POTENTIAL IMPACTS OF THE *TERMINATOR* TECHNOLOGY ON AGRICULTURAL PRODUCTION: STATEMENTS FROM BRAZILIAN FARMERS

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ACRONYMS

ABRASEM – Brazilian Association of Seeds and Saplings
BACEN – Central Bank of Brazil
CONAB – National Supply Company
COODETEC – Central Cooperative of Agricultural Research
DERAL/SEAB – Department of Rural Economy of the Secretary of Agriculture and Supply of Paraná State
DIEESE – Interunion Department for Statistics and Socioeconomic Studies
EMBRAPA – Brazilian Agricultural Research Institution
ETC Group – Action Group on Erosion, Technology and Concentration
FUNDAÇÃO MT – Foundation for Support to Agricultural Research of Mato Grosso State
GURTs - Genetic Use Restriction Technologies
GMOs - Genetically Modified Organisms
IAPAR – Agronomy Institute of Paraná State
IBGE – Brazilian Institute of Geography and Statistics
MAPA – Minister of Agriculture, Husbandry and Supply
RNC – National Register of Cultivars
SNARC **–** Brazilian System of Evaluation and Recommendation of Cultivars
SNPA – National System for Agricultural Research
SNPC – National Service for Protection of Cultivars
UPOV – Union for the Protection of New Plant Varieties

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PRESENTATION

Over the past two decades, the technological base used in agriculture has undergone great transformations, creating serious challenges to the conservation of genetic resources and the future of food security. Among these innovations highlights the “genetic use restriction technology” (GURT), which produces sterile seeds and/or inhibits vital plant functions, eliminating the ancestral right of farmers to save their own seeds.

Considering the serious implications that this type of technology brings to food production and to the conservation of biodiversity, the issue has been debated in various international forums. In 2003, the Technical Expert Group contracted by the United Nations evaluated the potential impact of GURTs on family farmers, peasants and traditional communities and concluded that the negative impacts exceed the positive ones, characterizing them as a strong threat to the sovereignty and food security of these communities. The 8th Conference of the Parties to the Biological Diversity Convention, held in Curitiba in March of 2006, reiterated previous decisions, maintaining restrictions to the *Terminator* technology.

This document presents the result of discussions with Brazilian farmers about the impacts of *Terminator* technology on their activities. The first part presents the context of the Brazilian seed market and a profile of Brazilian agriculture, recent changes in the seed sector, the main stakeholders in the market and an estimate of the cost if Brazilians would be forced to purchase 100% of the seeds needed to meet the demand for planting corn and soybeans.

The second part presents seven interviews with small and medium farmers from different locations in Brazil’s Northeast, Midwest and South. These farmers raise soybeans and or corn, on farms that vary from 2 – 200 hectares. The interviews describe the production system, the origin of the seeds used and the opinion of the farmers about the potential impacts of *Terminator* technology. Part three presents final considerations about the possible impacts of the concentration in the seed sector, and particularly of the *Terminator* technology on the autonomy and income of farmers, on agrobiodiversity and on food security, in a process that affects society as a whole.

It is hoped that the statements recorded here, together with others that are being collected by collaborators of ETC Group in other countries, will be a source of inspiration for

the 9th Conference of the Parties to the CBD that will be held in Berlin, in 2009. Certainly, the issue of *Terminator* seeds will return to the agenda. Let the farmers' voices be heard.

1. THE BRAZILIAN SEED MARKET

1.1. Profile of Brazilian Agriculture

Brazil has 153 million hectares of farmable land, an area equivalent to the total territory of France, Germany, Spain and Portugal. Currently, 41% of the farmable lands are used for annual and perennial crops. Pasture occupies another 177 million hectares, sustaining the world's largest cattle stock. Favored by climatic conditions and an abundance of land and water, Brazilian agriculture has undergone expressive growth in the past decade, making the country one of the world's leading agricultural producers. This has had direct impact on the domestic economy, with agribusiness accounting for 33% of Brazil's Gross National Product (GNP), 42% of its exports and 37% of the nation's jobs (MAPA, 2007a).

Production for the domestic and export markets comes from some 4.2 million rural properties, of which 57% occupy areas smaller than 25 ha (DIEESE, 2006). Family farming is concentrated, above all, in the country's Northeast, Southeast and South. Intensive, large scale agriculture has greater presence in the Midwestern region. The annual crops are highlighted by soybeans and corn, both produced on small, medium and large properties. In 2006, the soybean and corn crops were responsible for 44.3% and 36.1% of Brazilian crop production respectively (IBGE, 2007). In 2004, family farming accounted for 27.8% of the value of soybean production and 44.3% of the value of corn production, while generating nearly one third of total Brazilian agricultural production (Guilhoto *et al*, 2007).

Brazil is now the world's second largest soybean producer. The economic importance of soybeans grew significantly since the 1980's, when the culture expanded from the country's Southern to Midwestern region, occupying large areas of the *cerrado* (Brazilian savanna). This was possible thanks to investments in genetic improvement made by public research agencies since the 1970's. In the 2005-2006 harvest, soybeans were cultivated on 22 million hectares, resulting in production of 52 million tons. As the leading agricultural export, the main soy products[1] generated annual revenues of US$9.3 billion.

The corn harvest is aimed mainly at the domestic market and is a key component in the chicken production chain. Since 2003, Brazil is the world's leading chicken exporter, with annual shipments of 3.2 million tons. To meet this demand, corn production doubled in the past 15 years, reaching 52 million tons in 2007. Occupying an area of 14 million hectares,

[1] Beans, meal and oil

corn is raised from northern to southern Brazil on small to large properties. In family farming, corn is an important component of domestic consumption, whether directly in the form of flours and grains or in feed for small animals such as pork and poultry.

1.2. Changes in the Brazilian Seed Sector

The organization of the seed supply system in Brazil began in 1920, with the creation of the Seed Service in the realm of the Ministry of Agriculture, whose attributes included multiplication, production control, analysis and distribution of seeds (França-Neto *et al*, 1998). In the 1940's, the São Paulo state government established a state cotton seed distribution system. In this period, the Agroceres company was created in Minas Gerais State and with the support of the Federal University at Viçosa, released the first hybrid corn cultivars.

In 1965, the promulgation of the first Seeds Law established rules for the sector, creating the bases for the development of the country's seed industry. The CARGILL company was the first multinational to enter the Brazilian market, installing itself in the country in 1965. With the advance of the green revolution in the 1970's, other multinational companies entered the market.

With the creation of the Brazilian Agricultural Research Institution (Embrapa) in 1973 the public sector built a national network for the evaluation of cultivars and organized improvement programs maintained by universities and government research agencies. This public system guaranteed the development of research in the improvement of plants, making it the pillar of the country's seed industry for a few decades. The identification of genes related to the juvenile period of soybeans allowed the development of cultivars adapted to low latitude regions and the expansion of this crop to Brazil's Midwest and North.

From 1979 to 1990, the National System of Agricultural Research (SNPA) released 497 new cultivars, of which 18% were of soybeans and 12% corn (Almeida, 1997). The strategy of working in partnership with seed producers and cooperatives allowed EMBRAPA to reach a high rate of adoption of its varieties, coming to occupy 64% of the soybean market in Paraná State in the 1999-2000 harvest (Domit *et al*. 2007).

The approval of a new regulatory standard during the 1990's caused a large transformation in the seed sector. In 2005, Brazilian Law 11.105 was approved, establishing security and inspection norms for genetically modified organisms (to substitute the previous law nº 8.974, of January 1995). Law 9.456, approved on April 28, 1997, established the National Crop Protection Service (SNPC), linked to the Ministry of Agriculture and defined rules for the registration of crops in the forms established by the Union for the Protection of New Plant Varieties (UPOV) (Hathaway, 1997). The new Seed Law, sent to Congress in

1998, and approved in 2003, established major restrictions on replanting commercial seeds for medium and large farmers and extended to the private initiative some responsibilities that were previously exclusive to the public sector, in the case of seed producer certification services.

