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IPC Technology Issue Brief
March 2006

The Costs of Implementing the Biosafety Protocol - A Look at Brazil

As countries prepare to take decisions on the Biosafety Protocol's (BSP) documentation requirements for shipments of living modified organisms (LMOs) intended for food, feed and processing (LMOs-FFP), many questions remain about the appropriate ways that the BSP might be implemented and about its potential impacts. The International Food & Agricultural Trade Policy Council (IPC) has consistently urged parties to the BSP to assess the likely impacts of the different options. As a developing country and a major agricultural exporter, as well as a signatory to the BSP, the stakes for Brazil are very high. For this reason, the IPC has commissioned a study on the economic impact of the BSP on Brazil to be completed shortly.[1]

Some of the BSP provisions still lack details on how they are to be implemented in practice, among them the requirements for the labeling of LMOs-FFP. Since most agricultural commodities around the world are produced and traded for food, feed, and processing, biosafety labels for LMOs-FFP could prove costly and disruptive for world agricultural commodity trade. Ultimately, the extent of these costs and disruptions will be determined by which labeling scheme for LMOs-FFP is agreed upon under the BSP, and by how countries decide to comply with such schemes.

The Biosafety Protocol

The Biosafety Protocol entered into force in 2003 as part of the Convention on Biological Diversity (CBD), with the main objective to contribute to the safe transfer across countries of LMOs, which will be released into the environment and could affect the conservation and sustainability of biological diversity. The BSP includes guidelines on how countries exporting LMOs need to get a green light from importing countries through the use of "Advanced Informed Agreements."

The BSP rightly does not require Advanced Informed Agreements in the case of transboundary shipments of LMOs that are intended for food, feed and processing and not for release in the environment. For these uses, the BSP requires countries to provide information about the types of LMOs present or likely to be present in bulk crop shipments through a web-based international Biosafety Clearinghouse and indicate that these shipments may contain LMOs and are intended for food, feed and processing and not for planting. The BSP, however, asked that members agree on whether more detailed labeling requirements for such shipments are necessary. Among the documentation options being considered are indicating that a cargo:

a) "**may contain**" LMOs (current BSP requirement and current practice in Brazil);
b) "**contains**" LMOs, **identifying** the specific LMOs in the cargo;
c) "**contains**" LMOs, identifying the specific LMOs in the cargo as well as **quantifying** their amounts.

[1] Silveira José Maria et al, "Impacts of Implementing the Cartagena Protocol on the Brazilian Agricultural Commodity System" NEA/IE- Unicamp, Brazil, March 2006. Work on this project was supported in part by the International Grain Trade Coalition and ABIOVE (the Brazilian Association of Vegetable Oils Industry).

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The parties have not been able to reach an agreement until now and another attempt will be undertaken in a meeting of the BSP parties in March 2006 in Brazil.

Brazil and the BSP

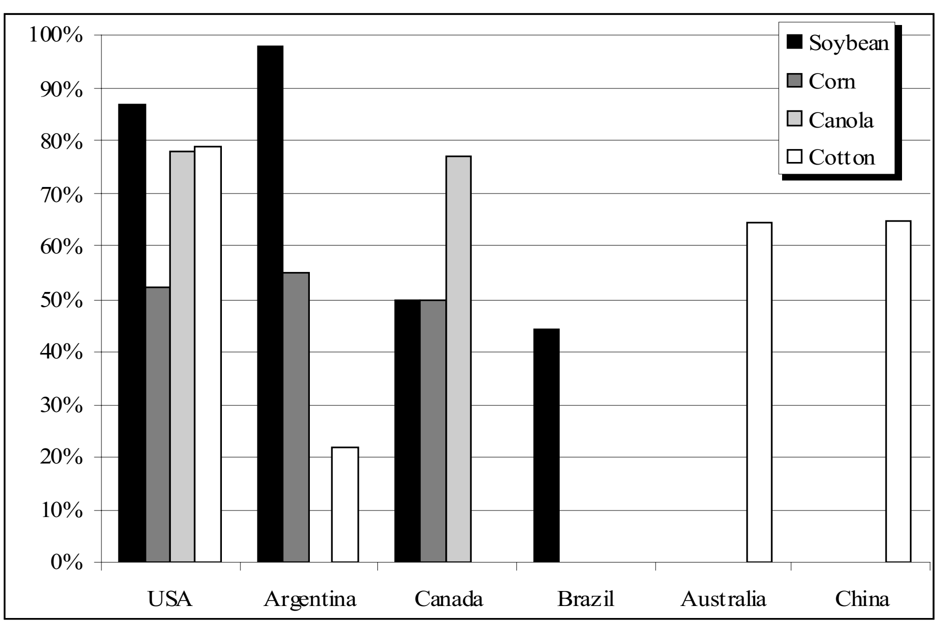
Brazil is not only the host of the BSP meetings in March 2006 but also the only large agricultural exporter to have ratified both the CBD and the BSP. As such it has consistently argued for the "may contain" option. However, Brazil is relatively isolated in its position, since other large agricultural exporters (e.g. the United States and Argentina) have not ratified the BSP and have no significant voice in the current BSP negotiations.

