



CENTRO DE TECNOLOGIA CANAVIEIRA



Expert Workshop for the *How2Guide for Bioenergy*
Biomass Resources and Bioenergy Potential in South America – Focus on Biofuels

Date: 27-28 November 2014

Location: Sugarcane Technology Center – CTC (Piracicaba-SP), São Paulo, Brazil



CENTRO DE TECNOLOGIA CANAVIEIRA

CTC- CENTRO DE TECNOLOGIA CANAVIEIRA

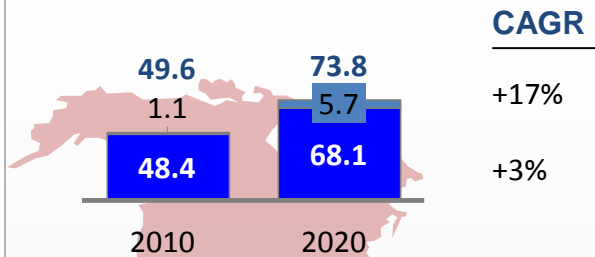
Biofuels market is large and growing fast...

■ Biodiesel ■ Bioethanol

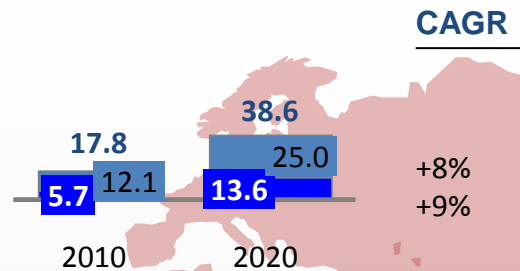
Biodiesel and Bioethanol consumption, 2010 and 2020

Billion liters per year

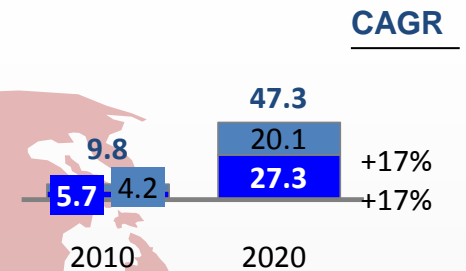
USA



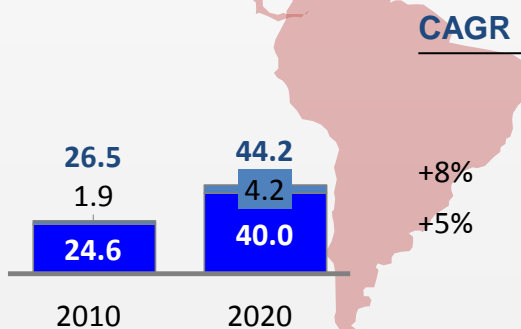
Europe (UE-27)



