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# Soybean Production and GMO Issues in Brazil

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## Summary

Based on data collected and research done in Brazil, this paper tries to show the situation of soybean production in Brazil. Soybean production is in a time of great change, technologically and socio-logically speaking, due to the commercialisation of GMOs. In the midst of this change arises the question of whether one should adopt the new products and ideology created by transnational corporations. Brazil's two most important competitors, the U.S.A. and Argentina, have already adopted the new technology and increased their soybean production. This situation has made the Brazilian government and farmers insecure and willing to accept whatever helps increase their productivity and the economy. Indeed, one may well ask whether the country will be able to survive in the international market if it does not adopt the new reality. However, this is not the only concern regarding these changes; consumers in Europe, Japan and even the United States are questioning the usefulness and safety of the new technology. NGOs and some scientists are concerned about its effect on the environment. Lawyers in Brazil are pushing for legislation to make labeling the products developed with this new technology mandatory in order to let consumers know how they were produced. The decision-makers do not know what to do about this difficult situation, with economics on one side and environmental and consumer concerns on the other. It seems that only time will tell where Brazil will find itself in this situation. Meanwhile, small family farmers are struggling to survive against heavy competition and stay away from the political controversy over GMO issues. In this paper, we also examine their situation and provide some alternatives to help them.

## 1. Introduction

Brazil is a great producer of agricultural products. Among them, soybeans lead the agricultural sector in terms of production value. No other export products approach the value of soybean complex exports. Since the 1970s, a soybean boom has happened in Brazil, as a result of growing demand for soybean products and the industry's response to changes in capacity that have been shaped by public policy. In the mid 1990s, soybeans occupied about 25 per cent of total area harvested. Now, Brazil is the world's second largest soybean producer and accounts for 20 per cent of world production and 21 per cent of world exports. The soybean industry's rapid expansion has had profound impacts

on Brazil's agriculture and economy.

This paper is based on the information collected during interviews and a field survey conducted in Brazil, August 2000. What we are mainly concerned with here is the current and future situation of Brazil's soybean industry under the global market restructuring caused partly by the commercialization of new biotechnology, because soybeans are one of the main targets of genetic engineering.

The introduction of genetically modified organisms (GMO) in the international market is changing beliefs and raising questions about food safety into the country. The entire world is discussing what to do about the new biotechnology and its products. Currently, in Brazil, it is forbidden to grow GM crops on farmland, bring-

ing a lot of controversial debates inside and outside the country. One part of the Government is interested in approving such seeds, while consumers and NGOs are concerned about food and environmental safety. Some countries that import soybeans from Brazil don't want to buy GM products, while the Brazilian competitors in the international market are improving their productivity due to the new biotechnology, threatening the position of the second largest soybean exporter. So, the point we must clarify in this paper is how competitive market conditions and global disputes over GMOs are influencing Brazilian policies, industries' responses, and consumers and farmers' attitudes.

## 2. Soybeans in Brazil<sup>1</sup>

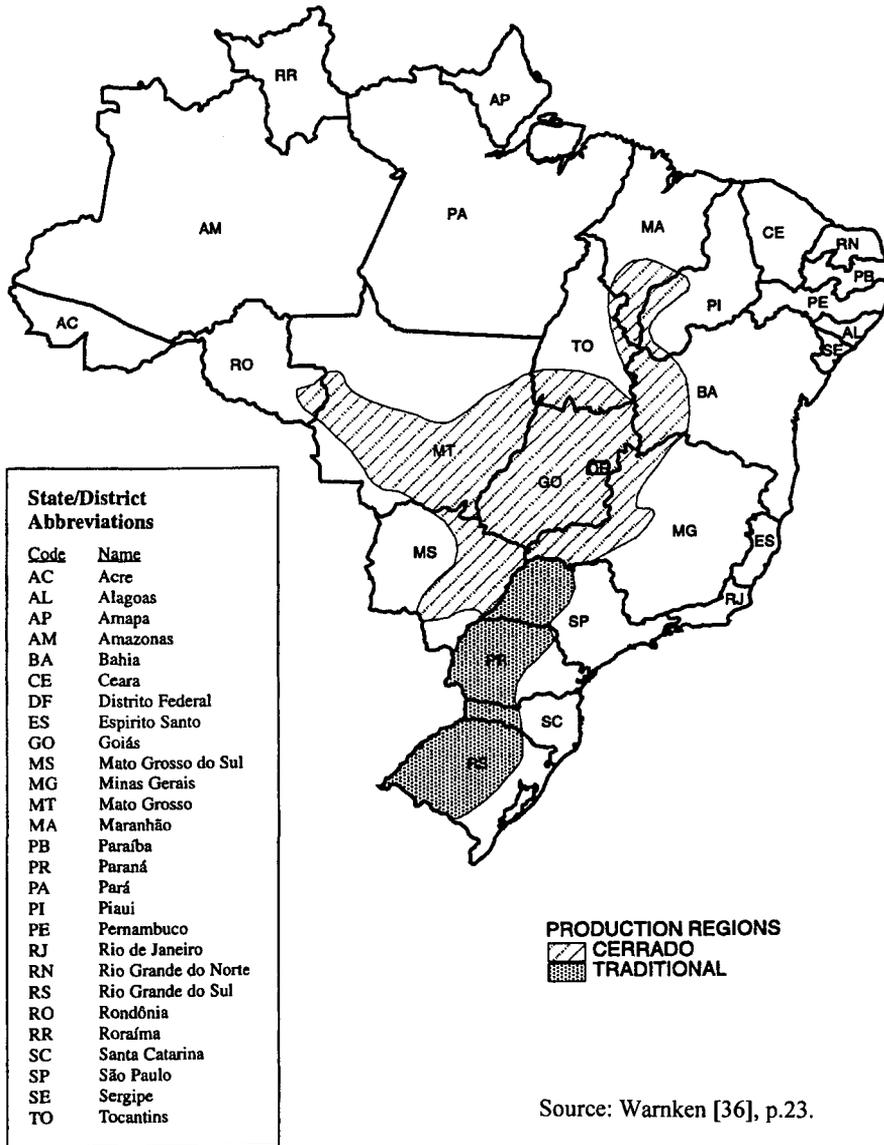
### 2. 1 Outline of Soybean Production

Various conditions brought about the Brazilian soybean boom. The most popular answer is that Brazil's soybean production growth was simply a response to sharp shifts in domestic and world demand for soybean products. However, even this most important external factor is not simple. In the early 1970s, there was a series of events, including the official devaluation of the U.S. dollar in 1971, the Soviet Union's purchasing of the U.S. grain crop in 1972, and the failure of the anchovy harvest off the Peruvian coast due to the harsh El Nino of 1972-73, which contributed to high soybean prices. Also, the U.S. embargo on soybeans and soy-meal in June 1973 forced Japan and European countries to look at Brazil as an alternative source of soybeans. In addition to these external factors, Brazil's soybean boom was stimulated by the following political economy goals ; (i) saving foreign exchange by import substitution of vegetable oil and processed foods, (ii) increasing foreign exchange earnings by growing soy-meal and soy-oil exports, (iii) improving the national diet by stimulating increased production of poultry fed on soy-meal, (iv) stimulating industrial devel-

opment, (v) holding down food price increases, and (vi) territorial occupation, as soybeans have been regarded as the engine of demographic and economic growth of the *cerrado* region (central western and northern Brazil). In summary, national and international political economy factors together contributed to the development and rapid growth of Brazil's soybean industry.