The definition of a legal standard for the commercial release of GMOs and the possibility to restrict access to genetic material established by the Law of Cultivars and by the Seed Law motivated a series of acquisitions of Brazilian companies by large multinationals in the seed sector. These acquisitions were highlighted by the U.S.-based Monsanto company's purchase of the soybean division of FT Sementes, a leader in the soybean market and of the corn division of Agroceres – the largest Brazilian seed company at the time – in 1996 and 1997 respectively. In 1998, four other Brazilian companies were purchased by Dow AgroScience while Monsanto purchased part of three other multinationals operating in Brazil. In 1999, Agrevo – previously purchased by Bayer – bought three Brazilian companies in the corn and soybean sectors. In the same year, DuPont acquired a Brazilian company in the corn sector and the corn division of Pioneer, which was present in Brazil since the 1970's.

The acquisitions continued in the following decade. In 2005, Nidera purchased 100% of Bayer's soybean and corn programs in Brazil. In 2007, the acquisitions reached a peak with Dow AgroScience's purchase of Agromen's seed division – a Brazilian corn seed producer with 11% of the national market. In the same year, Monsanto purchased 100% of Agroeste, another leading Brazilian company in the hybrid corn seed sector. Thus, in the 10 years after the approval of the Cultivar Law, Brazil experienced a growing concentration of the seed market, following the same trend found in other developing countries.

In addition to the denationalization process of the corn and soybean segments, the changes in the legal standards required substantial changes in the institutional arrangements for improvement, evaluation and release of the cultivars. The Brazilian System for the Evaluation and Recommendation of Cultivars – SNARC, instituted by the Ministry of Agriculture in 1981 – and operated until 1997 in a cooperative system coordinated by EMBRAPA – joined public and private institutions acting in seed improvement and production. In this period, regional and product Commissions composed of representatives of the various segments evaluated and recommended cultivars in a collaborative manner.

This collaborative system was also extended to the work of plant improvement, The establishment of a network to experiment with different lines and cultivars also allowed

sharing germplasm. Once a superior line was identified, it was made available for the other members of the network to use in crossings with other materials in the local experiments.

Approval of the Cultivars Law revoked the 1981 regulation that established SNARC and extinguished the Regional Commissions for the Evaluation of Cultivars. The collaborative work ended, giving place to competitive relationships based on secret contractual relations between the parties. The recommendation for new cultivars came to be the exclusive responsibility of the breeders and the germplasm was no longer shared.

1.3. Principal Actors in the Brazilian Seed Market

The seed supply market now includes the government sector, large multinational companies and small Brazilian companies. The participation of each segment in the market varies according to the crop, with a distinct competitive capacity in each link of the productive chain, including improvement, production, sale, distribution and extension service. There are companies that dominate the entire chain, with great capacity for investment in the field of plant improvement. There are other companies that only operate as multipliers of genetic material developed by EMBRAPA or by large private companies. Private foundations are important actors in facilitating the access by large farmers to new cultivars, significantly contributing to the diffusion of material developed by EMPRABA and by large private companies.

The collaboration between the public and private segments takes place through technology partnership contracts. In the field of soybeans, EMBRAPA is the leader in contracts with private companies, especially with institutions that focus on the needs of agribusiness (Santini *et al*, 2002). The partnerships include trials to evaluate the cultivars as well as the exchange or licensing of genes for genetically modified plants. An example is the partnership contract between EMBRAPA and Monsanto, signed in 1996 for the development of genetically modified soybeans tolerant to glyphosate. As a result of this partnership, 18 soybean varieties developed by EMBRAPA, recommended for the 2007-2008 harvest, incorporated the *RR* gene licensed by Monsanto. In 2006, the two companies reached an agreement for the creation of a biotechnology project fund, extending the technical cooperation to the joint development of other GMO crops (SeedQuest, 2006). In addition to Monsanto, EMBRAPA established a contract with BASF for the development of genetically modified soybeans tolerant to the imidazoline class of herbicides (SeedQuest, 2007).

The collaboration between the public and private sector is not limited to bilateral relations as in the Embrapa-Monsanto model described above. Legal regulations demand

the formation of new institutional arrangements to meet the challenges created by the geographic distances and environmental variability found in Brazil. Private foundations, which encompass representation of the private sector in farm inputs, seed multipliers and public and private research companies are important stakeholders in this new scenery (Fuck, 2006). They are highlighted by the Fundação de Apoio à Pesquisa Agropecuária do Mato Grosso [the Agricultural Research and Support Foundation of Mato Grosso] (Fundação MT), created in 1993, the largest Brazilian soybean producer. The Fundação MT is a network of partnerships for the development and distribution of soybean varieties adapted to the *cerrado* region, involving shareholder members, EMBRAPA, companies in the supply sector, member farmers and municipal governments. Royalties and technology fees on the seeds multiplied constitute the main sources of income, generating a return of R$1.6 million[2], which is split equally with EMBRAPA (Nassar, 1998).

This model inspired similar arrangements in other regions of the country, as is the case of the Fundação Meridional, created in 1999, in Londrina. The Fundação was formed around a network of participants in the states of São Paulo, Paraná and Santa Catarina, with its research partners being EMBRAPA Soja and the Instituto Agronômico of Paraná - IAPAR. In the same year, seed producers from Rio Grande do Sul created the Fundação Pró-Sementes, establishing a partnership with EMBRAPA for the development and multiplication of new soybean, wheat and triticale cultivars.

The farmer's cooperatives, whether in association with the foundations, or individually, also have an important role in the seed production chain, especially in the evaluation of new cultivars and in their multiplication and distribution. In the field of soybean improvement, the Central Agricultural Research Cooperative (COODETEC), created in 1995, in Paraná State, stands out, having originated in the former research department created in the 1970's by the Organization of Cooperatives of Paraná State (OCEPAR). COODETEC develops cultivars, licensing the protected materials to other partners who distribute the seeds. Its network congregates 40 other associated cooperatives in Paraná, Santa Catarina, Rio Grande do Sul, São Paulo, Goiás and Mato Grosso do Sul States. The technology partnership with Monsanto allowed COODETEC to release 6 cultivars with the glyphosate tolerant gene RR.

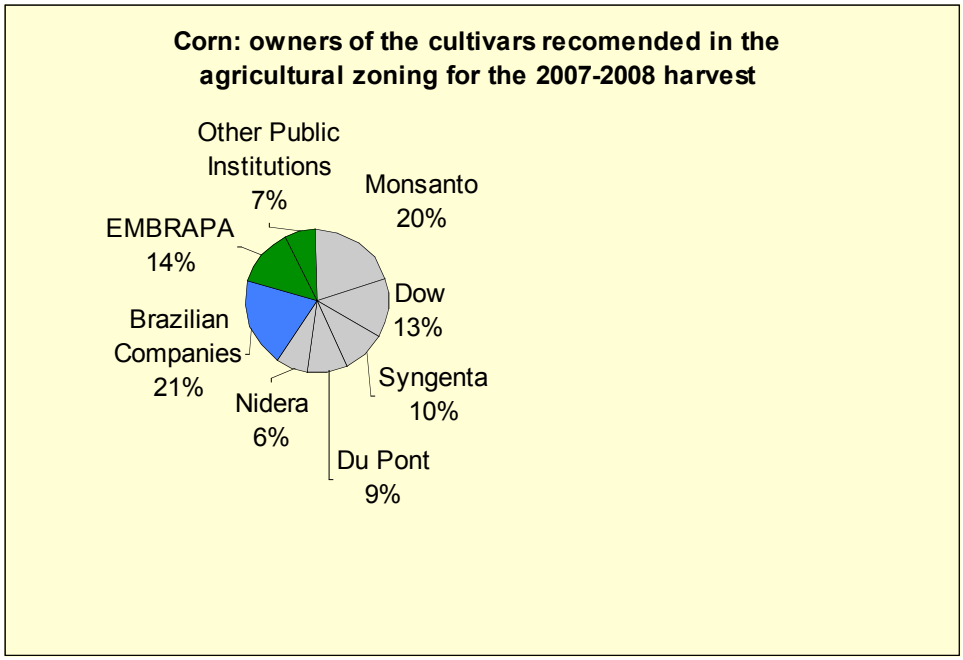
The inexistence of a data base that monitors planted area by cultivar in each state prevents a precise estimate of the participation of the public and private sector in the seed market. An econometric study about the impact of the research conducted by EMBRAPA estimated that from 1976-1998 the soybean varieties developed by EMBRAPA occupied an