A technical brief produced for the IPC by Kalaitzandonakes (2004) points out that some of the BSP provisions could lead to trade restrictions and significant compliance costs, and that the costs of different options vary widely. Silveira et al (2006) have calculated some of these compliance costs and potential trade restrictions in the case of Brazil. This issue brief is based on these technical reports and summarizes the likely costs Brazil could incur under the alternative documentation options of the BSP for LMOs-FFP that are currently under discussion.

The Importance of Crop Production and Trade for Brazil

Brazil is in a unique position among the members of the BSP due to its large agricultural sector and exports. Competing countries and large LMO producers, such as the United States and Argentina, are not signatories of the Cartagena Protocol. It is worth noting that the United States, Brazil and Argentina, are the three most significant crop producers and exporters in the world. These countries hold about 80% of the world's grain production, and all of them have significant rates of LMO adoption (see Figure 1). The Cartagena Protocol's implementation of LMOs-FFP documentation requirements would have uneven effects not only on exporting versus importing countries; those engaged in trade versus those not engaged in trade; but also those which have ratified the Protocol versus those which have not done so. They could thus impact the relative competitiveness of different exporters. In this context, Brazil is confronting the possibility that higher potential costs could handicap its agricultural competitiveness and export capacity vis-à-vis its main competitors.

Figure 1: Adoption of LMOs in Various Crops and Major Exporting Countries in 2005



Source: USDA NASS, USDA FAS, AAFC, and ISAAA

The work of Silveira et al (2006) shows that Brazil has a clear comparative advantage in crop and animal protein (i.e. chicken) production, which is reflected in its foreign trade. It also shows that Argentina, one of Brazil's main competitors, is becoming increasingly competitive, especially in soybean production, in large part due to the widespread adoption of transgenics in that country. Brazil is therefore justifiably concerned about documentation requirements that might further impact its competitiveness in agricultural commodity markets.

Brazil's competitiveness is based on lower land costs but also on recent gains in factor productivity. The expansion of production in new areas since the 1970s has also been important, and this process continues, albeit at a decreased rate. Furthermore, the spread of no-tillage cultivation practices – estimated by EMBRAPA (the Brazilian Agricultural Research Corporation) at 23 million hectares – have maximized the benefits brought by new technologies, including the introduction of a transgenic soybean variety.

Under these conditions, Brazil has been able to produce and export agricultural commodities and value added food products at competitive prices. Brazil exports to many countries whose burgeoning populations are seeking to improve their nutritional intake – especially the consumption of better quality proteins – such as China and India. Yet, these same countries do not hesitate to tax certain food derivatives to protect their agribusiness sectors.[2]

Brazil's competitive position is held back significantly by inefficiencies in its agrifood supply chain. Inefficient transportation logistics and shortages in storage infrastructure have a negative impact on its export capacity. Such limitations are especially acute in new areas of production from which grains and oilseeds have to travel long ways to their final destinations

According to ABIOVE (the Brazilian Association of Vegetable Oils Industries) in 2005, 60 percent of the total volume of soybeans was transported by road, 33 percent by rail and 7 percent by waterways. As for other grains, essentially all transportation is by road.

Brazilian soy and grains, often produced at great distance from the ports, mainly make their way to export channels via trucks. Shipments are co-mingled with others and transported in other trucks, sometimes also by rail or waterway. Since approved GM varieties are treated the same as conventional varieties, no attempts are made at Identity Preservation (IP) either at harvest or at other points in the supply chain.

Cost of Testing at Export

As pointed out by Kalaitzandonakes (2004) in the absence of substantial efforts to source and identity preserve non-LMOs under strict protocols, export vessels originating from countries with meaningful production (i.e. export vessels from Brazil of some 50,000 - 70,000 tons) should generally be expected to contain LMOs. The exact level of LMOs and the share of individual LMO events will vary drastically across vessels depending on the production in the regions where crops originated. Importantly, commercial production of an LMO event does not automatically imply that it is present in a particular cargo.

In Brazil, as in other large producers and users of GM varieties, exporters could therefore only reliably indicate that a cargo "may contain" LMOs. If exporters had to specifically identify or quantify the LMO content of export cargoes, they would need to undertake extensive tests for each cargo shipment and change their operations accordingly.

[2] For example, according to the Letter of IBRE (the Brazilian Economic Institute, 2006), India taxes Brazilian oil at 45 percent and meal at 30 percent. Japan does not tax meal, just oil at 30 percent.

As pointed out by Kalaitzandonakes (2004), beyond the laboratory costs, additional compliance costs in testing export cargoes for LMO content exist but are more difficult to calculate. These include handling and overhead charges incurred by exporters for maintaining an inventory of samples and managing the interface and test reporting with labs, sampling authorities, regulators and their customers.

