

PERSPECTIVES FOR THE BIODIESEL PRODUCTION AND THE BRAZILIAN FAMILY FARMERS IN THE SEMI-ARID REGION

Abstract: The demand expansion for biofuels from oleaginous plants (biodiesel) can effectively represent an opportunity of employment and income generation for the small family farms in the Northeastern semi-arid region as intended by the current government. This is due to some arboreal and shrubby plants whose characteristics are favorable to oil production that may foster family farms in terms of hand labor availability. There are, however, two main obstacles which are not appropriately addressed by the current official incentive policies: the first one concerns the fragility of productive structure of the family farms in the region, specially the lack of the producers' self organization capacity; the second one is related to agronomic problems of the main crops still to be properly addressed by additional research investment. The solution for both limitations demands a great effort of rural extension and agronomic research.

Keywords: Family Farm, Brazilian Semi-Arid Region, Biodiesel.

1. Introduction

The idea of the biodiesel¹ in Brazil started in the Northeastern Region, more precisely in the State of Ceará in the 1970's in the Federal University of Ceará, whose objective was to find alternative sources of energy. After studies developed by Brazilian researchers for the production of a substitute for diesel oil, Brazilian Government was motivated to propose some public policies and programs (Pro-oil – Plan on the Production of Vegetable Oils for Energetic Use;

¹ The biodiesel is a substitute for the diesel oil obtained from vegetable and animal oil or residual oil through a chemical reaction. So there are several processes patented to get biodiesel. However, the most used process in the world is the transesterification ethyl and methyl reaction

OVEG – Vegetable Oil Program; PROBIODIESEL – Brazilian Biodiesel Program and; Green Fuel Program).

However, none of these programs reached sufficient repercussion to stimulate the biodiesel commercial production in the country. It was only after almost three decades from the beginning of the researches in the country and a decade of lagging behind the United States and behind some European countries that the Brazilian government launched a program to stimulate the biodiesel commercial production: National Program of Production and Use of Biodiesel (PNPB). It was launched in 2004.

The official launching of the National Program of Production and Use of Biodiesel (PNPB) as originally drafted opened one more alternative for the income and job generation for family farms in the country. This program aims at the insertion of family farmers in Brazilian Agribusiness through supplying raw material (vegetable oils) to the industrial sector. A whole set of incentives was finally established, such as fiscal exemption, financial subsidy and the creation of compulsory market for the biodiesel among other measures.

This paper aims at analyzing the perspectives on the production of biodiesel in the Semi-arid Northeastern Region based on this government new agro-industrial policy. Thus, this paper was divided in four sections, besides this introduction. The second section presents the characteristics of the Brazilian Semi-Arid Region such as space delimitation, geographical, climate and soil aspects and socioeconomic analysis. In the third one, there is an analysis of the production of agricultural energetic cultures in the semi-arid region. In the fourth section, the analysis aims at the National Program of Production and Use of Biodiesel (PNPB), especially its regulatory framework and the advancements reached in the period. Finally, the last one carries out an analysis on the principal results, challenges and perspectives for the biodiesel production in the Brazilian semi-arid region.

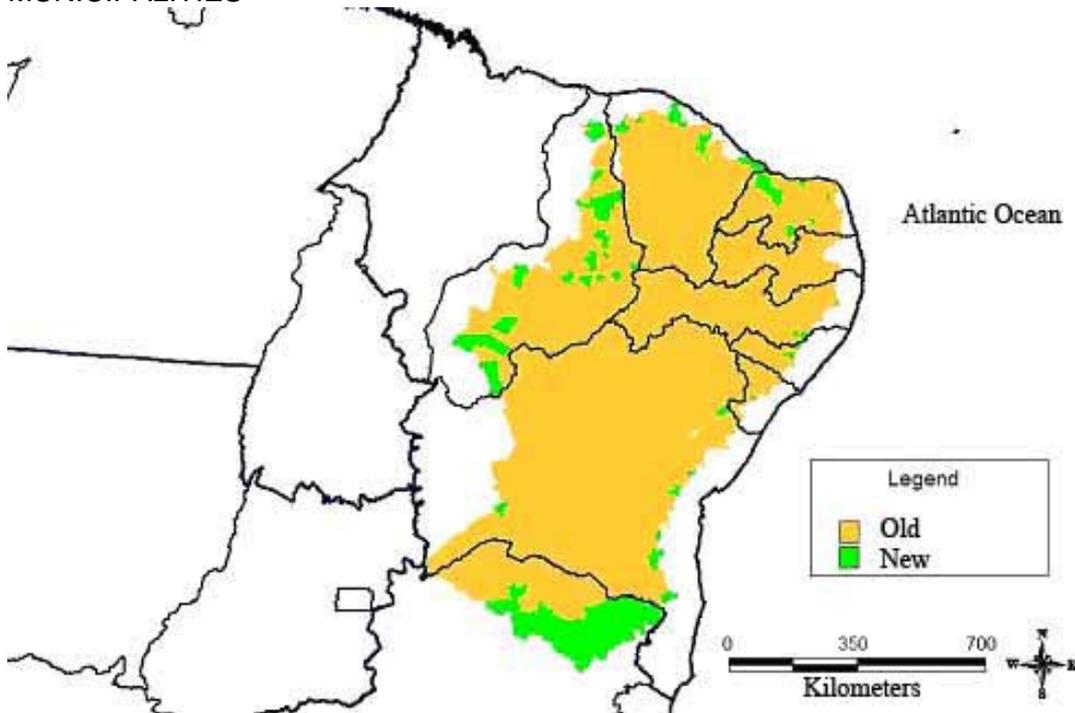
2. Brazilian semi-arid region: some characteristics

Brazilian Semi-arid was defined by Law nº 7.827, December 27th, 1989, as “the region included in the responsibility of Northeast Development Superintendence (SUDENE), with an annual rainfall average of less than or equal to 800 millimeter (...)”. In 2005, the Integration Ministry changed the delimitation of Brazilian Semi-arid Region based on new technical criteria²: i) annual rainfall average less than 800 millimeter; ii) acidity rate up to 0.5 calculated by water balance; and iii) risk of drought is more than 60%.