Soybean is grown in two main regions : the traditional (southern and south-central Brazil) and the *cerrados* as shown in Figure 1. The traditional region includes the States of: Rio Grande do Sul, Santa Catarina, Parana and Sao Paulo. The *cerrado* region includes the States of: Minas Gerais, Mato Grosso, Mato Grosso do Sul, Goias, Tocantins, Distrito Federal, Bahia and Maranhao.

Although production has traditionally come from relatively small farms, agriculture in the traditional region, especially in Parana and Sao Paulo, was regarded as the most modern in Brazil. In 1995, 4 states in the traditional regions together produced about half of all national soybean production. But, the entire traditional region has shown little change in production or yield over the past twenty years. Since 1980, most of Brazil's soybean output growth has come from the *cerrados*. Comparing the two regions using harvested area and yield, we can observe that soybean production in the *cerrados* has been more dynamic. Brazilian *cerrados* occupies an estimated 207 million hectares – 24 per cent of the nation's territories, providing a huge capacity to further increase soybean production. Although it was believed that the *cerrados* could not be cultivated, from 1980 to 1995 regional production rose from 2 to 13 million metric tons because of the development of new varieties suitable for local conditions and the improvement of soils and infrastructures. Large, corporate-like farms that are highly mechanized dominate productions in the *cerrados*, un-



Source: Warnken [36], p.23.

Figure 1 : Brazilian *Cerrado* and Traditional Soybean Production Regions

like the traditional regions.

The difference between these two regions is nearly equal to the difference between small family farms and large corporate-like farms (Table 1). In this paper, we focus mainly on the traditional region, not only because it consists of small family farms, but also because this re-

gion is suffering from the conflict between the GMO-free policy of the state government and illegal GMOs smuggled in from neighboring countries, in addition to the national level controversy over GMOs.

**Table 1** : Comparisons between Brazil (total), the State of Mato Grosso (*cerrado*) and the States of Rio Grande do Sul and Parana (traditional), by Size Groups, in 1995/96

**a. Number of Farms Producing Soybeans/Temporary-plantations by Size Groups**

Size Groups of Total Area (ha)	Number of Farms, Brazil		Mato Grosso*		Rio Grande do Sul and Parana*	
	Number	%	Number	%	Number	%
Less than 10	57,203	23.5	5,951	14.7	256,452	37.5
From 10 to less than 100	157,148	64.7	21,267	52.7	383,236	56.1
From 100 to less than 1,000	24,713	10.2	10,373	25.7	40,361	5.9
From 1,000 to less than 10,000	3,774	1.6	2,576	6.4	3,020	0.4
More than 10,000	153	0.1	221	0.5	17	0.0
TOTAL	242,999	100.0	40,388	100.0	683,086	100.0

\* Data of number of soybean farms by size groups in each state /region are not available. We use data of number of temporary plantation including soybean and other crops here.

**b. Harvested Area of Soybeans by Size Groups**

Size Groups of Total Area (ha)	Harvested Area, Brazil		Mato Grosso		Rio Grande do Sul and Parana	
	ha	%	ha	%	ha	%
Less than 10	195,068	2.1	1,316	0.1	183,891	3.9
From 10 to less than 100	2,328,920	24.6	4,127	0.2	2,072,453	44.4
From 100 to less than 1,000	3,759,820	39.7	383,055	22.0	1,984,049	42.5
From 1,000 to less than 10,000	2,809,816	29.6	1,121,895	64.5	425,794	9.1
More than 10,000	386,171	4.1	229,999	13.2	5,015	0.1
TOTAL	9,479,893	100.0	1,740,392	100.0	4,671,202	100.0

**c. Production Value of Soybeans by Size Groups**

Size Groups of Total Area (ha)	Production Value, Brazil		Mato Grosso		Rio Grande do Sul and Parana	
	1,000 R\$	%	1,000 R\$	%	1,000 R\$	%
Less than 10	75,336	1.8	578	0.1	70,290	3.3
From 10 to less than 100	1,042,391	24.6	1,517	0.2	922,393	42.8
From 100 to less than 1,000	1,728,286	40.7	160,663	21.9	950,760	44.1
From 1,000 to less than 10,000	1,229,123	29.0	474,380	64.7	207,042	9.6
More than 10,000	166,952	3.9	95,691	13.1	3,177	0.1
TOTAL	4,242,124	100.0	732,828	100.0	2,153,662	100.0

Source : IBGE, *Censo Agropecuario*, available in the website ([www.sidra.ibge.gov.br](http://www.sidra.ibge.gov.br))

**2. 2 Internal Market and Exportation**

In Brazil, the internal commercialization of soybeans as a food is very low and the consumption is primarily of soy-oil (cooking-oil, lecithin, etc) and soy-meal (animal feed). As shown in Figure 2, 27.4 per cent of the domestic soybean supply is exported, and with the other 66.4 per

cent being crushed for soy-oil and soy-meal.

There are several barriers, including a bitter taste, that must be overcome before soybeans will be accepted by Brazilian consumers<sup>2</sup>. To solve this specific problem and to increase soy-food consumption in the domestic market, EMBRAPA has tested grains and found a spe-

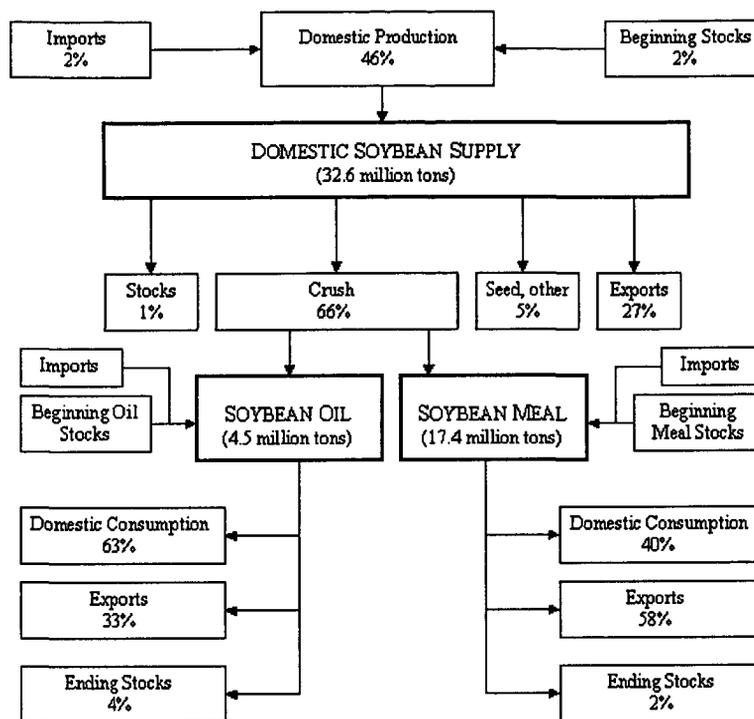


Figure 2 : Soybean Product Marketing Channels in Brazil

Source : ABIOV (Brazilian Vegetable Oils Industry Association) and Wamken [37]

cific enzyme producing the taste, which can be neutralized using a thermal shock. EMBRAPA has made many campaigns to increase consumption, distributing recipes and trying to make the population aware of the advantages of eating soybeans –but everything has been in vain. Brazilians don't accepted soybeans in their daily diets and don't even consume it as *tofu* or *natto*. So, only specific niches exist in the domestic market for soybean consumption, like the Japanese community or naturalists.