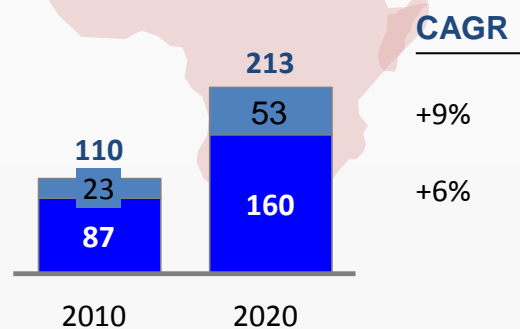
APAC



Brazil



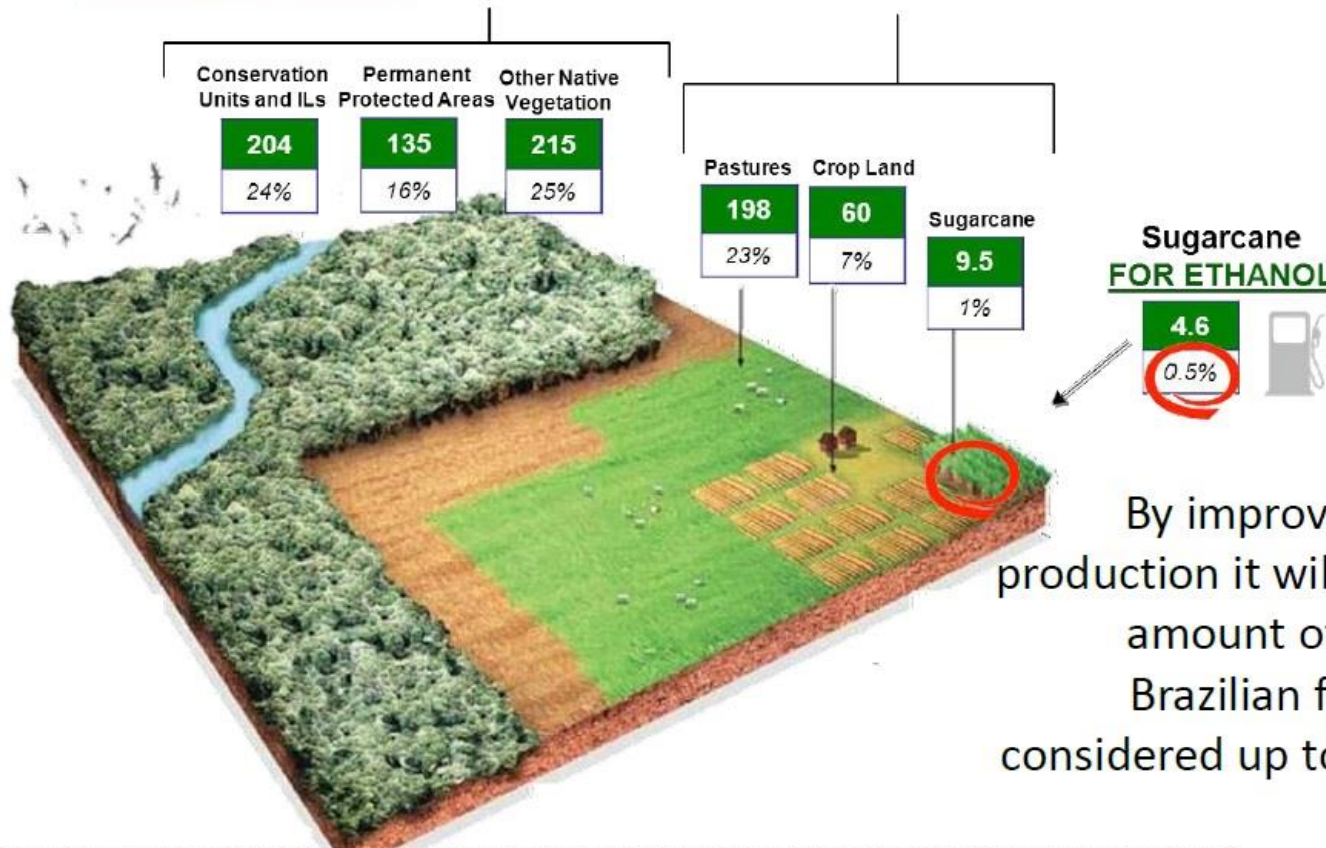
Global



Land for Sustainable Sugarcane

Million Hectares

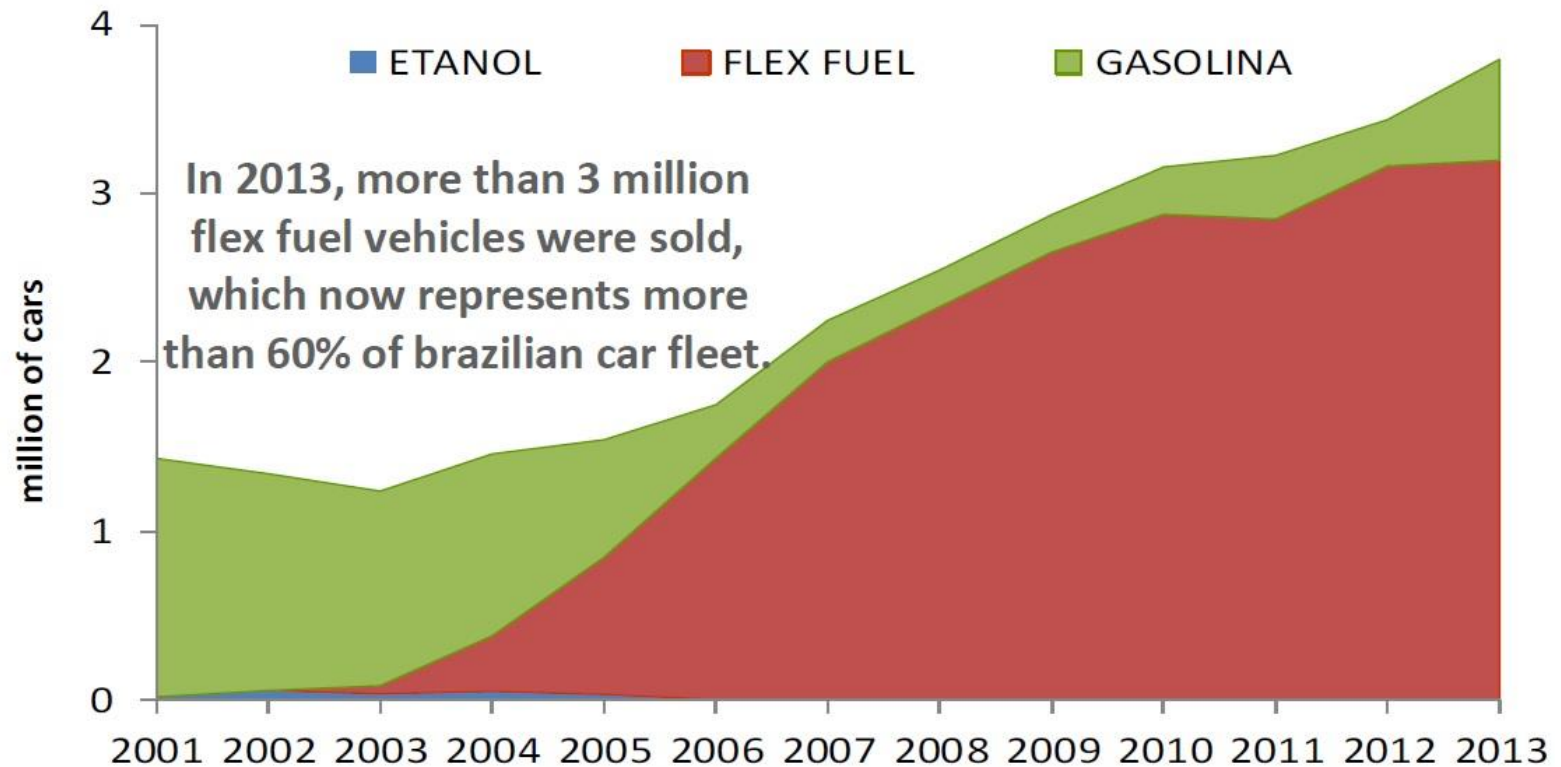
| Total Area | Native Vegetation | Land in Actual Use | Other Uses |
|------------|-------------------|--------------------|------------|
| 851 | 554 | 258 | 38 |
| 100% | 65% | 30% | 5% |



By improving the low yield of cattle production it will be possible to free large amount of land for other purposes. Brazilian federal agricultural zoning considered up to 64 Mha able to produce sugarcane w/o irrigation.