These three criteria were applied to all the municipalities that belonged to the management area of the former SUDENE, also including municipalities in the Northern part of the state of Minas Gerais. This methodology brought about the incorporation of 102 new municipalities to the list provided by the former SUDENE, so that the semi-arid region is composed now by 1,133 municipalities distributed in eight States of the Brazilian Northeastern Region (Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe e Bahia), and the North of Minas Gerais State, occupying an area of 969.5 thousand Km² (map 01).

² This updating study was performed by the Inter-ministry Working Group established under the Government Regulation nº 6, March 29, 2004, issued by the National Integration and Environment Ministries.

MAP 01 – NEW DELIMITATION OF THE BRAZILIAN SEMI-ARID REGION PER MUNICIPALITIES



SOURCE: Prepared by the authors based on MMA, 2007. (Ministry of Environment)

The caatinga ecosystem dominates the Brazilian semi-arid region, which is characterized by arboreous and shrubby vegetation and which is distinguished by spines and wilting species with high degree of xerophitism. This ecosystem is also characterized by low rainfall, whose rate is from 500 to 700 millimeters per year. In some regions, as in Ceará, some periods have an average rate exceeding 1,000 millimeter per year, but the average rate in other regions is equal to or less than 200 millimeter.

These soils are sandy or sandy-clay, very poor in organic matter, but with a certain amount of calcium and potassium. The flat and rocky soils derive mainly from crystalline rocks which are practically impermeable, and in which the possibilities of water accumulation are restricted to the fractured zones.

Around 21 million people live in this region, corresponding to 12% of the Brazilian population and 43% of the Northeastern one. Approximately 9 million souls (around 43%) live in rural areas (table 01). This is the poorest Brazilian region, where around 49% of permanent private householders received an average income of up to 1 Brazilian minimum wage (around US\$ 180 per month) (map 02). The social programs of income transfer in the region are

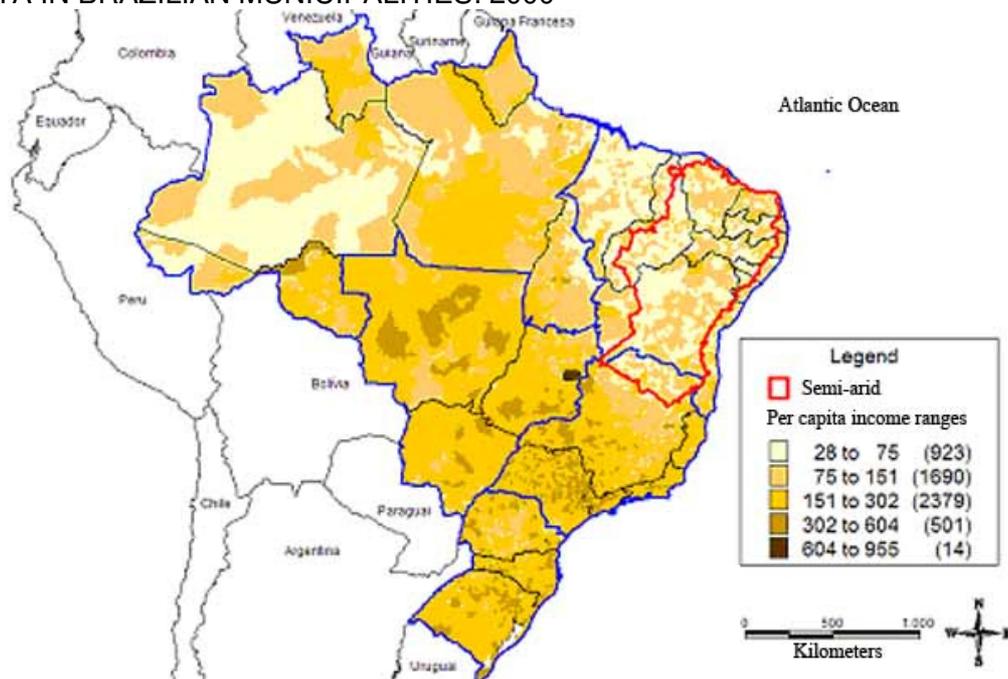
responsible for half the income of 20% of the population (IBGE, 2000). The small family farm ³ can be basically characterized by the low levels of capital availability for investment, education and technical qualification.

TABLE 01 – TOTAL RURAL AND URBAN POPULATION OF THE BRAZILIAN SEMI-ARID ACCORDING TO THE DEMOGRAPHIC SENSUS DATA 2000

Brazilian States	Total	Rural	Urban
Alagoas	844,560	398,509	446,051
Bahia	6,214,670	2,897,320	3,317,350
Ceará	3,847,792	1,649,828	2,197,964
Minas Gerais	1,256,491	580,227	676,264
Paraíba	2,112,817	828,555	1,284,262
Pernambuco	3,166,813	1,339,273	1,827,540
Piauí	1,179,444	565,839	613,605
Rio Grande do Norte	1,837,311	625,640	1,211,671
Sergipe	469,632	183,664	285,968
Total	20,929,530	9,068,855	11,860,675

SOURCE: Prepared by the authors based on IBGE, 2000.

MAP 02 – SPATIAL DISTRIBUTION OF MONTHLY AVERAGE INCOME PER CAPITA IN BRAZILIAN MUNICIPALITIES: 2000



SOURCE: Prepared by the authors based on PNUD (2003).