[2] Equivalent to US$ 941 thousand in Nov. 2007.

average of 34% of the annually seeded areas in Paraná and Goiás states (Pardey *et al*, 2004). In Rio Grande do Sul, in the period from 1973 - 2000, the estimate was of 44%. The same amount was estimated for Mato Grosso, from 1980 to 2000.

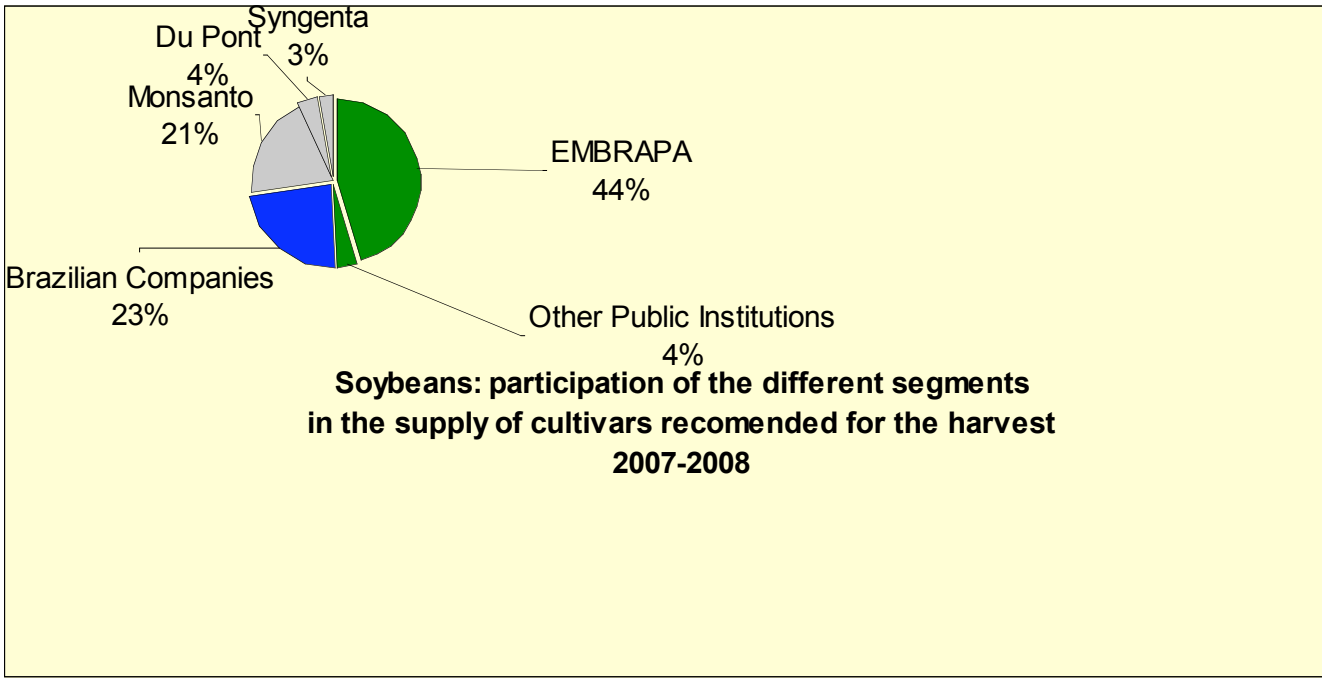
Although it does not portray the real value of the seeds sold, analysis of the list of cultivars recommended in the 2007-2008 harvest gives an indication of the current participation of the different market segments. In the case of corn, 310 cultivars were recommended (MAPA, 2007b), of which 58% were from multinational companies, 21% from Brazilian companies and 21% from public research institutions. Monsanto took a leadership position, accounting for 20% of the recommended cultivars compared with 14% for EMBRAPA (Fig.1). The purchase of Agroeste, in 2007, elevated Monsanto's participation by 10 percentage points, and left it with a 40% share of Brazil's hybrid corn seed market (Gazeta Mercantil, 2007). It is estimated that the corn cultivars developed by EMBRAPA and sold by small Brazilian companies franchised under UNIMILHO corresponded to no more than 5% of the national market.

In the case of soybeans, the analysis of the list of cultivars recommended in the 2007-2008 harvest demonstrated a different situation. Of 341 recommended cultivars (MAPA, 2007c), the public research institutions accounted for 49% of supply, Brazilian companies 23% and transnationals 28%. EMBRAPA led with 44% of the cultivars offered, followed by Monsanto with 21% (Fig.2). Although it occupied 2nd place, the RR gene was incorporated in 15% of the cultivars offered by the Brazilian public and private sectors, providing Monsanto additional profits from the technology fee charged for the seeds sold by companies that license the RR gene.



Source: organized from the list published by MAPA (2007b).

Figure 1: Participation of different segments in the supply of corn cultivars recommended in the agricultural zoning for the 2007-2008 harvest.



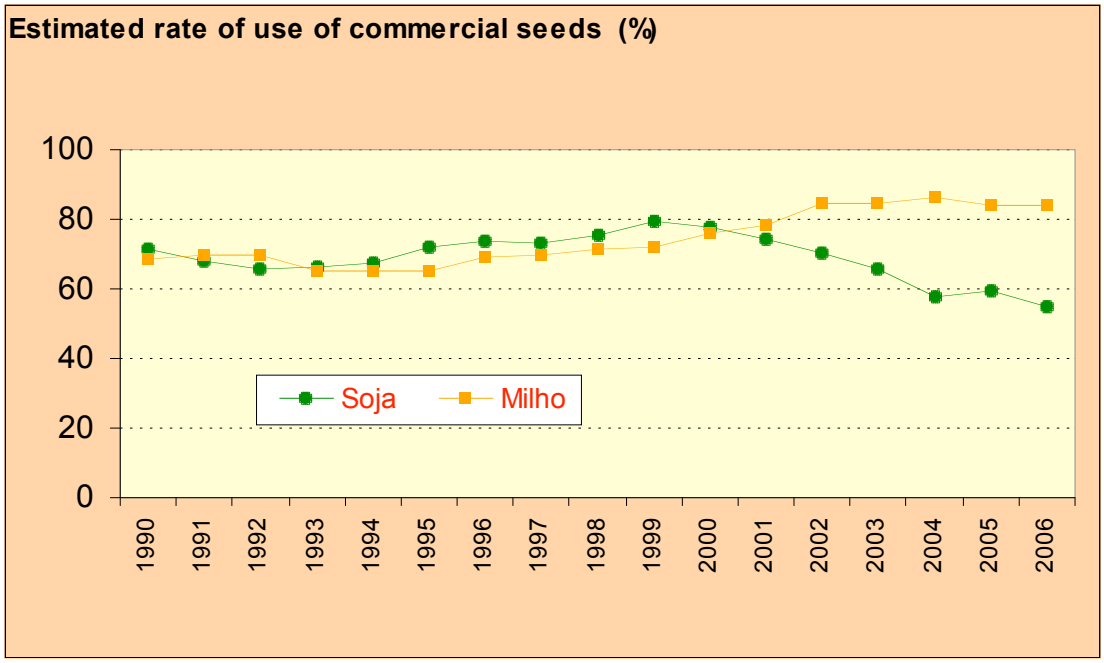
Source: organized from the list published by MAPA (2007c).
Figure 2: Participation of the different segments in the supply of soybeans recommended in the agricultural zoning for the 2007-2008 harvest.