Costs from Repeated Testing and Identity Preservation

While the BSP documentation requirements pertain to export cargoes, compliance costs are likely to spread to other parts of the agrifood supply chain in Brazil. Indeed, BSP labeling and reporting requirements could force repeated testing and some IP at various parts of the supply chain either to protect certain export markets or to guard against liability.

Specifically, it is possible that certain importing countries could impose restrictions on certain LMOs based on BSP allowances. In such cases, exporters, like Brazil, will need to be able to segment their export flows to prevent such LMOs from being directed to such countries. Furthermore, qualitative or quantitative reporting requirement could lead Brazilian exporters, concerned about liability, to ask their suppliers for relevant documentation, leading them, in turn, to ask their suppliers and so on.[3] Such repeated testing could be used for the issuance of certificates to protect from liability claims or to assist with efforts in IP and segregating cargoes directed to certain export markets.

Clearly, such IP and repeated testing is costly. Yet, similar efforts would be required from all exporters that agree to abide by the BSP's documentation requirements and as Kalaitzandonakes (2004) proposed, these costs would likely be born by importers. Hence, it can be expected that all exporting countries would be equally concerned about such compliance costs, unless, of course, these costs are unevenly distributed among them.

The United States and Argentina are in a position to identity preserve a significant portion of their grain production at a competitive cost for different reasons. The United States has a demonstrated ability to identity preserve (already doing so for the Japanese markets for a premium of 10-15 percent)[4] by exploiting a significant on-farm and commercial storage infrastructure with surplus capacity and an efficient, dense transport network that can effectively manage IP and timely testing. Argentina has not had as much of a reason to implement IP so far, but proximity of the production areas to the export ports and single transport modes (trucks) can easily facilitate such IP systems at reasonable costs. Brazil with its large distances between production areas and export locations, its undercapitalized multimodal transport system and thin storage infrastructure is at a competitive disadvantage when it comes to segregating grain lots or testing and retesting for export markets.

To implement any kinds of IP and participate in all possible export markets or appropriately test to properly limit liability, Brazil will have to use testing at multiple points of its supply chain. This will likely prove both costly and difficult. The forthcoming Silveira et al (2006) study quantifies the implied costs for implementing such a test-based IP system. The study first measures the testing costs that might be incurred under different labeling and documentation scenarios. These effectively represent direct compliance costs for implementing the BSP for LMOs-FFP in Brazil. The direct costs of implementing some degree of IP to appropriately segment cargoes are also examined and quantified. Other less direct costs, certain to occur when such a system is implemented, are not calculated but should be considered. For instance, a supply chain that must facilitate some degree of IP will, inevitably, face

[3] Such liability concerns are most valid considering the risks inherent in the fact that importers may also choose to sample and test a shipment at its point of arrival. As pointed out by Kalaitzandonakes (2004), since LMO testing is a statistical process, even with identical testing protocols, repeated sampling of the very same cargo would likely produce different results. If re-testing is required or if vessels must be diverted to other locations, there are potentially very high hold-up costs, as well as possible reloading or demurrage costs, and costs due to quality deterioration. An exporter would be well advised to seek some legal protection.

[4] Kalaitzandonakes (2004)

increased complexity in storing and blending grain (and hence, added costs from supplemental labor, delays, and inefficiencies in the utilization rates of storage/transport assets). While such incremental costs are recognized, they are difficult to measure and are not directly accounted for in this study.

The greater the number of transshipments, the greater the costs of testing and retesting (and potentially identity preserving) cargoes along a supply chain will be. Similarly, the further the production area is from the ports, the greater the need to transship a particular cargo of grains is likely to be. In Brazil, the new producing regions are very far from the ports, leading players in the supply chain to focus on the most efficient route. Despite trucking being the predominant mode of transportation, the combination with trains, and less often with waterways, implies the formation of large "lots." Because of the quality of the highways, the deficit in field storage and intermediate warehouses, as well as the seasonality of exports, companies look for optimization along the highway the cargo travels. For a large percentage of the cargo, such transportation and storage practices are not compatible with IP processes and costly for testing and retesting at every transfer.

In the case of maize, logistical problems for IP systems emerge from the dispersed cultivation areas rather than large distances to the ports. Disperse production at relative small regional scale makes IP a task that demands significant coordination – for example, by coops. Accordingly, the minimum scale required by transportation and storage logistics, mainly at the ports, is difficult to meet.

Indeed, the importance of public terminals in the main Brazilian ports, their configuration and the lack of adequate conditions for parking trucks at the pre-loading structures necessitate the use of private terminals (owned or rented) to facilitate increasing IP. This port reorganization would likely imply very high costs that are difficult to evaluate.