³ According to the National Program for the Family Farm Strengthening (Pronaf) all farmers classified as family producers, regardless ownership conditions of land, shall observe the following requirements: i) shall not have, in any circumstance, an area bigger than four fiscal modules calculated by law in force; ii) shall use predominantly familiar hand labor; iii) shall get familiar income from activities associated with agricultural property; and iv) shall live on the establishment or in a place nearby.

3. The production of energetic crops in Brazilian semi-arid region

From this new energetic perspective Brazilian Semi-arid Region presents peculiar features that can look very attractive for the biodiesel production, especially in the family farm context. This region, as mentioned before, is characterized by high participation of small-scale subsistence family farm in the whole agriculture production, whose hand labor is underused. It means that, the energetic crops present a high occupancy potential for this semi- idle hand labor and monetary income generation.

This refers to the growing of shrubby varieties of oleaginous plants such as Babassu nut (*Orbignya phalerata*, Mart), Castor Bean (*Ricinus communis* L) and Barbados nut or Physic nut (*Jatropha curcas* L.) whose production demands an intensive hand labor. These crops have a higher productivity of oil per hectare, but they still need investments in research (table 02).

TABLE 02 – POTENTIAL AGRICULTURAL RAW-MATERIAL AND MAIN ENERGETIC CROPS FOR BIODIESEL PROCESSING IN BRAZIL

Species	Production System	Content of oil (%)	Efficiency Cycle (in years)	Harvest months	Productivity (oil ton /ha)
Avocado oil	Intensive Labor	7 - 35	7	12	1,3 - 1,5
Cotton seed oil	Mechanized	15	Annual	3	0,1 - 0,2
Peanut oil	Mechanized	40 - 43	Annual	3	0,6 - 0,8
Babassu palm	Intensive Labor	66 ¹	7	12	0,1 - 0,3
Canola oil	Mechanized	40 - 48	Annual	3	0,5 - 0,9
Coconut oil	Intensive Labor	55 - 60	7	12	1,3 - 1,9
Sunflower oil	Mechanized	38 - 48	Annual	3	0,5 - 0,9
Castor bean oil	Intensive Labor	43 - 47	Annual	3	0,5 - 0,9
Palm oil	Intensive Labor	20	8	12	3,0 - 6,0
Barbados nut oil	Intensive Labor	28 - 37	Average 40	It is not uniform	3,0 - 4,0
Soybean oil	Mechanized	17	Annual	3	0,2 - 0,4

SOURCE: Prepared by the authors based on NOGUEIRA, 2002 *apud* MEIRELLES DE SALLES (2003, p. 11); ARRUDA et al. (2006); & AMORIM (2005, p. 41).

It is also important to note that the growing of raw-material crops for biodiesel processing may and should be done together (associated) with other crops (traditional crops), especially subsistence crops originating from Brazilian semi-arid region. Within the energetic crops already mentioned the castor bean is the most important one, due to its traditional growing and its adaptability to soil and climatic features in this region (table 03).

TABLE 03 – AGRICULTURAL ZONING OF CLIMATE RISK FOR NORTHEASTERN BRAZILIAN STATES WITH THE FORSEEN CROPS EXPECTED IN THE PRODUCTION YEAR 2006/07

Northeastern Brazilian States	Crops				
	Palm oil	Castor bean	Cotton seed	Sunflower	Soybean
Alagoas					
Bahia					
Ceará					
Maranhão					
Paraíba					
Pernambuco					
Piauí					
Rio Grande do Norte					
Sergipe					

SOURCE: CHING & RODRIGUES (2007, p. 33).

Castor bean, whose scientific name is *Ricinus communis* from *Euphorbia* family; it is also known in Brazil as *mamoneira*, *ricino*, *carrapateira*, *bafureira*. It is the main energetic crop encouraged by PNPB to be cultivated by family farms, especially in Brazilian Northeastern Region. In Brazil, castor bean species vary in size and in the content of oil in seeds.

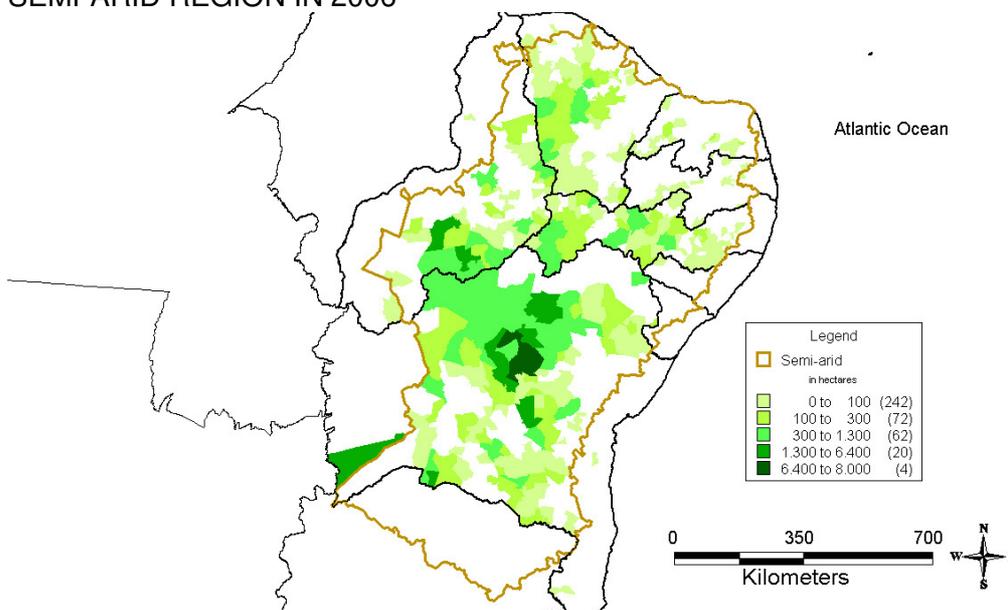
Concerning the cropping systems, they also differ according to the region, the varieties and the biological cycle of species. For example, in the Brazilian Northern and Northeastern Regions the castor bean plants are very tall (over two meters) and, consequently, it is difficult to adopt mechanization (BIODIESELBR, 2007 & SANTOS & BARROS, 2003).