The demand for soy-oil accounts for 90 per cent of all vegetable oil available in the internal market. Almost all soy-oil production is consumed in Brazil and only a small amount exported. Increased supplies of soy-oil have met growing demand and helped hold down consumer price increases. Soy-meal, which is not consumed as a human food, has been a vital intermediate product in the animal protein food

chain, because expanding supplies of soy-meal have permitted rapid growth of Brazil's poultry industry.

### 2.3 International Competition

Brazil is the second largest producer of soybeans in the world and a leading exporter. The situation of the country in the international market was stable for years. But, it is reported that the productivity of the world's first and third largest soybean producers are increasing because of improvements in technology and the introduction of GM seeds. Although these competitors' advantages don't only come from technology, but are also supported by public policy, recent trends in technology leads Brazilian farmers and economists to worry about competitiveness in the international market. The Brazilian government also is worried about losing market share. But the government is neither in-

vesting enough in agriculture nor giving incentives to the farmers like the governments of the United States and Argentina, making it even harder for Brazilian farmers to keep up with their overseas competitors.

### 2. 3. 1 United States of America

In the United States, in 1999, Soybeans were planted on a record 73.8 million acres (29.9 million hectares), which is about 23 per cent of total planted area. U.S. soybeans stand out among the world market, representing 46 per cent of the world's soybean production, 60 per cent of the world's soybeans exports and 16 per cent of soy-meal exports (United Soybean Board [30]).

In 1999, the average price paid to U.S. farmers was \$ 4.65 per bushel ( \$ 171 per metric ton), the lowest average price since 1972. This represents a 36 per cent decline over the last three years (USDA [31]). However, the U.S. government gives financial supports to farmers so that, even when the price and the production of soybeans fluctuates and the market gets more competitive, farmers can receive a stable income. In general, it is considered that the Federal Agricultural Improvement and Reform (FAIR) Act of 1996 is based on a concept of "Freedom to Farm", which eliminates the government's role in managing production of major crops. According to the United Soybean Board, this law is helping U.S. soybean producers compete for domestic acreage and international markets, while allowing the commodities to be marketed freely and competitively. On the other hand, it has been suggested that this law should be titled "Freedom from Farming", for it has turned into an economic disaster for the nation's family farmers (Akrebs [1]). Although this issue is not our subject, we should pay attention to the fact that this "Freedom" Act maintains a number of economic support devices.

For example, it requires that non-resource marketing assistance loans and loan deficiency

payments be implemented for the 1996-2002 crops of soybeans and other commodities<sup>3</sup>. The prevailing rate for crop years 1997 to 2000 was \$ 5.26, above the average market price in these three years (USDA [31]). It can be said that marketing loan benefits are expected to support soybean net returns that are comparatively better than other commodities, and that, at least during the period of low market prices, this supportive policy can keep soybean producers on the farm. Nevertheless, the uncertain and unstable situation of the current competitive market can not be avoided, which explains the fact that the U.S. farmers have quickly and massively adopted GM soybeans with expectations of profitability and convenience in growing practices (Hisano [19]). According to the National Agricultural Statistics Service of USDA, about 54 per cent of soybean acres were planted in GM varieties during 2000 crop season, while 25 per cent of corn and 61 per cent of cotton were GM varieties (USDA [35]).

### 2. 3. 2 Argentina

Argentina is the third biggest producer of soybeans in the world, with 12 per cent of the world's production in 1998, behind Brazil (20%) and U.S.A. (48%). Argentina is responsible for 9 per cent of the world's exports and is the second largest soy-meal exporter, representing 32 per cent of world trade (USDA [34]). Argentina has great agricultural potential, and just began to develop during the last decade, when grain and oilseed production started increasing in the late 1980s.

A great part of the recent gains in production are due to area expansion and dramatic increases in yields because of improved seed and more use of fertilizers, irrigation and machinery. Future growth is expected to happen in the form of higher yields, instead of area expansion. Although soybeans yields are still low, Argentina will rapidly improve itself with the adoption of higher-yielding plant varieties and more

intensive inputs. Additionally, according to the EU's working document, in 1999 GM soybeans represented about 75 per cent of total soybean area in Argentina, with 5.5 million hectares or 37 per cent of the world total GM soybean area (EC [12]). Although it is not sure what influence GMOs will have on productivity, the fact that Argentina is aggressively accepting GMOs is important for the Brazilian soybean industry. Besides improvements in agricultural technology, many things remain to be done. Argentine farmers have a lack of knowledge of grain marketing techniques, and also lack basic information on market developments and sales. At the national level, common markets still have some outmoded concepts, including price setting via committee (Hager [17]). Because of these problems, the Argentine government, marketing institutions and private consultants are working to transform the grain marketing system, providing education and promoting reforms in the country. Although the Argentine government does not play a direct role in marketing grains and oilseeds, it has taken several steps to reform the country's grain marketing system. These changes will create an efficient soybean marketing system with fewer price swings, benefiting all in Argentina's agricultural industry, and making the country even more competitive in the international market (USDA [32]).

#### 2.4 Government Policies under Transition

Under such a competitive market condition, what is the Brazilian government doing for its soybean sector? In general, the Brazilian government has had a great influence over Brazilian agriculture during the past several years. Some economic and governmental actors were making efforts to liberalize the economy; they wanted to offer the private sector a major role and integrate the country into the international market. But, there was a mixture of ideologies and a great part of the economic forces didn't

support this trend and the parallel fiscal and agrarian reforms. They wanted to keep the Brazilian market operating as it always had been.

Over the last decade, as policies started to change, agriculture started to develop more, and technology improved. In 1994, the Brazilian government restructured the Brazilian economy, creating the stabilization program known as the *Real* Plan. The main goals of this plan were: the privatization of government-owned industries, lower tariffs, tight credits, "de-indexation" of prices and the creation of new stable currency, the *real* – R\$ – (Wainio [36]).

When the *Real* Plan really took effect, the Brazilian economy experienced positive real GDP growth, less inflation and a more opened market for external capital. And, before opening even more of the market to transnational corporations, the Brazilian government helped soybean farmers in September 1996. The government published a law eliminating the state value-added tax (ICMS) on primary and semi-manufactured exports. This law had a great impact on the soybean sector, increasing soybean exports to a record of 8.3 million tons in 1996/97. In 1997/98, planted soybean area was forecasted to have grown 9 per cent and the removal of the ICMS helped this increase. The USDA projects the growing of soybean area to more than 14 million hectares by 2007 (Wainio [36]).

However, under the *Real* Plan, government policy and support started changing from paternalistic to market-oriented. The Government gradually removed itself from direct management, trying to intervene as little as possible and let decisions be made within the market. This means that Brazilian farmers have to get involved directly in the global restructuring of the soybeans market. One of the big challenges for them is the GMO issue.

