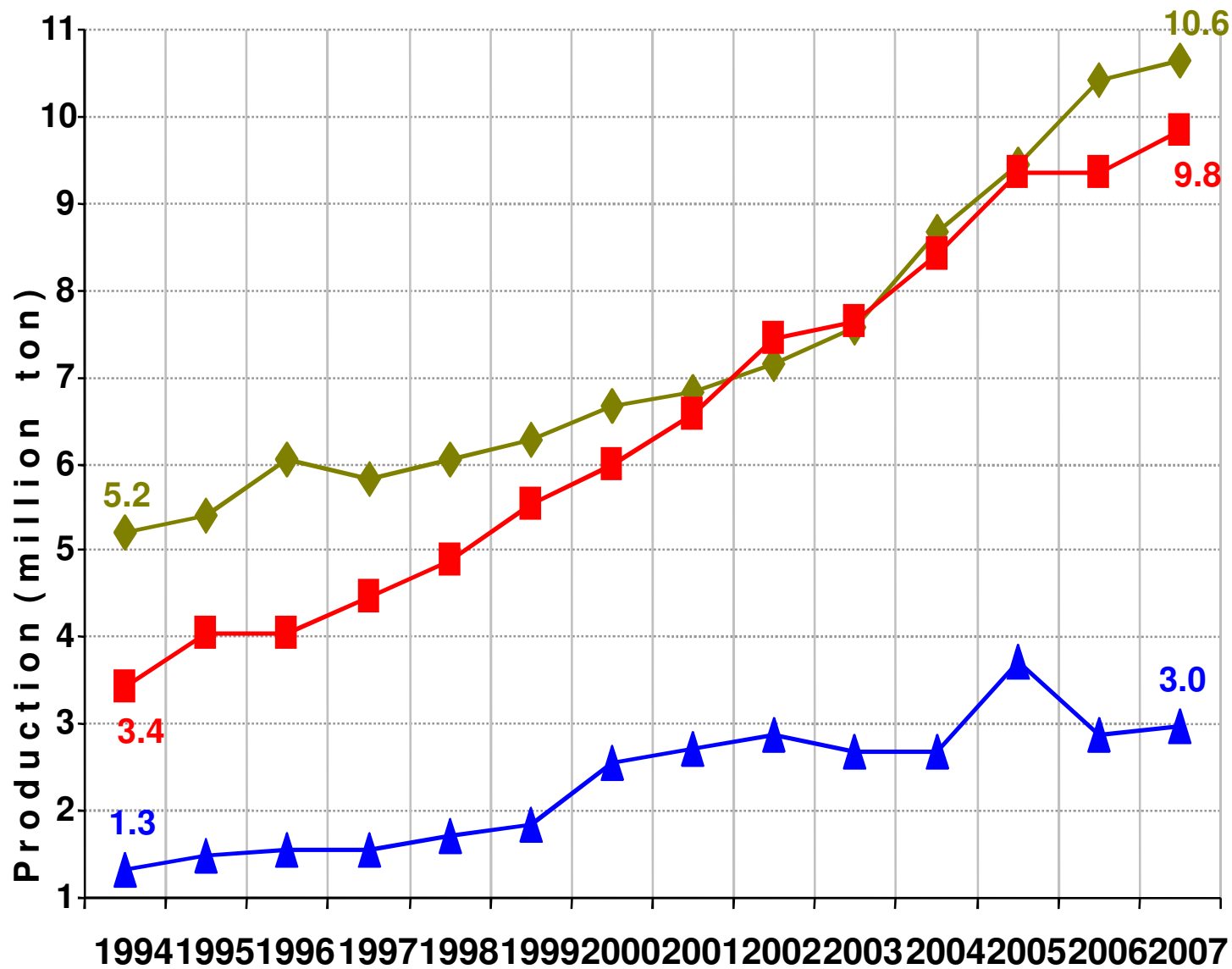
- ✓ Brazil had the biggest increase in productivity among countries, in the last 33 yrs (3.7%/yr).
- ✓ Why? = Technological innovations.
- ✓ Improvements in crops, pastures, meat, forestry...
- ✓ Genetic improvements (GMOs), soil management, plant nutrition, crop protection, mechanization...



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Beef: 104%

Poultry: 188%

Pork 124%

Sources: APINCO, ABEF, ABIEC and ABIPECS



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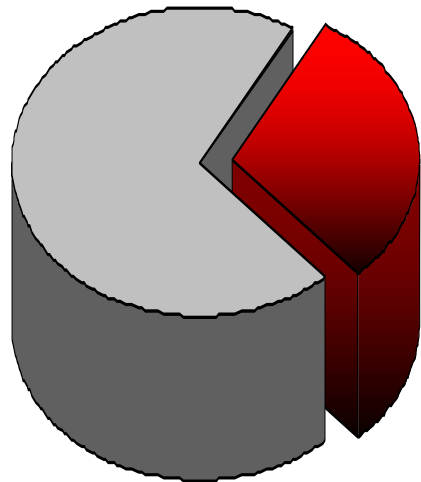
BRAZIL IN THE WORLD MARKET

<u>✓ Products</u>	<u>2008 (%)</u>	<u>2018 (%)</u>
✓ BEEF	31,0	60,6
✓ PORK	10,1	21,0
✓ POULTRY	44,6	89,7

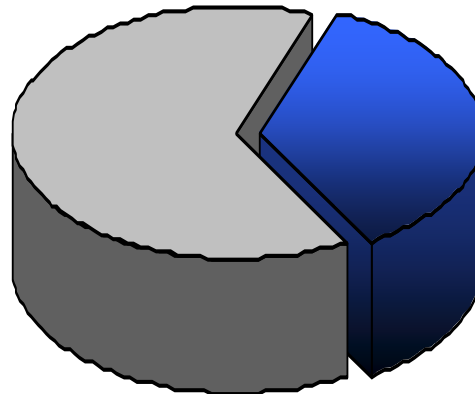
✓ Soy <u>BEANS</u>	36,0	40,0
✓ Soybean oil	63,0	73,5
✓ Corn	13,0	21,4
✓ Sugar	58,4	74,3

The importance of agribusiness in the Brazilian economy (2008)

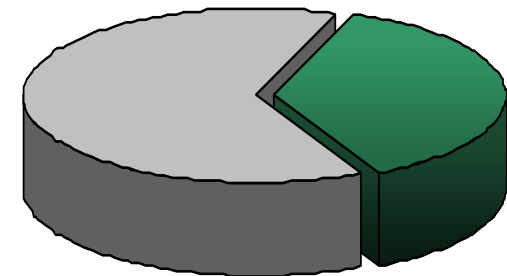
GDP = 30%



**TOTAL EXPORTS
36%**



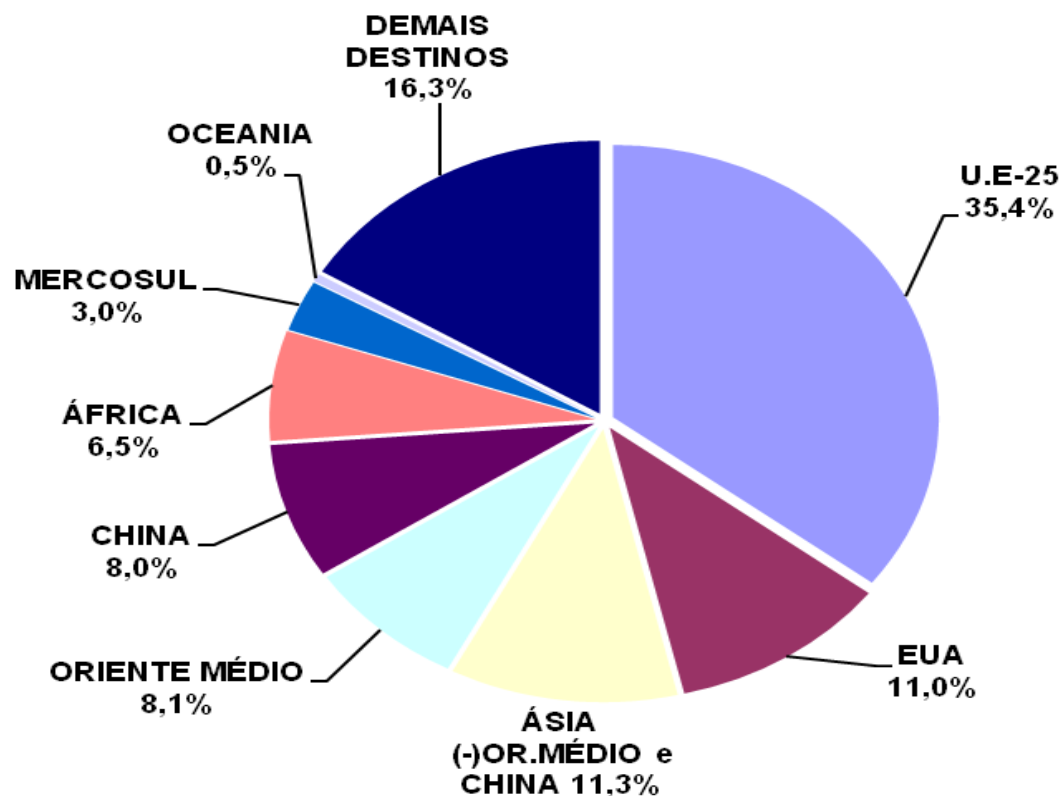
**EMPLOYMENT
37%**



Brazil 2008: agricultural exports (%)

SP	21,85			
RS	14,81			
PR	14,24			
MT		7,7		
MG			5,9	
SC			5,1	
BA				3,3
GO				3,1
ES				1,9
MS				1,7

Destination of agricultural products - 2007



USA + EC = 54% in 2002

USA + EC = 46% in 2007

USA + EC = 38% in 2008

Source: AgroStat Brasil



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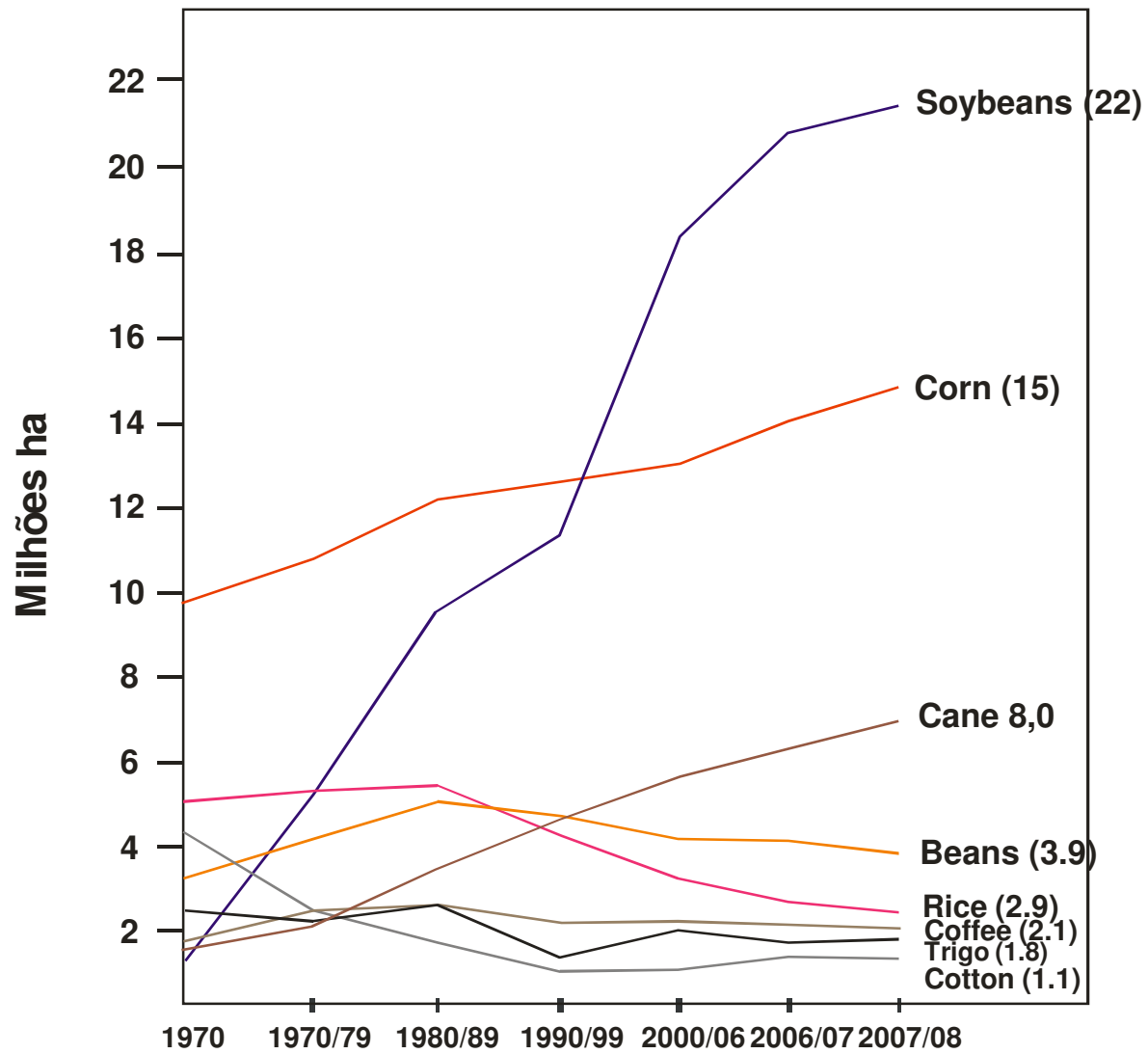
Brazilian agribusiness has two phases: before and after soybeans

- ✓ **Commercial production started with soybeans.**
- ✓ **Main promoter of mechanization of farms.**
- ✓ **Expansion of the agricultural frontier (cerrado).**
- ✓ **Moved people from overpopulated South and East to the empty West.**
- ✓ **Cropping improvements in other crops: corn.**