1.4. The Cost of Seed

The utilization fee for commercial seeds is another data element that is difficult to present precisely. There is great variation among the regions of the country and among the different segments. Family farms tied to the official credit system and large farmers purchase a large amount of commercial seeds, which is a condition for gaining access to credit for agricultural expenses. The annual purchase of seeds occurs principally among those who use hybrid corn. Since soybeans are a self-pollinating plant, even the large growers customarily store their seeds, a practice that has been prohibited by Ministry of Agriculture inspections.

According to data from ABRASEM, considering the total area planted and the effective demand for seeds in 2006, the average rate of use of commercial soybean and corn seeds this year was 55% and 84%, respectively, showing a decline in the rate of use of certified soybean seeds since 1999 (Fig.3). A study conducted in 2004 with a sample of 246 farmers in Paraná State, Brazil's second largest soybean producer, identified that the use of commercial seed remained around 87.4% (Carraro *et al*, 2005). In Rio Grande do Sul State,

the average use of commercial soybean seeds from 1983 and 1998 remained below 60%. The entrance of smuggle seeds from Argentina dropped these rates to 30% in 2001 and 19% in 2002.



Source: organized from ABRASEM data.

Figure 3: Estimated rate of use of commercial soybean and corn seeds in the period of 1990 – 2006.

From August 1994 to August 2006, the average price of seeds increased 246% (CONAB, 2007). The weight of seed in production costs varied from region to region, and according to the production system and technology used. For family farmers who use little or no inputs and who work with animal power, the cost of seed has a greater total cost in production, and can reach up to 100% of monetary expenses. In Paraná State, the country's main corn producer, the Agricultural Secretariat estimated that for the 2007-2008 harvest the cost of seed corresponds to 6% - 10% of production costs (SEAB/DERAL, 2007). In the case of soybeans, the cost of seed corresponded to 5.8% in conventional planting and 6.4% in the system of zero tillage.

Tables 1 and 2 provide estimates of the cost of seeds to meet 100% of the demand for planting of the area cultivated with corn and soybeans in the 2005-2006 harvest. In the case of corn, 12.9 million hectares were cultivated that year, generating demand of nearly 260 thousand tons of seeds. Applied in August 2005 for the amount of seeds, the total cost of seed would be about US$162 million according to the exchange rate at the time. (Tab.1). This would be equivalent to 3.5% of the value of corn production in the 2006 harvest. Using the prices and exchange rates for the 2007-2008 harvest for the same area (12.9 million

hectares), the cost of seed for 100% of the area planted would be about R$ 1,68 billion reals, equivalent to 10% of production costs. This rise is due to a combination of factors that includes the rise in price of the seed and the currency devaluation.

The same exercise can be done for soybeans (Tab.2). In the 2005-06 harvest, 22 million hectares were planted, resulting in production of 52 million tons. The demand for seeds for the planting of 100% of this area would be 1.6 million tons, with a cost estimated at US$ 375 million for the planting of conventional seeds and US$ 612 million for the planting of genetically modified seeds. Applying prices of the 2007-2008 harvest for the same planted area, the cost of seeds would rise to US$ 1 billion for conventional seeds and US$1.7 billion for genetically modified seeds.

In the case of corn, the region most penalized by the requirement to purchase seeds would be the semi-arid Northeast, which is home to the largest portion of Brazil's small farmers. The semi-arid region has special characteristics to its local production systems, making the seeds a key element in the food security strategy of family farmers (Almeida *et al*, 2002). In this way, in addition to being a significant burden to Brazilian agriculture, the *Terminator* technology would have a strong impact on the poorest segments of the population who maintain the practice of producing their own seeds based on the use and conservation of agrobiodiversity.

Table 1: Estimated cost of corn seeds to sow 100% of the area planted in the 2005-2006 harvest and to sow the same area (in ha) with price estimates for the 2007-08 harvest

Description	BRAZIL	North	Northeast	Southeast	South	Midwest
Area planted in hectares 2005-06 harvest	12,996,355	549,711	2,867,101	2,430,792	4,685,004	2,463,747
Production in tons 2006 harvest	42,662,578	1,102,369	3,168,720	9,634,743	18,654,269	10,102,477
Seed demand in tons 2005- 06 harvest	259,927	10,994	57,342	48,616	93,700	49,275
Value of production 2006[i] harvest (In thousands of US$)	4,673,811	178,038	504,634	1,148,336	1,891,423	951,379
Cost of seed demand[ii] (In thousands of US$)	**162,727**	**6,883**	**35,899**	**30,436**	**58,661**	**30,849**
Seed Cost/production value(%)	3.5	3.9	7.1	2.7	3.1	3.2
Estimated production value 2007-08[iii] harvest (In thousands of US$)	11,584,408	299,332	860,420	2,616,176	5,065,298	2,743,182
Cost of demand for seeds[iii] (In thousands of US$)	**1,168,212**	**49,412**	**257,717**	**218,498**	**421,124**	**221,460**
Seed Cost/production value(%)	10.1	16.5	30.0	8.4	8.3	8.1

Notes: (i) Exchange rate Dec. 2006 =US$2.13; (ii) 1 20 kg bag of seed Dual Hybrid = R$30, exchange rate Aug. 2005=US$2.38; (iii) estimated value for Jan. 2008 60kg sack =R$29, exchange rate = US$1.78; (iv) 20kg sack of Dual Hybrid seed =R$160, exchange rate =R$1.78

Source: Organized from production data from IBGE (2007); Price indexes from CONAB (2007); exchange rate from BACEN.

Table 2: Estimated cost of soybean seeds to sow 100% of the area planted in the 2005-2006 harvest and the same area (in hectares) with price estimates for the 2007-2008 harvest, using GMO seeds.

Description	BRAZIL	North	Northeast	Southeast	South	Midwest
Area planted in hectares 2005-06 harvest	22,082,666	517,943	1,488,313	1,665,966	8,131,849	10,278,595
Production in tons 2006 harvest	52,464,640	1,262,418	3,467,918	4,102,075	17,721,001	25,911,228
Seed demand in tons 2005-06 harvest	1,656,200	38,846	111,623	124,947	609,889	770,895
Value of Production 2006[i] harvest (In thousands of US$)	8,671,695	218,519	570,692	761,927	3,328,627	3,791,929
Cost of seed demand[ii] (In thousands of US$) (conventional)	**375,776**	**8,814**	**25,326**	**28,349**	**138,378**	**174,909**
Cost of seed demand [ii] (In thousands of US$) (genetically modified)	**612,376**	**14,363**	**41,273**	**46,199**	**225,505**	**285,037**
Seed cost/Production value (%) (conventional)	4.3	4.0	4.4	3.7	4.2	4.6
Cost Seed/Production Value (%) (genetically modified)	7.1	6.6	7.2	6.1	6.8	7.5
Value (Thousands of Brazilian R$) (45;5/ 60kg sacks)	39,785,685	957,334	2,629,838	3,110,740	13,438,426	19,649,348
Estimated production value 2007-08[iii] harvest (In thousands of US dollars)	22,351,509	537,828	1,477,437	1,747,607	7,549,677	11,038,959
Cost of seed demand[iv] (US$ 1,000) (conventional)	**1,042,103**	**24,442**	**70,235**	**78,619**	**383,750**	**485,057**
Cost of seed demand[iv] (US$ 1,000) (GMO)	**1,674,809**	**39,282**	**112,878**	**126,351**	**616,741**	**779,556**
Seed cost/Production Value(%) (conventional)	4.7	4.5	4.8	4.5	5.1	4.4
Seed cost/Production value(%) (GMO)	7.5	7.3	7.6	7.2	8.2	7.1

Notes: (i) exchange rate Dec 2006=US$2.13; (ii) 1kg conventional seed=R$0.54 and 1 kg GMO Seed =R$0.88, exchange rate Aug. 2005=US$2.38; (iii) estimated value for Jan. 2008 60kg sack =R$45.50, exchange rate=US$1.78; (iv) 1kg conventional seed = R$1.12 and 1 kg GMO seed =R$1.80, exchange rate=R$1.78.

