Brazilian Family Farming Agriculture in the Biodiesel Production: A Portrait of Regional Possibilities

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ABSTRACT

Brazil is a country deeply labeled by economic and social contradictions when the distinct regions are placed in comparison. The living conditions of peasant vary greatly according to region where he lives. After the promulgation of the constitution of 1988 policies aimed to remedy these regional imbalances, mainly related to rural people have been settled. In this sense, one of the governmental initiatives to lower this problem was the encouraging incentive program to cultivate castor beans and other crops by family farmers to produce biodiesel to share 50% of the mixture with mineral diesel in the proportion defined by law. The blend was initially 2% starting in 2006 and 5% until 2012. The Brazilian consumption of diesel oil in the 2006 was approximately 40 billions of liters in the transportation, agriculture and others sectors, so that a market of 800 millions of liters of biodiesel was suddenly created at attractive prices with total exemption from federal taxes. This paper analyzes what actually such market means in economic terms to various regions of Brazil. Two regions - North and Midwest still display a high degree of poverty for small farmers. The national biodiesel program may represent an interesting economical alternative for them.

Keywords: Family Agriculture Farming, Regional Planning, Biodiesel Production

1. Introduction

Brazil has 190.7 million people in 2010 [1] which represent the fifth most populous nation on earth, occupying an area of 8,760 thousand square kilometers. This population is distributed across the regions of Brazil as follows: Midwest MW (7.3%), North N (8.4%), Northeast NE (27.8%), South S (14.4%) and Southeast SE (42.1%). About 15.6% of the population lives in the rural area, distributed in the following way: MW (0.8%), N (2.1%), NE (7.4%), S (2.4%) and SE (2.9%). Over the past years, the country’s population growth has slowed the pace, which was very high until the 1960s. With a population density of 22 inhabitants per kilometer square, the main problem is still the endemic poverty and social imbalance in several regions, especially in the rural areas. The Table 1 shows the poverty distribution between 1996 and 2009.

The National Brazilian Biodiesel Program was created through the law 11,097 of January, 13, 2005. That decision was taken on the basis of several aims: to promoting

<table>
<thead>
<tr>
<th>Regions</th>
<th>1996 (%)</th>
<th>2009 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midwest</td>
<td>27.4</td>
<td>11.6</td>
</tr>
<tr>
<td>North</td>
<td>45.1</td>
<td>32.5</td>
</tr>
<tr>
<td>Northeast</td>
<td>61.4</td>
<td>39.6</td>
</tr>
<tr>
<td>South</td>
<td>25.7</td>
<td>11.6</td>
</tr>
<tr>
<td>Southeast</td>
<td>20.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Brazil</td>
<td>34.7</td>
<td>21.4</td>
</tr>
</tbody>
</table>

Source: IPEA (2010) [2] and PNAD/IBGE (2010) [3]. This percentage includes the extremely poor people defined on the basis of the value of a food basket with a minimum of calories needed to adequately supply a person, as recommended by FAO [4] and the World Health Organization. In Brazil (2009), this percentage is 34% of the total poor people.
regional sustainable development, to reduce social im-
balances, to reduce the rural exodus, to generate jobs and
income in rural areas, to reduce CO₂ emission caused by
the combustion of fossil based diesel and to reduce the
need for import of diesel. The initial 2% blend of bio-
diesel to mineral diesel becomes mandatory only in
January, 2008 and the expected mixture requirement was
the 5% by 2013. However, in the second half of 2008,
the government raised the mixture to 3% and in the sec-
ond half of 2009 to 4% and the initial target of 5% in
2013 was anticipated to January. The apparent success of
this program was due to the massive participation of the
major producers of soybeans and did not benefit the
small farmer, which was the original goal of the govern-
ment. In fact, the total of biodiesel in September 2010,
the soybean accounted for about 75% of the raw material,
coming from the major agro entrepreneurs instead the
family farmers. The soybean crop is a typical large scale
monoculture, responsible both for the expansion of the
agricultural frontier and deforestation of large areas. The
other raw materials are bovine fat (16%), cotton (6%)
and other crops (3%) [5,6].

The political decision of the society to face the rural
endemic poverty earned a landmark in Brazilian history
with the promulgation of the 1988s Constitution. The
social problems associated with the rural area, origin and
focus of a significant portion of the dynamics of gener-
atting poverty go beyond the peasant himself. In this
sense the large concentration of poverty in urban areas
has its origin from rural areas, where the peasant was
unable to survive. The combat against poverty had effect-
tively its beginning with the Cost and Benefits Acts of
1991 and take effect from 1992s, consolidating its posi-
tion between 1996s and 2006s, through the unification of
the Social Security and also a series of actions directed
in the rural area, origin and focus of a significant portion of the dynamics of generating poverty. The Social Security and also a series of actions directed in the rural area were causing a significant change in the socio-economic development. Since then, a set of financial instruments and actions have been directed to the rural sector:

   It is a debt financial instrument trade able in the
   stock market and secured by future harvest crop.