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Fonte: CONAB/ IBGE

Period

Brazil: area of the main crops



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SOYBEANS

Evolution of production in Brazil



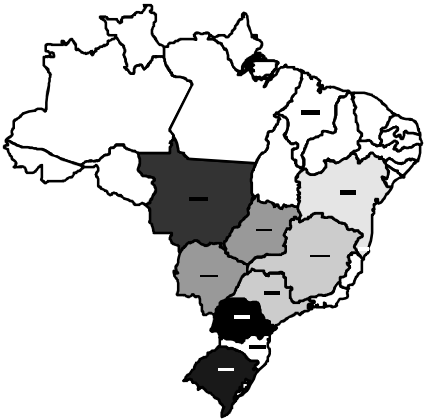
Anos 60



Anos 70



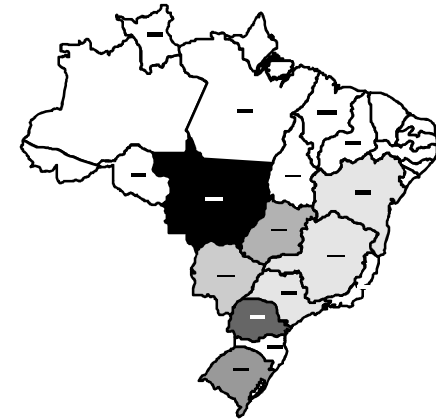
Anos 80



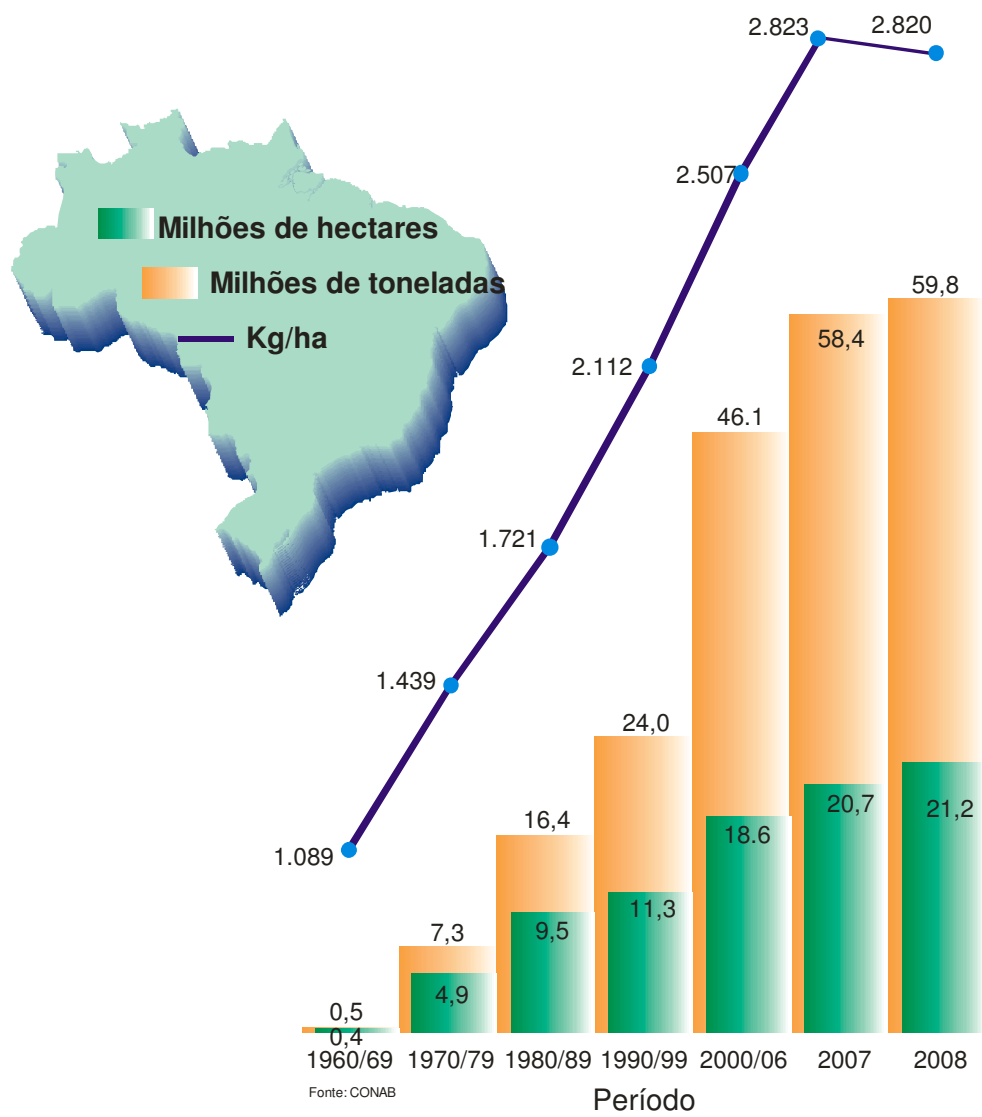
Anos 90



Anos 00/05



Ano 2006

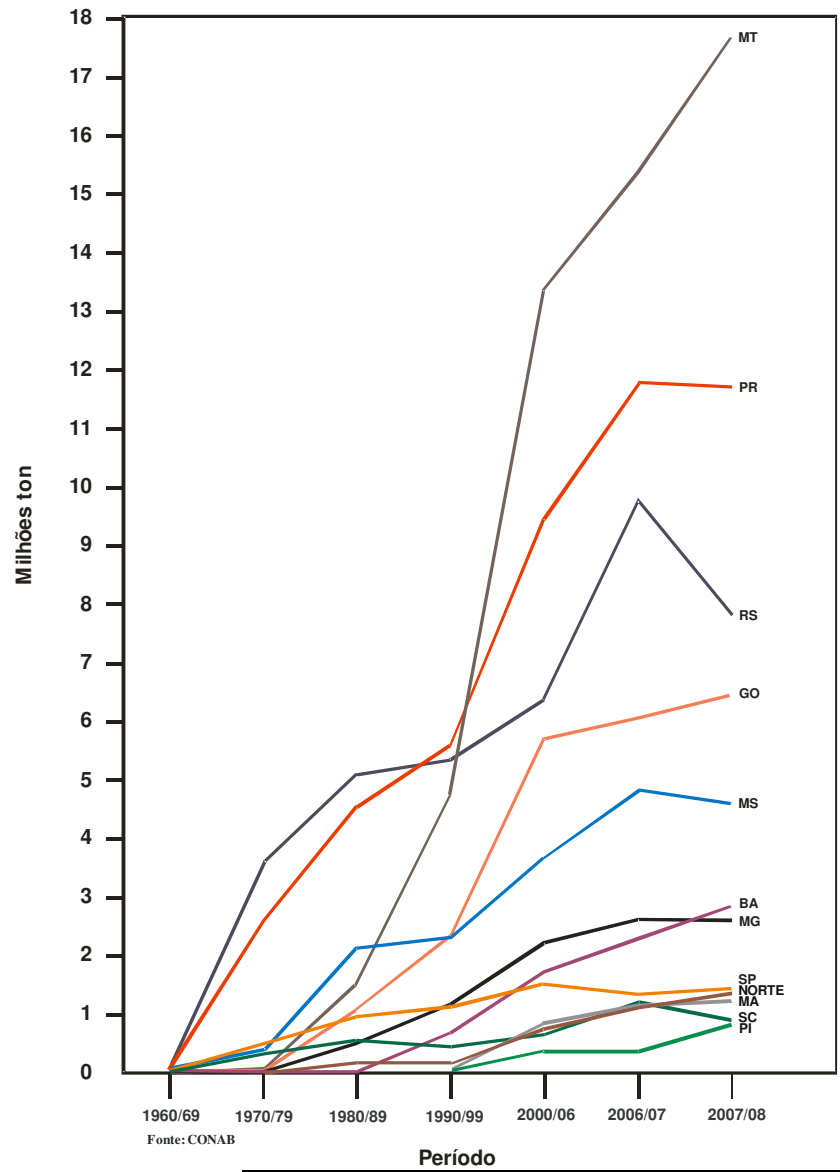


Evolution of soybeans in Brazil



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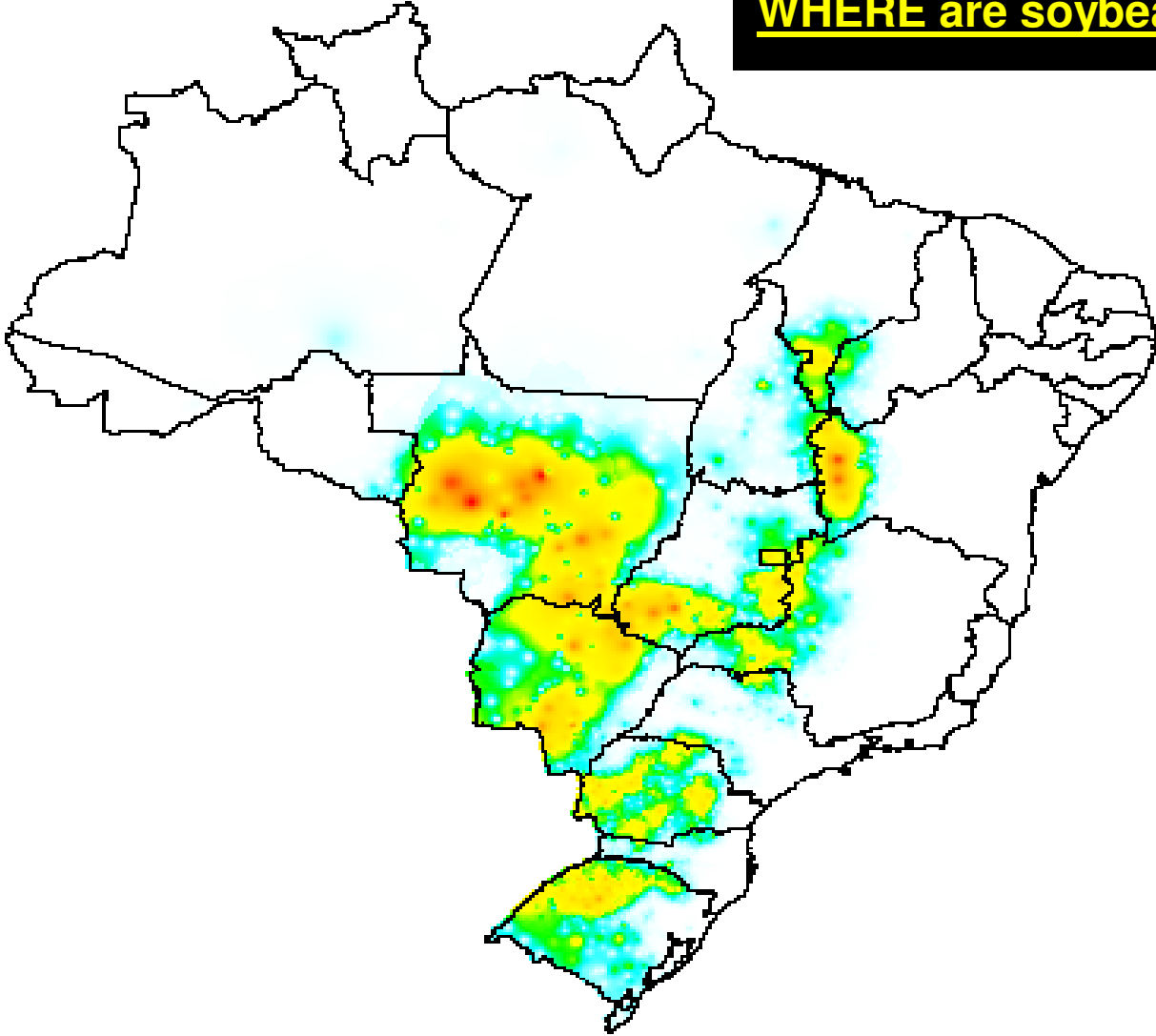
Evolution of soybean production by State



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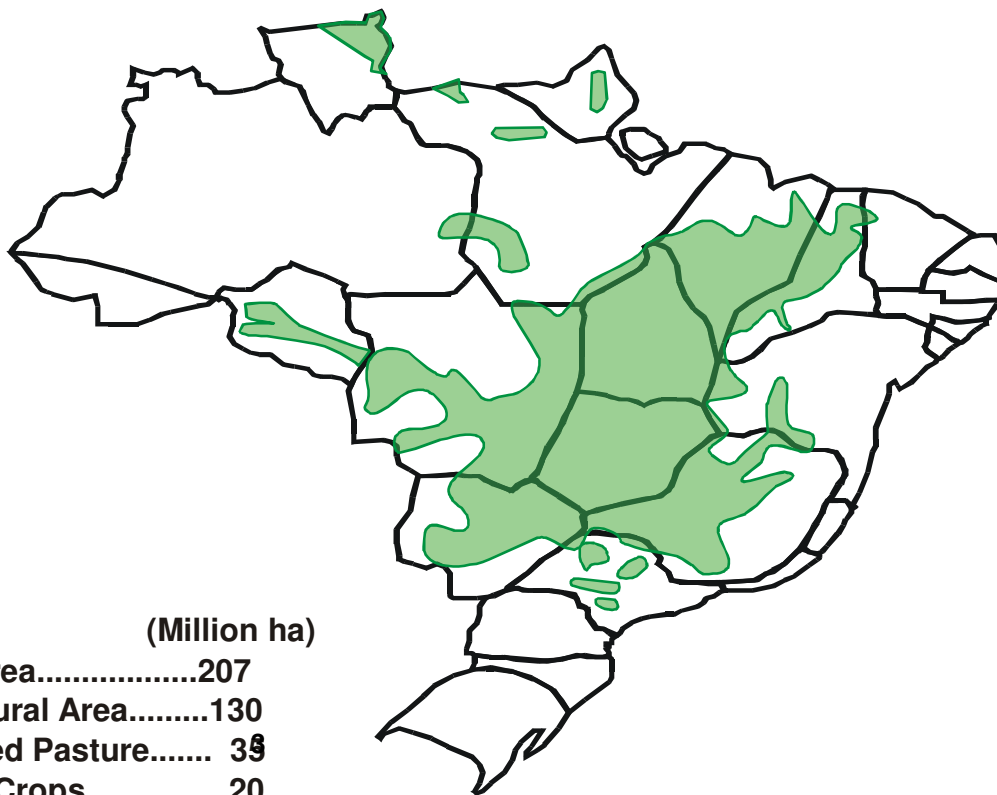