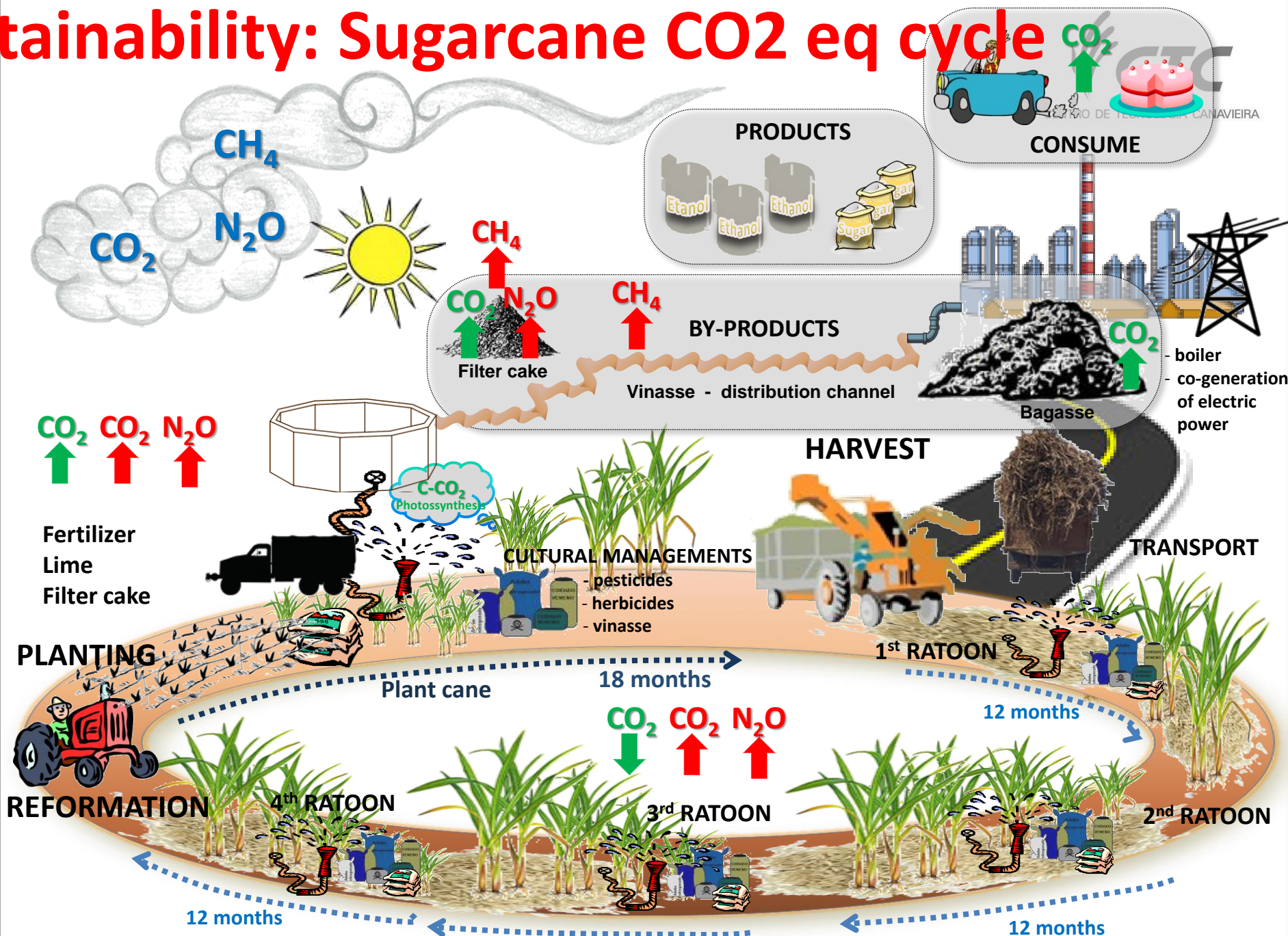
Demand for Sugarcane

Growing fuel market



Source: ANFAVEA

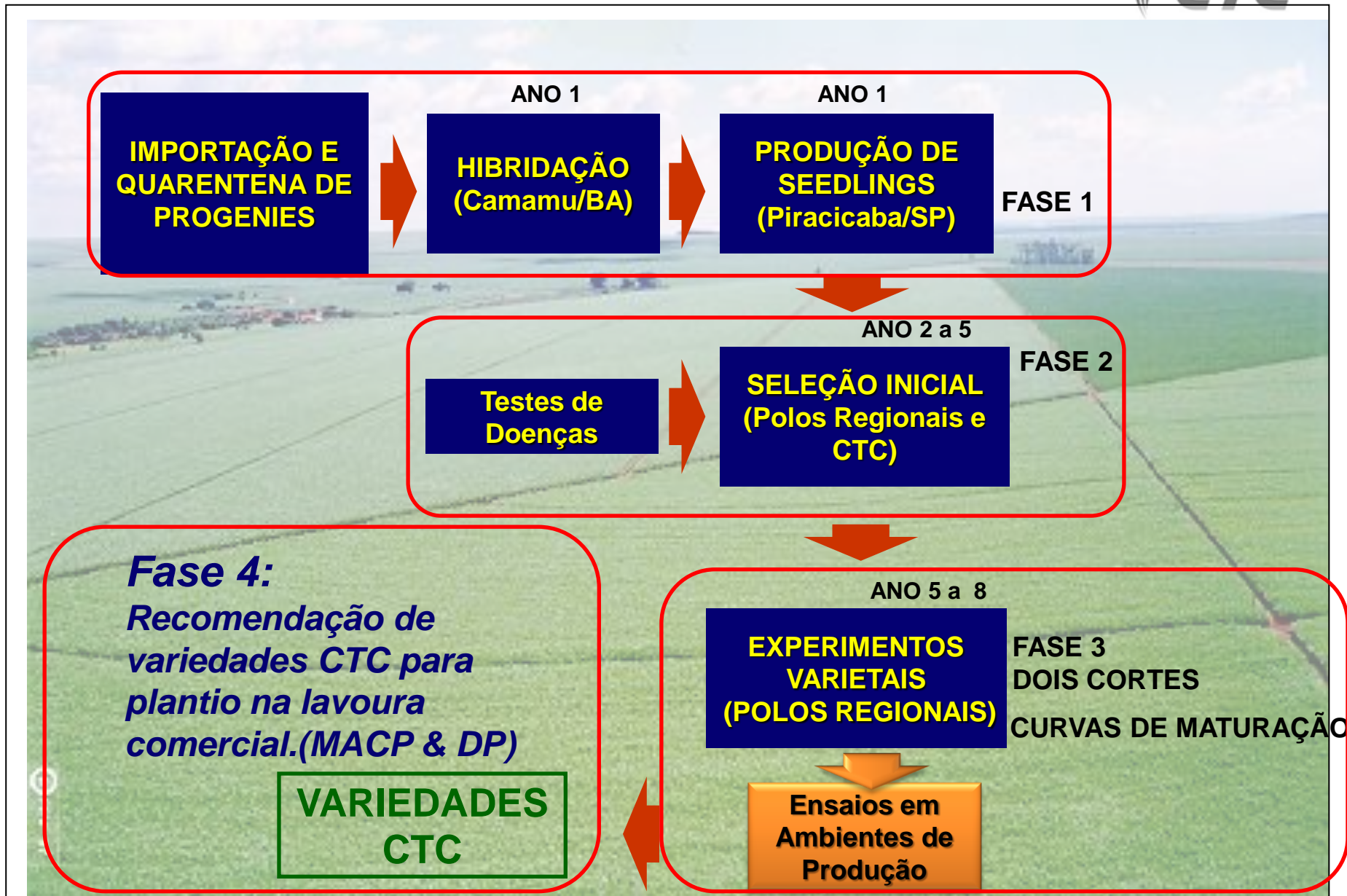
Sustainability: Sugarcane CO2 eq cycle



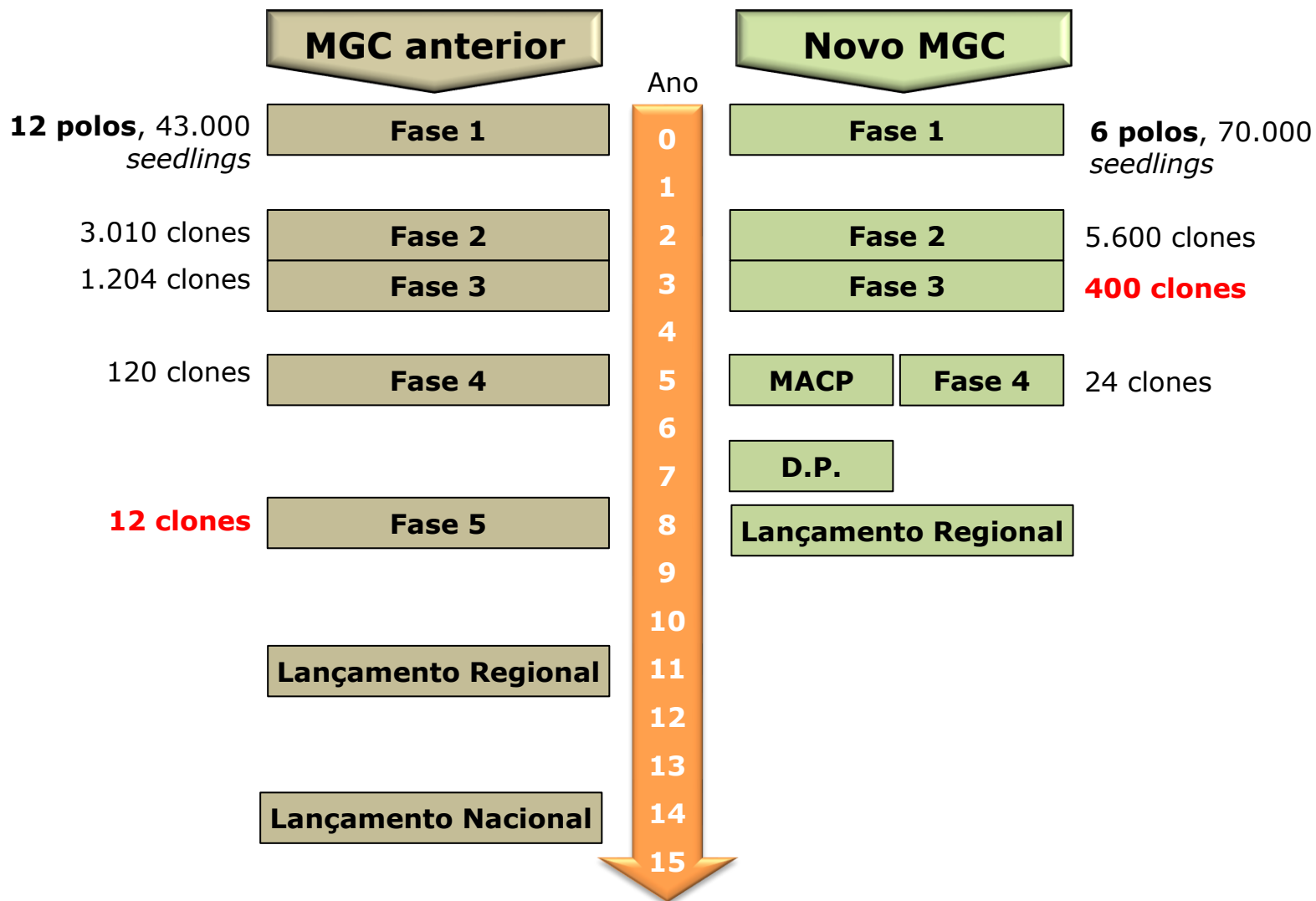
FLUXOGRAMA DO PROGRAMA DE MELHORAMENTO



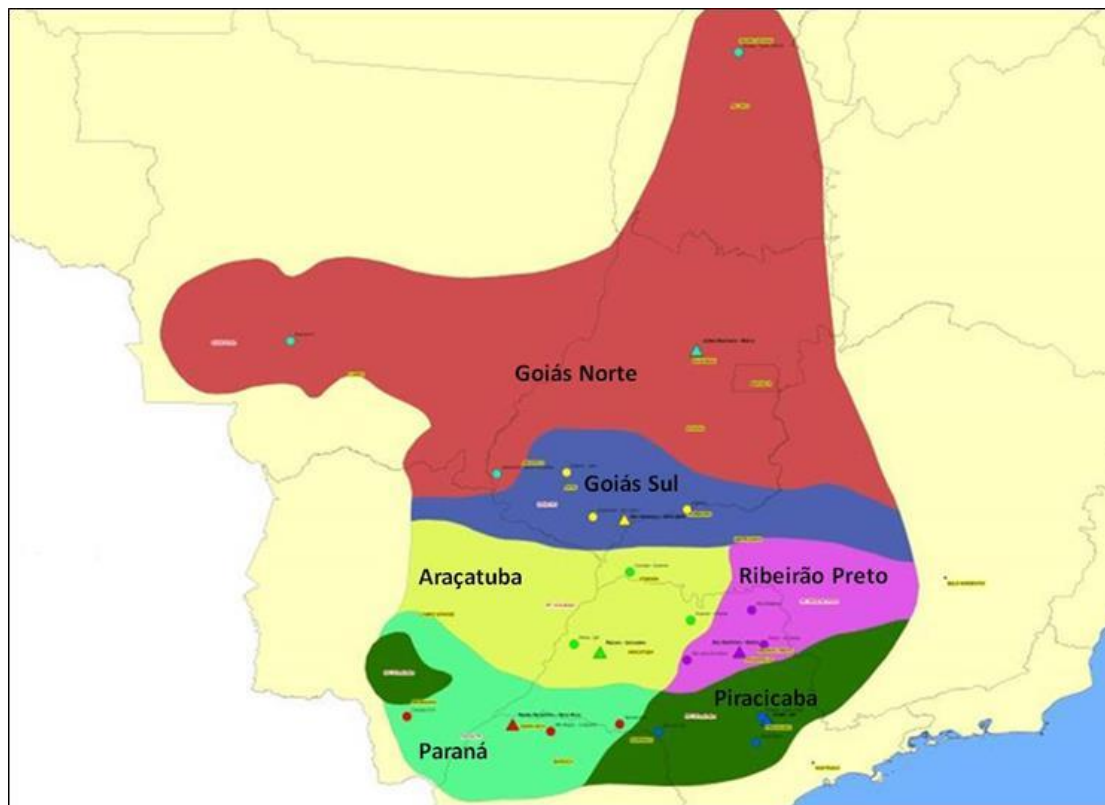
FLUXOGRAMA DO PROGRAMA DE MELHORAMENTO



Novo modelo de Melhoramento Genético – Fluxos



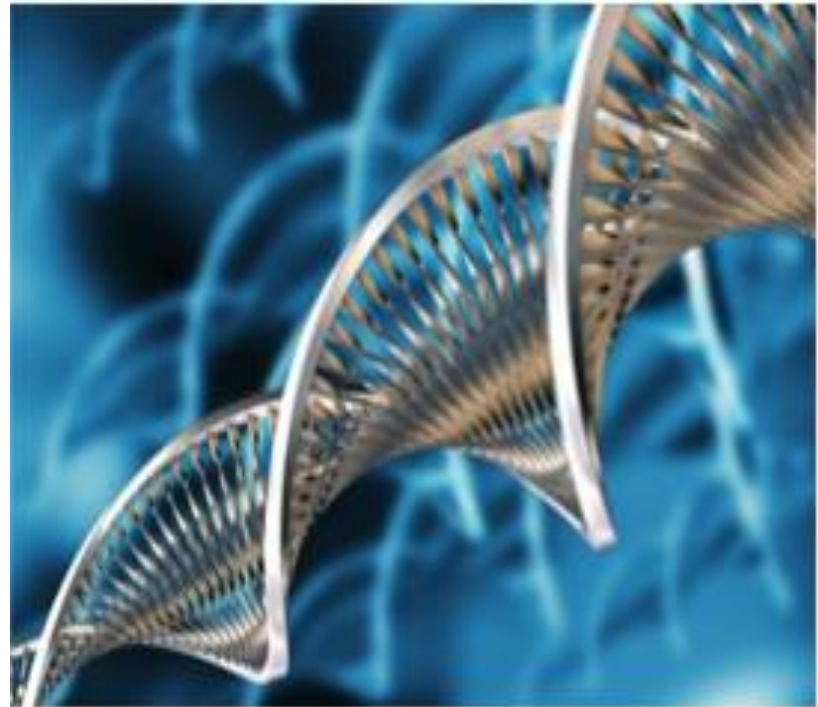
Polos Regionais – cobertura edafoclimática



| | | | |
|-------------------|---|--------------|---|