Within the species cropped in Brazil, *Mamoneiras BRS 149 Nordestina* and the *BRS 188 Paraguaçu Cultivar de Mamona* may be put in relief. The first one has an average height of 1.9 meters, oil content around 48.9% and even without fertilization it can produce about 1,500 kg/ha of seeds, or approximately 750 kg/ha of oil. This is in the Brazilian semi-arid region. The BRS 188 reaches an average height of 1.6 meters, oil content is around 47.7% and an average productivity without fertilization is around 1,500 kg/ha of seeds, also in the Northeastern semi-arid conditions (BELTRÃO et al., 2002 & PAULA NETO & CARVALHO, 2006).

However, the average productivity per hectare registered in the late harvests, castor bean crops reached 750 kg/ha, without irrigation, but with appropriate technology and handling this productivity can be tripled (SANTANA, 2003).

In Brazilian Northeastern Region castor bean is cultivated in conditions of drought, without irrigation, being the state of Bahia the most important national producer of castor bean, responsible for 78% of the national production (168,8 thousand tons) and 85.9% of registered production in the Northeastern Region (154 thousand tons) in 2005. But, in 2006, due to climate problems and pests, the castor bean national production suffered a strong reduction of 43.5% over the previous year. The production volume in 2006 reached only 94.9 thousand tons, of which the Northeastern Region was responsible for 83.2 thousand tons (IBGE, 2007b & MAPA, 2007) (map 03).

MAP 03 – CASTOR BEAN HARVESTED AREA IN BRAZILIAN NORTHEASTERN SEMI-ARID REGION IN 2006



SOURCE: Prepared by the authors based on IBGE, 2006.

Finally, it is worth mentioning that the Northeastern producers do not use selected seeds, but they use seeds obtained directly from other producers (SILVA, 2006), which may explain the high diversity of species (castor bean), the low productivity and vulnerability to climate changes and to pests attacks. Thus, it is necessary to foster genetic improvement to search more resistant

and productive seeds, both in terms of oil content and in seed productivity per hectare, as well as appropriate technical guidance to family farmers (GARCIA, 2007).

4. National Program of Production and Use of Biodiesel in Brazil (PNPB)

It is a program of Inter-ministry nature launched by Federal Government, whose official launch was December 2004⁴. This program has as its main general objective the sustainability implementation in technical, economical and environmental terms for biodiesel production and use in Brazil. It also aims at the social inclusion and regional development, especially job and income generation for family farm.

To reach the objective proposed on this program, Federal Government, ministries and other institutions⁵ are making use of many instruments of public policy to stimulate the biodiesel production together with family farming.

Some instruments that are worth mentioning are the creation of compulsory market; the adoption of total or partial federal tax exemption (table 03); the standardization of ICMS (Tax on the Circulation of Goods and Services)⁶; financial subsidies through specific lines of financing, among others (table 04).

Brazilian government, by means of specific legislation⁷, will ensure the market demand for biodiesel for an indeterminate period, independently of transaction and production costs. As a result, Brazilian government determined that from 2008 until 2012 a compulsory mixture of 2% biodiesel will be added to

⁴ The launching of National Program for Production and Use of Biodiesel was issued with its regulatory framework and fiscal targets (Decrees nº 5.297 and 5.298, 6th December 2004; and the Decree nº 5.448, 20th May 2005; and subsequently, the Law nº 11.097, 13th January 2005).

⁵ Entities with relative autonomy within the public administration.

⁶ ICMS convention Nº 113, 6th October 2006, which defined a percentage of 12% for some state taxes – ICMS – (CARVALHO, 2006). This means that besides Federal Government partial or total exemption offer for the federal tributes, it is also trying to avoid the incident of a fiscal war between the states of the federation in the investment attraction for the biodiesel production.

⁷ The Law that disposes over the introduction of biodiesel in Brazilian energetic matrix is the Law nº 11.097/2005.

diesel oil and, from 2013 on, it will turn to 5%⁸. The commercialization of biodiesel in the Brazilian market will adopt the voluntary mixture, an intermediary phase, of 2% mixture of biodiesel and it will be in the form of public auctions, organized by the National Agency of Petroleum, Natural Gas and Biofuels (ANP).

Regarding fiscal issues, the Brazilian Government through law n^o 11.116/05, that regulates on the total or partial exoneration of the federal tax on biodiesel (PIS/PASEP – Social Integration Program - and COFINS – Social Security on Financing Contribution), proposed the following table of fiscal exemption: 31% reduction for castor bean and palm oil produced by agribusiness in Brazilian Northern, Northeastern and semi-arid regions; 68% reduction for family farms in any region of the country and with any oleaginous plant and a 100% reduction for castor bean and palm oil produced by family farms in Brazilian Northern, Northeastern and semi-arid regions (table 04).

TABLE 04 – THE PIS/PASEP AND COFINS ALIQUOTS ON BIODIESEL

Regions / raw material	IPI*	CIDE	PIS/PASEP and COFINS (R\$/L of the biodiesel)	
			Without Social Label	With Social Label
Northern, Northeastern and Semi-arid				
Castor oil and Palm	Exempt	Tax relief	R\$ 0,150	R\$ 0,00
Other raw materials	Exempt	Tax relief	R\$ 0,218	R\$ 0,07
Middle West, Southeast and South				
Any raw materials	Exempt	Tax relief	R\$ 0,218	R\$ 0,07

SOURCE: Prepared by the authors based on MDA, 2006.