WHERE are soybeans in Brazil



Source: Bayer Cropscience

Brazilian Savannas (Cerrados)



(Million ha)

Total Area.....	207
Agricultural Area.....	130
Cultivated Pasture.....	39
Annual Crops.....	20
Perennial Crop	
Available Area.....	72

“Cerrado” during the rainy season



TROPICAL SOILS



Deep, easy to manage and well drained

Harvesting soybeans and sowing corn



Technological main results

Development of tropical Soybeans

- ✓ Until 1970 soybeans were grown around to or above 30°



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WHAT WE ENPHASIZE IN A NEW SOYBEAN VARIETY

- ✓ **Productiveness.**
- ✓ **Resistance to main diseases: Frog eye leaf spot, Stem canker, Asian rust, Nematodes, Screrotinia.**
- ✓ **Adequate cycle to meet farmer's needs (2nd summer crop and rust incidence).**
- ✓ **Adequate height for mechanical harvesting.**
- ✓ **No lodging and natural threshing.**
- ✓ **Stability through latitudes and planting time: long juvenile period.**



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Characteristics of a photosensitive x no sensitive variety

Variety	Date of planting	
	September 15 (March)	November 7 (May)
Days to flower		
Bossier	41	54
Br 23	60	53
Days to Mature		
Bossier	159	127
Br 23	151	127
Plant height (cm)		
Bossier	31	70
Br 23	56	72
Yield (Kg / ha)		
Bossier	2,460	3,240
Br 23	3,60	3,18

Technological main results

- ✓ **Seed technology for tropical climates.**
- ✓ **Biological control of VC and stink bugs.**



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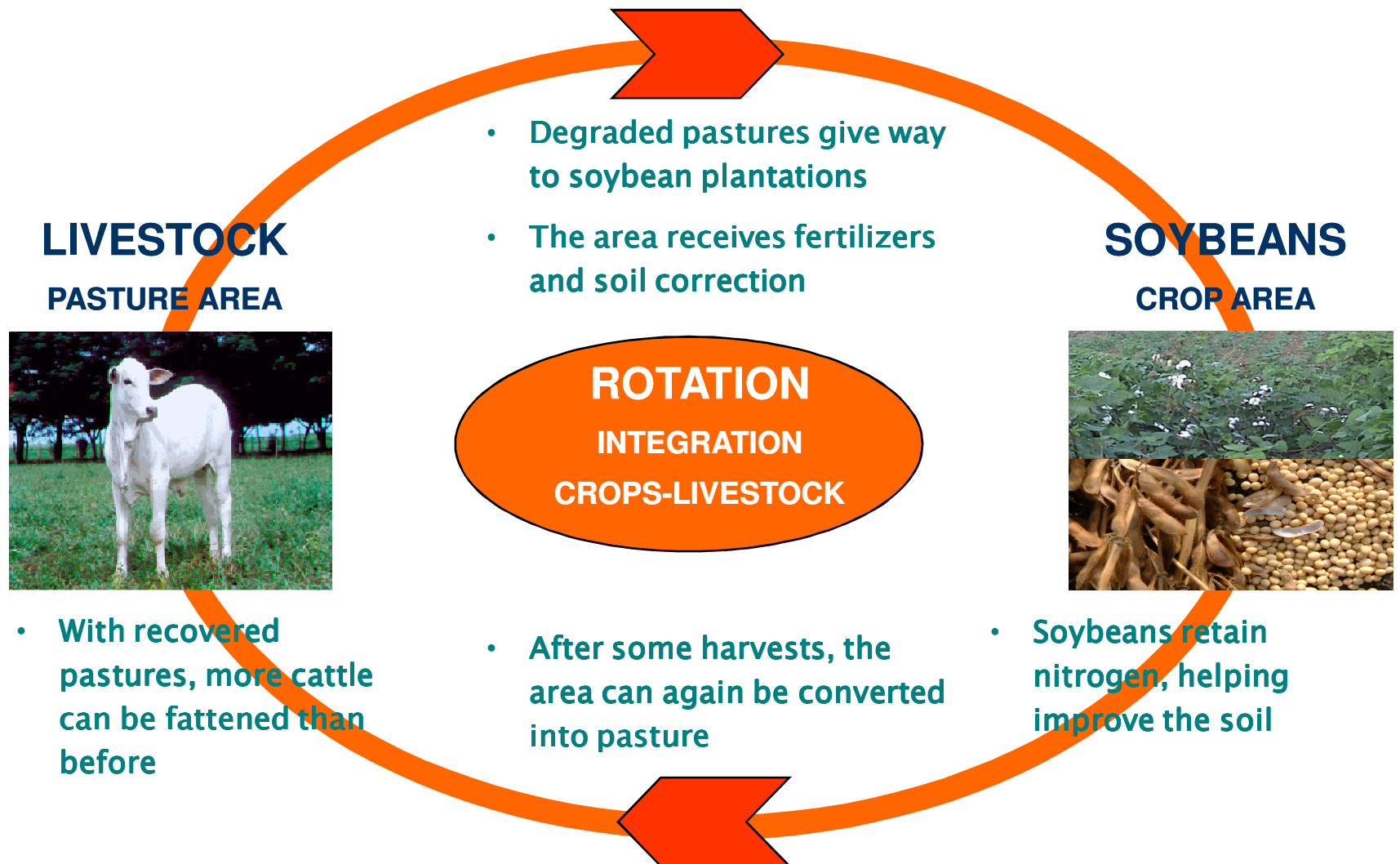
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Technological main results

Soil management:

- ✓ No till,
- ✓ Crop rotation and
- ✓ Integrated production of
 - ✓ crops
 - ✓ pastures and
 - ✓ forestry.

Integration of Soybeans with Livestock



Sistema Santa
Tecnologia
Embrapa

20 3 2003

INTEGRAÇÃO AGRICULTURA E PECUÁRIA NO ARENITO CAIUÁ
OPÇÕES: Lavouras Perenes e Pecuária



NO TILL CROPPING SYSTEM

- **75% reduction in soil erosion.**
- **69% reduction in nutrient lixiviation**
- **Reduction in CO² emission.**
- **Reduction diesel consumption.**
- **More efficient use of inputs.**
- **Better water retention.**





Direto: 14ºano
Sucessão (trigo)

Direto: 2º ano
Sucessão (trigo)

Technological main results

NITROGEN FIXATION.



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Nitrogen fixing NODULES



Don't confuse nodules with cyst
nematodes



Don't confuse nodules with Gall Nematodes



Technological main results

CROP ROTATION



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Crop rotation reduces soil compaction



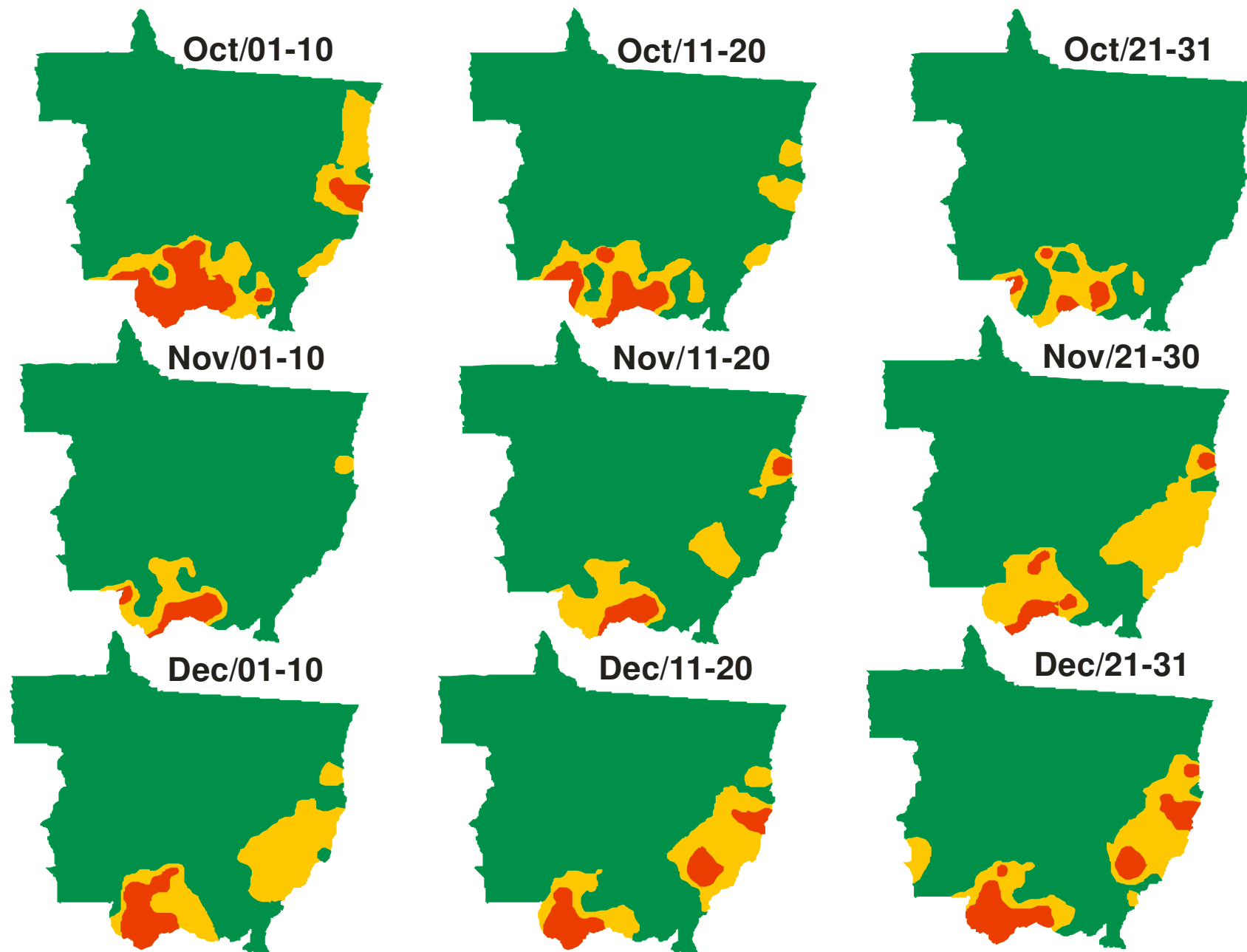
Technological main results

AGRICULTURAL ZONING



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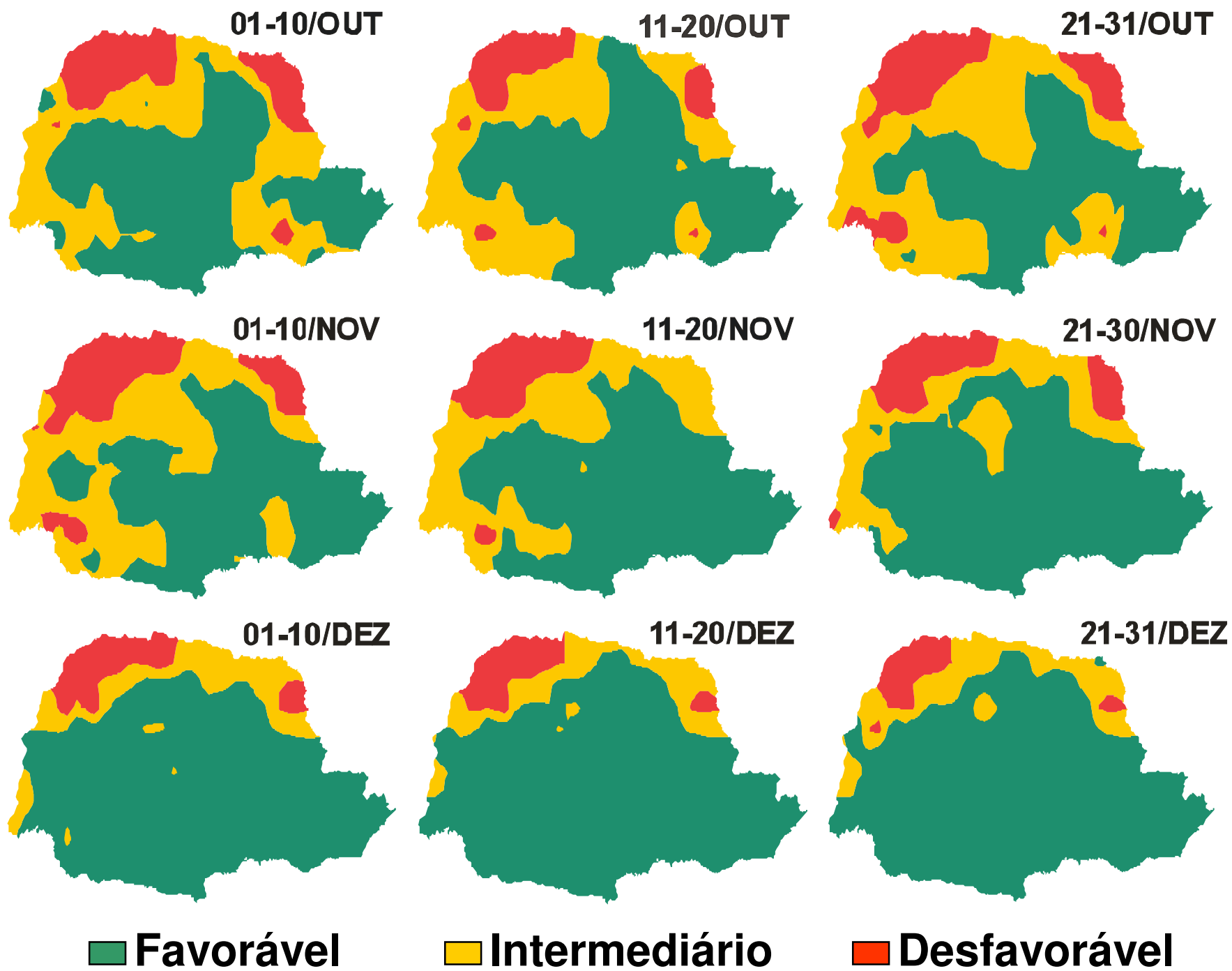