### 3. GMO Situation in Brazil

#### 3.1 Emergence of Transnationals

Before the stabilization of the *Real Plan* and the discussions about a new agricultural law, companies that produced or sold seeds had no legal protection and had not received any financial reward for investing in new seeds for the Brazilian market. The idea at that time was to concentrate on open-pollinated varieties so that there could be free distribution and easy access to seeds. The Brazilian Government (via EMBRAPA) was the major developer of new varieties. Brazilian companies invested little in research and development of new varieties, and foreign companies were afraid to release their own, fearing that the Brazilian Government would place the seeds in the public domain.

In April 1997, the Government approved a law called the Cultivar Law (intellectual property right protection) and the situation became more interesting for private companies (USDA [34]). The private sector got more power and a great number of transnational corporations entered the market, making the agricultural sector more competitive and different from what it used to be. The Cultivar Law has increased the incentives to invest in biotechnology. One typical example is Monsanto, who has been trying to sell the genetically modified crops, especially Roundup Ready soybeans, in Brazil since 1998. Monsanto started the legal procedures in June of that year, and since then seeds have been imported and tests implemented, authorized by both the Ministry of Agriculture and the National Biosafety Committee (CTNBio).

Although there a huge polemic was created around Monsanto's product, CTNBio approved the commercialization of a genetically modified soybean in Brazil on September 29, 1998. However, some time before this liberalization, IDEC (Brazilian Institution of Consumer Defence) filed an injunction against Monsanto and

against CTNBio. They asked a judge to invalidate the approval for the commercialization of Roundup Ready Soybeans, stating that this product could be harmful to the environment and sufficient testing has not been conducted<sup>4</sup>. The argument was made that Brazilian agriculture (Tropical) is different from the one where this product had been tested (Temperate). IDEC contented that protocols should be required for field trials, risk assessment for environmental and food safety, registration of products and public acceptance.

Since 1998, Monsanto has been fighting for the commercialization rights of genetically modified crops in Brazil, with no success. The Brazilian Executive Federal Power (President and Ministries) is in favour of GMOs, believing that they will help decrease the use of pesticides and other chemicals. ABIA, the Brazilian Food Industry Association, is another proponent and insists that GMOs are scientifically safe. They both want the liberalization of GMO production. IDEC, Greenpeace and IBAMA (Brazilian Institute of Environment and Natural Renewable Resources) are opposed and are fighting through the Brazilian Justice system and creating a political-governmental impasse in the country.

On August 10, 1999, Judge Antonio Prudente prohibited the commercial plantation of GMOs, making it definitive rather than preliminary and rendering any appeal by Monsanto less likely to succeed. It also prevented the Ministries of Agriculture, Science and Technology, and Health from taking any actions that alter the ruling (Bell [3]). In August 2000, the Judge reiteratively pronounced the decision in favor of NGOs and rejected an appeal brought jointly by Monsanto and the Brazilian Attorney General's Office to overthrow an injunction on the planting and marketing of GMOs. The trials, however, continue to go on and legal maneuverings seem far from finished.

Besides the discussion about Roundup Ready soybeans and GM crops, there is also the new competitive environment that was created with the new law. In recent years, many seed companies were acquired by transnationals (Paula [28]). Sometimes these companies were not completely bought, only their genetic materials were purchased. In the soybean case, a great change happened after 1997 –Monsanto acquired 18 per cent of the seed market and EMBRAPA saw its share decline from 70 per cent to 65 per cent. Not only did Monsanto move strongly into the Brazilian market, but other transnational corporations went to Brazil and made acquisitions in the same way, as shown in Table 2.

### 3.2 A Role of EMBRAPA

Because of the new market reality, public institutions like EMBRAPA had to restructure to find more financing to do their research, forcing them to look for associations with other companies or agricultural entities. Known worldwide, it is impossible to discuss Brazilian agriculture without mentioning EMBRAPA.

EMBRAPA is an institution linked to the Brazilian Ministry of Agriculture and Food Supply. It was created in 1973 with the mission to

“provide feasible solutions for the sustainable development of Brazilian agribusiness by generating, adapting and transferring knowledge and technology that benefits Brazilian Society” (EMBRAPA [11]). The initial objective of EMBRAPA is to find and implement technological solutions for the development of a competitive agricultural market, increasing productivity, enhancing the quality of products, improving the performance of production chains, and making more efficient use of resources and inputs. These technological solutions should also promote the sustainability of commercial farming activities while ensuring the development and conservation of the natural resources base, without sacrificing production efficiency and environmental quality.

Networking through 37 research units, 3 services and 15 central units, EMBRAPA is present in almost all the States of Brazil, each with its own unique ecological conditions. EMBRAPA-Soja is located in Londrina, Parana State, and has as its priority the development of technologies, services and products to provide solutions for the soybean sector. EMBRAPA-Soja has released more than 100 new high yielding and disease resistant cultivars, and developed the first cultivars adapted to tropical re-

**Table 2 : Latest M&A of Seed Companies by Transnationals in Brazil**

Buyers	Acquired Seed Company (year)
Monsanto	FT Sementes de Soja (1996)
	Monsoy (1996, the largest soy-seed producer)
	Agrocerec (1998, the largest corn seed producer)
	Cargill Seeds (1998, subsidiary of U. S. company)
AgrEvo	Braskalb (1998, subsidiary of U. S. company)
	Granja 4 Irmaos do Grupo Josapar (1998)
	Sementes Ribeiral (1999)
	Mitla Pesquisa Agricola
Dow AgroSciences	Sementes Fatura (1999)
	Hibridos Colorado (1998)
	Dinamilho Carol (1998)
	Sementes Hata
Pioneer/DuPont	FT Biogenetica de Milho (1998)
	Agropecuaria Dois Marcos de Soja (1999)

Source : *Gazeta Mercantil*, June 16th, 1999, and *Seedling*, September 1999.

gions, which made possible the production of soybeans in the *cerrados* region. For several years, EMBRAPA had a great income to fund its own studies. The Government directed its investments towards biotechnology and agricultural innovation. At that time, the private sector wouldn't invest in this area due to lack of favourable business conditions, leaving the entire market to EMBRAPA.

However, at the end of the 1980's, EMBRAPA's budget started to diminish and Government expenditures on research and technical services reduced by 26 per cent from 1986 to 1987 (EMBRAPA [11]). In addition to that, in 1997, after the approval of the *Cultivar Law*, the market situation changed and it became more feasible for private companies to develop their own seeds or to import them from foreign countries. The Brazilian Government incorporated new concepts in technological development and market competition, forcing EMBRAPA to adapt itself to the new environment. Under these drastic government policy changes, EMBRAPA could not get enough money to compete at the same level as its private competitors. As a result, EMBRAPA is starting to collaborate with transnationals, like Monsanto, in research and development of GMOs<sup>5</sup>.

EMBRAPA is establishing two forms of association in the competitive market (Paula [28]). The first one is a partnership with some foundations of seed producers. Through these partnerships in more than 7 States, 67 soybean varieties have been released, satisfying a great number of producers in different regions. The second one is a partnership with private companies, particularly Monsanto, to develop and research genetically modified varieties. In this agreement, Monsanto authorizes EMBRAPA-Soja to use Roundup Ready technology to develop original varieties that will belong to EMBRAPA, although the controversial issues related to the intellectual property rights of ge-

netic resources and technologies remain unsolved.