Given these issues, an examination of the compliance costs of the BSP require adequate analysis of the current situation of Brazil's grain transportation and storage systems. Today's deficit in bulk storage capacity is estimated at 36 percent. This deficit would be aggravated by the implementation of an IP system based on tests. With an estimated 5 percent annual expansion of Brazilian agriculture by the year 2012, the need to expand port capacity is estimated to be 560,000 tons/year (due to the need to increase the capacity to move crops to 46.5 million tons of grains).

Currently, about 50 percent of the soybean and maize production go through intermediate warehouses and 30 percent combine farm storage and transshipments to reach the port. Only 20 percent of the production is stored in the field. This entire system will need to be readapted if significant IP of crops must be achieved after harvest.

Improvement in Brazil's storage and transportation system efficiency is directly associated with the use of large volume storage "lungs" that makes for an agile process and attenuates the seasonal characteristic of agricultural markets, avoiding the peaks which pressure the ports' capacity for moving crops. Most bulk silos located near farms have a capacity of 1,500-10,000 tons more than the capacity foreseen by IP systems based on certification (see http//:log.esalq.usp.br). Private or coop warehouses have large capacities, about 10,000-60,000 tons (see: http//:log.esalq.usp.br). Such volumes are incompatible with IP/certification programs that seek to avoid the presence of certain LMOs in crop cargoes.

Therefore, certain interpretations of the meaning of the BSP labeling requirements for LMOs-FFP would aggravate the current infrastructural deficit in Brazil which could worsen over time as production and trade increase in this country over the next ten years.

There are other indirect compliance costs that are even more difficult to anticipate, though equally important. The costs associated with port delays (demurrage costs) could be very significant. The cost of a vessel stopped at a port is estimated at US$ 40,000/day. Such delays are almost inevitable. For instance, PCR tests alone that might be required for the strictest of BSP labeling requirements can add delays as they take 2-3 days to complete. Similarly, in a test-driven system, holdup costs are also likely to emerge. The results of quantitative tests applied at Brazilian ports could be contested at the port of arrival, since sampling and resampling 50,000-70,000 ton vessels could yield different results. These divergences in test results could provide an argument for the rejection of cargo, causing losses due to the search for a new market to unload the product.

Estimated Costs of LMO Testing Under Conditions in Brazil

LMO Detection Methods

If the term “may contain LMOs” were to be adopted, it would be enough to use system documentation, listing those events authorized for trading by the CTNBIO (the Brazilian National Biosafety Committee). Acceptance of the term “contains LMOs” would mean the application of tests whose parameters (number, type and costs) would be influenced by the volume of crops moved through the supply chain, the conditions of transport and storage at the time of such movement and other relevant factors.

LMO analysis can involve three different types of tests. The first is simple detection (screening) with the objective of getting a qualitative answer regarding the composition of a specific product. The objective is to know whether the product analyzed contains LMOs or not.

Two types of LMO analysis methods have been developed: a method based on protein analysis and one based on analysis of DNA. Protein tests, also known as “tape tests”, are easy to use and inexpensive, but less accurate. DNA tests (mainly those based on polymerase chain reaction or PCR) are recommended by several international certifying organizations. These are more time consuming and expensive as they require laboratories accredited by the Ministry of Agriculture, Livestock and Supply (a process that takes an average of six months) and a Certificate of Biosafety Quality, which implies hiring highly specialized and costly labor.

Table 1: Summary of GMO Analysis Methods

Parameters	Methods Based on Protein Analysis		Methods Based on DNA Analysis		
	Immuno-chromatographic (Tape Tests)	ELISA	PCR Qualitative	PCR Competitive	PCR in Real Time
Easy to use	Simple	Moderate	Difficult	Difficult	Difficult
Special equipment needed	No	Yes	Yes	Yes	Yes
Sensibility	High	High	Very High	High	High
Duration	10 minutes	30-90 minutes	1.5 days	2 days	1 day
Gives Qualitative Results?	No	Yes	No	Yes	Yes
Appropriate for field tests?	Yes	Yes	No	No	No
Cost/Sample (US$)	2.00	5.00	250.00	350.00	450.00

Source: Reported in Silveira et al, 2006

In addition to technical criteria, the choice of tests is also influenced by economic criteria. Parameters such as time and the costs of the tests are fundamental in the case of agricultural commodities, which have small profit margins and waiting time at ports or warehouses represents extra costs that could exceed the exporter's profit. As shown in Table 1, the tape tests are the quickest and cheapest, and are therefore the ones used most for simple detection.

It should also be noted that the quality of an LMO detection analysis depends on the sampling process because that determines the representativeness of the results. The selection and preparation of the sample are crucial parameters in the LMO detection process. The detection limit of an analytical method can only be determined by the size of the sample.

The sample withdrawal process has important effects on the current analysis:

a) it delays by about 3 minutes the conventional sample withdrawal process and the truck unloading in mechanized receiving systems (a process that takes an average of 7 minutes)
b) in the case of the ports with automatic withdrawals from the ship's loading lines which receive grain from more than one intermediate silo at the same time, it could require adding "automatic sample takers". And in this case, the problem is knowing if the process for taking samples from lots of 3,000 tons on average accurately reflects the content of sampled cargo.