Favorável

Intermediário

Desfavorável



Technological main results

OGMS

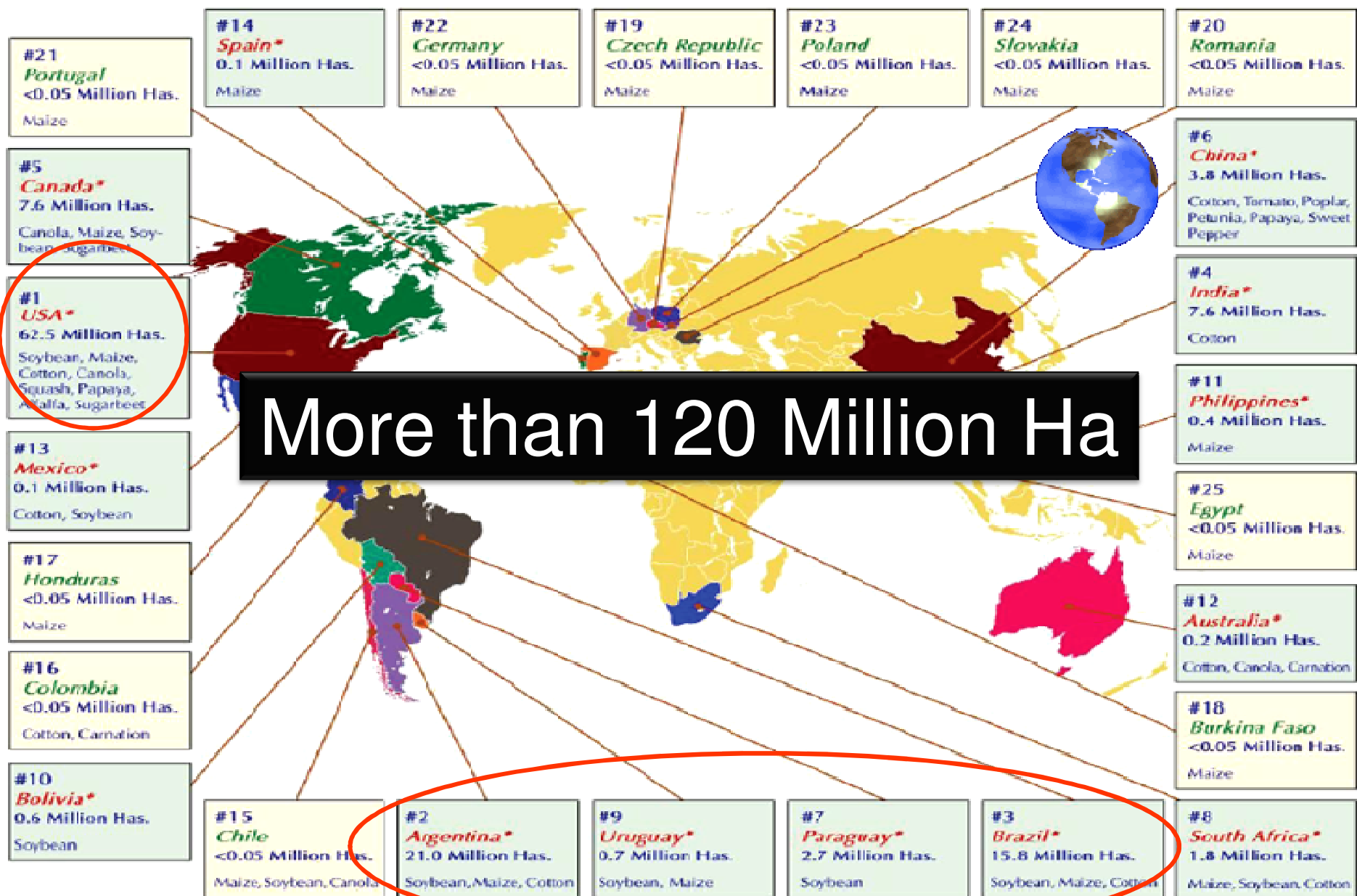
CROPS



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Biotech Crop Countries and Mega-Countries*, 2008



More than 120 Million Ha

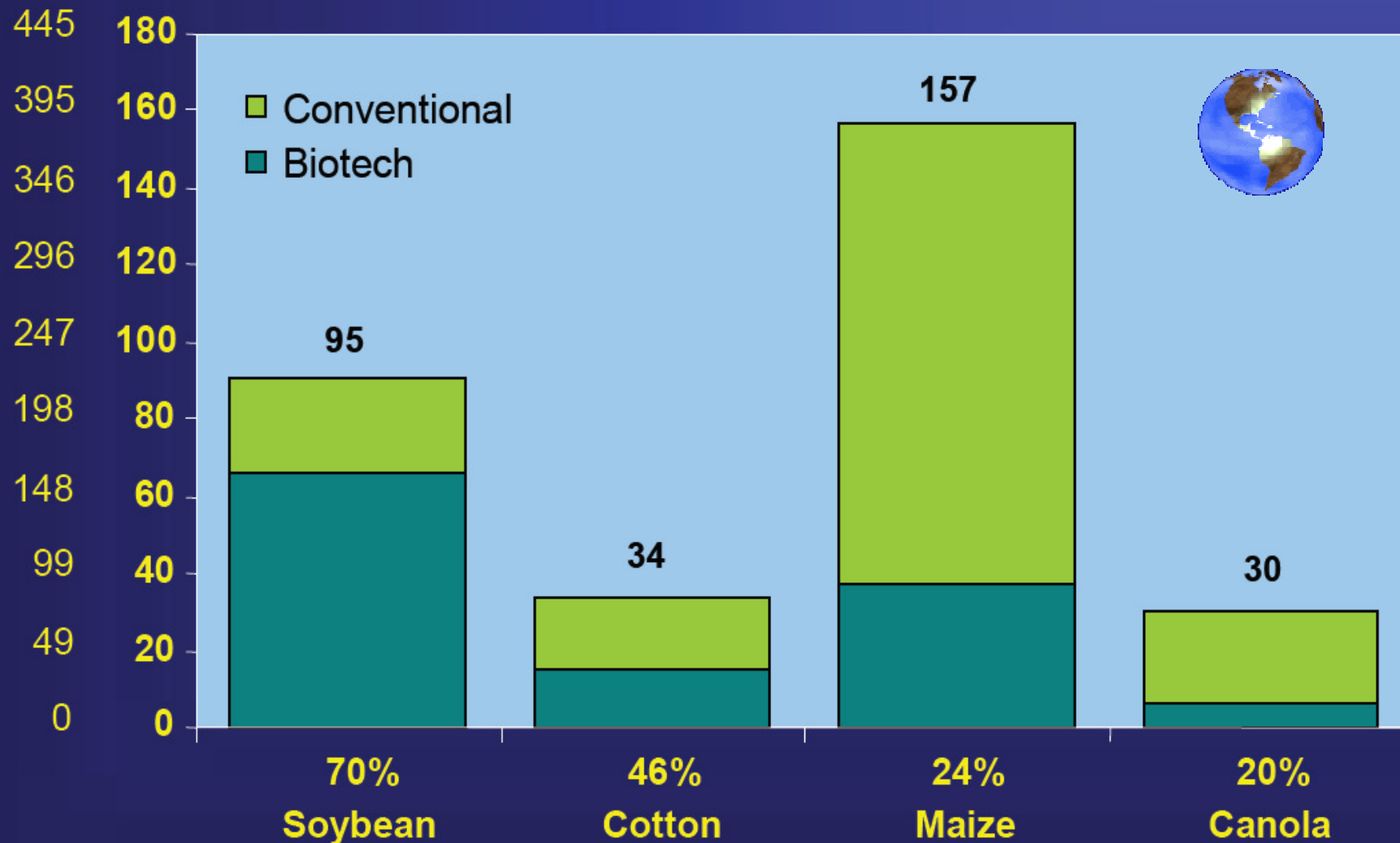
* 14 biotech mega-countries growing 50,000 hectares, or more, of biotech crops.

Source: Clive James, 2008.

Global Adoption Rates (%) for Principal Biotech Crops (Million Hectares, Million Acres), 2008



M Acres

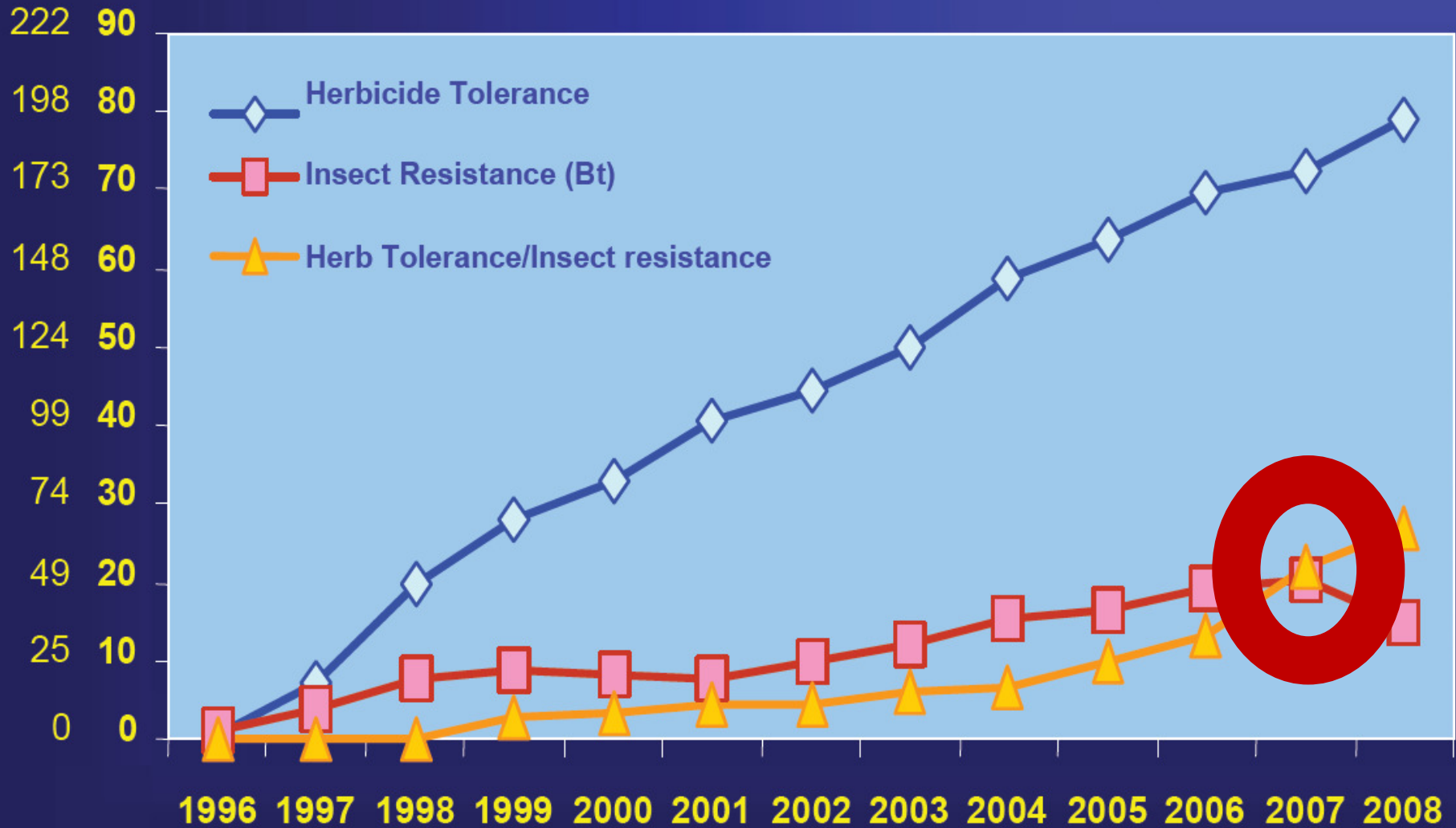


Source: Clive James, 2009

Global Area of Biotech Crops, 1996 to 2008: By Trait (Million Hectares, Million Acres)



M Acres



Source: Clive James, 2009



Technological main results

SOYBEAN RUST:

FREE HOST PERIOD.