2) The National Program to Strengthen Family Agri-
   culture – PRONAF (1995) finances individual and
   group projects that generate income for family
   farmers and agrarian reform settlers. The program
   has the lowest interest rates in the rural financing,
   in addition to lower rates of default among credit
   systems in the country.

3) Program for Employment Generation and Rural
   Income - PROGER (1995): provides credit for the
   creation of small enterprises, cooperatives and as-
   sociative forms.

4) Guarantee of minimum agricultural prices (1996)
   to stabilize farmer’s income.

5) Program for the Debt Securitization (1995) given
   the high indebtedness of the sector. The debtor
   purchased the equivalent of its debt in ASTN
   (Treasury Certificates), with which he can repay
debts to banks operating in rural credit.

6) Special Program for Sanitization Assets - PESA
   (1998). It is a similar instrument to the previous
   item for large debts and payment schedules also
   higher.

7) Creation of Land Asset and Land Bank (97/98)
   regulated in 2001 with its establishment of settle-
ments under the responsibility of INCRA (National
   Institute of Colonization and Agrarian Reform),
   intensified after 1995.

8) Kandir Act (1996) to encourage exportation trough
tax waiver.

9) Option contracts establishment (1997). It is a kind
   of insurance that gives the producer the right to sell
   their product in the future to the government at a
   prefixed price.

10) Moderfrota (1999). It is a financing program for
   modernization and mechanization of agriculture.

    Economic subsidy granted those who are willing to
    purchase agricultural products at minimum price
    directly from the producer and promote its flow to
    a region of consumption.

12) Creation of the Ministry of Agrarian Development
    - MDA, initially by interim (1999) and confirmed
    by Decree (2004).

13) Storage Act (2000): Law No. 9973 which provides
    for the storage system of agricultural products.

14) Harvest Guarantee (2002), Law No. 10.420 estab-
    lishing the Fund for farmers who have suffered
    natural disasters, mainly a drought.

    10.696, art. 19 aim to purchase without bidding the
    food crops produced by FF.

16) National Program of Development of Rural Areas -
    PRONAT (2003). It is a training program in the ar-
    eas: social administration, economic strengthening,
    strengthening social networks and cooperatives and
    articulation of public policies.

17) New bonds for support of funding as the Certificate
    of Deposit Agricultural Law and Agribusiness
    Warrant CDA/WA (2004). It is a credit certificate
    that represents the promise of delivery of the agri-
    cultural product stored.

18) Family Farm Insurance - Proagro Mais (2004). It’s
    insurance for FF that aims to relieve the financial
    obligation against natural disaster.
The law No. 11 097, which establishes a minimum percentage blend of biodiesel to mineral diesel suddenly created a market of approximately 800 million liters of biodiesel at attractive prices in 2006. This market was promptly answered by the major farmers and by the large installed capacity of soybean oil (1 359 510 m³/year in June/2007 [6]). However, one of the goals of the government with the National Biodiesel Program was to help in eradicating poverty in rural areas with a program to cultivate other crops by FF to produce biodiesel to share 50% of the compulsory blend through the incentives coming from the creation of Selo Combustivel Social - social fuel seal, (Decree No. 5 297, Dec/06/2004). This seal aliviate federal tax for the industrial producers of biodiesel who acquire their raw material other than monoculture crop (typically associated with FF, like dendê palm fruit and castor bean) from FF. In addition, this seal gives also good financing conditions from federal government institutions. However, despite the efforts of the government, this program has failed mainly due to the inability of FF to self adjust in time to the demands of this new market. The industry, although keen to benefit from the fuel seal, can not acquire sufficient raw materials for biodiesel production from FF producers. The factors of such failure regarding FF producers can be briefly summarized:

1) High logistic and harvesting costs due to the micro pulverized production.
2) Low economies of scale compared with major agro entrepreneurs.
3) Lack of organizing into associations and cooperatives.
4) Low education degree and lack of technical knowledge associated with traditionally archaic workers.
5) Low utilization of agricultural machinery, artificial irrigation and fertilizer.
6) Lack of access to financing due to bureaucracy.
7) Lack of competitive prices for the biodiesel compared with other crops production, mainly associated with food production. Moreover, the castor oil has high viscosity and has good price on the market for lubricants. So the price offered by the biodiesel industry cannot compete with this market.

However, as will be shown later by comparing the agricultural census data, the policy of combating poverty in rural areas was a great success especially in the Northeast.

The National Brazilian Biodiesel Program certainly could become a valuable additional tool in this regard mainly for North and Midwest regions since some identi-
fied problems are corrected.