| SP/Piracicaba | A-I, B-I, C-I | PR/Paraná | C-I, D-I e E-I |
| SP/Ribeirão Preto | A-II, B-II, C-II A-III, B-III, C-III | SP/Araçatuba | C-II, D-II e E-II C-III, D-III e E-III |
| GO/Goiás norte | B-IV, C-IV; D-IV B-V, C-V; D-V | GO/Goiás sul | C-IV, D-IV, E-IV C-V, D-V, E-V |

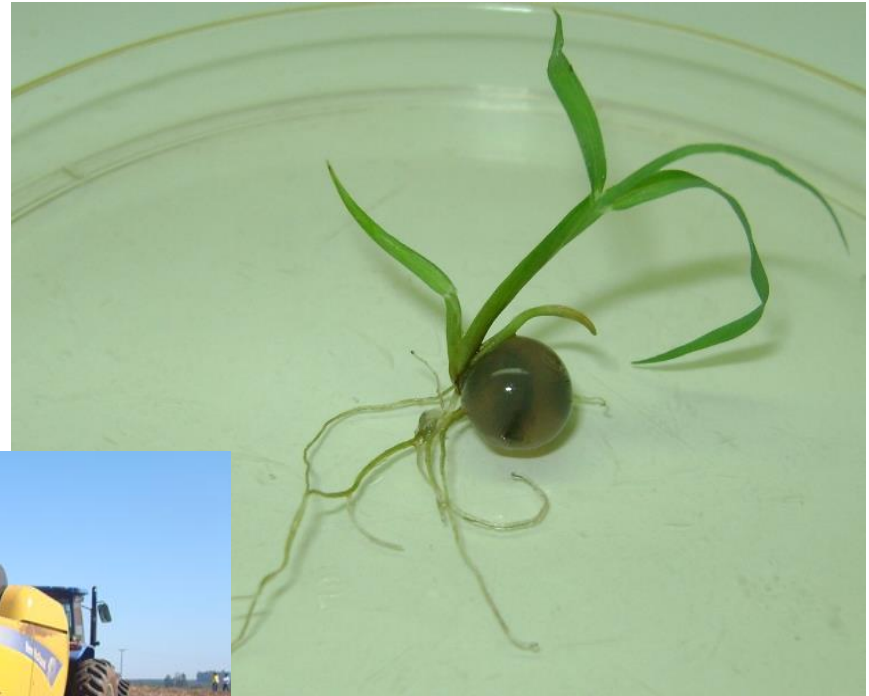
Biotechnology

- **Molecular-assisted breeding**
- **Traits under development**
 - *Insect resistance*
 - *Herbicide tolerance*
 - *Sugar content*
 - *Drought resistance*
 - *Yield*
- **Prospects**
 - *Nitrogen use efficiency*
 - *Hydrolysable biomass*