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SOYBEAN RUST

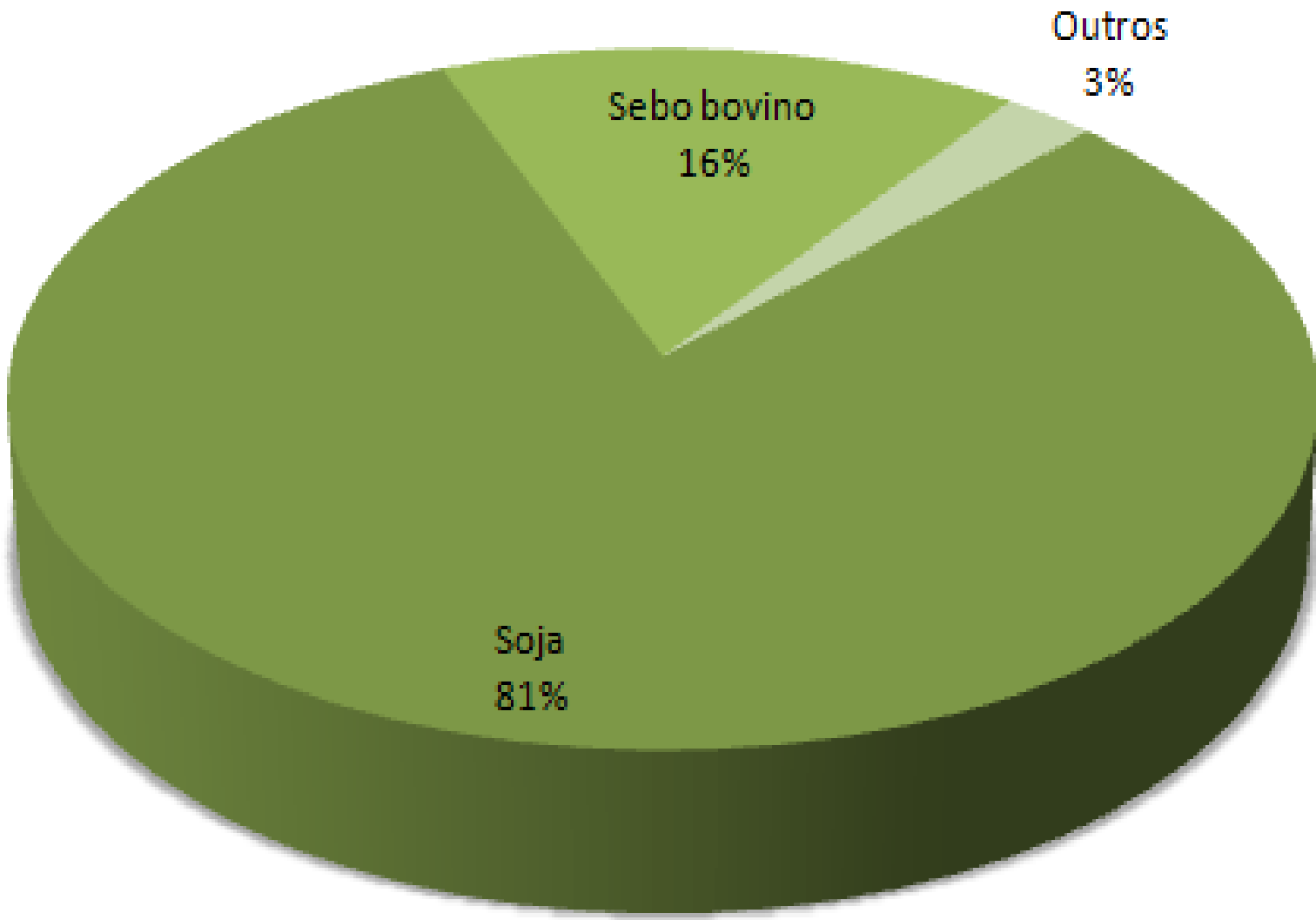


WHY BIODIESEL FROM SOYBEANS



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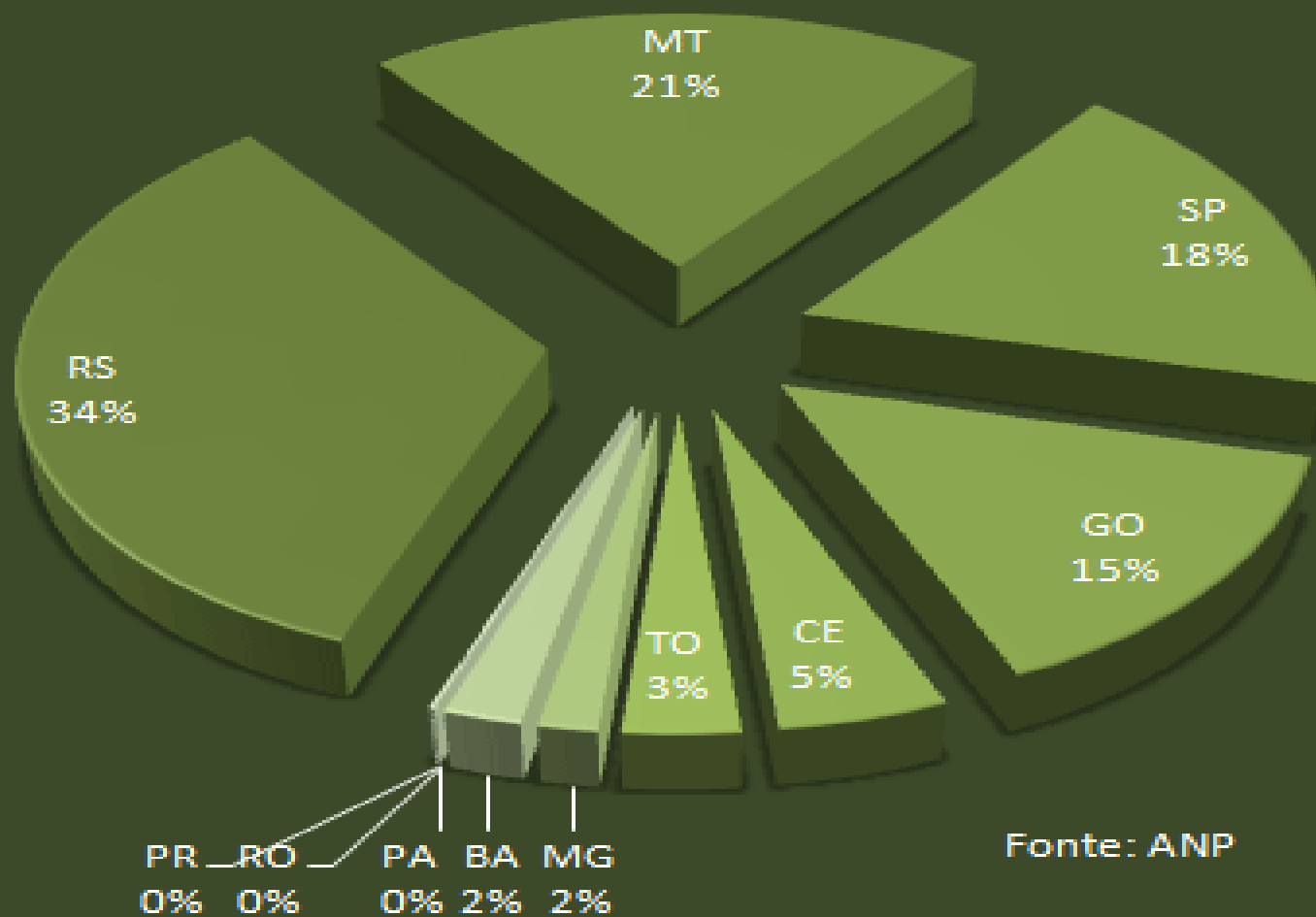




**Raw material used for biodiesel production in Brazil
May 2009**

Where is Biodiesel produced in Brazil

PRODUÇÃO DE BIODIESEL EM JANEIRO DE 2009



Fonte: ANP

BIODIESEL FROM SOYBEANS: advantages

- ✓ Soybean production chain is well structured:
 - ✓ Before and after the farm.
- ✓ Within the farm:
 - ✓ Production technologies are well established,
 - ✓ Ample research network.
- ✓ Is easy to sell soybean at any time:
 - ✓ Few producers,
 - ✓ Many buyers.



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BIODIESEL FROM SOYBEANS: advantages

- ✓ Its value is determined, not by the price of oil, but the value of oil plus meal .
- ✓ Soybeans can be stored & wait to be processed.
- ✓ Oil good for human consumption & for biodiesel .
- ✓ Soybean oil is one of the cheapest. Only cotton oil and animal fat are cheaper.

BIODIESEL FROM SOYBEANS: advantages

- ✓ **Global demand for meat is high: need more soybean meal.**
- ✓ **70% of protein meal used world wide to feed animals comes from soybean. 93% in Brazil.**
- ✓ **Present in large quantities throughout the Brazilian territory.**
- ✓ **The biodiesel made from soybean oil can be consumed in all regions of Brazil**

Biodiesel from soybeans: disadvantages

- ✓ **Low oil content (18 - 20%).**
- ✓ **Areas of production away from ports and consumer centers: High cost of transport.**
- ✓ **High levels of iodine.**
- ✓ **Susceptibility to the soybean rust.**

Biodiesel from palm oil = advantages

- ✓ 4 to 6,000 kg/ha. Can reach 15.000 kg/ha.
- ✓ Brazil cultivates 60,000 ha but has the potential to grow 70,000,000 ha.
- ✓ Tax incentives of 34% (0% for soybeans).
- ✓ Allows intercropping, especially fruit crops

Biodiesel from the palm oil = problems

- ✓ **First the industry, then the production.**
- ✓ **Plant must be close to production: processing within 48 hours (acidifies).**
- ✓ **High cost of deployment and long-maturity: 4 to 6 years.**
- ✓ **Small producers need support from the Government or from the industry.**

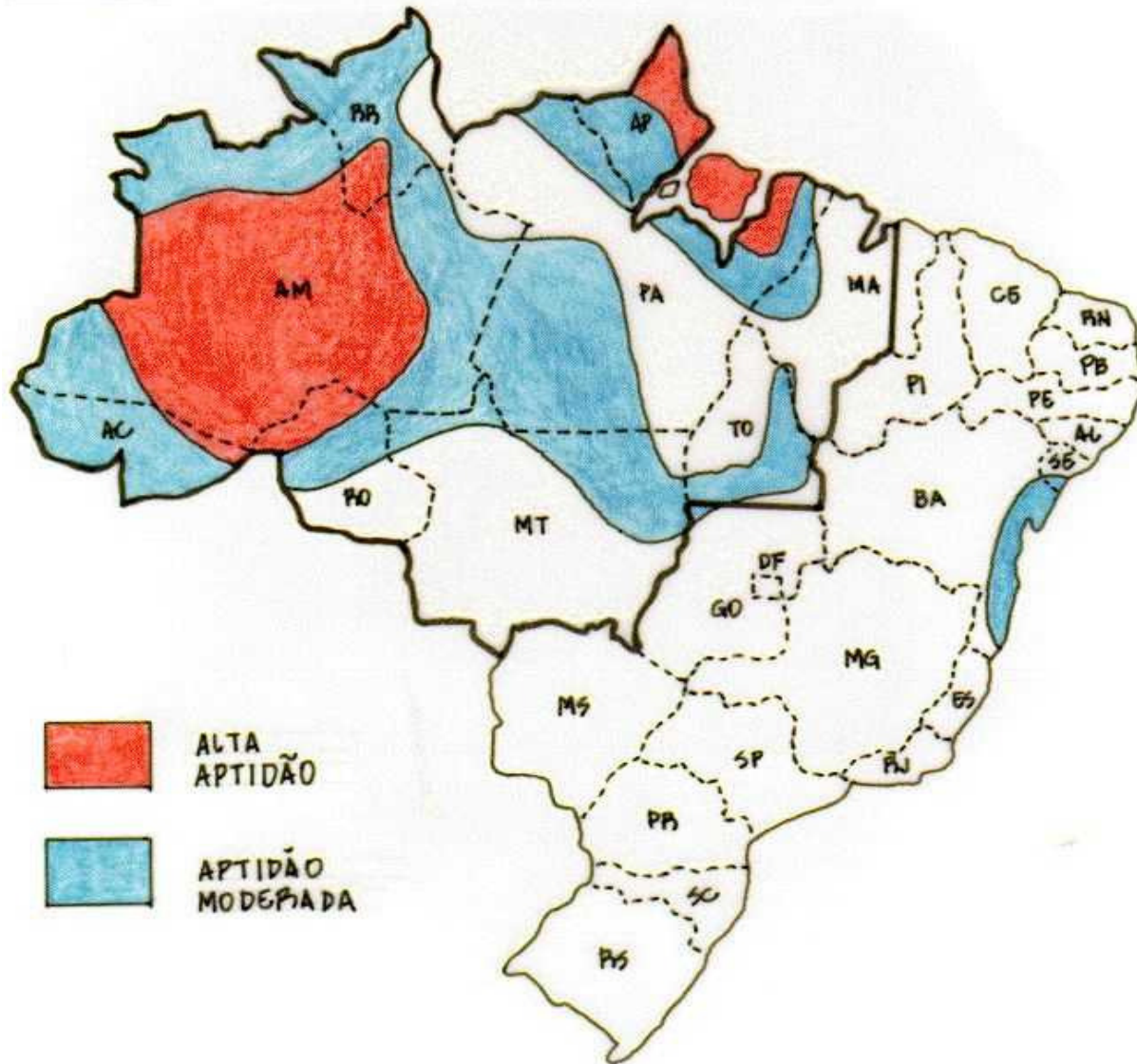
Biodiesel from palm oil = problems

- ✓ **The Amazonian land system is chaotic.**
- ✓ **The Amazonian infrastructure is poor.**
- ✓ **The Amazonian environmental legislation is very restrictive (80%).**
- ✓ **Consumer market is far.**
- ✓ **Its biodiesel solidifies in the cold South.**

Biodiesel from palm oil = problems

- ✓ **Harvesting is manual and labor, has no qualification.**
- ✓ **High cost of labor, whose availability is scarce, even in family farming.**
- ✓ **Little research.**
- ✓ **Residue has low commercial value (coal).**

Areas suitable for Palm oil in Brazil



Castor beans for biodiesel: advantages

- ✓ **High oil content: 45 to 52%.**
- ✓ **Excellent lubricant.**
- ✓ **Wide adaptation: almost the entire country.**
- ✓ **Tolerant to drought (root depth).**
- ✓ **Social impact on family farming**
- ✓ **Great genetic variability: good for breeding.**

Biodiesel from castor beans = problems

- ✓ **Production chain is deficient.**
- ✓ **Elected the main raw material for biodiesel by the government program, but failed:**
 - ✓ **high cost of production (labor work).**
 - ✓ **low productivity (300 = 1700/ha.**
 - ✓ **oil not edible, expensive and has limitations to produce biodiesel (density/viscosity).**
 - ✓ **Deficient in covering the soil: erosion and weed-competition.**

Biodiesel from castor beans = problems

- ✓ **Beans with low density: close to a processing plant or high cost of transport.**
- ✓ **Lack of good seeds: farmers sow grains.**
- ✓ **The cake is toxic**
- ✓ **Does not tolerate compacted or boggy soils. Prefers fertile soils (rustic?).**



THANK YOU

amelio@cnpso.embrapa.br

ENTOMOLOGY STUDIES

- ✓ **Survey of insect pests and of natural enemies under no till cultivation.**
- ✓ **Survivorship and impact of pest species associated with soybean under no till cultivation.**
- ✓ **Strategies to manage key pests under no till cultivation.**
- ✓ **Studies on the bioecology of main pests and their natural enemies.**
- ✓ **Rearing main pests using artificial diets and plant simulation models.**
- ✓ **Biological control of soybean pest species.**

PHYTOPATHOLOGY STUDIES

- ✓ **Screening soybeans for disease resistance.**
- ✓ **Integrated disease management in soybeans.**
- ✓ **Epidemiological studies of soybean pathogens.**
- ✓ **Evaluation of soybean yield losses caused by diseases.**
- ✓ **Chemical control of foliar and seed diseases.**
- ✓ **Spatial distribution of soybean pathogens.**

SEED TECHNOLOGY

- ✓ **Screening soybeans for resistance to mechanical damages**
- ✓ **Genetic heritage of seed coat lignin in soybeans.**
- ✓ **Screening methods to select high seed quality soybeans.**
- ✓ **Screening soybeans for tolerance to seed shriveling.**
- ✓ **Relationship bt isoflavone content and seed quality.**
- ✓ **Studies on seed vigor by using Tetrazolium and accelerated aging tests.**
- ✓ **Referee tests for evaluating seed vigor among labs.**

SEED TECHNOLOGY (continuation...)