Meeting the requirements that will be imposed by the Cartagena Protocol will depend on the existence of a network of laboratories in the country that is able to perform the required LMO detection tests. The country will need to have a reasonable number of laboratories located near strategic spots, such as warehouses and ports, to reduce the cost and the time waiting for the test results. As the tape tests can be done both in laboratories and in the field or in the warehouses, their use in Brazil requires the existence of competent laboratories and training services for producers and warehouses for field analyses. Brazil has good conditions to carry out such tests either at the field or in a laboratory.

As far as PCR tests are concerned, Brazil's situation is a little more complicated. Although there are laboratories in the country with significant experience with these tests, the country could experience bottlenecks with respect to quantity, regional distribution and the trustworthiness of the results. According to the Ministry of Agriculture, Livestock and Supply, there are 5 accredited laboratories in Brazil that can detect and quantify genetically modified organisms in crops and by-products. There are at least two more awaiting accreditation. These laboratories have certainly been able to meet demand for testing soybeans, maize and their derivatives in the past. However, they are not equipped to handle the demands of a system expanded to the levels that will be required by a "contains LMOs" requirement in the BSP. A rough estimate shows that, to obtain the qualitative/quantitative information required by the "contains LMOs" labeling regime, some 40,000 samples of PCR/year would be needed to make one PCR test at the ports – almost double the current installed capacity of the laboratories mentioned above.

In the case of qualitative and/or quantitative PCR tests, the laboratories must have the technical conditions – infrastructure, equipment and human resources – to conduct the tests with a maximum degree of trustworthiness and safety. This is a fundamental point because any doubts regarding the quality of the tests done in the country or any testing errors could lead to extra testing and demurrage costs.

Testing Costs for Implementing the Cartagena Protocol on Biosafety

Based on all these considerations, the potential direct costs of testing implied by alternative BSP labeling requirements can be evaluated. The laboratory costs will increase with:

a) the number of samples that will be tested;
b) the type of analysis that will be required by the Protocol (qualitative or quantitative);
c) the number of events that will be tested for;
d) the number of commodities that will be subject to evaluation.

In addition to the type of analytical procedure, the detection costs will also depend on the product's transportation logistics conditions because these will determine the number of transshipments between the production unit and the port of embarkation. A new set of tests will be required at each point of transshipment. Both the distance and the existence of different types of transportation along one route contribute to the increase in the number of transshipments and, consequently, the number of detection analysis points. Analysis by Silveira et al (2006) considers three types of routes:

Route 1: 5 transshipments, with 5 test points before arrival at the port;
Route 2: 4 transshipments, with 4 test points before arrival at the port;
Route 3: 3 transshipments, with 3 test points before arrival at the port.

It also considers alternatives under the three potential BSP labeling regimes:

a) a simple detection model;
b) a model with identification of each event;
c) a model with identification and quantification of each event. The simulations shown below reflect just such scenarios.

The simulations use 2005 soybean and maize export data. The calculations of the testing costs are based on shipments of 40 tons (approximately one truck) and shipments of 3,000 tons[5]. Each 40-ton shipment undergoes a tape test and that each 3,000-ton shipment is tested through PCR analysis. This relationship between tons and tests was established after interviews with the laboratories, with supplier companies of kits and with agricultural commodity exporting companies.

As shown in Table 2, in 2005, Brazil exported about 22 billion kg of soybeans, equivalent to 560,877 of 40-ton shipments or 7,478 of 3,000-ton shipments. This means that 560,877 tape tests for each transshipment and 7,478 PCR analyses are necessary for simple detection.

Table 2: Soybean and Maize Exports in 2005

Product	Kg	US$	Shipments with 40 tons	Shipments with 3,000 tons
Soybeans	22,435,071,195	5,345,047,155	560,877	7,478
Maize	1,057,673,226	102,041,918	26,442	353

Source: Reported in Silveira et al, 2006

[5] It should be noted that applying a PCR test requires the use of two kits, proof and counterproof.

Simple detection assumes that for each transshipment analysis involves a tape test and a PCR analysis at the port. Unit costs for a tape tests are equal to US$ 2.00 and for a PCR test equal to US$ 180.00. Three samples are taken from each 40 tons, which requires 3 tapes, giving a total of US$ 6.00 for every 40 tons. In the case of PCR, 4 samples are tested for each 3,000 tons, implying a total of US$ 720.00 for each 3,000 tons.

Table 3 shows the results of the simulation for the three types of routes. In the case of Route 1, with 5 transshipments, the cost for detecting the presence of LMOs in soybean and maize exports will be US$ 32.32 and US$ 1.52 million, respectively. For Route 3, with only 3 transshipments, the costs fall to US$ 21.54 and US$ 1.02 million, respectively. In terms of percentages, the costs vary from 0.60 percent to 0.40 percent of the export value, for soybeans, and 1.5 percent to 1 percent for maize.