### 3.3 External Pressures to Reject GMOs

#### 3.3.1 Europe

Europe is a great importer of Brazilian soybeans, and 70-80 per cent of Brazilian soybeans go to the EU market. In other words, EU domestic soybean production covers only a small percentage of consumption; the degree of self-sufficiency varied between 6 per cent (soy-meal) and 18 per cent (soy-oil) in 1998/99 (EC [12]). Therefore, at least with respect to soybeans, it is understandable that European nations are concerned about food safety, just like Japan, whose self-sufficiency rate in soybeans is only 3 per cent.

Data from the fourth Eurobarometer survey carried out in November/December 1999 suggested that Europeans have become increasingly opposed to GM foods (INRA-ECOSA [23]). The public is worried about the product safety and cultural identity, and not willing to accept the risks of the new technology. A considerable percentage of the citizens feel insufficiently informed about the topic and is worried about the "unnaturalness" of biotechnology. The Europeans believe that biotechnology perceived to have only modest benefits, is usefulness and have no support, even though the risks may be modest. And, around 50 per cent of supporters of GM foods say that they would be prepared to buy them, suggesting that even those who are in favour of the new technology would endorse the demand for the labelling of GM foods (INRA-ECOSA [23]).

Traditionally, cultural identity — a unique relation maintained with the traditional food, as a source of pleasure, and an act of socialization and communication — has been considered to be important value within European society (Menasche [27]). The new food reality is affecting European culture to the point where it is be-

coming harder for Europeans to accept the genetically modified foods and changing the optimism they had about biotechnology. The “uselessness” and absence of consumer benefits may accentuate concerns about safety and moral issues (Gaskell [15]). It has also been noted that consumers in EU countries already had some problems with food safety in past years and don't want to feel insecure about what they are going to eat. The last great problem was the “mad cow disease” that started in the United Kingdom and is still prevailing in European countries.

The labelling rules under Regulation 258/97, known as the Novel Foods Regulation, requires that GM food products that consist of or contain GMOs must be labelled as such. Regulation 1139/98 and Regulation 49/2000, both targeted to GM plants authorized before legislation of Regulation 258/97, i.e. Roundup Ready soybean (Monsanto) and Bt corn (Novartis), also requires that products containing less than 1 per cent of GM materials don't have to be labelled. These labelling measures, however, do not apply if neither protein nor DNA resulting from genetic modification is present in the final product because of destruction due to successive stages of processing. Therefore, food products using soy-oil may be excluded from mandatory labelling, although any official “negative list” of such products has not been drawn up yet. Furthermore, there is no specification about labelling of GM feed (EC [13], Dewar [8]). Still, according to the Eurobarometer, only a small number of opponents of GM food said they would buy GM foods such as cooking oil (9%) or eat eggs from chickens fed on GM corn (7%).

Some governments in Europe already have taken some other actions against GMOs besides labelling. Austria and Luxembourg banned the import of Bt maize and France brought in a two-year ban on commercial growing of an herbicide-resistant oilseed rape. In the U.K. ,

the government called for a five-year ban on the commercial growing of Bt and herbicide-resistant crops and retailers have banned GM products, while others are actively looking for sources of soybean and maize that are not genetically modified (Cornerhouse [7]). Although the EU allows GM seeds and products already approved to enter the region, and some products are not labelled due to lack of effective regulation, current and future legislation in the EU on GMOs will have a significant impact on the Brazilian soybean industry and related policies.

### 3. 3. 2 Japan

Some studies and statistics have shown that the Japanese market has remained relatively calm regarding foods containing ingredients developed through biotechnology (Hoban [20], [21]), and that Japanese consumers are giving more support for biotechnology than consumers in the U.S.A. and Europe (Macer & Chen [26]). However, a major worldwide research study on consumer awareness of GMOs released by the Angus Reid Group states that the percentage of consumer negativity towards GM foods in Japan is 82 per cent, which is far higher than Germany (73%), France (71%), U.K. (58%), and the U.S.A. (51%) (Angus Reido Group [2]).

Since the 1960s, with the rapid expansion of the economy, Japanese consumers have become concerned about food safety. And their worries increased after a series of food poisoning incidents, including the Morinaga incident in 1955 and the Kanemi Rice Oil case in 1968, as well as the Minamata Poisoning of 1953 in Kumamoto and 1964 in Niigata that made Japanese citizens aware of environmental degradation and its affects on food safety (Jussaume et al. [24]). Until the present year, problems with food poisoning continue to happen in Japan, like the Snow Brand Milk case, which made more than 14 thousand consumers seriously

sick. It is also important to see the increasing awareness over how heavy dependence on imports might affect food safety and security, because Japanese people experienced the U.S. soybean embargo of 1973, and the use of a lot of post-harvest chemicals on imported agricultural products. These concerns are reflected in a survey released by the Japanese Ministry of Agriculture, Forestry and Fisheries (MAFF) in May 2000, proving that almost all respondents (1,020 housewives) have great concern about food safety in general (Table 3 a). Although the information for common citizens was not sufficient and consumers were not aware of all the positives and negatives aspects in the beginning, several surveys have shown growing concerns about new biotechnologies (Table 3 b, Table 4).

Not only are common citizens worried about these new technologies, but Consumers' Cooperatives and supermarkets are also unwilling to have GM food and crops in their products' list, in part because of their customers' attitude towards GMOs (Jussaume et al. [24]). Consumers' Cooperatives (74 co-ops, March-June 1999) and supermarkets (42 chains, March-April 1999) were interviewed by the Japanese NGO known as the "No! GMO Food Campaign". The results of this survey are shown in Table 5 below.

After considering the findings of its technical sub-committee, in August 1999, MAFF published draft legislation proposing that GM food be subject to mandatory labelling from April 2001. The Ministry of Health and Welfare is already considering shifting its guideline for GMO safety evaluation to a "law" in order to strengthen the risk assessment process.

The Japanese market is very important for soybean producers, due to the fact that *tofu*, *natto*, *shoyu* (soy source) and *miso* are daily products in this country and are all soybean based. All data mentioned above show that GM

**Table 3 a : Consumers' Concern about Food Safety**

Are you concerned about safety of ...?	
Imported source of foods	88.9%
Process of agricultural producing	79.1%
Restaurants or fast-food shops	74.3%
Process of food manufacturing	68.5%
Are you not concerned about safety of ...?	
Cooking at home	62.4%
Process of distributing	52.4%

**Table 3 b : Consumers' Concern about GM Soybeans**

Do you like to purchase GM soybean products?	
Prefer non-GMO, even if the price is higher	81.1%
Prefer GMO, if the price is lower	4.3%
Not worried about ingredients	2.0%
Don't know	12.0%

Source : MAFF, *Consumers Monitor Report*, May 2000.