- ✓ **Seed quality under different thrashing systems.**
- ✓ **Effects of early harvesting and drying seeds.**
- ✓ **Planting dates vs seed quality in soybeans.**
- ✓ **Storage potential of soybean seeds under different environments.**
- ✓ **Evaluation of impermeable bags for storage of beans in tropical climates.**
- ✓ **Pelletization of soybean seeds with fungicides, micronutrients and inoculants.**

BIOTECHNOLOGY STUDIES

- ✓ **Identification and cloning genes for stress situations.**
- ✓ **Use of RAPD molecular markers to study genetic diversity of soybean pests.**
- ✓ **Use of RAPD and AFLP molecular markers to study genetic diversity of entomopathogenic fungi.**
- ✓ **Use of RAPD Micro satellites molecular markers to study soybean resistance to diseases and nematodes.**
- ✓ **USE of RAPD, and single Nucleotide Polymorphism to study Bradyrhizobium genetic diversity.**
- ✓ **Identification of chemical compounds, important for soybean used directly for human consumption.**

CROP PHYSIOLOGY STUDIES

- ✓ **Morphological and physiological traits conferring tolerance to environmental stresses.**
- ✓ **Physiological mechanisms delivering tolerance to environmental stresses.**
- ✓ **Interactions among traits and physiological mechanisms involved in the response of specific genotypes to environment.**
- ✓ **Modeling of crop responses to the environment to support crop risk assessment and decision making.**
- ✓ **Characterization, identification and sequencing of the main genes controlling environmental responses of specific genotypes.**
- ✓ **Identification of agronomic practices capable of increasing sustainability and decreasing yield fluctuations.**

SOIL AND CROP MANAGEMENT

- ✓ **Studies on soil physic characteristics under different systems of soil management and crop rotation.**
- ✓ **Studies on tillage processes, looking for improvements in soil characteristics.**
- ✓ **Technical and economical studies of crop residues.**

C SEQUESTRATION AND N BALANCE IN SOYBEAN FIELDS

- ✓ **Carbon and Nitrogen sequestration under several crop rotation systems.**
- ✓ **Desk review of literature on C and N sequestration.**
- ✓ **Studies on N₂ balance in soils cropped to soybeans under different cropping and management systems.**
- ✓ **Effect of N₂ fertilizers in different stages of plant growth, yield of inoculated soybeans and N₂ balance.**

SOYBEAN NUTRITION STUDIES

- ✓ **Greenhouse studies on the mobility, distribution and redistribution of Zn, Mn, Cu, and B, compared to plants grown in nutrient solution.**
- ✓ **Field experiments with micronutrients applied in the oil and sprayed on the leaves using radio tracers.**
- ✓ **Field studies on the efficiency of micronutrients from different sources.**
- ✓ **Field studies on methods of application of different sources of micronutrients.**

SOYBEANS AS FOR HUMAN FOOD

- ✓ **Evaluation of soybean germoplasm for food processing.**
- ✓ **Evaluation of soybean germoplasm for soymilk, tofu, miso, natto, edamame, sprouts and soymeal production.**
- ✓ **Processing optimization of soybean products in a pilot plant.**

INTEGRATED WEED MANAGEMENT

- ✓ **Competitive ability of soybean cvs. grown under different plant densities and row spacing.**
- ✓ **Managing winter crops as for soil mulching.**
- ✓ **Dynamics of weed establishment.**
- ✓ **Weed resistance to herbicides and alternative control techniques.**
- ✓ **Changes in weed flora under GMO soybeans.**
- ✓ **Evaluation of new herbicide formulations.**

PRECISION AGRICULTURE

- ✓ **Studies on causes of farm yield variability, to improve soybean production efficiency.**
- ✓ **Studies on vegetation indexes to support fertilizer corrections.**
- ✓ **Studies on Soil Smart Sampling System and on Decision Support Systems, based on site-specific data.**

BRAZILIAN GDP = US\$ 1,3 trillions
Participation (%) of each State (2006)

<u>SP</u>	<u>33,87</u>
RJ	11,62
MG	9,06
RS	6,62
PR	5,77
Bahia	4,07
SC	3,93
DF	3,78

Others 21,27

<u>Southeast</u>	<u>56,8</u>
South	16,3
Northeast	13,1
Midwest	8,7
North	5,1



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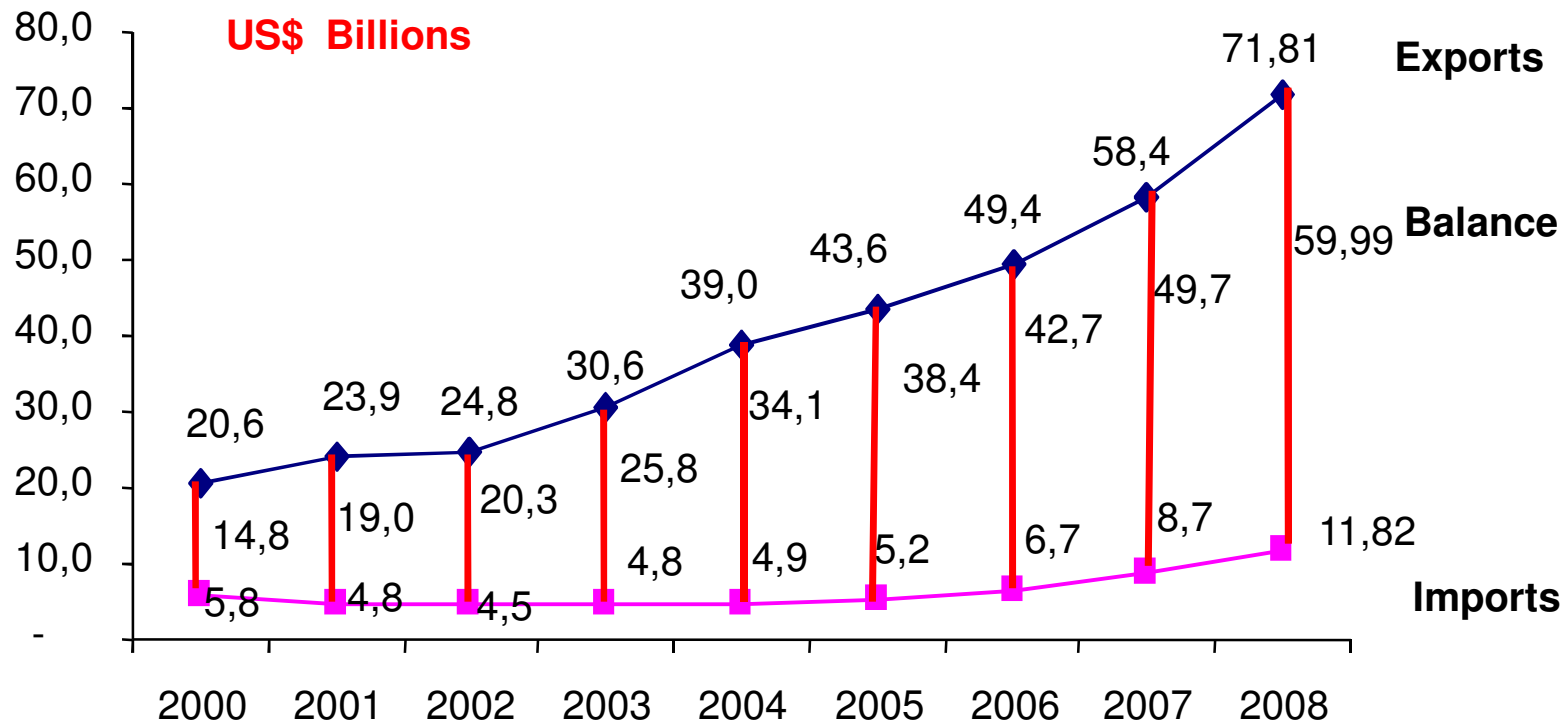


The Brazilian agribusiness: Production and Exports

Main products	Brazil – World Ranking	
	Production	Exports
Ethanol	2º	1º
Sugar	1º	1º
Coffee	1º	1º
Orange juice	1º	1º
Tobaco	1º	1º
Soybean complex	2º	2º
Beef	2º	1º
Poultry	3º	1º
Corn	3º	3º
Fruits	3º	-
Pork	4º	4º

Fonte: USDA/MAPA/CONAB - 2007

Trade balance of Brazilian agribusiness 2000/2008



2008: No agribusiness balance = deficit US\$ 23 billions

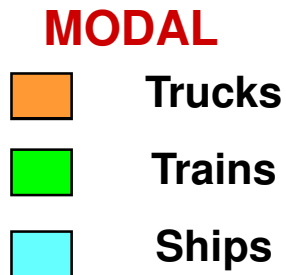
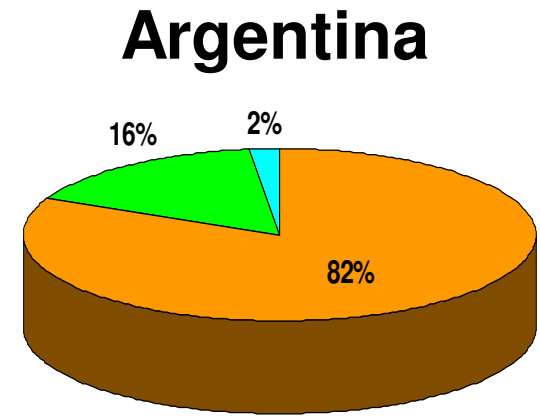
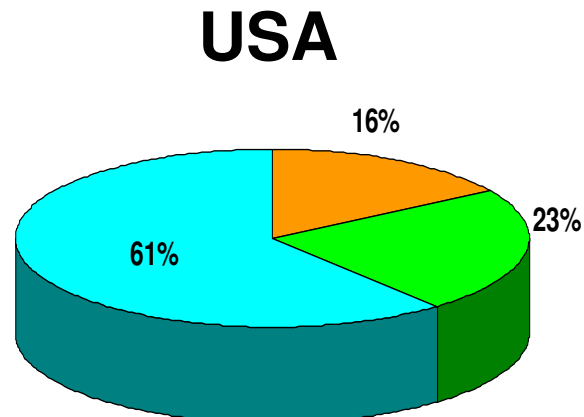
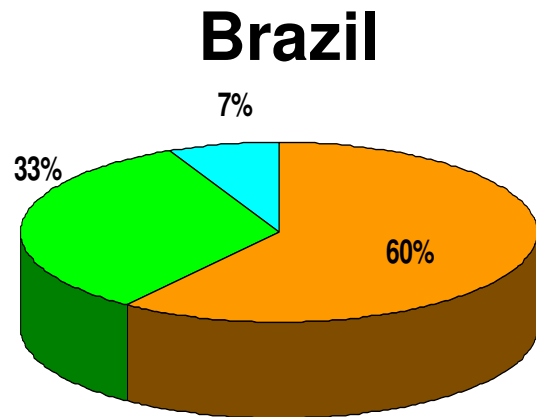
Fonte: Secex-MDIC