Source: Organized by authors based on production data from IBGE (2007); Price indexes from CONAB (2007); exchange rate from BACEN.

2. IMPACTS OF THE *TERMINATOR* TECHNOLOGY: STATEMENTS FROM FARMERS

This section presents the opinions of seven Brazilian farmers about the possible impacts of *Terminator* technology on agricultural production. Considering the regional diversity existing in Brazil, the research includes interviews with small and medium size farmers from different locations in Brazil's Northeast, Midwest and South (Fig. 4). The criteria for the selection of those interviewed were the importance of soybean and corn crops to the farmers and their availability to provide a statement. The interviews used a semi-structured questionnaire with questions about the local production system, the source and cost of seeds and the opinion of the farmer about the impact of *Terminator* technology. The interviews were recorded, then transcribed and edited.

Graphic 4: Locations of the properties of the farmers interviewed

STATMENT OF Mr. JOSÉ DE OLIVEIRA LUNA (JOSÉ PEQUENO)

Location: Lagoa Nova, Paraíba State, Brazil
Principal activity: Diversified family farm production

Production System:

"Our agriculture is diversified. We have a little of everything".

Mr. José de Oliveira Luna, known as José Pequeno, is 60 years old and lives with his family on 11 hectares in Brazil's semi-arid region, about 8 km from the center of the municipality of Lagoa Nova. Of his entire area, 2 hectares are destined for growing corn (*Zea mays*) mixed with fava beans (*Phaseolus lunatus*) and beans (*Phaseolus vulgaris*). The production system is diversified, including, in addition to planted area, areas of pasture for cattle and for small animals such as pigs and poultry. The production guarantees the family's supply and surpluses are sold in agroecological fairs, a recent initiative in the region that helps to open the market for produce from family farms.

Seed sources:

> "I have lived my whole life on the farm and don't know what it is to buy 1 kg of beans for human consumption or for planting. This is a family tradition. I have 11 brothers and all tell the same story".

Producing his own seed is a tradition that comes from the times of José's father. He states that his father never purchased seed for planting:

> "I come from a family that considers the seed to be sacred. In my father's time, the neighbors slept relaxed because they knew that my father could guarantee seeds for the planting*".*

In 1974, José began a community seed bank with two varieties of corn. The community seed bank is a security system for the seed supply in Northeastern Brazil. In this system, the families of a community collectively store a reserve of seeds to supply the periods of scarcity that occur in drought years. José's community seed bank now has 50 varieties of the main species planted in the region.

> "*We revived the varieties that had been lost in our region which is the traditional seed, the landrace seed, the seed of passion, the seed of life, not the seed of death".*

In the case of corn, the community seed bank stores 6 varieties. José plants two varieties called Pontinha and Jaboatão, both planted since the time of his grandparents.

"My father said that a farmer without seeds is a sufferer".

In addition to corn, José cultivates various varieties of different species of beans: beans (*Phaseolus vulgaris);* macassa beans (*Vigna unguiculata*) and fava beans (*Phaseolus lunatus*)

"*The farmer takes the seed to the field according to his passion, according to the love that he has, based on the trust that he has in each seed variety*".

In addition to the production of their own seeds, the farmers in the region maintain the practice of exchanging seeds at festivals and farmers markets. In Paraíba the community seed banks are organized in a network of more than 200 seed banks, encompassing 3,000 families. Each year, the community seed banks network holds the Passion Seed Festival, a special space for the exchange of seeds and knowledge about care and use of local agro-biodiversity. It is also a time in which the farmers revive a variety that had disappeared.

José believes that a bigger advantage to planting one's own variety is the adaptation to the local conditions. This provides farmers greater control of the characteristics of the variety.

"*We know which seed sprouts earliest, the seed for a rainy year, the seed for a warmer location. It means that it is a seed that we know how to work with".*

Cost of Seed:

Since the farmer's have their seeds at home or in the community seed bank, José explains that the cost of seed is the work of harvesting, drying and storing it for the next year. In his region, few people purchase seeds, a fact that has been reinforced with the expansion of community seed banks.

The seed itself is exchanged among farmers, at a base price of R$1,50 per kilo, in the case of corn varieties. On the local market, the commercial varieties can reach up to R$12,00 per kilo, a price that is eight times higher. In addition to the higher cost, the hybrid seeds cannot be harvested and stored for planting the following year.

> *"The hybrid seed that is planted this year in the next season is no longer the same, and in the following year it no longer produces. With our seed, the more you plant it, the better it multiplies".*

In reality, the family farmers are able to earn income with the seeds produced locally. Government programs have been acquiring seeds of local varieties to distribute to the communities when there are supply shortages.

Impacts of the *Terminator*:

> *"I don't know the* Terminator *seed and I don't want to. Our reality is different. We defend the seed of life, the seed that will bring life and not the other one".*

José maintains that he is not interested in the *Terminator* technology and that it is not suitable to the strategy of the family farmers, and sees this technology as a true threat. Therefore, he would not accept this type of seed, even if it was free of charge. To the contrary, he suggests that this type of technology as well as other types of GMO's should be fought so as not to harm the farmers who seek "agriculture for life". This view is shared by the 3,000 families who participate in the community seed bank network.

If a neighbor plants a *Terminator* seed, the community would be significantly harmed, because it can harm local varieties. This would perhaps require the community to mobilize to demand the removal of this person from the region. Anything must be done to avoid contamination.

Instead of *Terminator* technology, Mr. José recommends that the seed sector be organized to support the seeds from the region, the farmers and the community seed banks. He also suggests that in regions with insufficient seeds and diversity, activities be undertaken to revive the seeds that disappeared from the hands of farmers as well as the multiplication of community seed banks.

2.1. STATEMENT OF MR. VALDEMAR FREIBERGER

Location: Estrada MT 240, Tangará da Serra, Mato Grosso State, Brazil
Principal activity: Soybean production

Production System:

Mr. Valdemar has an area of 450 hectares, of which 210 are used for an integrated system of planting and husbandry, 190 for pasture and 50 hectares have forest. The property also has the equipment needed for production in large areas, including tractors and other implements.

The 210 hectares were purchased in 1983 in partnership with his brother. On this land Valdemar raises soybeans in a monoculture system and between soy harvests, plants corn, sorghum and millet. Since 1991, the soybeans are cultivated in a zero tillage system over the cut stalks of corn, millet or sorghum.

In the first harvest years, soybean productivity was about 2.16 tons/ha, rising to 2.4 tons/ha. In 2004, productivity reached 3.42 tons/ha, falling in recent years to 2.7 tons/ha. Valdemar believes that part of this drop is due to the attack of soybean rust, caused by the *Phakopsora* fungus. The rise in value of the Brazilian currency in relation to the U.S. dollar also contributed to raising prices of inputs and reducing the value of soybeans.

Source of seeds:

Valdemar believes that the use of good quality seed is indispensable to obtain a crop without problems in the "*stand*" and with high productive potential. Therefore, the seed must have excellent genetic, physical, biological and sanitary quality.