Table 3: Simple Detection Costs for LMOs

Procedures	Products	Amount in US$ millions	As a % of export value
Route 1	Soybeans	32.31	0.60%
	Maize	1.52	1.49%
Route 2	Soybeans	26.92	0.50%
	Maize	1.27	1.24%
Route 3	Soybeans	21.54	0.40%
	Maize	1.02	1.00%

Source: Reported in Silveira et al, 2006

Two other possible scenarios in the implementation of the Cartagena Protocol were considered: the need to identify and quantify the events in shipments of commodities. The results show that, if it is necessary to identify and quantify the LMOs, there will be a significant increase in the cost of the analyses.

Tables 4 and 5 show the testing costs when the LMOs in shipment need to be identified. Testing costs are calculated and presented for up to six events to account for both current and future introductions of new LMOs in the market. The results show that there is a significant increase in costs, compared to the simple detection procedure. In the case of six events, testing costs are double that of simple detection.

Table 4: Costs to Detect and Identify LMOs (US$ millions)

Routes	Product	Simple Detection	Identification				
			2 events	3 events	4 events	5 events	6 events
Route 1	Soybeans	32.35	43.12	48.50	53.89	59.27	64.66
	Maize	1.52	2.03	2.28	2.54	2.79	3.05
Route 2	Soybeans	26.92	37.69	43.08	48.46	53.84	59.23
	Maize	1.27	1.78	2.03	2.28	2.54	2.79
Route 3	Soybeans	21.54	32.31	37.69	43.08	48.46	53.84
	Maize	1.02	1.52	1.78	2.03	2.28	2.54

Source: Reported in Silveira et al, 2006

Table 5: Cost to Detect and Identify LMOs (as a percentage of 2005 export value)

Routes	Product	Simple Detection	Identification				
			2 events	3 events	4 events	5 events	6 events
Route 1	Soybeans	0.61%	0.81%	0.91%	1.01%	1.11%	1.21%
	Maize	1.49%	1.99%	2.24%	2.49%	2.74%	2.99%
Route 2	Soybeans	0.50%	0.71%	0.81%	0.91%	1.01%	1.11%
	Maize	1.24%	1.74%	1.99%	2.24%	2.49%	2.74%
Route 3	Soybeans	0.40%	0.60%	0.71%	0.81%	0.91%	1.01%
	Maize	1.00%	1.49%	1.74%	1.99%	2.24%	2.49%

Source: Reported in Silveira et al., 2006

Tables 6 and 7 show testing costs for the third possible BSP labeling regime: identification and quantification of all events in the shipments. In this case, the costs could be three times as high as those in the simple detection analysis.

Table 6: Costs to Detect, Identify and Quantify LMOs (US$ millions)

Routes	Product	Simple Detection	Identification and Quantification				
			2 events	3 events	4 events	5 events	6 events
Route 1	Soybeans	32.35	53.89	64.66	75.43	86.19	96.96
	Maize	1.52	2.54	3.05	3.55	4.06	4.57
Route 2	Soybeans	26.92	48.46	59.23	70.00	80.77	91.54
	Maize	1.27	2.28	2.79	3.30	3.81	4.32
Route 3	Soybeans	21.54	43.08	53.84	64.61	75.38	86.15
	Maize	1.02	2.03	2.54	3.05	3.55	4.06

Source: Reported in Silveira et al, 2006

Table 7: Cost to Detect, Identify and Quantify LMOs (as a percentage of 2005 export value)

		Simple Detection	Identification and Quantification				
			2 events	3 events	4 events	5 events	6 events
Route 1	Soybeans	0.61%	1.01%	1.21%	1.41%	1.61%	1.81%
	Maize	1.49%	2.49%	2.99%	3.48%	3.98%	4.48%
Route 2	Soybeans	0.50%	0.91%	1.11%	1.31%	1.51%	1.71%
	Maize	1.24%	2.24%	2.74%	3.23%	3.73%	4.23%
Route 3	Soybeans	0.40%	0.81%	1.01%	1.21%	1.41%	1.61%
	Maize	1.00%	1.99%	2.49%	2.99%	3.48%	3.98%

Source: Reported in Silveira et al, 2006

IP Processes: Impacts on Grain Transportation and Storage Costs in Brazil

While direct testing costs are significant they do not account for all the possible costs that could be incurred if IP was required in the case of a strict interpretation of BSP labeling requirements for LMOs-FFP. Silveira et al (2006) also calculated the potential impacts of “contains LMOs” types of BSP labels on Brazil’s current transportation and storage logistics conditions. Their evaluation does not incorporate fixed costs from investments in storage infrastructure and port installations, corresponding to the implementation of a complete information system on LMOs. However, their analysis examines and quantifies certain variable costs for implementing a test-based IP system in Brazil.