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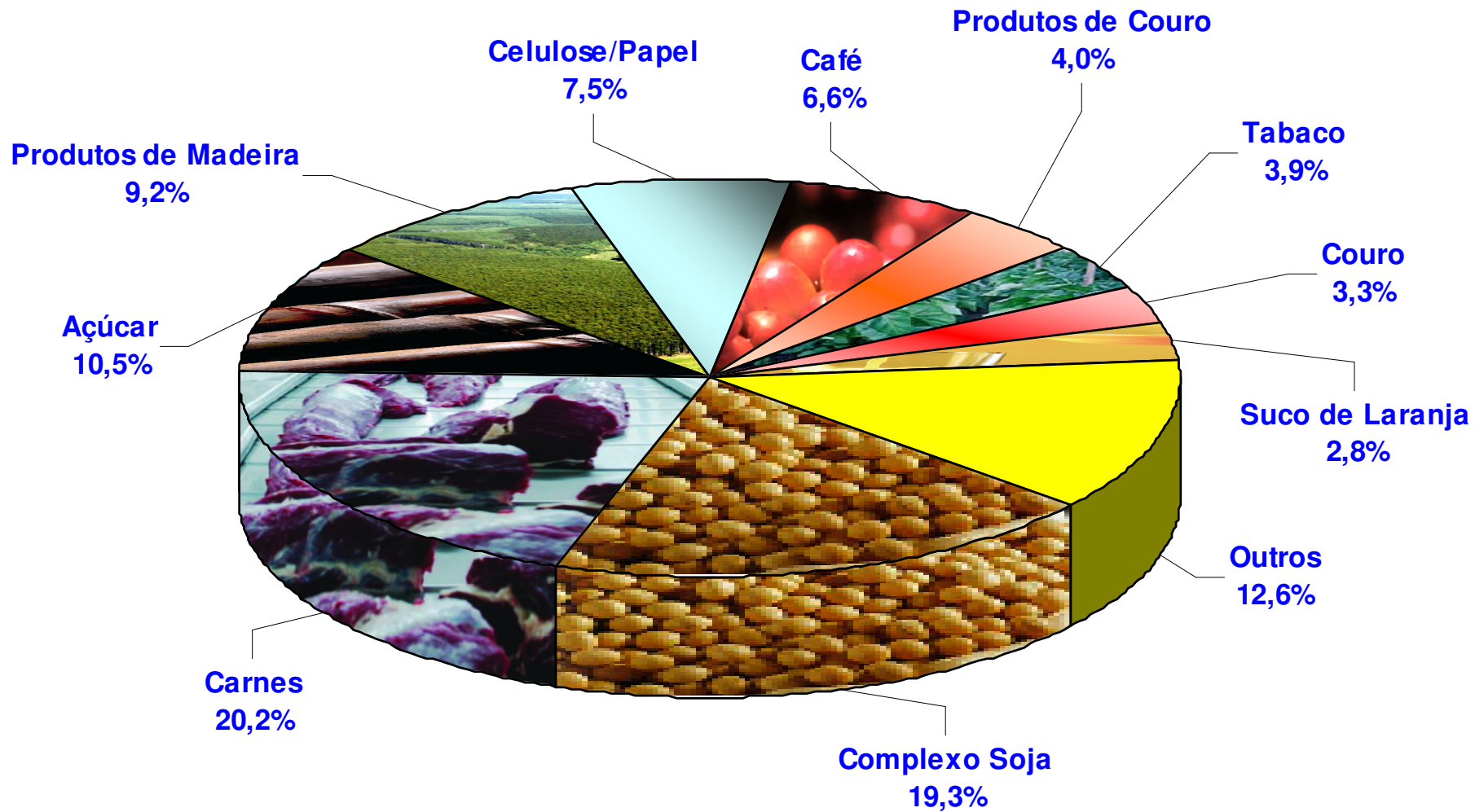
Beans transportation systems



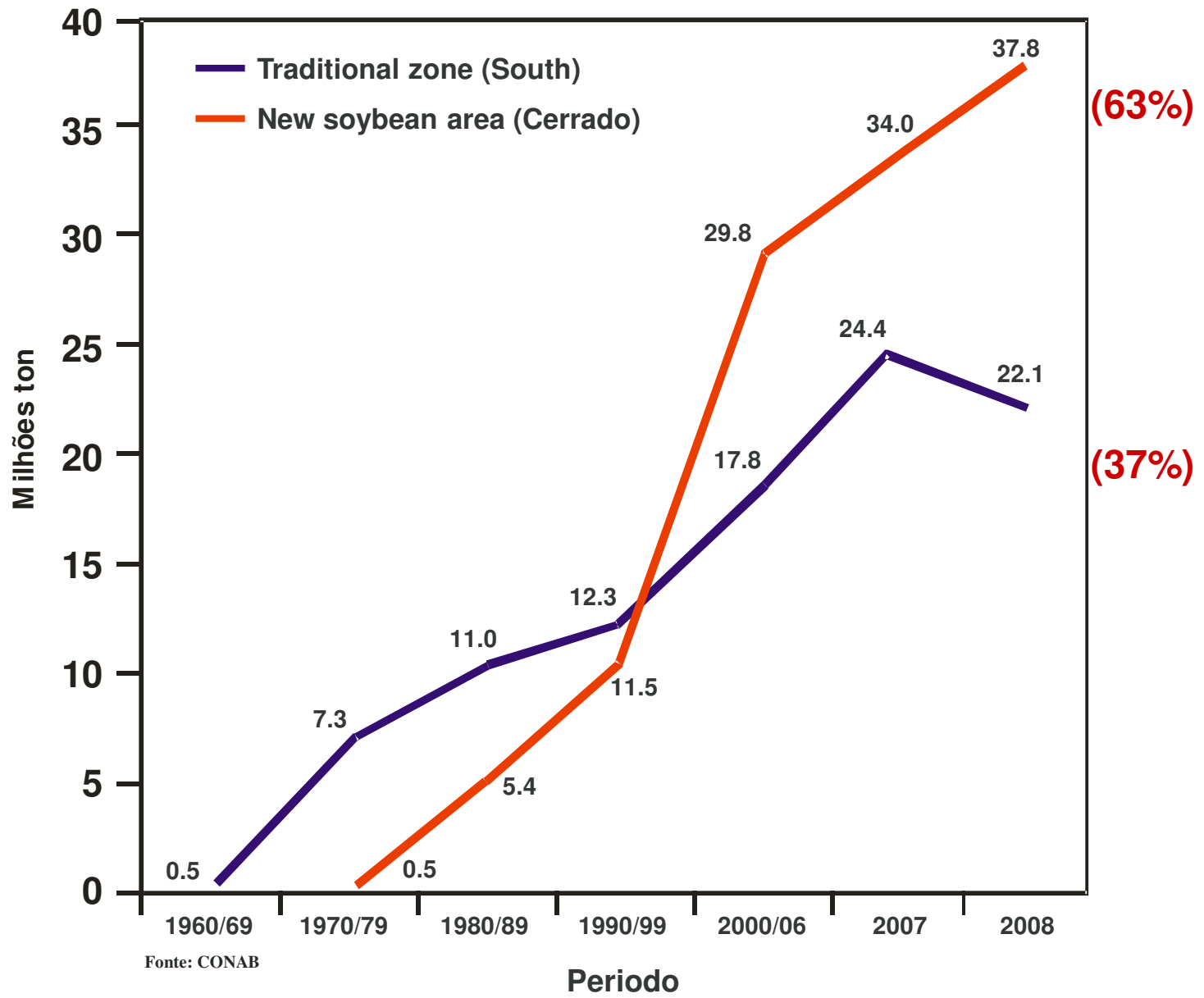
**Brazil: average distance to ports > 1.000 km
Argentina = 300 km**

What Brazil exports

-Oct/2004 a Mai2008-



Fonte: MAPA



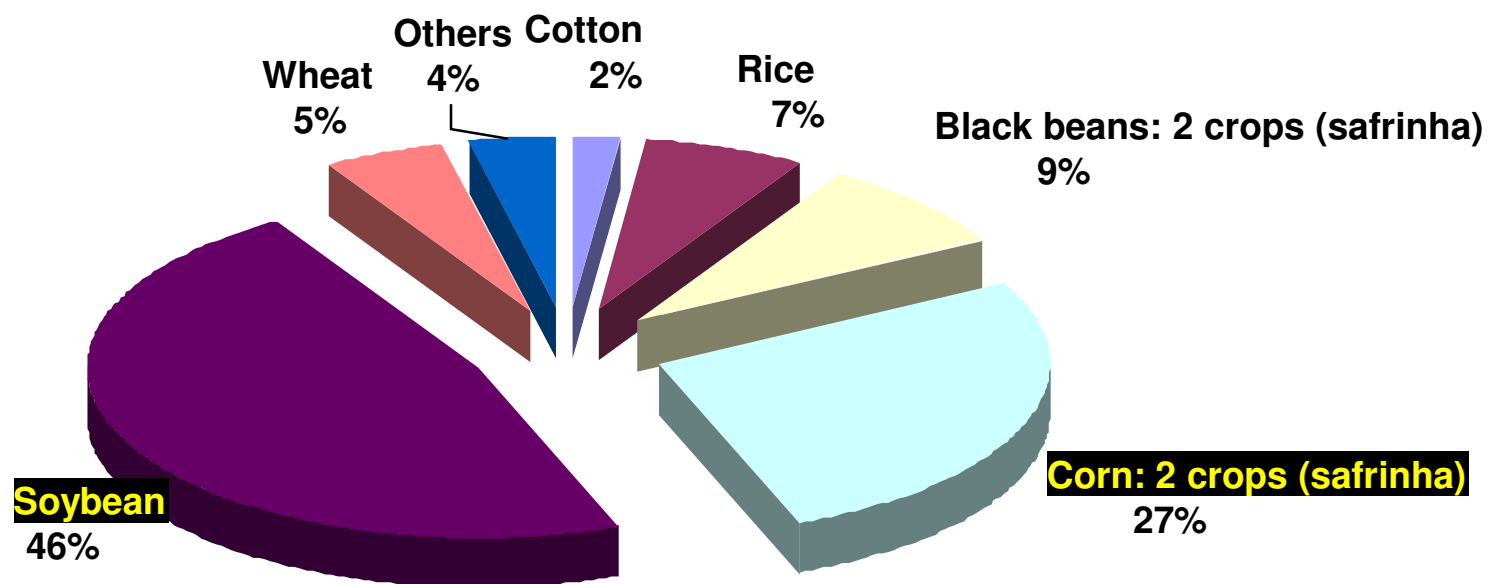
Soybean production in the South x Midwest



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Brazilian cropped area (2008): Around 50 Mha + 15 Mha double cropped



Fonte: CONAB

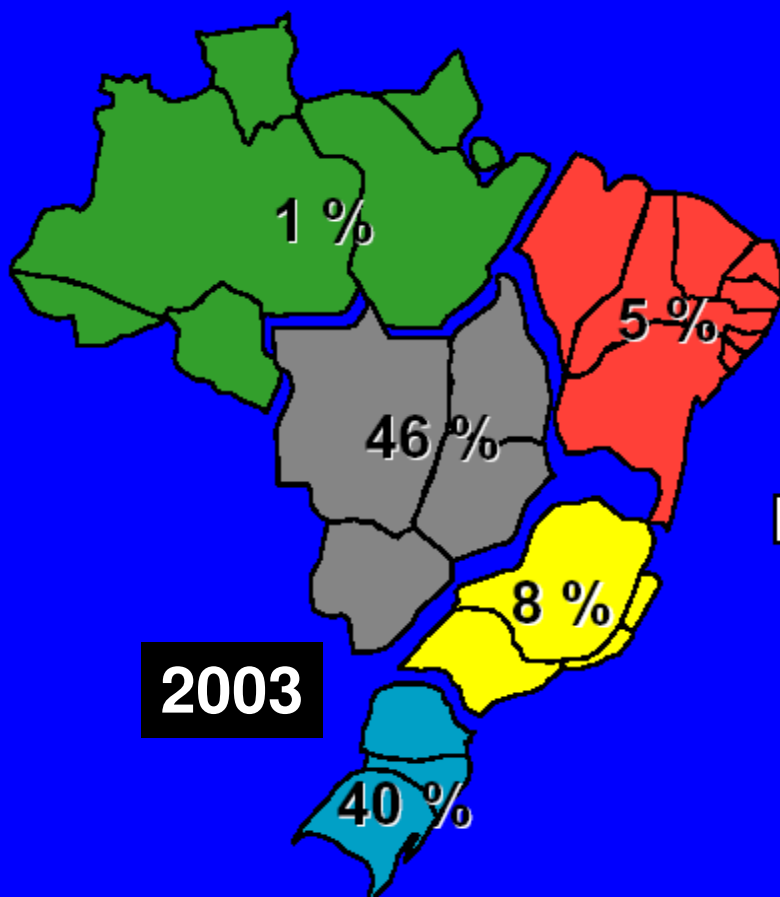


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O Agronegócio Soja no Brasil

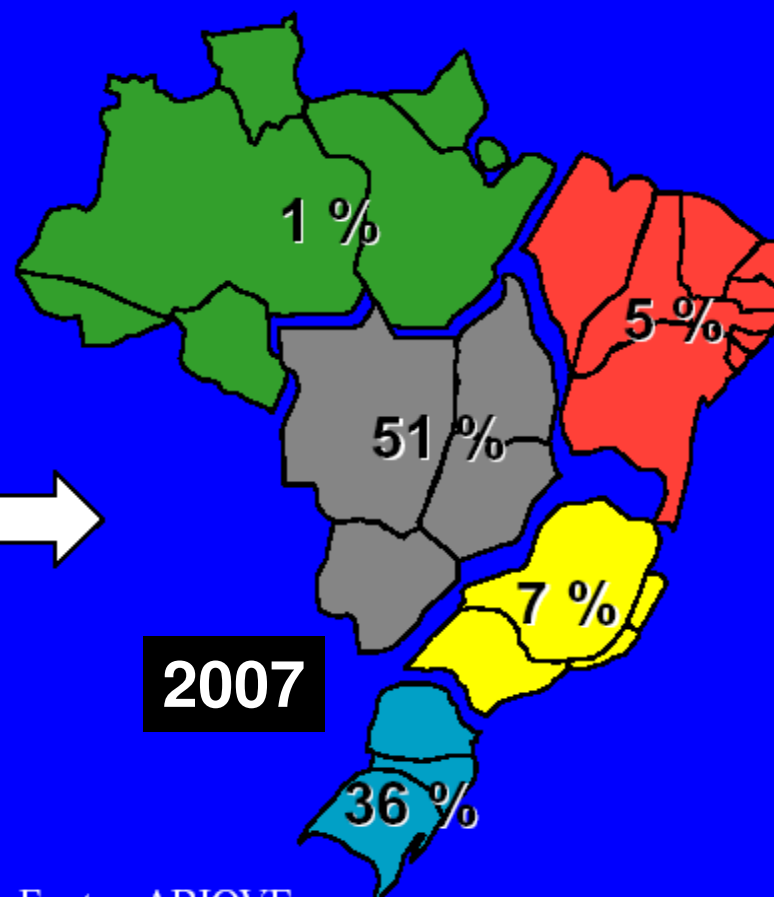
Participação na produção de soja
por região em 2003



2003

Fonte: CONAB

Estimativa da Participação na produção de soja
por região em 2007



2007

Fonte: ABIOVE

Agricultural production in selected countries

Product	Brazil	China	EUA	India	EU-27
Beans/Cereals ^{4º}	143,7	401,8	422,3	204,0	247,4
Meat ^{3º}	21,6	70,1	37,6	4,4	37,0