**Table 4 : Consumers Attitude toward GMOs (Nov. 1999)**

Very concerned	45.7% (28.6% in April 1998)
Somewhat concerned	41.0% (39.8% in April 1998)
Unwilling to buy	82.7%
* Female only	89.1%
Not so unwilling to buy	15.0%
Not at all unwilling to buy	2.3%

Source : Agriculture, Forestry and Fisheries Finance Corporation (AFC)

# The questionnaire was sent to randomly selected 2,300 people who live in the main cities on each prefecture of Japan (excluding Okinawa) ;600 people answered.

products will have obstacles to overcome in the Japanese market and also that GMO-free producers will be able to find a profitable market. According to MAFF's labelling rule, however, most processed foods using just soy-oil or lecithin, including soy-source, will be excluded from mandatory labelling. About 80 per cent of soybean demand is in the form of soy-oil and soy-meal, and only a quarter of all soybeans, including those produced domestically, are used for soy foods. Nevertheless, many manufacturers

**Table 5 a :** Supermarkets' Attitude toward GMOs and Non-GMOs

Have you already sold or had a plan to sell products labelled non-GMO?			
Yes, 26%	Planning, 19%	No, 38%	No Answer, 17%
Have you sold domestic products (so far, non-GMO) as a marketing strategy?			
Yes, 67%	No, 21%		No Answer, 12%
Do you think that non-GMO sales appeal to customers like in the EU?			
Yes, 45%	No, 21%	Don't know, 10%	No Answer, 24%

**Table 5 b :** Consumer Co-ops' Attitude toward GMOs

Are there requests for non-GMO from your members (consumers) ?			
Yes, 89.2%	No, 4.1%		No Answer, 6.7%
How do you access to non-GMO sources?			
Domestic, 55.6%	Area specification, 33.3%	Organic, 6.5%	Others/N.A., 4.6%
Do you have a plan to develop your original GMO-free products?			
Yes, 82.6%	No, 11.6%		No Answer, 5.8%

Source : The No! GMO Food Campaign

and distributors are already utilizing a voluntary GMO-free labelling scheme, even on non-targeted foods, and are establishing alternative sources for non-GMO soybeans. So, we can say that the extent to which Japanese companies and consumers will demand non-GMO soybeans will have a tremendous impact on the world soybean market.

### 3. 4 Internal Pressure to Reject GMO

Although some transnational corporations are already in the Brazilian market, the law is still cautious in the approach to GMOs. Consumers, aligned with NGOs, are watching the situation very closely. At the present moment, products containing GM substances are being commercialized, but not commercially grown in the country. Brazilian importers of maize are able to buy cheaper products from countries that grow GMOs, but are being constantly observed by consumers. Discussions are still going on in Brazil, about the law that prohibits GM seeds from being grown in Brazilian fields, and concerning the push by NGOs that the Brazilian Consumers Law requires labelling on prod-

ucts containing genetically modified products.

As mentioned before, IDEC (Brazilian Institute of Consumer Defence) is a non-profit consumers' association founded in 1987. It has no ties with companies, governments or political parties. IDEC's main objectives are to contribute to the equity within consumers, to contribute to the enforcement and enhancement of consumer-oriented legislation, and to promote a better lifestyle, especially on the quality of services and products. IDEC is a full member of the Consumers International, an international organization that articulates the activities of consumer's advocates throughout the world (IDEC [22]).

In Brazil, the discussion about the risks of genetically modified food is causing a lot of controversies. IDEC and other NGOs, like the SBPC (Brazilian Society for the Science Progress) and Greenpeace, as well as some government entities including the Ministry of Federal Public, IBAMA (Brazilian Institute of Environment and Natural Renewable Resources) and the PROCON (National Consumer Protection System)<sup>6</sup>, are asking for the Federal Govern-

ment to be careful before approving the planting and commercialization of GMOs. These entities are trying to represent and defend consumers' rights.

Though IDEC, since 1996, is closely watching the GMO situation in Brazil and doesn't approve of the way the government is handling the issue, the GMO issue is still unknown by a great part of the population. There is insufficient information about genetically modified products from the government to Brazilian citizens.

IDEC believes that the approval to plant GMOs by CTNBio was not based on sufficient field research and tests, and also not based on the consumers' right to know about what they are buying and eating. According to IDEC, there are two main consumers' rights that must be respected: information and free choice<sup>7</sup>. That is the reason why compulsory information must be established, and why there must be labelling about the genetic modification of each product. IDEC also claims that there is a great resistance from some sectors of the government that receive support from private companies. These sectors would be hiding relevant information about the origin, nature, quality and risks of the products, disrespecting the Brazilian Consumer's Defence Code.

#### 4. Farm-Level Dilemmas of Opposition to GMOs

##### 4.1 The Case of Rio Grande do Sul

The State of Rio Grande do Sul, the second largest soybean producer and the largest seed producer in Brazil, has decided to go GM-free. In Rio Grande do Sul, 80 per cent of its agriculture is based on small family farms, 70 per cent of agricultural production comes from farmer's cooperatives, and about a half of all soybeans produced are exported.

The State Government, in January 1999, with the coming to power of the Workers Party

(PT), announced a new decision and declared all 79 ongoing GMO trials illegal. The Government was convinced that the introduction of GMOs would result in the loss of seed production. The Government was concerned that patented industrial seeds wouldn't be affordable nor appropriate for small-scale farmers, and stated that being GM-free was a good commercial move (Bell [3]).

In April 1999, the State of Rio Grande do Sul was visited by representatives of a consortium of leading European supermarkets, including Sainsbury (U.K.) and Carrefour (France), which had committed themselves to eliminating GM ingredients from their own-brand products. Actually Carrefour is reported to have signed contracts with some producers in the southern states to buy a yearly volume of 300,000 metric tons of GMO-free soybeans (USDA [34]). In August of the same year, Marks & Spencer (U.K.) announced the intention to go GM-free in animal feeding and soy products, noting that they will be buying the products from Brazil (Bell[3]). These cases made the State Government even more cautious of GMO commercialization.

The Government began a new policy of enforcing the 1991 State Biosafety Law, which requires that environmental impact assessments be undertaken before GMO trials, although there have been no agreed upon criteria for environmental impact assessments. The Government is doing everything possible to create a GM-free, although it seems that the State Government and farmers think differently. It is reported in various news sources that Rio Grande do Sul's farmers are smuggling GMO seeds from Argentina and growing them even though it is against the law. They believe that the genetically modified crops are not going to cause any harm because the United States Government assures their safety. They believe that, if the North Americans are growing GMOs, then

they should do the same.

According to the Brazilian Association of Seed Producers (ABRASEM), about 300,000 ha (10 per cent of the soybean crop area in the state) was planted with GMO soybeans smuggled in from Argentina during the 1998/99 season<sup>8</sup>. The State Government of Rio Grande do Sul acquired five thousand identification test kits in order to guarantee that the State is a GM-free zone for commercial reasons (Sampaio [29])<sup>9</sup>. So far, GMO soybean production in the state seems to be centered in the central part of the state near the city of Cruz Alta, where the average farm size is larger than other part of the southern states and where there are also strong anti-government sentiments. If the State Government cannot cope with this problem and assure foreign customers of the purity of their soybeans, European and Japanese buyers may have to focus their buying on other regions, especially the *cerrado* region, where only conventional varieties are grown because GMO varieties for hot and dry conditions have not yet been developed<sup>10</sup>.