The analysis is based on the following calculations: For each region and route, the transportation modes are identified and the distance from production area to the ports is measured in order to calculate the number of transshipments along the route. With this information, the number of tests needed to detect LMOs along the route is arrived at – with the number of verifications being equal to the number of transshipments. It follows that the higher the number of detection tests along the route, the higher the average transportation costs.

About 60 percent of Brazil's soybean production passes through the port terminals of Paranaguá and Santos. Usually, these soybeans originate from the Goiás, Mato Grosso and Paraná regions. In 2005, the port of Vitória gained in importance, handling over 10 percent of soybean shipments. In addition to these terminals, the port of Rio Grande is an important terminal, with soybeans from the state of Rio Grande do Sul passing through there.

Using information from the four main port terminals, the number of transshipments was calculated along the main routes: from the rural production areas to the ports, passing through warehouses and intermodal transportation exchanges. There are two large regions, subdivided into five subregions:[6]

1. *Southern Region*: North Paraná and Rio Grande do Sul
2. *Central-Western Region*: Southeast Goiás, Southeast Mato Grosso and West Mato Grosso.

The costs and margins were considered on a 2003 RS$/hectare basis for each of these regions, i.e. the impact of implementing a system reflects the composition of the specific costs for each region, as well as an estimate of the application of tests in accordance with the number of transshipments needed for each route considered in the calculations[7].

According to the methodology applied in Silveira et al (2006), total costs are subdivided into operational costs, inputs, administrative costs and post-harvest (storage) costs. From the statistics, it can be seen that the storage cost is around 6 percent to 9 percent of total costs, with a variation among the states.

To estimate the increases in logistic costs (transportation and storage), the exporting regions were classified into areas of high, medium, and low risk for IP. Brazil's southern regions have a high risk of co-mingling LMOs with conventional crops, while the São Paulo, Rio de Janeiro and Vitória port regions have a medium risk. Finally, when the Central-Western region's soybeans are transported through the North and Northeast of the country, the non-conservation risk is greatly reduced. It should be noted that Rio Grande do Sul State is already considered an LMO producing region (i.e. the risk is at maximum) and is therefore excluded from this classification. In this region, with about 100,000 farmers growing LMOs, the BSP requirements would simply add costs to obtain information that is already reported in the documentation and in the seed certification process.

Increases in the costs of transportation are estimated for various regions (Table 8). In addition to the transportation and storage costs, the costs of the tests (tape tests in the intermodal transshipments and PCR in the port region), were estimated according to the number of transshipments on each route. In this way, for a scenario in which an IP system is implemented, the additional transportation, storage and test costs are calculated (Table 8).

[6] The details on storage and freight costs, plus the calculation of the number of transshipments, are in Silveira et al (2006)

[7] The details of the costs and number of transshipments used is presented in Silveira et al (2006)

Table 8: Estimate of the Increase in Logistic Costs of Soybeans with IP and Certification for the Main Brazilian Producing Regions, Compared with the Average Soybean Price per Region (R$/ tons)

Region	Main Routes	Increase in Cost (R$/ton)			Price (R$, 2004)	Participation of cost increase in soybean price per region			
		Transport	Storage	Tests		Transport	Storage	Tests	Total
Southeast Goiás	Rio Verde – Uberlândia - Vitória	24.4	10.7	1.5	548.3	4.5%	2.0%	0.3%	6.7%
	Rio Verde – Santos	24.4	10.7	1.2	548.3	4.5%	2.0%	0.2%	6.6%
	Rio Verde - São Simão - Anhembi – Santos	24.4	10.7	1.5	548.3	4.5%	2.0%	0.3%	6.7%
	Rio Verde – Paranaguá	30.5	15.9	1.2	548.3	5.6%	2.9%	0.2%	8.7%
Southeast Mato Grosso	Rondonópolis – Paranaguá	30.5	13.4	1.2	523.3	5.8%	2.6%	0.2%	8.6%
	Rondonópolis – Alto Taquari – Santos	24.4	10.7	1.5	523.3	4.7%	2.0%	0.3%	7.0%
	Rondonópolis – Uberlândia - Vitória	24.4	10.7	1.5	523.3	4.7%	2.0%	0.3%	7.0%
	Rondonópolis - Santos	24.4	10.7	1.2	523.3	4.7%	2.0%	0.2%	6.9%
	Rondonópolis – Porto Velho – Itacoatiara	18.3	8	1.9	523.3	3.5%	1.5%	0.4%	5.4%
West Mato Grosso	Sapezal - Porto Velho - Itacoatiara	18.3	8	1.9	523.3	3.5%	1.5%	0.4%	5.4%
	Sapezal – Uberlândia - Vitória	24.4	10.7	1.5	523.3	4.7%	2.0%	0.3%	7.0%
	Sapezal - Alto do Taquari - Santos	24.4	10.7	1.5	523.3	4.7%	2.0%	0.3%	7.0%
	Sapezal – Paranaguá	30.5	13.4	1.2	523.3	5.8%	2.6%	0.2%	8.6%
	Sapezal – Santos	24.4	10.7	1.2	523.3	4.7%	2.0%	0.2%	6.9%
North Paraná	Maringá – Paranaguá	30.5	13.4	1.2	603.3	5.1%	2.2%	0.2%	7.5%
Rio Grande do Sul	Passo Fundo – Rio Grande	0	0	1.2	616.7	0.0%	0.0%	0.2%	0.2%