Due to the warm and dry climate and the lack of suitable storage technology, Valdemar is not able to produce soybean seeds, requiring him to buy them each year. This raises production costs. In recent years, he has planted the following soybean varieties: Conquista, an early season variety that is excellent for corrected and well fertilized soils; M-SOY 8914, a mid season variety of high productive potential; Uirapuru, a late season variety that is highly productive in soils of high and medium fertility. The cultivars Conquista and Uirapuru were developed by the Fundação MT and MSOY by MONSOY, a Monsanto subsidiary.

Seed costs:

According to Valdemar, comparing the relation between beans and seed, he notes that the seed price has not changed in recent years. Each kilo of seed purchased is paid with three kilos of beans. In this way, the seed represents the equivalent of 4% of the total value of the gross income for an average productivity of 2.7 ton/ha.

Impacts of *Terminator* Technology:

In relation to *Terminator* technology, Valdemar emphasized that he wants to continue with his current practices, without depending on outside technologies that create dependence. He does not know the potential impact on the cost of seeds and believes that this will be determined by the companies. In any case, he risks affirming that seed prices could triple. Valdemar is not sure about the environmental impacts, imagining that there would be almost none. His greatest concern is in becoming subject to the dictates of a given company or group of companies that manipulate the technology. He said, "*the companies will do with the farmers whatever they want".*

2.2. STATMENT FROM MR. SILVIO CESAR GUERINI

Location: São Miguel do Iguaçu, Paraná, Brazil, close to Iguaçu National Park.
Principal Activity: Soybean and corn production.

Production System:

Silvio is the son of farmers and has worked in agriculture for 15 years. His property has a total of 350 hectares, of which 250 are planted. The area was purchased by the family in 2001 with the intention of working with organic production, which they did for six years. Nevertheless, due to technical difficulties, the family decided to return to conventional production. They now raise soybeans, corn and beans in the summer and in the winter plant oats for soil coverage.

Seed source:

From 1968 to 2000, Silvio worked with his parents on a property they purchased in the neighboring country of Paraguay, raising corn and soybeans. Since they did not have financial resources and suitable technology, they were required to produce their own seeds.

The seeds were selected from the best areas and the best plants. When he returned to Brazil the family found it strange that many farmers did not store their seeds.

Currently, due to the lack of suitable technology for producing quality seeds, they are required to purchase soybean seeds. Insects such as stink bugs[3] and diseases such as soybean rust harm the seed quality. Mr Silvio plants a very good and very productive variety, which he selected and conserved. He also selects and produces oat and bean seeds.

Seed costs:

Silvio could not say precisely the cost of the seed, but considers it quite high and much more than the cost of the beans. He knows that if he raises the seed at home the cost falls considerably. For this reason, since 2008 he expects to overcome the technological difficulties and return to producing soybean seeds. In addition, he believes that seeds produced locally, based on the selection made by the farmer, result in varieties that are better adapted to the region's climate and soil, thus increasing production.

Impacts of the *Terminator* Technology:

Silvio considers the *Terminator* technology to be a tragedy for agriculture because farmers would lose all of their freedom in the field. He also maintains that the control of the seeds by a few companies threatens national sovereignty. He affirmed:

> *"It seems like they want to leave us more dependent than we already are in conventional agriculture, extremely dependent on the group of pesticides and herbicides. It is a public calamity, a question of food safety and of national sovereignty. I hope that it is not liberated in our country".*

Silvio estimates that family farming would be more affected, because he believes that small-scale production is sustainable only if it produces its own seed. He also said:

> *"If these farmers become dependent on large companies they are destined to disappear. Not taking into account the environmental problems that this will cause. The issue concerns me, because we will have a nation dominated by the control of seeds, making our food controlled by a few companies. Our food is formed by the seed and thus this comes to be a question of food security. I hope that the State intervenes so that we do not run the risk of losing our national sovereignty".*

[3] There are various species in this group, including *Nezara viridula*, *Piezedorus guildinii*, *Euchisthus eros* .

2.3. STATEMENT OF MR. NEURI PEDRO CARRARO

Location: Linha Colônia Cela, Municipality of Chapecó, Santa Catarina, Brazil
Principal activity: Corn and Soybean Production

Production System:

Neuri lives with his father on 24 hectares of land. He has 12.1 hectares of his own and leases another 20 hectares from others. Corn is one of his main crops, occupying a total area of 20 hectares. The rest of the area is occupied by pasture. Nearly 50% of the corn production is used for his own consumption and the rest is sold.

> *"We have planted corn all our lives. A little more or less, continuing from my father, we always planted corn and other crops as well, but there was always corn on our farm".*

Source of seeds:

Neuri now purchases commercial hybrid seeds from the local Cooperative or from other agricultural product stores. But it was not always like that. When he was a child he remembers that his father planted his own seed, a habit that the children gradually lost over time.

> *"I remember that in the old days my father planted his own seeds. I was still a child and he bought a seed one year and kept the same seed for 20 years. And then, we let it get away, we lost the seed. And we regret it until today, because it was producing constantly more. We stopped planting it because of our own lack of care. And since it is easier to go to the store and buy a ready seed, we wound up letting that seed get away. And with this lack of care we wound up losing the seed and were never able to find it again. I think we were the only ones that had that seed. I remember that the name was Asteca, I don't know where the name came from and I don't know what it means."*

Neuri has heard of the genetically modified corn seed, but has still not planted it.

Seed Costs:

> *"Its expensive, it's like this, I consider the seed to be expensive, the most expensive cost".*

Although he recognizes that the price of seed has been rising over the years, Neuri has no precise data about the cost of seed, because he is not accustomed to separating the cost of seed from the general production costs. In his opinion, the rise in the cost of seed is a

great concern. In addition to the seeds, there is a continuous rise in the price of fertilizers and herbicides and pesticides, increasingly decreasing earnings for farmers.

> *"This is a concern because each year the costs rise and this does not mean that later, at the sale of the product, there is also a price increase; at times, in the following year we sell the product for less money than the previous year, so this is the concern."*

Neuri recognizes that in the past ten years many varieties with good productivity have appeared, but at a higher cost. At the same time, many commercial brands disappear from the market in an unexpected manner.

> *"For example, there were companies that produced good seeds and that from one moment to the other disappeared from the market. I don't know why they disappeared."*

Impacts of *Terminator* Technology:

"If the seed dies, it will certainly cost us more in the future".

Neuri has nothing against using genetically modified seeds. He believes that this technology has some benefits. In the case of GMO soybeans, for example, he sees as an advantage the reduction in the number of herbicides used to control weeds. Control is possible with a single herbicide, which he believes to be much better for nature.

Nevertheless, he says he is against the *Terminator* technology. He believes that it will raise the cost of seed and will also concentrate the market, leaving farmers in a situation of dependence. He also fears the consequences of contamination, especially in species such as corn that are open pollinated.

> *"If a neighbor plants and it crosses with another it is certainly harmful for the production of the farmers. This will cause many problems, serious problems. I think that each property is individual and each farmer does what he wants on his property. But if I place a seed of this type on my property I will automatically harm the life of others. In the case of corn, the seed would be contaminated."*

Neuri hopes that any technological change that takes place is for the better, for the good of nature and the benefit of all farmers.

> *"I hope that change on this side is better for all and not just for some. But today, technology often advances to improve the life of the few and not the majority. So I hope the changes are for the majority and not just for the minority."*

2.4. STATEMENT OF MR. VALDEMAR JOSÉ BIANCHI

Location: Sede Figueira, Chapecó, SC, Brazil
Principal Activity: Diversified family farm

Production System:

Mr. Bianchi lives with his parents on a 11.6 hectare property, of which 4 hectares are planted with corn. In addition to farming, he has a farm stand in the town fair. His land is hilly and for this reason, all the work is conducted manually, without the use of machinery. In addition to corn, the family plants other crops for home consumption.