N. B. According to Decree n^o 5.298/04.

Regarding the state taxation a Standard Aliquot for the Tax on the Circulation of Goods and Services (ICMS) (ICMS Convention n^o 113, 6th October, 2006) was established, which decided for a 12% aliquot for all the Federation States.

The Federal Government is trying to stimulate the production and use of biodiesel through the offering of credit lines subsidized to agricultural and

⁸ However, the CNPE, through Resolution n^o 3, September 23, 2005, anticipated for January 1st, 2006 the compulsoriness of B2 mixture, whose obligatoriness will be restrict to the biodiesel volume produced by industrial producers granted with "Social Fuel Label".

industrial producers. Nevertheless, a great part of the financial subsidies is linked to projects that aim at the integration of the family farms in the biodiesel productive chain, that is, the granting of the Social Fuel Seal by industrial producers.

In this way, the Ministry of the Agrarian Development (MDA) created some instruments for the financing of the production of oleaginous plants, which were incorporated to the National Program for the Strengthening of Family Farms (Pronaf) (CARVALHO, 2006):

- i) Pronaf biodiesel: credit for the production costs of oleaginous plants, which will not jeopardize the already financed cultures (0.5% interest rate per year with a 2-year lack). However, Pronaf biodiesel will attend only family farmers with gross income of up to R\$ 4000,00 yearly, providing a credit limit up to R\$ 1.500.00 per operation. There will also be a credit line about R\$ 10 million for the harvest 2007/08, but these farmers will also be able to finance sugar-cane growing for the ethanol production (MDA, 2007a), that is, besides the insufficiency in the volume of resources that were released for the production of raw materials for biodiesel, these activities will have to compete with the sugar-cane cultivation;
- ii) Pronaf Agro-industry: machines and equipments for the industrial process of compressing (raw oil) and transesterification (biodiesel). The harvest plan 2007/08 does not consider the production of biodiesel separate from other activities, so, for this harvest year the family farmers will have to compete with all the projects of this kind, that is, in fact, there is not a Pronaf Agro-industry for the biodiesel for this harvest year and the same is valid for the next two instruments;
- iii) Pronaf infrastructure: there is a support to the productive arrangement in the territories. This group is not listed in the harvest plan 2007/08 of the MDA either; and
- iv) Pronaf diversification, training, Ater⁹, innovation and inputs.

⁹ Technical Assistance and Rural Extension (ATER in Portuguese).

At the same time, the National Bank of Economic and Social Development (BNDES) launched the Program of Financial Support to Investments in Biodiesel, which consists of : bank participation in up to 90% in industrial projects that hold the Social Fuel Seal, and up to 80% for other projects; FINAME (Special Industrial Financing Agency) for the acquisition of machines and equipments ratified the use of at least 20% of the biodiesel mixture (B20) to the diesel oil, with amortization term 25% longer and reduction of real guarantees from 130% to 100% of the financed amount, with differentiated interest rates according to the size of the undertaking (table 05) (MME, 2004).

TABLE 05 – CRITERIA TO ACCESS BNDES CREDIT LINES

Type of industrial undertaking	Criteria	
	With SCS ¹	Without SCS ¹
MPME's ²	TJLP + 1% p.y.	TJLP + 2% p.y.
Big Enterprise	TJLP + 2% p.y.	TJLP + 3% p.y.

SOURCE: Prepared by the authors based on MME, 2004.

N. B.1) Social Fuel Seal; 2) Micro, Small and Medium Enterprise; 3) Long Term Rate Interest.

At the same time, Federal Government has also introduced the “Social Fuel Seal”. This seal is an identification component to be granted to the industrial biodiesel producers who are promoting family farmers to be included into the agribusiness.

Thus, following the premise of Decree nº 5.297, and the objectives of the program itself, MDA established the Normative Instructions nº 01/2005 and 02/2005, which dispose over Label Social Fuel granting. In the first instruction it was defined that for the producer to receive this seal the following requirements are necessary: the industrial producer is to acquire minimum percentages of the raw material from family farms which are framed in Pronaf (50% for Brazilian Northeastern and semi-arid region; 30% for Brazilian Southeastern and Southern regions; and 10% for Brazilian Middle Western and Northern regions) (map 04)¹⁰; and the industrial producer shall keep records with documents

¹⁰ This percentage was changed by the MDA through the Normative Instruction nº 1, 19th February, 2009. It provides the criteria and procedures for the granting, maintenance and use of