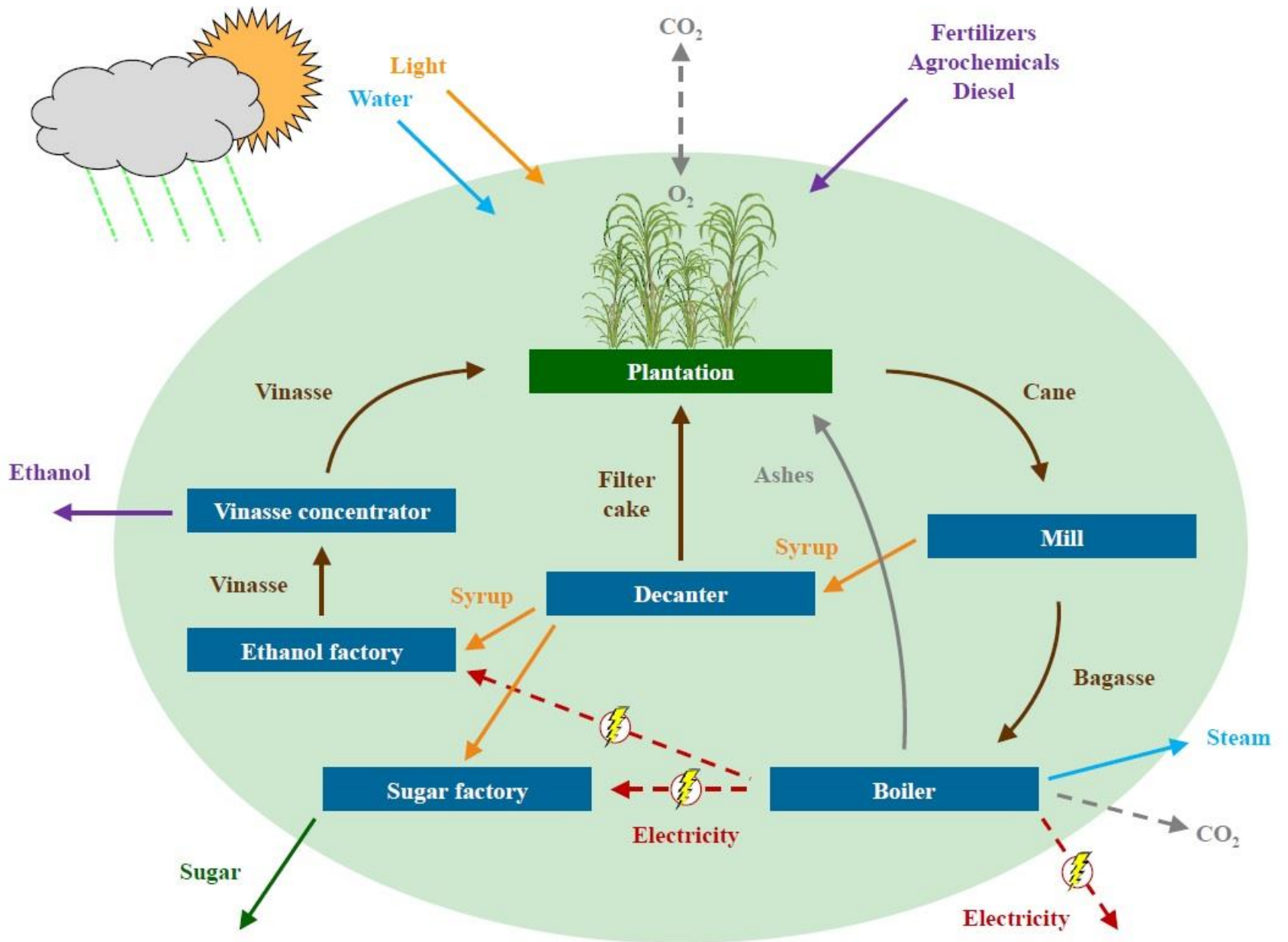
Crop Management

- **Artificial Seeds**
- **Biomass Supply**
- **Accelerated Propagation**
- **Precision Agriculture**



Average, maximum and theoretical sugarcane yields and total dry matter production (Paul Moore)

| Type (Australia, Colombia, South Africa) | Cane yield (t ha ⁻¹ yr ⁻¹) fresh weight | Biomass* | |
|---|--|--|--------------------------------------|
| | | (t ha ⁻¹ yr ⁻¹) dry weight | (g m ⁻² d ⁻¹) |
| Average | 84 | 39 | 10.7 |
| Commercial maximum | 148 | 69 | 18.8 |
| Experimental maximum | 212 | 98 | 27.0 |
| Theoretical maximum | 472 | 219 | 72.4 |