Besides the problems with the farmers, Rio Grande do Sul is facing a legal struggle with the Federal Government, which authorized experiments with GMOs in 59 areas of the State on February 10, 1999. Seven companies are testing rice, soybean and maize in 16 municipalities. The Federal Government is strongly enthusiastic due to the biotech lobby, which has convinced people that GMOs will be far more profitable for the Brazilian economy. Even though the State itself believes it is strategically better not to grow genetically modified crops, it is said that the State cannot go against the Federal Government for very long.

#### 4.2 Farmers' Attitude towards GMOs

Brazilian farmers are very curious about the new technology. They have heard about the "results" on North American farms; the in-

crease in productivity, and how much more free time they will have if they use the Roundup Ready soybeans. They were visited, at home, by representatives of the transnational corporations and were informed about the "advantages" of planting GMOs; how much they will be able to preserve the environment by reducing pesticide use. They also heard from EMBRAPA and the Ministry of Agriculture that there is "no proof" that GMOs can cause harm for the environment or consumers.

Brazilian farmers have also been informed that in Argentina the farmers are increasing their productivity, increasing their market share and getting more profit by using GM seeds. Nobody wants to lose their place in the international market and nobody wants their rivals to have better products, more money and more free time. Brazilian farmers want all the "advantages" of the new technology. They believe that they will be doing the best for the environment and consumers, as well as receive more money for it.

But, actually, there are lots of concerns discussed all over the world; that the genetic engineering offers little prospect for reducing chemical use; that the adoption of genetically engineered crops is likely to reduce genetic diversity; and that the need to buy seeds every year will lead to a steep rise in farmers' input costs (Cornerhouse [7]). Especially, farmers don't have access to information about the marketing strategy developed by some TNCs, in which farmers will have to pay a "technological fee" when buying seeds. Generally, this fee will be first paid by the seed firms and then transferred to the farmers. And, besides having to buy these high-priced-seeds, by contract firms will not allow farmers to save seeds for the coming year, which raises the question of increasing farmer dependency on a limited number of seed suppliers (EC [12])<sup>11</sup>.

Brazilian farmers are likely to hear only

one side of the GMO situation. The NGOs and the people from the Ministries of Health and Environment can't reach those farmers, can't go to their houses and can't give speeches on the Cooperatives. These institutions don't have the same access to farmers as the transnational corporations and don't have enough money to use on marketing to spread their information. These institutions cannot make the farmers conscious of possible environmental problems, the possible oligopoly of the TNCs, and the new market opportunities of GMO-free products, organic production or other alternatives.

#### 4. 3 Family Farmers' Situation in Brazil

In general, to compete in the market with the United States and Argentina, Brazilian farmers have to overcome many barriers that farmers from the other countries don't face. Compared with the U.S.A. and Argentina, Brazil's soybeans and soybean products have a high marketing cost. The first great problem for Brazilian farmers is the cost of transportation (Warnken [37]). Most of the raw beans, processed meal and oil are transported by trucks. Thus, transportation costs are very high due to long hauls, poor roads and equipment shortages in post-harvest periods. The two other alternatives for transportation are the use of the national rail system, which is not feasible as in some areas of Brazil the maximum speed the train achieves is 4 km/h, and the use of the waterways, which is difficult due to the endless problems in the poor ports. The Brazilian Government wants to privatize the railroads and also have some rail system construction projects (Warnken[37]). Additionally, the Government is planning the construction of a waterway in the Paraguay-Parana River and a major port in the heart of the Pantanal (the world's largest wetland), which is very controversial at the moment due to environmental issues (Halwell [18]). Because these projects will benefit

mostly the large and corporate-like farms in the *cerrado* region, small family farms, especially those in the traditional region, will face further difficulties competing in the market if these projects are completed.

Besides the transport issue, the other problem that farmers have to face is the huge tax rates. In principle, there have been four different basic tax rates; an intrastate rate, two interstate rates and an export rate. But, instead of only four tax rates, there are more than 400 different rates in Brazil (Warnken [37]). The large number of rates makes it difficult to estimate the incidence and impact of the tax on specific agricultural products. Producers are receiving less for their products than they would in the absence of taxation.

In the short term, it may not be advantageous, especially for small farmers, to grow soybeans for the export market, given that they have to pay all these taxes, as well as transportation and additional costs for commercialization. To get a good profit in the international market, a farmer will have to grow crops on an increasingly large scale. Even now, small farmers cannot compete in the domestic market against big producers. As long as there remains a huge gap between small and large scale farmers, the adoption of GMOs is not likely to change and improve the economic conditions of small family farmers. This can be explained by the "treadmill of technology" theory — anytime and anywhere family farmers are urged to adopt the new technology so as to be stay in business, they tend to be slow adopters or non-adopters, and always turn out to receive less profits and more debts (Cochrane [5]).

Researchers at EMBRAPA believe that small farmers cannot get a great profit from planting soybeans and that they should diversify their operations. The small farmers should analyze their income and evaluate whether soybeans are a profitable decision or whether they

would be better off diversifying their production system like EMBRAPA has advised them to do. Small farmers should try to avoid competition with big farmers and with the international market. Instead of spending their money and their time with a competitive grain, they should try for specific (niche) markets or to sell their products in their neighbourhood.

Of course it is not an easy decision. Even if they diversify their farming successfully, it is very hard to get money from the Banks and even more difficult to get subsidies from the Government, for the subsidies directed to the agricultural matters have been considerably small since 1982. But, still, it is worth to considering the possibility of alternative options.

#### 4. 4 Alternative Options for Farmers

##### 4. 4. 1 Edible and Organic Soybeans

In the State of Santa Catarina (Coritibanos) there is already a small group of farmers that plant a kind of edible soybean for export specifically to the Japanese market. EMBRAPA and the Universities of Vicosa, Londrina and Sao Paulo are developing projects with these edible varieties<sup>12</sup>. Some of them have partnerships with Japanese companies, universities, and public research institutions like JIRCAS<sup>13</sup>. But, the production of edible soybeans is very small in Brazil, although 0.4 per cent of the population is of Asian descent. Whether this alternative option will help soybean farmers or not may depend on the possibility of developing a domestic soy-food market.

In Brazil, organic production began as an isolated initiative in some regions, especially in the Southern states (Fonseca & Feliconio [14]). Although commercial production is still limited, growth of organic farming in Brazil is estimated to be around 20 per cent, or about US \$ 150 million, annually in recent years (USDA[33]). The rapid growth of organic farming prompted the Brazilian Government to regulate the sector. In

October 1998, the Ministry of Agriculture and Food Supply published Directive 505 with the purpose of establishing national standards for the production, classification, processing, packaging, distribution, identification and certification of organic products, and republished the Directive in April 1999 after the public comment period.

This organic boom may come from growing consumers' concerns about food safety and environmental problems. Organic farming requires more hard work than conventional farming. Pest and weed control has to be without chemicals, fertilizer has to be organic, and several requirements have to be completed to receive the certificate. In spite of these factors, farmers' benefits, such as the reduced cost of production (especially because the cost of agricultural inputs is high in Brazil) or attractive prices for the commodities they produce (the "premium" is paid for organic producers), are contributing to increased organic production. Recently, this shift has been stimulated by the large interest on the part of Brazilian supermarkets in buying organic products. According to the USDA, there are market opportunities for selling organic foods in Brazil. Also, according to supermarket managers, demand for these products is much higher than the current supply, particularly for vegetables, fruits and refrigerated processed foods. Organic soybeans are also regarded as the most important product being exported to the EU (mainly Germany) and Japan (USDA [33]).