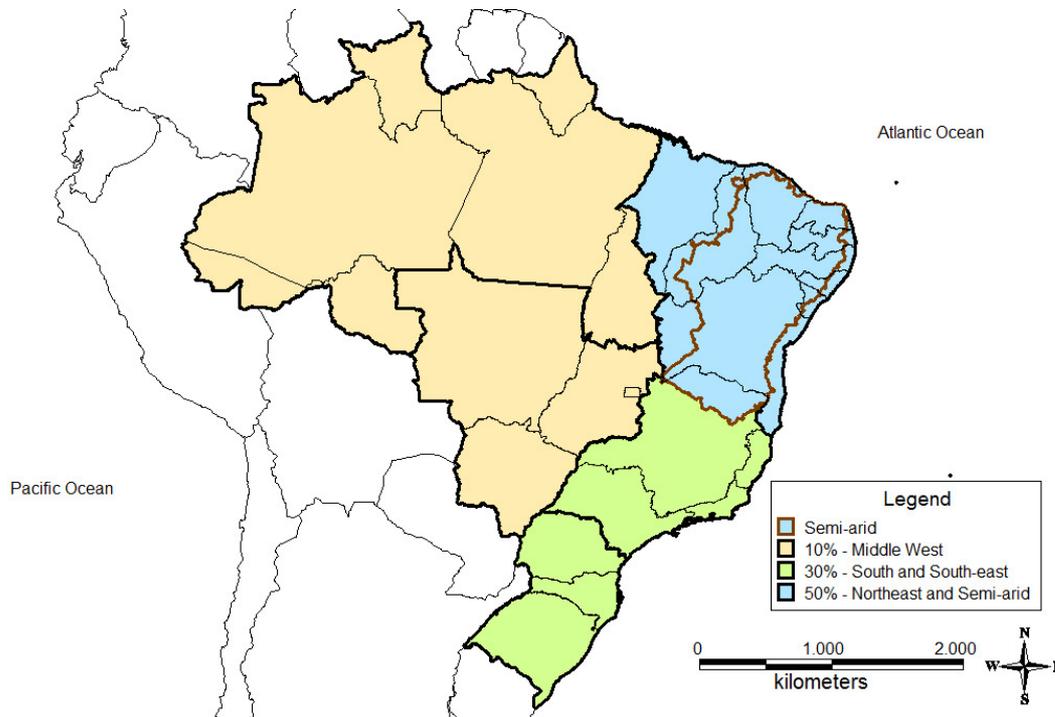
certifying the total purchases of annual raw materials during a five-year period; the industrial producer has also to provide technical assistance and training to all family farmers who supply the raw material¹¹. This Normative Instruction also concerns the contracts to be established between the industrial biodiesel producer and the family farmer. The industrial producer will have to assign separate contracts with all the family farmers and their representatives, at least with one of them¹².

the Social Fuel Sea, for the following percentages: 10% from the harvest 2009/2010, and 15% from the harvest 2010/2011 for the acquisitions coming from Brazilian Northern and Middle Western Regions; and 30% for the acquisitions coming from Brazilian Southern, Southeastern and Northeastern and semi-arid regions (Brazil, 2009).

¹¹ This activity may be developed by the biodiesel factory itself or by **contracted** institutions. Nevertheless, the industrial producer will have to prepare a plan to supply the assistance and technical training, which are compatible with the acquisitions from the family farms and with the principles and directives of the National Policy of Technical Assistance and Rural Extension of MDA.

¹² This negotiation may be made with: a) Labor Union of Rural Workers or Workers in Family Farms or Federations adopted to the National Confederation of the Workers in the Agriculture (National *Confederacies of Agriculture Workers* - Contag); b) Labor Union of Rural Workers or of Workers in the Family farms or Federations adopted to the Federation of the Workers of the Family Farms (*Federação dos Trabalhadores da Agricultura Familiar* – Fetraf); c) Labor Union of Rural Workers or Family Farms connected with the National Association of the Small Farmers (ANPA); and d) other institutions accredited by MDA.

MAP 04 – SPATIAL DISTRIBUTION OF MINIMUM PARTICIPATIONS OF FAMILY FARMS IN THE PRODUCTIVE CHAIN OF BIODIESEL UP TO 2009



SOURCE: Prepared by the authors based on IBGE (2007a) & BRASIL (2005a; 2005b). N.B. For the Middle Western and Northern Regions it will be 10% until the crop of 2009/10 and 15% from the crop of 2010/2011; for Northeastern, Southern, Southeastern and semi-arid it will be 30% (Brazil, 2009).

These contracts must have at least these items: i) the contractual deadline; ii) the raw material purchase cost (seeds or oil); iii) the readjustment criteria of contracted price (raw material price); iv) raw material delivery conditions; v) contractual safeguards; and vi) the identification and agreements of contractual terms of family farmer's representative who took part in the negotiation process.

The Second Normative Instruction, in turn, differs from the first one only when it regards the physical and institutional state of the industrial unit. While the First Normative Instruction deals with firms already established (in operation), the second one deals with projects of the future constitution of enterprises and/or industrial plants (still as projects and / or in construction phase). In other words, the projects will have to present all the requisites included in the First Normative Instruction to obtain the MDA certificate attesting that the project has all the requirements for the Social Fuel Seal.

Summarizing, the biodiesel industrial producer or entrepreneur who gets this Social Fuel Seal will receive fiscal incentives and will have access to better conditions of financing and even facilities for the commercialization of their product¹³. That means that the biodiesel industrial producer who is granted the seal will get a differentiated reduction of federal tributes (PIS/PASEP and COFINS)¹⁴, will benefit from better financing conditions by BNDES and its financial accredited institutions or, even, by other financial institutions that have special programs for the financing of projects connected with the production of biodiesel when family farms are integrated. This seal may also be used aiming at the enterprise commercial promotion (MDA, 2006).

Finally, it is important to discuss the main characteristics of the Brazilian biodiesel market. After the creation of biodiesel compulsory market, the regulations about commercialization were carried out by the Ministry of Mines and Energy (MME), which established (through Decree nº 483 of October 3rd, 2005) the directives for biodiesel acquisition through public sale auctions. The public auctions will be carried out by ANP, at the transitory phase.

These public auctions were framed as public bidding, with every bid being done electronically. These auctions must be in accordance to the Regulation for the Acquisition of Goods and Service Contracts of the ANP¹⁵.

The biodiesel industrial suppliers interested in participating in these auctions shall observe the following requisites: a) to be granted with the Social Fuel Seal or to present a production project recognized by MDA as the owner of the necessary requisites to get the Social Fuel Seal and; b) to present the

¹³ The commercialization of biodiesel in Brazil will be carried out, at the intermediary period, through public auctions, which will be organized by the National Agency of the Oil (ANP).

¹⁴ This exemption is not exclusive of producers granted with the seal, according to law nº 11.116/05, that disposes total or partial exoneration from federal tributes on biodiesel (PIS/Pasep and COFINS). All the producers who attend the requisites will have benefits from the fiscal exemption.