The detailed production costs of each crop vary widely depending on each region and are not available yet. However there is an estimate of the production cost of castor beans in Brazil (US$189.59/t), China (US$302.89/t) and India (US$423.32/t) [9] based on data published by FAO [4].

The Table 2 shows the more promising crops elected to produce biodiesel and the respective productivity in Brazil.

Suppose only as an example, a castor bean crop with a productivity of 0.7 ton Oil/ha/year, equivalent to 830 liters Oil/ha/year. In 2006 the diesel price at constant price of 1996 was about 0.5 R$ (96)/liter, without considering federal and local taxes. This gives an approximate value for the profitability (GPV) of 415 R$ (96)/hectare/year, which is lower only than the south FF profitability and considerably larger than the Northern (69.9 R$ (96)/ha) and Midwest (89.9 R$ (96)/ha) 2006 FF profitability (Table 2).

The Brazilian total diesel oil consumption in 2008s was 44 154 000 m$^3$. Assuming a growth rate of 4.6% per year seen in recent years we will have a consumption of 52 978 000 m$^3$ in 2012. The consumption of biodiesel established by law for this year is 5% of total diesel consumption, equivalent to 2 648 900 m$^3$. The government’s intention is to reserve half of this market for FF agriculture, equivalent to 1 324 450 m$^3$. To produce this amount of biodiesel we need 1 595 723 ha, representing approximately 5% of Northern and Midwest family farm area and 1.5% of FF total area. This numbers may seem insignificant to cause a difference in the development of these regions. However, it is important to remember that the National Biodiesel Program is only one of the several government actions for rural development and, beyond this fact the main government concern is not to cause food production shortages. In fact, the biofuels production, until now, has not threatened food production in Brazil [11].

3. The Brazilian FF Regional Portrait

3.1. The 1995/1996 Agriculture Census

In 1996 there were in the country a total of 4,859,864 farms covering an area of 353.6 million hectares, of which 4 139 369 were FF’s covering an area of 107.8 million hectares. They produced 37.9% of the total agriculture Gross Production Value (GPV) which was R$ 47.8 billion. Of the total R$3 707 112 thousands of funding only 25.3% were destined for the FF’s [7].

Table 3 shows the economic disparity existing between the Brazilian regions, particularly in relation to FF profitability per hectare in these regions in the 1996s.

The FF profitability in the South shows the major advantage compared to the other regions, especially North, Midwest and Northeast, setting up a portrait of the historical imbalance noted in the Introduction to this work. The causes of this imbalance, by one side are intuitive and easy to point up in a generic way. However, it is difficult to prove statistically, due to the scarcity of reliable data and absence of time series. Some evidence, however, can be raised and provide a clue to establish which factors

<table>
<thead>
<tr>
<th>Crop specie</th>
<th>Productivity (ton/ha)</th>
<th>Oil percentage (%)</th>
<th>Oil prod. (ton/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elaeis guineensis</td>
<td>15 to 25</td>
<td>20</td>
<td>3 to 6</td>
</tr>
<tr>
<td>Helianthus annuus</td>
<td>1.5 to 2</td>
<td>38 to 48</td>
<td>0.5 to 0.9</td>
</tr>
<tr>
<td>Ricinus communis (castor bean)</td>
<td>0.5 to 1.5</td>
<td>43 to 45</td>
<td>0.5 to 0.9</td>
</tr>
<tr>
<td>Arachis hypogaea (peanut)</td>
<td>1.5 to 2</td>
<td>40 to 43</td>
<td>0.6 to 0.8</td>
</tr>
<tr>
<td>Glycine max (soybean)</td>
<td>2 to 3</td>
<td>17</td>
<td>0.2 to 0.4</td>
</tr>
<tr>
<td>Gossypium hirsutum (cotton)</td>
<td>0.86 to 1.4</td>
<td>15</td>
<td>0.1 to 0.2</td>
</tr>
<tr>
<td>Jatropha curcas (physic nut)</td>
<td>2 to 12</td>
<td>50 to 52</td>
<td>1 to 6</td>
</tr>
</tbody>
</table>

Source: Meirelles, F. S. [10].

Table 3. Family farm in Brazilian regions: FF number, covered area, Gross Production Value GPV, total funding and profitability by hectare in Reais of 1996s (R$ 96/ha).