CTC History



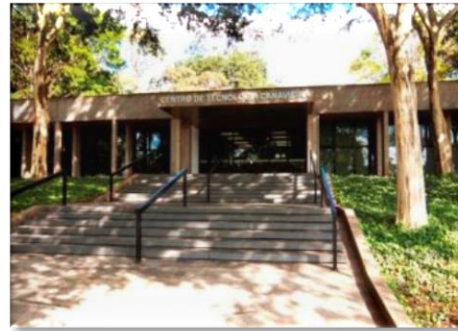
Experimental Station Camamu



Quarentine Station Miracatú



Experimental Station Piracicaba



CTC headquarters



CTC- Centro de Tecnologia Canavieira



CENTRO DE TECNOLOGIA CANAVIEIRA

1969

1979

2004

2011

Copersucar Technology Center



CT Canavieira
Oscip



CTC S/A

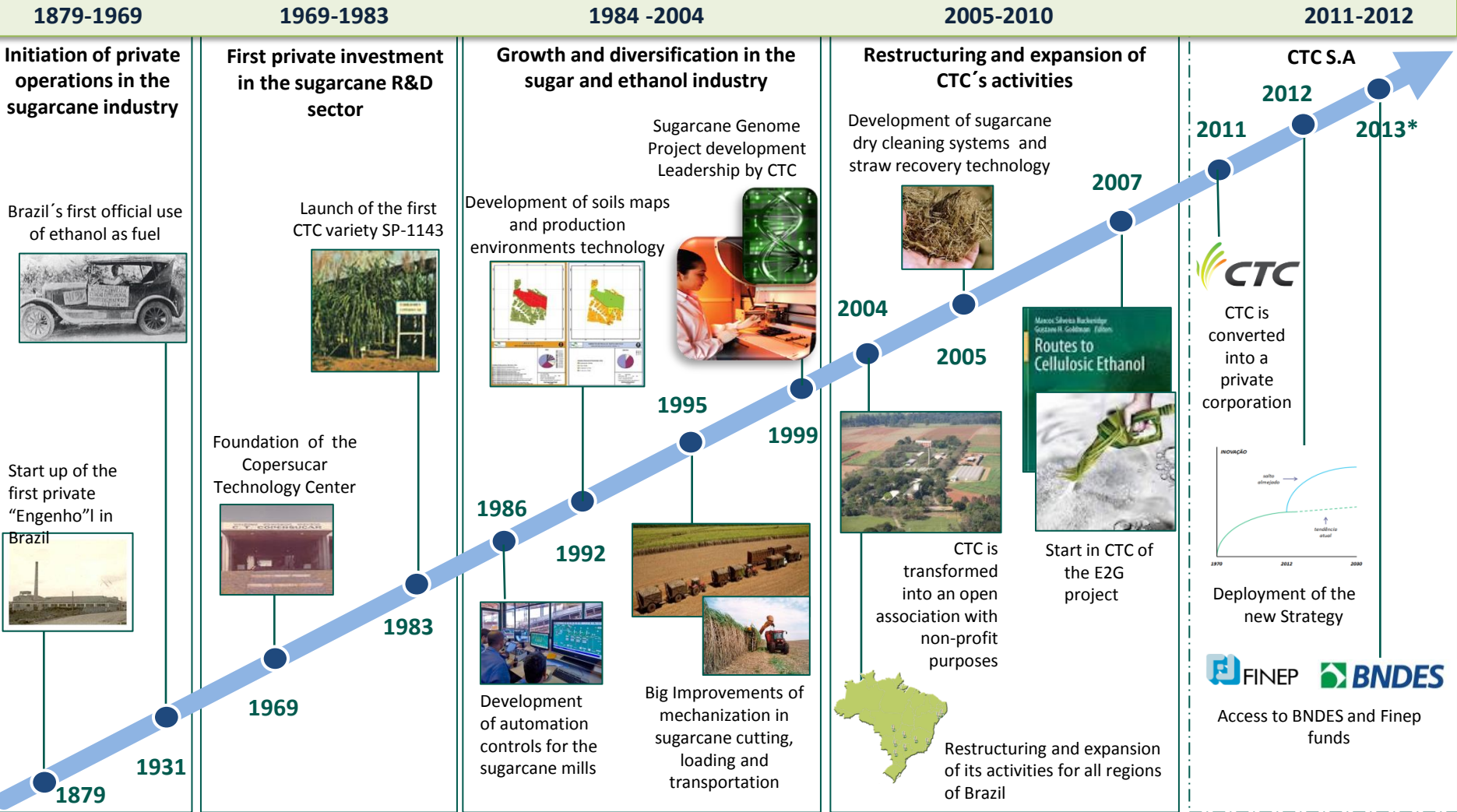


CTC Overview

Timeline



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CTC Evolution

2004



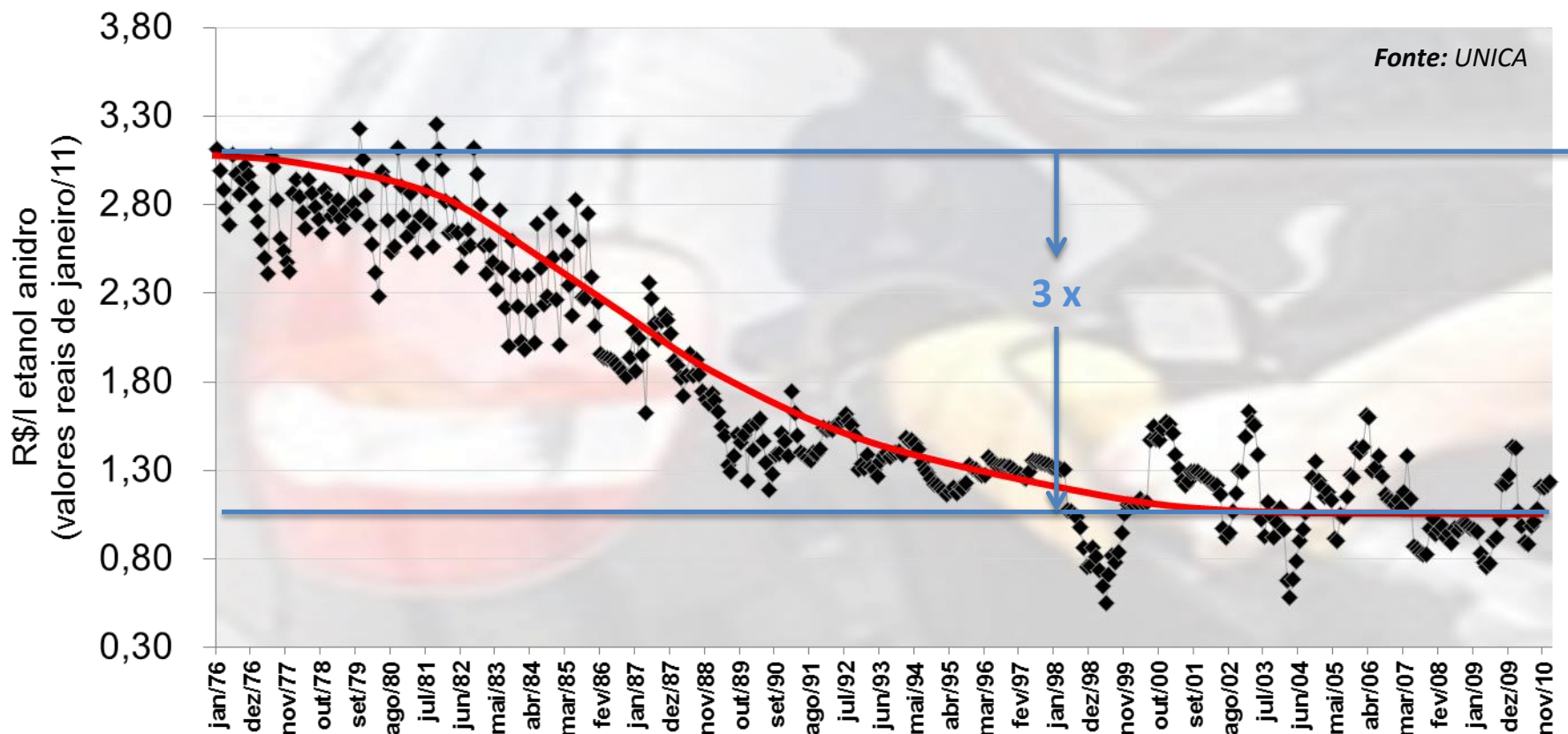
2012



From 2004 to 2012 - CTC has increased from 73 associated members up to 154 stakeholders , including 12 thousand cane growers.

Today this represent 60% of all sugarcane planted in Brazil

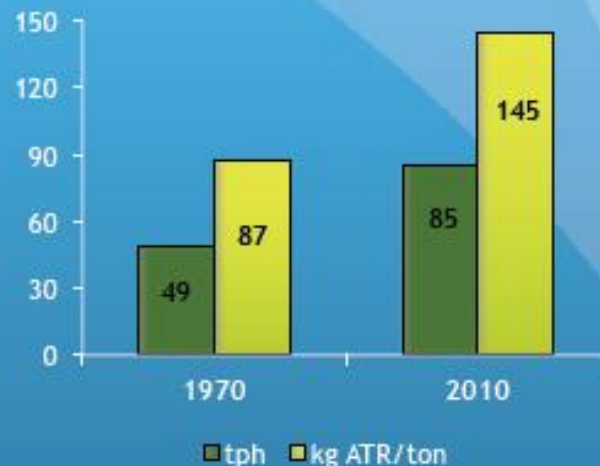
Ethanol price evolution (CONSTANT R\$ deflated jan 2011)



Last year : 97 kg products / TC or ~ R\$ 103,00/TC = 3 kg wax= 0,5 kg yeast extract
 Sugar in sugarcane 136,75 kg Total Sugars / TC Price of TS: R\$ 0,4728 1 TC: R\$64,66

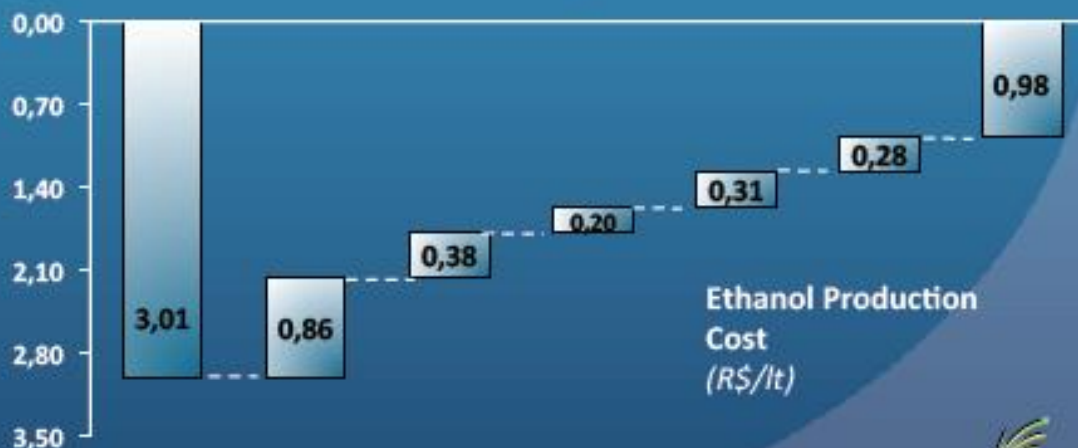
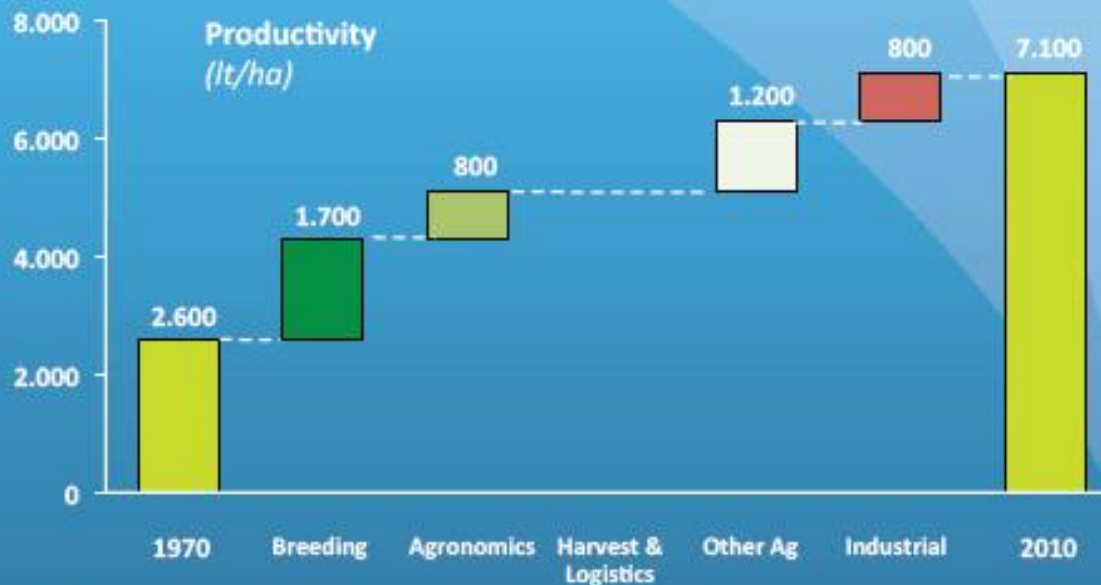
Technological development in all aspects of sugar & ethanol production led productivity to almost triple in the last 40 years.

