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Economics Manager

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Sustainability on Three Pillars

Biodiesel in Brazil:

Brazilian Vegetable Oil Industries Association
"change mitigation" sustainable development and climate fundamental tool to facilitate projects.

- As stated in preface, "this is a sustainable indicators for energy countries, GEBP developed 24 based on contributions from several.

**GBEP has 24 sustainable indicators**
The three pillars are equally important

- Environmental
- Economic
- Social
Economic: viability and efficiency

✓ Productivity
✓ Net energy balance
✓ Gross value added
✓ Energy diversity
✓ Infrastructure and logistics for distribution of bioenergy
✓ Capacity and flexibility of use of bioenergy
Fossil energy utilized for each unit of biodiesel produced per each soy biodiesel reaches 4.75 - this represents almost 5 units of soy biodiesel from vegetable oils has a high energy balance.

1% such as waste cooking oil – almost
Better usage of other raw materials,
Increasing participation
Animal fats and cotton oil have an
75% from 81% in previous year
Soy oil’s share reduced in 2012 to
Oils seeds productivity in Brazil
Brazil has 35 years of research into soybeans.

81% of global production.

Productivity
Oilsseeds productivity in Brazil

- Brazil - World interval

- Soybeans, cottonseed, and groundnuts are on state of the art technologies

- Other oilsseeds need investments

To raise yields


-4% 4% 1% -28% 46% -60%
Already deforested are suitable for planting over 7 million hectares (27,000 square miles).

Agro-Ecological Zoning for Palms
Soy Complex – 2013
Strategic Importance of this Sector
• Facilities spread on 15 out of 27 states of the federation
• 56 active factories
• Industrial capacity of almost 6.7 billion liters/year
Billion in diesel imports
Savings of more than US$ 7.5 billion
Brazil can increase production to 60% capacity utilization is around 1.000 m^3

Source: ANP.
same trucks which deliver diesel to São Paulo is transported by the production from Center-West region

- Biodiesel improved logistics of fuels

\[ \frac{\text{2008}}{\text{2012}} = -1.9\% \]

* Values as of Dez/2012. Deflator: IPA-10

Source: ESALQ-LOG/SIFRECA and ANP.
Incidence of occupational injury, illness and fatalities

Jobs in the biorenewables sector

Change in income

Price and supply of a national food basket
Inflationary impacts: tiny

- **Bus tariff:** +R$ 0,007/ticket
- **Food basket:** US$ 0,10/un
- **IPCA (consumer price index):** 0,021%
<table>
<thead>
<tr>
<th>Description</th>
<th>2018-2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiesel Program</td>
<td>104,295</td>
</tr>
<tr>
<td>Families benefited</td>
<td>1,519</td>
</tr>
<tr>
<td>Raw material acquisitions</td>
<td>1,519</td>
</tr>
<tr>
<td>Family</td>
<td>57</td>
</tr>
</tbody>
</table>
Represents about 1.5% of Brazil’s GDP

Soy complex generates about 1.5 million direct and indirect jobs; and

exporter.

This year, Brazil may become the world’s largest soy producer and be in exports.

In 2013, this crop will more US$ 45 billion, of which US$ 30 billion will

income, and is grown by more than 216,000 rural producers;

So is Brazil’s main agricultural crop, both in volume and generation of

Strategic Importance of this Sector
Social development through soybeans
Land use and land-use change related to bioenergy feedstock production

Biological diversity in the landscape

Water quality

Water use and efficiency

Emissions of non-GHG air pollutants, including air toxics

Soil quality

Life-cycle GHG emissions

Environment: Improvement
PRODUCTION STAGES

ABOVE

Carbon footprint of Brazilian soy biodiesel
CHG Reduction %

72
69

23.1 - 25.8

APRÓSOLA
ABÍOVE
ABÍOVE
ABÍOVE

83.8 gCO₂/MJ
European Diesel

Biodiesel B100

Carbon footprint of Brazilian soy biodiesel

Source: Delta CO₂ and ABÍOVE.
Pure diesel emissions: 85.2 g CO₂e/MJ

Air quality

Source: Delta CO₂
Emissions using Biodiesel

Reduction of non GHG emissions
Consequences of Zero Tillage

- Water conservation
- Less rainfall impact
- Soil cover protects it from the impact
- Consequences of soil structure
- Erosion
- Rivers and lakes
- Of reservoirs
- Damage and silting
- Pollution, road destruction

Consequences of Conventional Tillage

- The Niagara Falls
- Erosion
<table>
<thead>
<tr>
<th>Rainfall Runoff (mm/yr)</th>
<th>Erosion Losses (ton/ha/yr)</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>69.2</td>
<td>42.4</td>
<td>137.6</td>
</tr>
<tr>
<td>76</td>
<td>56</td>
<td>233</td>
</tr>
<tr>
<td>(reduction)</td>
<td>(tiltage)</td>
<td>(zero)</td>
</tr>
<tr>
<td>(%)</td>
<td>(tiltage)</td>
<td>(conventional)</td>
</tr>
</tbody>
</table>

Source: de Marfa et al., 1999

Annual Crops: ZT vs CT Average Soil & Water Losses

Brazil
Biological pest control
Seed inoculation
Other Techniques
Greater water retention
Reduction in carbon emissions
69% reduction in leaching
75% reduction in losses from erosion
No Till

Environmmentally Friendly Technology
Soybean Production in Brazil:
Challenges and Opportunities - Sustainability
Zero Tillage
The key to safe renovation of hill pastures

Foto: Prof. Hernani UFV
No Erosion

Initiation Rate.

Cover and high

Why Excellent

Soybeans planted on a 25% slope

Above
Above

Zero Tillage Increases Biological Activity

Roots penetrate fast over 20 holes/m², rainfall and into the soil up to 60 cm, with white grubs "corros" burrow.
Agrí-Silvopastoral Systems
A Solution from Minas Gerais
Sustainability: more production per area

Source: CONAB
Amazon Biomes

Million hectares in the Savannas and

Estimates indicate figures around 70

Now, most of Brazil's pastures are

Source of new crop areas: pastures
33 million hectares for crops
Paulo’s (1.4) could free up to

- Raising this yield to 540
  hectare / hectare
- Average national yield is 1
  significantly improve yields
  Investments in pastures can

Source of new crop areas: pastures
<table>
<thead>
<tr>
<th>Percentage of Soybeans Deforested</th>
<th>Soy Area (hectares)</th>
<th>Deforested Area in Biomem (hectares)</th>
<th>Poligons Monitored</th>
<th>Number of Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.41%</td>
<td>18,410</td>
<td>4.51 million</td>
<td>4,374</td>
<td>2012</td>
</tr>
</tbody>
</table>

Amazon Biomem factor in the deforestation of the Soybeans are not an important

Results of the Soy Moratorium
Environmental legislation

Stringent sustainability requirements

- **Areas of Permanent Preservation (APP):** The environmental legislation establishes the protection of areas bordering bodies and courses of water, springs, hillsides and hilltops.

- **Legal Reserve:** In addition to the APPs, landowners must also preserve a percentage of the native vegetation on their land, varying from 20% to 80% depending on the biome.
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