¹⁵ For each auction there will be an edict, which rules on the volume of acquisition and delivery conditions; the participation conditions; the producer accrediting; the electronic sending of price proposals; the divulging of the price proposals; the formulation of the bids (lowest price), that is, ANP presents a maximum price and based on this reference price the producers will make their bids presenting inferior prices to this reference price; the judgment of the price proposals; the competence (legal; fiscal regularity; financial-economical qualification and the presentation of the documents); the refutation of the convocation act and of the explanations, the resources; the adjudication, the homologation; the administrative sanctions; purchasers of the biodiesel to be offered; and general dispositions.

following documents: i) ANP authorization to produce biodiesel in the country and; ii) Special Register at Brazilian Federal Revenue.

Until December 2008, twelve auctions had been carried out and the total volume reached was 2.25 billion liters of biodiesel. Out of this volume, around 885 million liters should have been produced and delivered by December 2007. Out of this volume (that should have been delivered) around 335 million liters were (or should have been) produced in Brazilian Northeastern Region, where the participation of family farms reaches at least 50% of the raw material supply (seeds or oil). Another important issue about biodiesel commercialization is the average discount achieved at the first five public auctions, whose average rate was in general -6.2% below the opening price (table 06) and the late two ones – 22.3% discount was reached.

TABLE 06 – PUBLIC AUCTIONS HELD BY ANP BETWEEN 2005 / 2007

Characteristics	Public Auctions				
	1	2	3	4	5
Date when they were held	11/05	03/06	07/06	07/06	07/07
Volume (10 ⁶ liters)	70.0	170.0	50.0	550.0	45.0
Supplied volume (10 ⁶ liters)	92.5	315.5	95.4	1.054.5	143.0
Number of suppliers	8	12	6	27	6
Opening price (R\$/liter)*	1.920	1.908	1.905	1.905	1.904
Average sale price (R\$/liter)*	1.905	1.86	1.754	1.747	1.8621
Discount (%)	-0.8	-2.5	-7.9	-8.3	-2.2
Delivery deadline	01/06 to 12/06	07/06 to 07/07	01/07 to 12/07	01/07 to 12/07	12/07
Target public	Producers already installed or in final phase of operation	Producers already installed or in final phase of operation	Producers already in operation	New projects	-

SOURCE: Prepared by the authors based on MME, MDA e ANP (2007) *apud* Carvalho (2006), p. 26.
N. B. * Includes Federal Taxes (PIS/COFINS), but not ICMS.

As a result from these public auctions the incentives adopted by Brazilian government are encouraging the construction of this new productive chain, especially based on firms granted with the Social Fuel Seal. According to ANP (2008), in December, 2008 the productive capacity authorized by the agency

had already achieved the volume of 3.76 billion liters per year¹⁶, distributed in 62 industrial plants (table 07). This table also shows the regional distribution according to the volume traded at public sale auctions and the industrial capacity authorized by ANP. The active participation at public sale auctions of enterprises located in the Northeastern Region is clear.

TABLE 07 – NUMBER OF PRODUCTIVE PLANTS; AUTHORIZED CAPACITY IINSTALLED BY ANP AND VOLUME NEGOTIATED AT BIODIESEL AUCTIONS: January 30, 2008

Region	Number of industrial plants per region	* Annual authorized capacity (m³/year)	Total volume per region negotiated at the auctions (m³) **
Middle West	27	1,380,563	642,599
Northeast	8	720,264	601,500
North	6	203,040	159,520
Southeast	14	751,197	361,851
South	7	704,746	489,530
Total	62	3,759,810	2,255,000

SOURCE: Prepared by the authors based on ANP (2008).

N.B * 360 days. ** The included negotiated volumes at the 6th and 7th public sale auctions.

Around 2.25 billion liters of biodiesel were negotiated at public auctions, where practically all the bidders were seal holders (the bidders with no seals were responsible for only 1% of the average volume negotiated). So far it seems that an integration of family farms to biodiesel agribusiness has been taking place.

Considering the legislation that stipulates the minimum participations of family farms per region (map 04), it is estimated that a volume around 636.4 million liters of biodiesel was produced or will be produced by family farms. In other words, nearly one third of all the biodiesel traded at public sale auctions was or will be produced made from raw material supplied by family farms in Brazil.

The production capacity until January 2008 already provides subsidy to CNPE – National Council Energetic Policy (CNPE) to determine a new

¹⁶ This volume would be able to receive the addition of approximately 10% biodiesel to diesel oil, according to estimates based on Brazilian diesel oil consumption in 2005, which reached a volume of about 38 billion liters.

anticipation of compulsoriness of the biodiesel mixture to the diesel oil, at least in terms of industrial dynamics.

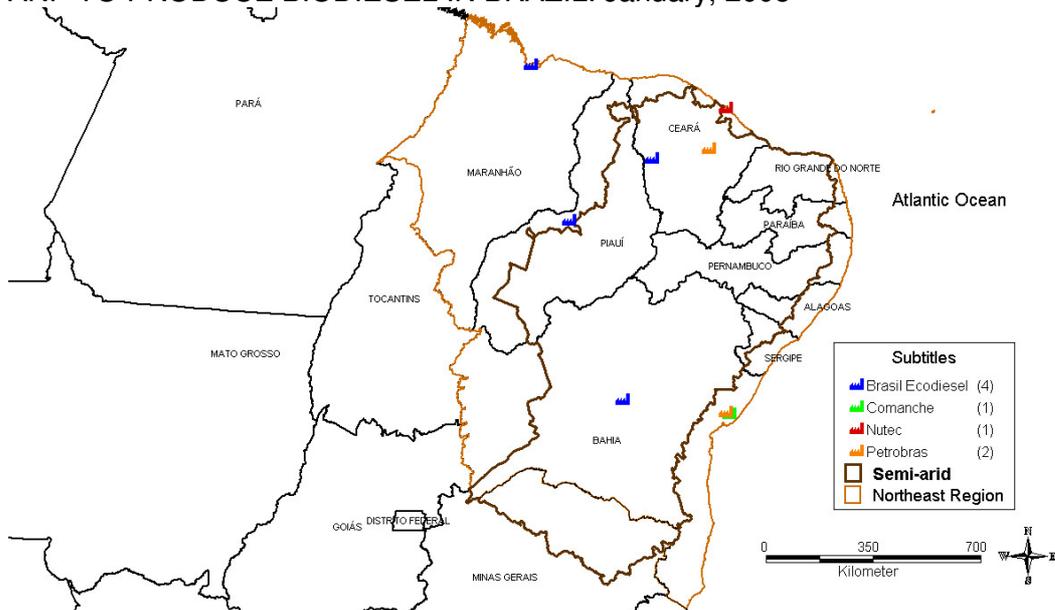
5. Results, challenges and biodiesel production perspectives in Brazilian semi-arid