- Sugarcane's productivity went from 3.5 to 10.5 tons of sugar per hectare.
- Additionally, development of new plant varieties enabled expansion towards more than 3 million hectares in new agricultural frontiers.
- CTC played a key role, while creating more than US\$ 200 billion of value in the period.



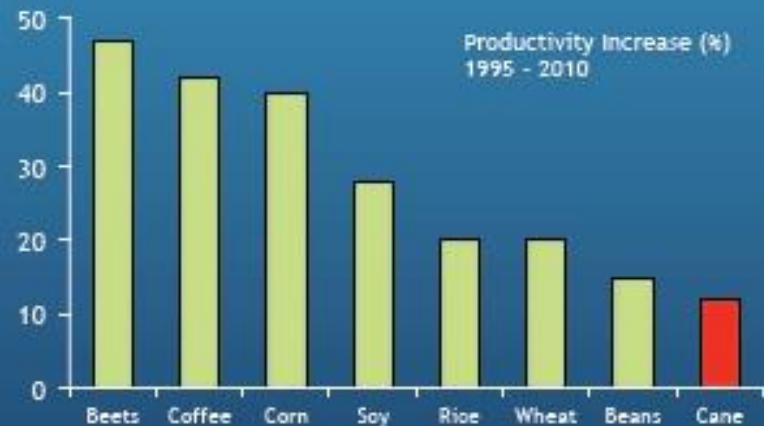
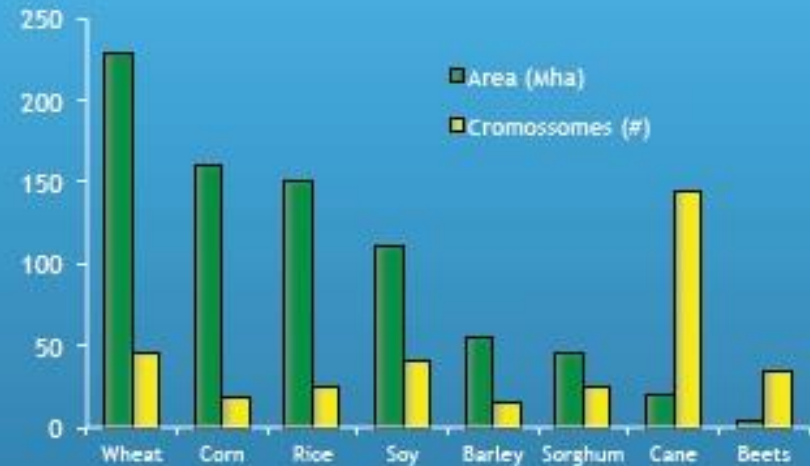
In the same period, ethanol production increased to 7,100 from 2,600 liters per hectare.

- The development of newer varieties generated 40% of the yield gains.
- Improved agronomic practices have allowed productivity to increase by 75%.
- The enhancement of industrial processes complemented the gains obtained in the fields.
- At the same time, different technologies made ethanol production environmentally friendly.

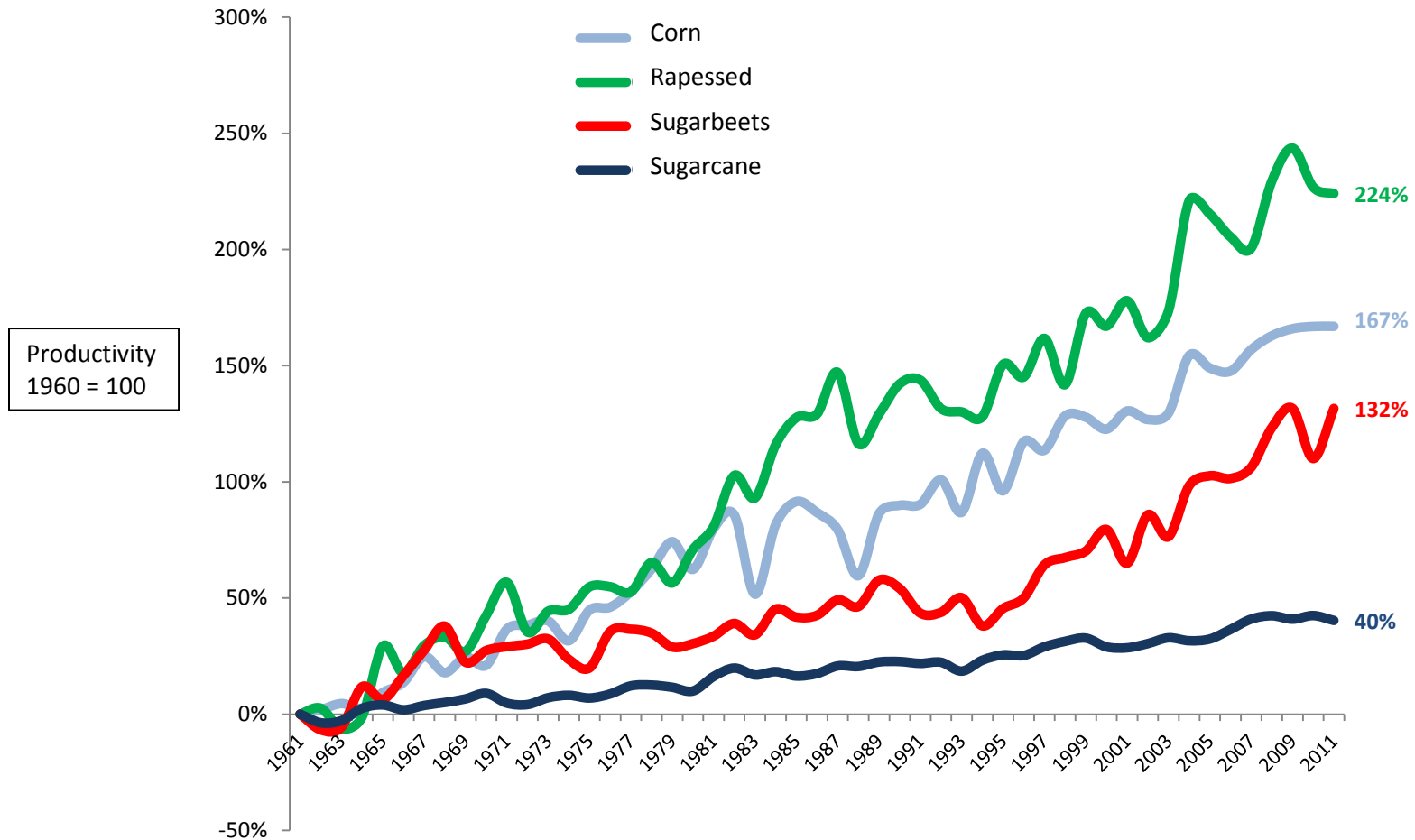


However, in the last 15 years, the productivity of other crops increased much faster than sugarcane's.