Fonte: Usda. Adapted by Ocepar/Getec



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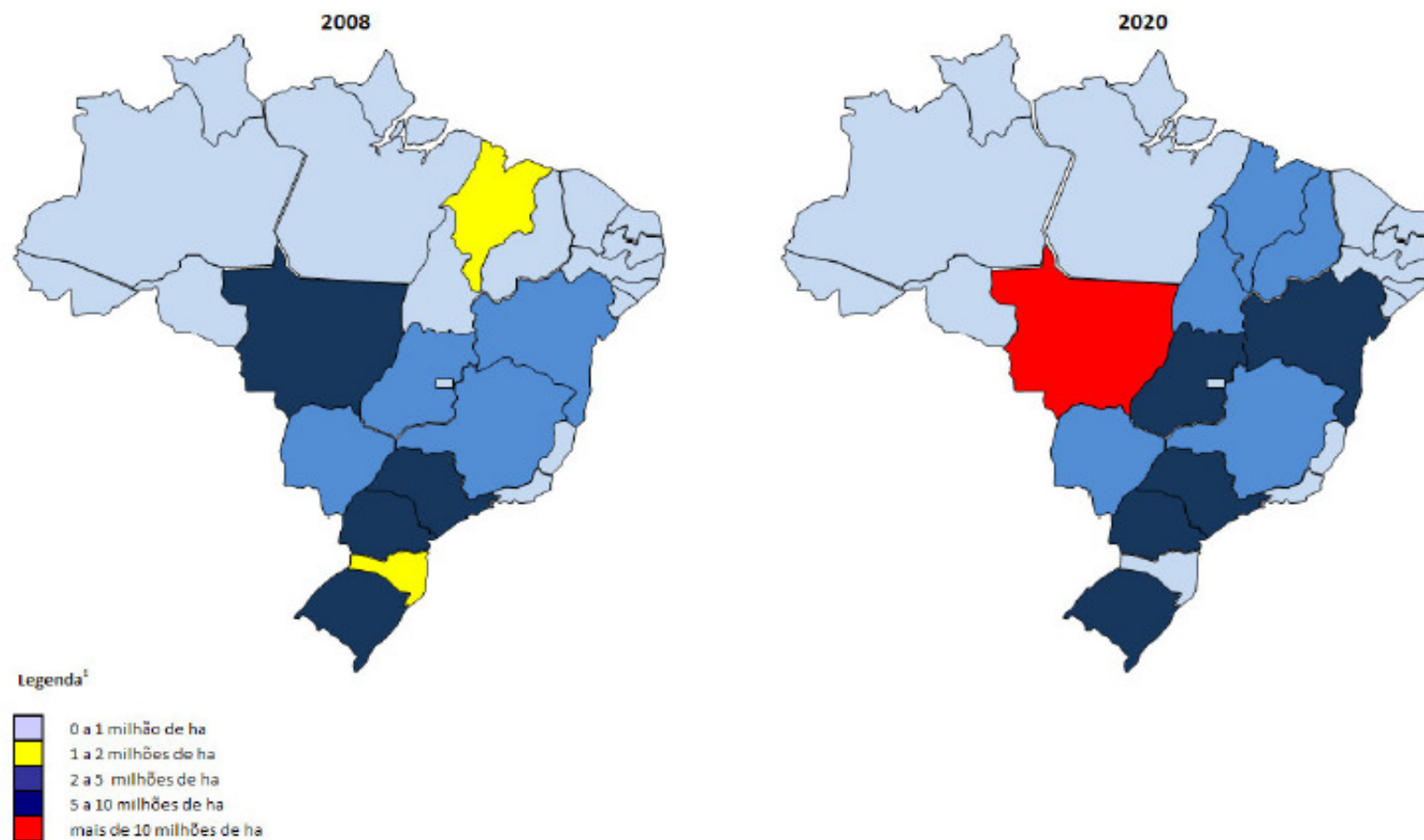


Predominant ecosystems in the Brazilian territory



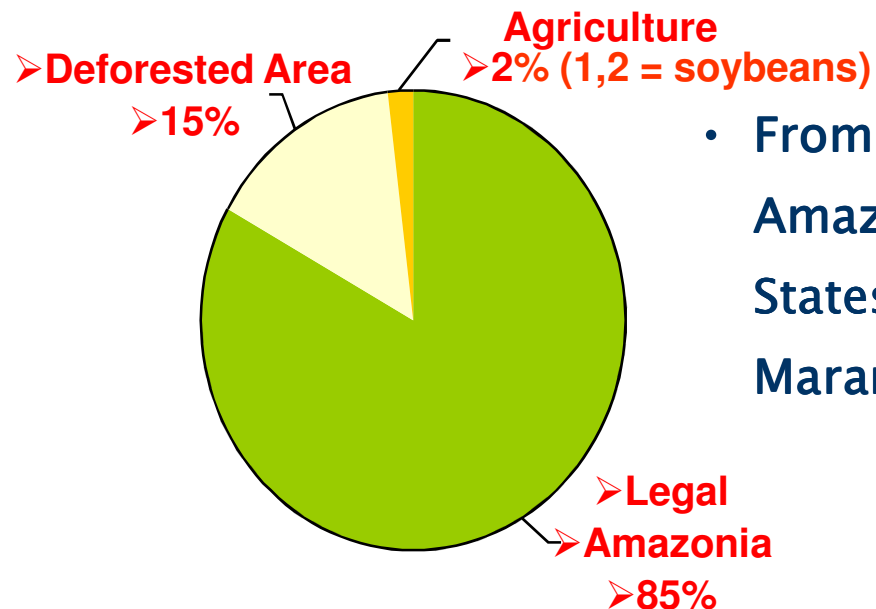
Cenário Bio Boom – Mapas de Ocupação.

Cenário Bio Boom - Mapas de Ocupação



²: áreas ocupadas com soja, milho, sorgo, algodão, cana-de-açúcar, arroz e pinhão manso.

Agriculture in Legal Amazonia



- From the 2% planted area in Legal Amazonia, 88% are concentrated in the States of Mato Grosso, Tocantins and Maranhão.

Therefore, the impact of soybeans on Legal Amazonia is not significant.

Antônio Gaudério/Folha Imagem

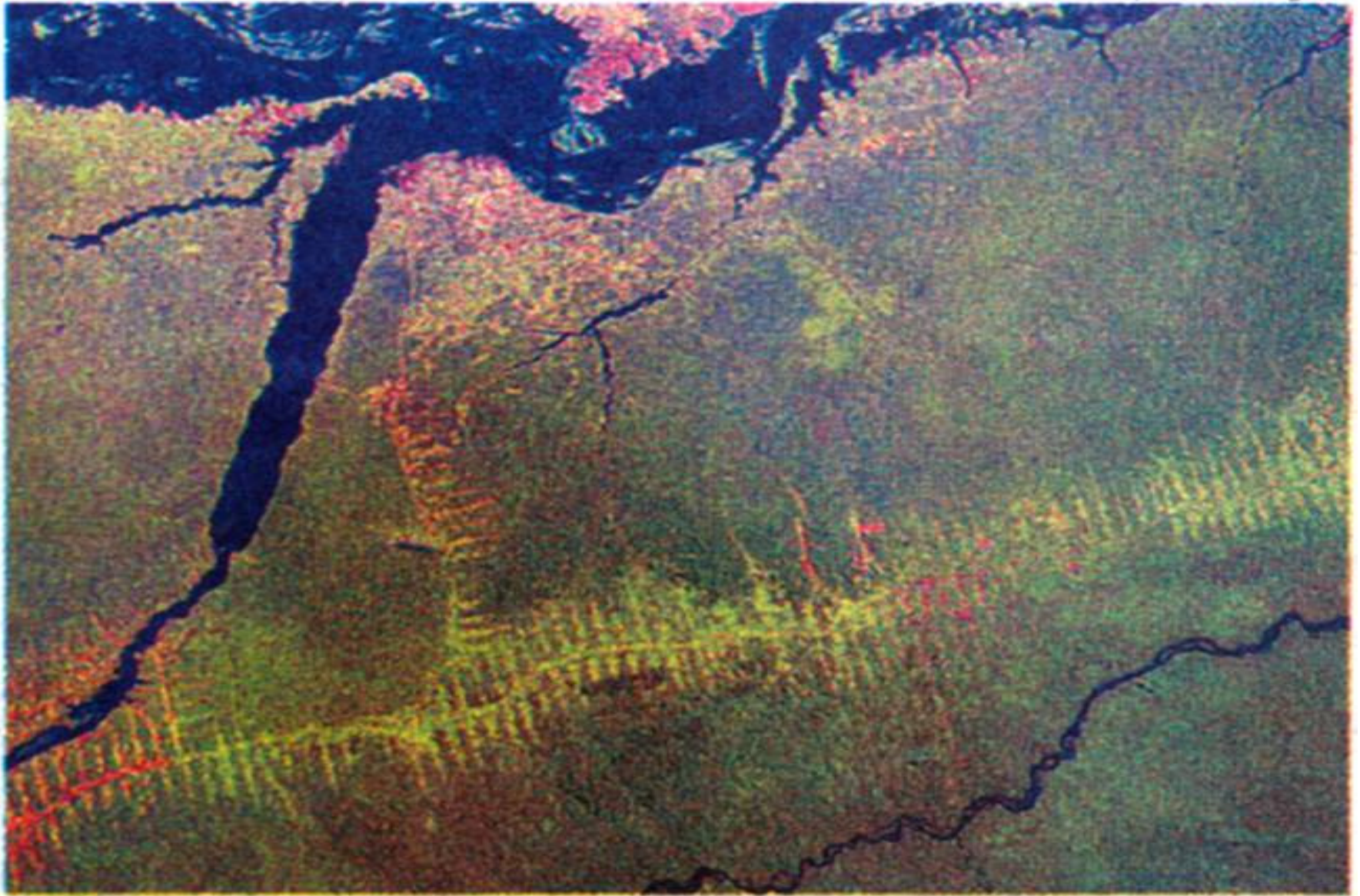
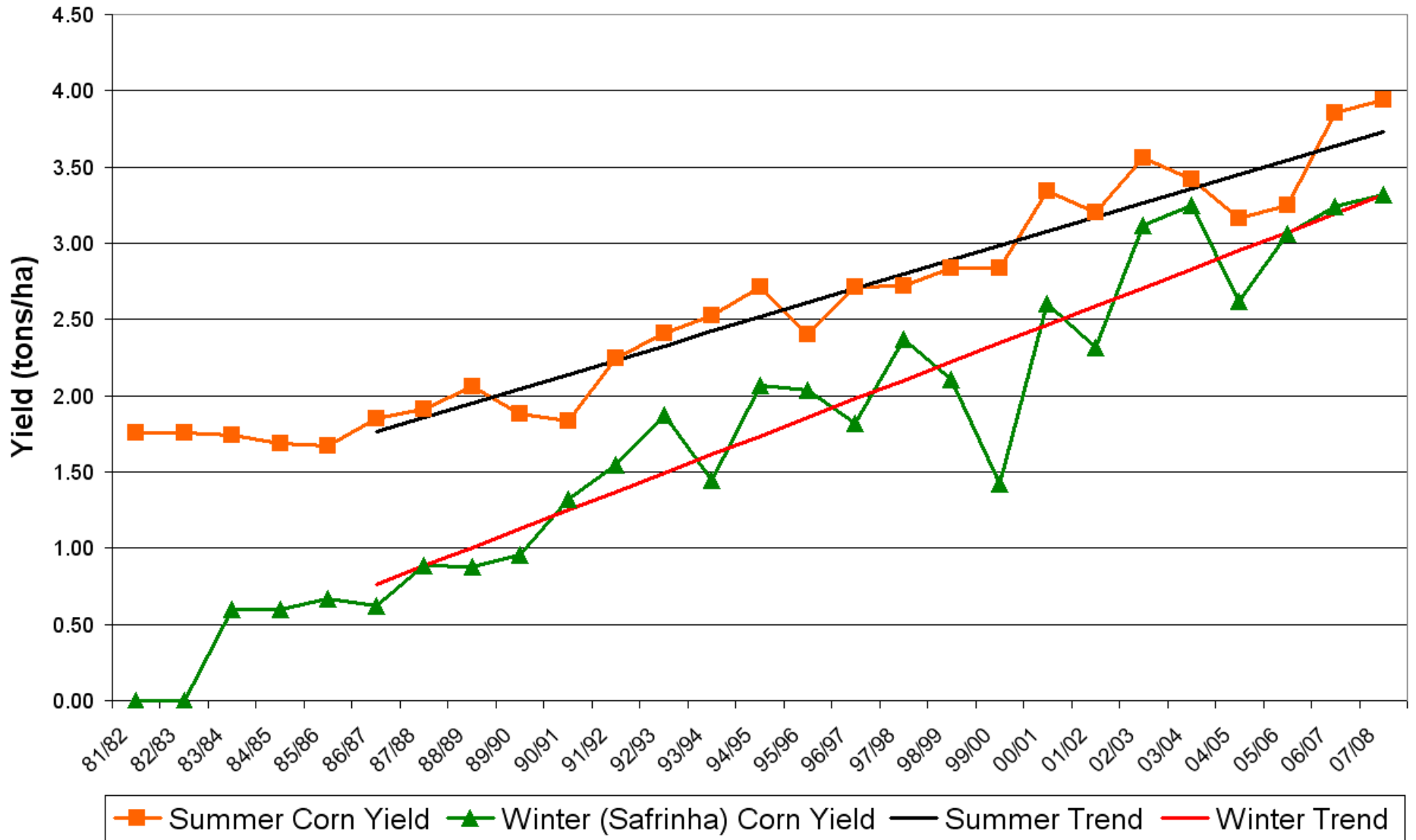


Imagem do satélite Landsat mostra a rodovia Transamazônica

Brazil Corn Yields



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LAND DESTINATIONS IN BRAZIL

- **Conservation units:** 2.294.343 km² 27%
- **Permanent preservation:** 1.442.544 km² 17%
- **Legal Reservation:** 2.685.542 km² 32%
- **TOTAL:** 6.059.526 km² 71%
- **Available for production:** 2.455.350 km² 29%