Sources of Seeds:

Mr. Bianchi has used hybrid corn seeds for seven years. Before that he planted local varieties. The change was due to the greater productivity of hybrid corn. There is also the problem of season duration. The local varieties usually have a longer season and farmers increasingly need faster materials.

> *"The local variety corn itself is a corn that is slower to produce. It is not short season but long season. It is also more sensitive to temperature variation and wind. For this reason it does not produce as much. But it produces with less technology than the hybrid."*

The seeds are purchased at the local Cooperative, but he believes that they come from Paraná or even from São Paulo. He currently plants the hybrid from the Santa Helena company.

> *"There are always some types of seeds that disappear from the market. Then come new ones. They have even increased the types of seed. There is diversity, but they discard the old ones and create new ones. Once there were various companies. Now it is all concentrated in the hands of Monsanto isn't it?"*

Cost of Seeds:

Mr. Bianchi said that he never calculated the cost of seed, but believes that it is about 15 - 20% of his production cost. In his opinion, the price of seeds has been rising each year.

> *"The cost is constantly increasing. And it is increasingly difficult to find a variety to be planted. I want to change but it is not easy to find seeds. And the large companies are increasingly producing so that only they are able to produce and sell. I would like to change to landrace corn".*

Impacts of *Terminator* Technology:

The increased cost of seed is one of the main impacts indicated by Mr. Bianchi. He fears that the *Terminator* technology will contribute to the disappearance of production by small family farmers.

> *"This will do away with the small farmers. The cost will increase a lot. It is already difficult enough without these additional costs - knowing that we can produce with a much lower cost. Only because the companies want the profit just for themselves, right? It will be difficult for the life of the farmer. It will increase production costs a lot."*

Another concern raised by Mr. Bianchi is related to the possible environmental impacts. Despite the affirmations to the contrary, he believes that the GMOs in general present environmental problems. Another factor that he highlights is the contamination with pollen from GM plants, which in his opinion could eliminate the autonomy of farmers to produce their own seed, a vital right for the survival of family farmers.

> *"Today they speak of taking care of the environment. But the way they are doing things, what is the environment going to be like in a few years? And farming? They are constantly adding a new gene. Isn't it going to be harmful to nature? Soon there won't be any control over this. What will life be like? Won't it harm the health of people and animals?"*

> *"And if this seed arrives, the landrace varieties of corn will disappear. Only the hybrids will remain. And since they have the product, the seed, we will have to buy the additive to be able to farm. And for how long can the small farmer survive who is not able to do this? The small farmer will disappear. They are doing everything to manipulate the small farmer, aren't they?"*

Mr. Bianchi's hope is that these issues are considered and the process is changed.

> *"I just hope that these companies are aware of what they are doing. They only think of profit, in possession and in power. And seeing that the world is being destroyed by greed. And they keep inventing new things that can harm the entire population on Earth. The extinction of the human being is foreseeable. They should think a bit. Because life here, a bit of what is suffered here on earth, it is good to be alive. They shouldn't think just of profits. They should think of the well being of people, not simply in having and earning, and in making a fortune which doesn't help at all, right."*

2.5. STATEMENT OF MR. JOÃO SÉRGIO ZUCA

Location: Distrito Marechal Borba, Chapecó, SC, Brazil

Principal Activity: Production of *Erva-mate* (*Ilex paraguayensis*), Soybeans and Corn

Production System:

Mr. João lives with his wife on 45 hectares, of which 12 are occupied with crops and the rest with *erva-mate* trees. The property was inherited from a larger area of his father that was divided among the children. The different parcels in the crop area are planted alternating one year with soybeans and the next with corn. The planting and care is done with his own machines and equipment, but the harvest is contracted to third parties.

João has planted corn since he was 12 years old when he still worked with his father. At that time, the corn was planted mixed with soybeans. Soybeans and corn are now planted in a monoculture system.

Source of seeds:

> *"Earlier, landrace seeds were planted. Years ago, when one planted with a hand machine, it was seeds saved in the barn. Later they began to plant hybrid corn, those 40 kg. sacks, then they were reduced to 20 kg and so on".*

In the past, the family raised local varieties with open pollination. Over time, they came to acquire hybrids. Since then, the corn seeds are purchased at the local Cooperative or in other agricultural product stores. In recent years they have planted hybrids from Agroceres and Agroeste, Brazilian companies that were purchased by Monsanto.

> *"We have purchased seeds from other companies, but today, AGROCERES has a monopoly. There are various brands today but they all belong to the AGROCERES group, which is MONSANTO. So they have brands, but it's the same owner. It means an increase in the price of seeds, because there is no more competition".*

In the case of soybeans Mr. João saves his own seed. He periodically exchanges seeds with a brother-in-law. Recently, he began to plan GM varieties, but he still saves the seed.

> *"Years ago we planted more than one type of soybean, lets say, it was more to mix with a long* season *soybean. Today, only the short* season *soybean is planted. But this does not bring any difference to production. It did not increase or decrease very much. It is in the same range."*

Cost of seeds:

> "*In the cost of production, the corn seed is about 30%. For soybeans it's a bit less because we still don't buy the seed. For this reason the cost is less, much less."*

João considers the price of corn seeds quite high. In the case of soybeans, the seed is saved and planted, decreasing production costs. In any case, João is required to pay the technology cost of the home-raised GM seed when he delivers the harvest to the Cooperative. At the time of delivery, the soybean is tested to verify if it is from a GM seed or not. For now, João thinks that it is worth planting the GM soy because of the ease that it offers in weed control. But he is not sure for how long it will be an advantage.

> *"The charge for these royalties is not correct. Because they charge to pressure us, who buy their seeds, right? The high cost of the seeds is the fault of the companies that control the entire seed production chain. They set the price and the agricultural stores together with the cooperatives cannot lower it. If the dollar dropped, why didn't the price of the seeds and inputs? They simply buy them and I think that the cooperatives have to begin to produce the seeds to see if they can lower the cost*."

Impacts of *Terminator* Technology:

> *"I think that this is all a political question, perhaps they could create a law that would prohibit charging these royalties and other companies could produce seeds."*

The price increase is the principal impact João expects if *Terminator* seeds are released. He believes that this would be worse in the case of soybeans, because it would eliminate any chance for the farmers to produce homegrown seeds. He expects an increase in the cost of soybean seeds from 50% - 70%.

In the case of corn, he raises the problem of contamination. Unlike soybeans, the corn is open pollinated and a cultivar with the *Terminator* technology would easily contaminate neighboring crops. João also does not believe that the GM corn offers an advantage. In soy, for example, he did not note any difference in productivity between the conventional and GM seed. He expects the same for corn, with the added factor the increased cost of seed.

> *"I think that the technology and the extension service must begin working so that the farmer can raise his crops without using herbicides. It would be good to work with the plant cycles for example, planting oats in August, knowing that in November he could plant soybeans because the oat has already dried. With ryegrass, radish and vetch it would be the same. The blade roller would bring down the plants without requiring herbicides for zero tillage, offering a great environmental advantage. But as long as we don't work well, and there is no support for this, the farmer must use herbicides to raise the crops.*"

2.6. STATEMENT OF MR. DIOGENES ANTÔNIO FRACASSO

Location: Santo Expedito do Sul, Rio Grande do Sul, Brasil
Principal Activity: Ecological vegetable production

Production System:

Diógenes lives with his family on a 5.6 hectare property, 10 km from the center of the city, on what he calls an "island of agroecology". The region is a traditional producer of soybeans and for this reason Diógenes' property is circled by soybean crops, including GM soya. The work is conducted by 4 family members.

He recalls that when he was a child, wheat was one of the main crops, although the production systems were very different than they are now. Today the properties do not go beyond a soybean monoculture and a bit of milk production.