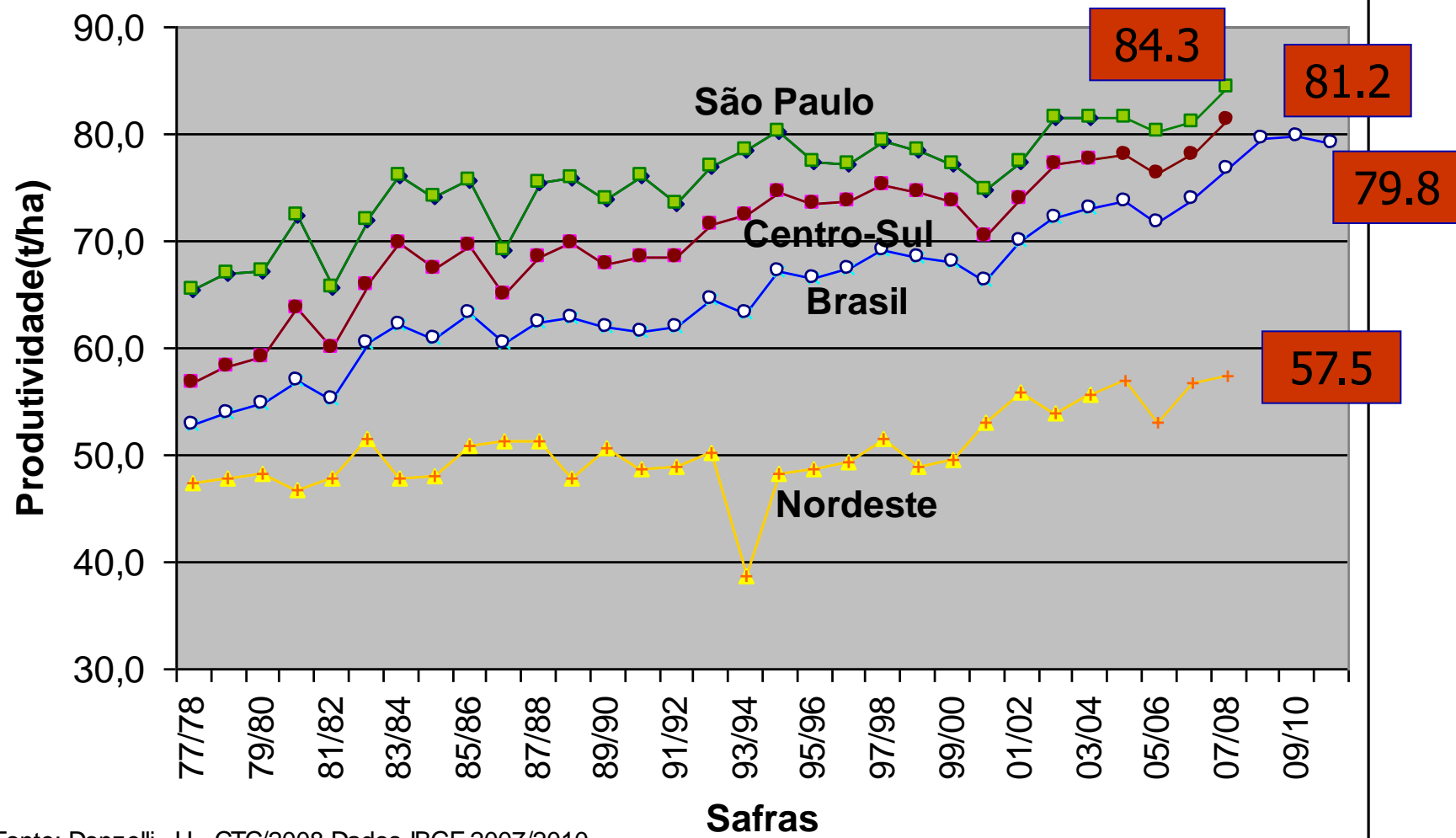
- While sugarcane's genetics is much more complex, its area is 8 times smaller than that of corn.
- These factors have made corn a preferential destination of R&D investments by large technology companies and institutions.
- Despite its unique potential, low R&D budgets have slowed down gains in sugarcane.
- As a result, in the last 15 years, sugarcane's productivity improvements lagged behind that those of most crops.



As a result, sugarcane was left far behind.

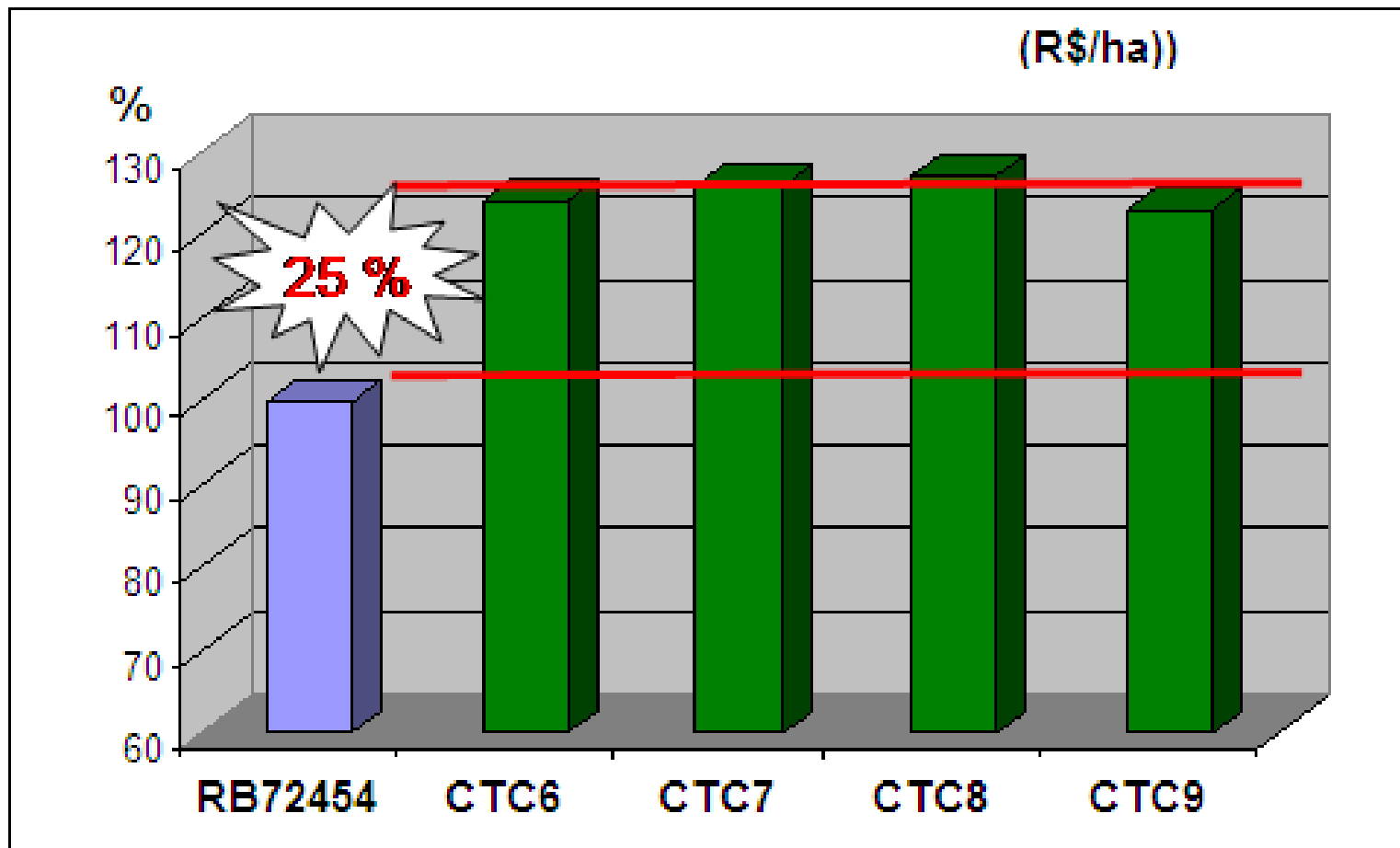


Produtividade por Regiões



Fonte: Donzelli, J.L., CTC/2008 Dados IBGE, 2007/2010

New Varieties benefits



Agro-Industrial Reference Unit - Processing Scales

Agricultural production + Logistics + Industrial Processing