##### 4. 4. 2 Researches and Extension

EMATER is a public institution, linked to the Brazilian Government, through the Agricultural Ministry. State Law 6969 established EMATER in December 1977, as the public institution responsible for technical assistance and official rural extension to farmers. The technicians working for EMATER give assistance to farmers, going to their farms, sometimes once a

week, disseminating new technologies developed by EMBRAPA, giving advice about what to do to prevent problems at harvesting time, announcing new meetings and helping farmers to take care of their properties. The farmers welcome these technicians and, after discussing all the positive and negative aspects together, they usually follow their advice.

About ten years ago, EMBRATER, a former institution of EMATER, was dissolved, and EMATER was established in each state. Among them, EMATER/PR (Parana) that we visited is famous for its strong and well-organized extension system. In 1999, following the directions of the State Government of Parana, the Rural Extension program had the family farms and its organizations as a priority, developing actions based in working contracts and dealing with results established beforehand. The numbers of contracts made by EMATER/PR for the year of 1999 is shown in Table 6 below :

Farmers assisted by EMATER/PR receive a great deal of information and join projects supported by public and private institutions (EMATER/PR [10]). The main projects are :

*Parana 12 Months* : this is the main project of the State for the agricultural sector financed by the World Bank. It is being implemented right now and the main purpose is to al-

leviate the poverty situation in the State, basing the help in the technological modernization of agriculture and creating more jobs. This project also wants to assist the environmental protection and improve the quality of life on family farms.

*Rural Villages* : the main goal of this project, developed with the Government of the State of Parana, is to build small farms in places close to the urban areas to give better life conditions to workers and families, increasing their incomes and keeping them in the rural lifestyle.

*Support to Small Property* : this project, developed with the Ministry of Agriculture, focuses on the development of small farmers, by giving them necessary conditions to increase their income, increasing their productivity and improving their competitive capacity in the market.

*Strengthening of the Family Farms (PRO-NAF)* : this project, developed with the Ministry of Agriculture, is trying to improve the productive capacity of farmers, to increase job opportunities, and to increase the families' income and life quality.

Of course, we cannot be optimistic about these projects and policies for family farms. And we can't deny the probability that these extension programs will be used as a way of dissemination of GMOs among small farmers. But, we dare to say here that there are many options for Brazilian farmers to improve their way of farming and management and their quality of life without depending on imported high technology like genetic modification.

## 5. Conclusion

So far we have explored the actual situation of Brazil. The country is the second biggest producer of soybeans, a great competitor in the international market and has a growing production capacity. In the soybean industry,

Table 6 : Extension Programs of EMATER/PR

Category	No. of Attendants
Family farmers	127,777
Farm labourers	12,335
Women (rural)	16,881
Adolescents (rural)	4,229
Fisher-man (subsistence)	456
Farmers settled in the land	2,051
Medium size farmers	5,966
Big size farmers	5,011
Urban public	11,407

Source : EMATER/PR

however, the country finds itself in an odd situation because of the introduction of GMOs.

On one side, consumers and environmentalists' groups and some government institutions, as well as European and Japanese consumers, are against GMOs. All of them are pressuring the Justice system not to allow the production of GM seeds. On the other side, there are the international competitors, the U.S.A. and Argentina, which are already growing GMOs, the Brazilian Executive Federal Power, the Brazilian Food Industry Association, some farmers and transnational corporations. All of them are in favour of the production and commercialization of GM varieties, and pressuring the Justice system to allow production on domestic fields.

What is puzzling for farmers, the government and economists is whether to become GM-free or not. The main question is whether consumers are actually going to pay more for conventional soybeans, and whether farmers can survive international competition by only growing conventional crops. Currently, the evaluation of acceptance of GM products is being analyzed. The governments are researching consumers' behaviour, as well as conducting field tests. At the moment, we are not sure whether consumers will get used to having GM products on the shelves or totally reject them. We remember what some researcher at EMBRAPA said to us ; the current moratorium policy on GMO approval ordered by the Judge system turned out appropriate strategically, because it would take some years to confirm the market reaction towards the products. We think, however, he should recognize that this moratorium is necessary to evaluate GMO safety issues, as well as social issues related to GMO commercialization, such as distribution of power and influence, risks of concentration of knowledge and technology to a few transnational corporations, relations between different

social groups and classes, between small-scale family farmers and corporate-like large farms. Many of these social issues are very important for Brazilian society to cope with.

We must not forget that growing GM and conventional crops are not the only option for the country and its farmers (especially small-scale family farmers) ; there are other alternatives, like growing edible soybeans or organic crops. As mentioned in the paper, some alternatives will help increasing the farmers' income and diversify their production. So, we should compare GMOs with these alternative options, instead of comparing with conventional farming. Neither GMOs nor conventional soybeans would not make family farmers to be better off unless current market conditions could drastically changed.

As long as we could explore in the paper, we can conclude that if we set GMO issues in a different context, the dilemmas that Brazilian farmers and the southern states governments seem to be caught in would be not a dilemma essentially. It is important to say that the interest of Brazilian soybean industry as a whole and the interest of each farmer are not necessarily the same. Further investigation into the actual situation of Brazilian soybean farmers at local level will be made in our next study.

#### Notes

1. In this and next sections, we mainly referred to Warnken [37].
2. Interview with Dr. Tuneo Sedyama at University of Vicosa, Vicosa, Brazil, in August 2000.
3. For soybeans, the loan rate is set annually based on the following formula and conditions ; 85 per cent of the 5 -year average price which disregards the highest and lowest years, with the floor set at \$ 4. 92 and the cap at \$ 5. 26 perbushel.
4. Interview with Ms. Andrea Salazar, a lawyer in charge of this case, at IDEC, Sao Paulo, Brazil, in August 2000.

5. Interview with researchers at EMBRAPA-Soja, Londrina, Brazil, in August 2000.
6. PROCON (National Consumer Protection System) consists of local and state consumer protection bodies.
7. Interview with Ms. Andrea Salazar of IDEC, Sao Paulo, Brazil, in August 2000.
8. Agrow World Crop Protection News, No. 337, October 1, 1999, p. 17.
9. The State of Parana has also started the statewide inspection of illegal plantings of GM soybeans for the 2000/01 season. Agrow World Crop Protection News, No. 361, September 29, 2000, p. 20.
10. These information and analysis provided by Pro Farmer Magazine are distributed through the Internet service named AgWeb.com, on October 10, 2000.
11. According to several news sources, Argentine farmers don't pay a technology fee to Monsanto due to lack of efficient control. In Brazil, although farmers do not pay it, neither, GM seeds are still quite expensive to buy. A typical Roundup Ready seed might sell for 22R\$ per 40kg bag (approximately \$ 8.50 per 60-pound bag), which is about double the price for conventional varieties.
12. Interview with Dr. Natal Vello at University of Sao Paulo, Piracicaba, Brazil, in August 2000.
13. Interviews with professors and researchers of these institutions, Brazil, in August 2000.

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