Diógenes property maintains a diversified production system and nearly all of what the family consumes is produced there. He only purchases a few products that are not produced in southern Brazil such as sugar, coffee and salt. In addition to vegetables, the rest of the production surplus is sold in farmers' markets and other points of sale of ecological foods.

> *"It should be recalled that some time ago my family was in this wave of large scale production, But as I said, the property is small and five years ago we decided to diversify the property, to stop raising soybeans and stop producing milk for the companies. Now many neighbors come to our property to buy products for their own consumption. The soybeans and milk cows came in so strongly that the grape vines, the orchards, the vegetable gardens gave way to monoculture."*

Although there is a market for organic soybeans, João stopped planting them. He noted that many fungal diseases that appear also attack organic soybeans making production difficult.

> *"The main advantage of not planting soybeans is that you are the owner of your own business, of your own life. Those who plant soybeans today, at least here in the region, take the inputs and the seed on the day that they plant, they harvest and it seems that it is a burden to have the product at home. The farmer wants to be free of the product that he harvests at the moment of harvest*."

Source of seeds:

On João's property, it is possible to find more than 50 seed varieties of various species, including corn, beans and vegetables. This work is done with the support of the NGOs and other organizations that work with agroecology.

> *"Although we did not plant these varieties we were able to get them at a time of seed scarcity to produce and multiply them as well. Much of this diversity of seeds and crops was lost in the region.*"

In João's region, to revive, save and multiply the seeds is an activity restricted to the ecological farmers.

> *"At planting time for soybeans, wheat and corn the trucks line up at the cooperatives and at the farm stores to sell seeds. There is no more tradition of saving the seed, It is a tradition that unfortunately was lost due to the technological package. It came so strongly that it brought, together with the purchase of seeds, the purchase of fertilizer, insecticide, herbicide and so on."*

João thinks it is strange that each year the companies offer new seed varieties, affirming that they are resistant to disease. He also realizes that the conventional farmers are beginning to understand that the varieties that are presented are for that specific year and at great cost they are able to produce with that seed. Therefore, João believes that the farmers began to realize a bit late that not saving their own seed is a great disadvantage.

> *"In the past 10 years we lost some varieties, such as beans of color, various varieties of wheat and soybeans. And corn. A very large variety of corn was lost, the Cateto type, the Cunha, the Oito Carreiras and so on. Mainly the corns were lost."*

Cost of Seed:

> *"It can be said with certainty that 100% of my neighbors buy seed. They lost the tradition of saving seed. This tradition, this habit of saving the seed was lost nearly 20 – 30 years ago. Before, everyone stored their corn, wheat and bean seeds in the grain bins. Today nearly no one stores any more. They prefer to buy the seed because it is easier.*

João is not sure of the cost of seed purchased by the neighbors but imagines that it is high. Looking from the outside, he imagines that the seed corresponds to a large part of production costs. Meanwhile, on his property the cost is very low, requiring only a bit of care in storage. In reality, João's seeds even provide a return, if not a monetary one. In his community, this represents little, because since the neighbors do not have diversified properties, they wind up not having demand for the diversity of varieties that João saves.

"The seed that is produced on my property is exchanged with other ecological farmers, mainly at the farmers markets. We make these exchanges to diversify the qualities of the seed. Getting better seeds, exchanging seed. But as a financial question, of income, there is not much to be earned with the seed."

There is easy access to landrace seed in the circles of farmer ecologists. Leaving this environment, João affirms that it is very difficult to have access to this type of seed. The conventional seeds sold by the companies are easily found in the cooperatives and farm stores.

"For the farmer, conventional farming is easy. Just wait for the planting season and the stores offer the maximum varieties possible, and in the quantity that the farmer wants. The seed became a very strong commodity, principally GM soybeans. It became a commodity very important for the companies that sell seeds and for the conventional farmer it became easy to get these seeds."

Impacts of *Terminator* Technology:

João is concerned that his neighbors become misguided by misleading advertising in the same way that happened with GM crops, and thus wind up adopting the *Terminator* technology, even if illegally.

"If the companies show to the farmers that the technology will improve income, that it will give higher returns, even if momentarily, perhaps the farmers will adhere to this technology. As it was with the GMs. Today there are many farmers who regret having lost their seeds and having entered the wave of GMOs."

"Although it is prohibited, there are many farmers producing GMO corn. They unfortunately don't know the impact that this will have on the biodiversity, for example, in the region where we live. But there are farmers taking the risk."

In João's opinion, the increased cost of production and the subordination to the companies are two great risks. If today the GMO soybean producers allege there are financial advantages to the use of this technology, the liberation of the *Terminator* seeds can end this cycle, decreasing income, generating poverty and a rural exodus.

Contamination is another serious problem raised by João, specially in the cultivation of corn. If a neighbor comes to use a seed of this type João's ecological production system and his strategy for use and conservation of local varieties would be completely compromised. In João's words, corn pollen does not respect fences.

"*Sincerely I feel my hands are tied because I have no way of preventing this possible contamination. I believe that there may be some formula related to the*

differences between the seeds and that we can discuss this with the neighbors. But I believe that there must be some government intervention and principally awareness on the part of farmers."

In the context in which he lives, João believes it is quite difficult to expect awareness from the part of the farmers.

"The farmers, as I said before, want to get rid of the product and of the seeds as well. As they get rid of the seeds they do not have this passion to store the seed at home and take care of them. They become hostage to the companies that have the seeds in their hands. It is going to be very sad to see – and I wouldn't want to see – but certainly this will happen, the farmer reaching planting season with no seed and without the ability to purchase them because the price will be too high."

As an alternative, João suggests that the seed sector be organized in order to provide incentives that the farmer produce his seed. In addition, he thinks it is important that governmental and non-governmental agencies provide support with information and structure.

"If by chance they need to purchase them they shouldn't be seeds that in the future bring problems both of environmental contamination, as well as financial dependence."

3. 3. FINAL CONSIDERATIONS

The analysis of the changes in the Brazilian seed sector indicates that, in the past two decades, there was a great concentration and denationalization of the sector. This process was only possible thanks to the significant alterations undertaken in legal regulations during the 1990's. These changes de-structured the *modus operandi* of the seed supply system, reducing the role of the state in the evaluation and recommendation of cultivars, and in the monitoring of the sector. The new legal regulations established norms that favor private control, reducing the right of farmers to produce their own seed.

In the case of corn and soybeans, even if there are countless small companies producing seeds, the initial links of the chain dedicated to improving and obtaining new cultivars came to be controlled by a few large transnational companies and EMBRAPA. With the entrance of the GM varieties, even the public companies, such as EMBRAPA and the private national foundations, with know how in the field of seed improvement, now incorporate patented genes in their cultivars, functioning as a transmission chain for technology imposed by the large transnational biotechnology and seed companies. In this

way, in addition to the acquisitions of Brazilian companies that own germplasm, the adoption of bilateral “cooperation” contracts has been an effective mechanism used by the large transnational companies to control the Brazilian seed market.

The statements of farmers described in this case study demonstrate that the concentration of the seed market does not benefit any segment, whether it is small, medium or large farmers. All of those interviewed expressed concern with the adoption of *Terminator* technology, which would completely eliminate the rights of the farmers to produce their own seed. In the same way that took place with other GM plants already introduced in Brazil, it will be impossible to impede genetic contamination resulting from the migration of pollen from neighboring crops or from seed mixtures that can occur during harvesting, processing, storage and transport.

While the current law still has some safeguards that allow small farmers to store their seed, the imposition of biological restrictions, as created by the *Terminator* technology, will not leave any option for farmers, condemning all to dependence on the cultivars imposed by the few companies that dominate the sector. In addition to the ethical issues that this type of technological imposition raises, the release of *Terminator* seeds will compromise the future of food sovereignty and security and the conservation of agrobiobiodiversity. It will, therefore, affect all of society.

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