The Northeastern Region and, consequently, the Brazilian semi-arid region have an outstanding position compared to other regions in the country, regarding the oleaginous plants (species) accessibility in terms of oil productivity per hectare/year (table 02), though these species demand intensive hand labor. This last aspect is highly positive, once there are around 50% of farms considered family farms that are placed in the Northeastern Region, with about 6.8 million inhabitants, which represents half of Brazilian family farmers.

The incentives proposed by PNPB that clearly favor the integration of family farmers to biodiesel agribusiness, especially in the Northeastern Region, made the region turn into an attractive spot for investments in the biodiesel processing sector. Around three years after PNPB was launched these regions (Brazilian Northeastern and Semi-arid Region) became responsible for 19% of the national installed capacity of biodiesel processing (720.3 million liters). About 27% (601.5 million liters) (table 07) of all biodiesel traded in all public sale auctions until December 2008 (2.25 billion liters – table 07) come from firms that are settled in that region.

It is important to emphasize that out of eight industrial plants authorized by ANP to produce in the Northeastern Region, seven have already been granted with the Social Fuel Seal. These plants have capacity of about 719.4 million liters, which represents around 21.3% of the national capacity in this category (MDA, 2008). Also, out of seven industrial plants settled in the Northeastern Region awarded with the seal, four industrial plants are in the semi-arid region and the other two are very close to this region (Comanche and Petrobras) (map 05).

MAP 05 – SPATIAL DISTRIBUTION OF INDUSTRIAL PLANTS AUTHORIZED BY ANP TO PRODUCE BIODIESEL IN BRAZIL: January, 2008



SOURCE: Prepared by the authors based on ANP (2008).

Therefore, it is important to observe that there was a positive response, at least from the industrial sector in terms of objectives proposed by PNPB, especially concerning the granting of the Social Fuel Seal in these regions. However, when it comes to the effective integration of Northeastern and Semi-arid family farmers to biodiesel agribusiness, there are still many challenges to be overcome by industrial producers and family farmers as well.

These challenges are particularly related to the organizational structure of agricultural production, which involves a greater commitment of the industrial and agricultural sectors, representative institutions from both sectors and the government itself. The main actions will be the development of policies that may minimize other demands, especially regarding historical -social issues and the researches on the potential oleaginous species related to both plant cultivation and industrial processing.

These demands are associated with farmers' empowerment, especially concerning basic and high school education, their capitalization in the beginning of the production, creation of transportation facilities to make a net of small suppliers feasible for the industrial sector and guarantees of minimum price for raw material or final product that will be integrated in the production of

energetic crops and biodiesel. Another important aspect is the technical and bureaucratic issues, which are directly related to crops developed by family farmers. An example of such thing occurred in 2007, when technicians from the Ministry of Agriculture, Livestock and Food Supply (*MAPA*), started an operation to confiscate seeds of Barbados nut (*Jatropha curcas L.*) in Brazil, because this species had not been registered in *MAPA*¹⁷ yet.

It is also quite important that scientific research aims at Brazilian Northeastern and Semi-arid Regions to promote energy crops production that can be based on dry agriculture, that is, with no need of irrigation, mainly those of the perennial oleaginous plants, because these plants would be more resistant to periodic droughts that occur in these regions. As these plants demand less intensive cultural treatments, “it would liberate” the rural worker to grow or to develop complementary crops in his property (System of Joined Production).

The adoption of other crops is explained due to PNPB preference for castor bean, which is an annual crop and which in recent years has presented a reduction in productivity and consequently in the 0 total production of the Northeastern Region. It is important to emphasize that the castor bean oil presents many applications such as in prosthesis for human bones, in the manufacture of paint and isolating material, as lubricant for aircrafts, as a compound for cosmetics manufacture and for many different kinds of pharmaceutical drugs. The castor bean oil is also used in the manufacture of dyes, anilines, disinfectants, germicides, low temperature lubricating oils, glues and adhesives, fungicides and insecticides, printing paint and varnishes, besides nylon and plastics in which that are of great importance (ODETE, NARCISO & CARVALHO, 2004).

In short, it is clear that despite the extremely positive response from the industrial sector to the objectives proposed by PNPB because of the industrial structure built in Northeastern and Semi-arid Region in a little more than three years, there still is a series of other challenges, especially in the political,

¹⁷ The seed of Barbados nut was not registered in the National Registry Cultivars (*RNC*) so its crop would not be respecting Law nº 10.711/2003, which provides for the production, the processing and the trade of seeds and seedlings in Brazil.

organizational, technical and scientific field. To overcome these challenges it is necessary an actual and effective inclusion of family farmers to the biodiesel agribusiness. Otherwise a new concentration in the processing of biofuels may come up in Brazil, based on a single raw material and on a large agricultural and industrial property.

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