<table>
<thead>
<tr>
<th>REGION</th>
<th>FF Number</th>
<th>Área</th>
<th>GPV</th>
<th>Total Funding</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast (NE)</td>
<td>2055.2</td>
<td>34043.22</td>
<td>3026.90</td>
<td>133.973</td>
<td>88.91</td>
</tr>
<tr>
<td>Midwest (MW)</td>
<td>162.1</td>
<td>13691.31</td>
<td>1122.70</td>
<td>94058</td>
<td>82.00</td>
</tr>
<tr>
<td>North (N)</td>
<td>380.9</td>
<td>21860.96</td>
<td>1352.66</td>
<td>50123</td>
<td>61.88</td>
</tr>
<tr>
<td>Southeast (SE)</td>
<td>633.6</td>
<td>18744.73</td>
<td>4039.48</td>
<td>143812</td>
<td>215.50</td>
</tr>
<tr>
<td>South (S)</td>
<td>907.6</td>
<td>19428.23</td>
<td>8575.99</td>
<td>515862</td>
<td>441.42</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>4139.4</td>
<td>107768.45</td>
<td>18117.73</td>
<td>937828</td>
<td>168.12</td>
</tr>
</tbody>
</table>

Source: Censo Agropecuário IBGE 1995/1996 [12]; and GUANZIROLI and CARDIM (2000) [7].

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or variables affecting the profitability of FF.

Figures 1 to 8 show the importance of some variables social, economic and technological in the Profitability (R$/ha) for the year 1996. As can be seen there is a systematic and coherent behavior in these curves showing a strong correlation between profitability and the chosen variables. Such results are expected corroborating the common sense. The variables affecting the Profitability (R$/ha) in the Figure 1 to Figure 8 are:

**Figure 1**: Percentage of rural population of the region with low scholarity (over 4 years and under 1 year of schooling).

**Figure 2**: Total funding for the FF by region per hectare.

**Figure 3**: Total investment for the FF by region per hectare.

**Figure 4**: Percentage of FF in the region that uses technical assistance.

**Figure 5**: Percentage of FF in the region that uses electricity.

**Figure 6**: Percentage of FF in the region that uses fertilizers and soil correctives.

**Figure 7**: Percentage of FF in the region that uses soil conservation techniques.

**Figure 8**: Percentage of FF in the region that uses only mechanical force more animal traction.

The southern region by far comes in the first place, followed by the southeast region that have the highest profitability per hectare.

### 3.2. The 2006 Agriculture Census

Table 4 shows the evolution - 1995/96 to 2006 of profitability at constant 1996 value (R$ (96)/ha) of FF in each region of the country. The 2006 monetary value was adjusted to 1996 by the General Market Price Index of the Fundacao Getulio Vargas - IGMP/FGV (2009).

The real growth of profitability of FF in the Northeast region was 85.9% between 1996 and 2006, corresponding to an annual rate of 6.4% per year. This rate was well above the rate of growth in other regions, including Brazil as a whole, which was 24.8% or 2.2% per year.

The other regions had the following growth rates: Midwest of 9.6% or 0.9% per year; North 5.8% or 0.9% per year; Center 24.4% or 2.2% per year; and South 4.9% or 0.5% per year.
per year; Southeast 29.7% or 2.6% per year and finally the Southern, traditionally with the highest rates, 14.6% or 1.4% per year, showing a sign of exhaustion for its expansion capacity.

Others reasons of the growth of profitability per hectare in the various regions of the country, besides the mentioned, were identified by the authors during the execution of several works by the Institute for Electrical Energy and the University of São Paulo - IEE/USP [13-18]. It was perceived that the government actions led to enormous transformation and increased economic metabolism [19], expanding capacity, quality and capillarity of the production, distribution and final destination of goods and services. At the same time innovative businesses appeared and some socioeconomic activities have been strengthened. For example, the agrotourism and related activities and goods production, the local supply networks establishment, homeownership program, school meal program, the National Biodiesel Program and others that heated the whole market and added value to goods and services. Besides these factors it is worth to emphasize the increased prices of some agricultural products, primarily driven by increased exports.

The Northeast was the region most favored by the policies, programs and government actions during the period corresponding to the two Censuses. This choice was justified by the FF amount and by the socio-economic and inhospitable climate associated to the region.

4. Conclusions

The recently published 2006 Agriculture Census initiated several comparative studies in relation to the 1995/96 Agriculture Census on the family farm in Brazil, showing in detail the evolution of this segment in the decade considered. What is evidenced in this work is the qualitative transformation of FF Northeast between 1996 and 2006, which at the beginning of the period crawling with other poor regions of the country. During the decade reaches growth rates much higher than the rates in regions traditionally vigorous as to maintain the trend, supplant them.
in a few years, breaking the old paradigm of endemic poverty. This was the result of applying a consistent public policy and a lot of money on significant projects for the economic and social development of the countryside region. Among the programs to combat poverty in rural areas the government created the PNPB - Biodiesel Production and Use National Program, which results in this regard were a failure in these six years of existence. The reasons for this failure were briefly outlined in Section 2 and should be considered in the continuation of this government program, especially if applied in the regions North and Midwest, whose FF workers, although has improved their living conditions over the past ten years continue with high level of poverty.

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