Source: Reported in Silveira et al., 2006

The results show that transportation costs see the greatest increase with the implementation of strict BSP labeling: about 20.5 percent on average, with a standard deviation of over 10 percent. The cost related to storage increases on average by 9.1 percent, with a 5.8 percent standard deviation between the main routes. It should be noted that the variability of the impact in these costs is related to each region's typical difficulties in implementing IP, mainly the more distant regions, which require many adaptations to implement the system.[8]

It is noteworthy that Rio Grande do Sul is the state with the least impact, since it is a declared LMO producer. In this state, the BSP would mean additional costs to test for LMOs, along the lines detailed in the previous section. The additional costs vary from 0.8 percent to 3.4 percent, with an average value of 1.5 percent. This represents approximately 0.3 percent of the soybean price in 2004.

In North Paraná, the impact of BSP would be larger. The study calculated an increase of 2.2 percent in storage costs related to the 2004 soybean price and 5.1 percent in transportation costs, also related to the 2004 soybean trading price, resulting in a total increase of 7.5 percent.[9]

[8] Remote regions need to use various modes of transportation to move their production. Therefore, cargoes originating in regions with a low potential for presence of foreign matter could become mixed with cargoes from regions with greater potential. The Brazilian situation makes it difficult to accept either low tolerance levels, such as 1 percent. Indeed, tolerance levels below 5 percent would probably be non-viable. In any case, the results are conservative estimates, which do not incorporate the costs from new investments that are adequate for the processes required by IP.

[9] With the availability of LMO crops adapted to the conditions of Paraná state, and because the region receives cargoes from other regions, this region is considered highly problematic for IP.

High cost increases would also be experienced in Southeast Goiás. For example, on the Rio Verde-Paranaguá route, the estimated increase in storage costs would be 2.9 percent, with a 5.6 percent increase in transportation costs, for a total 8.7 percent increase above the 2004 soybean price, the highest of all regions analyzed.

These results – additional costs of 5 to 9 percent above the 2004 prices – demonstrate how costly the implementation of an IP system would be in Brazil. It is also interesting to note that such costs exceed premiums paid in markets that trade crops certified as free of GMOs, where such premiums range from 4 to 7 percent. In a scenario of falling international prices, requirements for IP appear as fixed costs for exporting countries like Brazil. A greater offer of IP products, however, by the world's largest supplier, Brazil, would result in a fall in premiums, aggravating the picture painted by the study.

Final Observations and Policy Recommendations

As the forthcoming study on Brazil shows, stringent BSP documentation requirements imply at the very least costs pertaining to testing at the point of export. Moreover, if the requirements are seen as necessitating IP and testing throughout the supply chain, costs of implementation will be even larger. Implementing Article 18.2A of the BSP in a way that goes beyond the current "may contain" regime would result in significant costs and could require IP and grain certification processes in Brazil. Issues pertaining to IP and grain certification for shipments of LMOs-FFP are best addressed in commercial contracts between buyers and sellers

One should not lose sight of the main objective of the BSP, namely the protection of biodiversity. This can best be achieved by strengthening the information exchange component of the Protocol and by assessing the possible impact of adopting transgenics as well as other modern agricultural practices on biodiversity.

The imposition of strict documentation requirements for LMOs-FFP, wrongly places the onus of biodiversity preservation on exporters (and importers) of bulk commodities. Producing and exporting countries should continue to be able to take advantage of new technologies, and not be hampered by having to guarantee that their products – which are after all meant for food, feed or processing and not for planting – do not have a negative impact on the biodiversity of the importing country.

Implementing stricter documentation requirements in the BSP will raise fixed costs without any offsetting benefits: these requirements will not in any way help meet the objectives of the BSP, and as such can be characterized as unnecessary technical barriers to trade.

Brazil, as other major commodity producers and exporters, relies on gains in efficiency based on agility and economies of scale. The storage and transport capacity deficits it is presently experiencing impede such potential efficiency gains. The need for extensive IP systems would not only create unnecessary expenses, but would also send conflicting signals about the types of investment needed for Brazil to live up to its full potential as a producer and exporter.

The imposition of strict IP systems can cost close to 9 percent of the product value (mean prices from 1999 to 2003) for certain regions in Brazil. Moreover, such systems are likely to have a negative impact on the adoption of new technologies that help to reduce pesticide use as well as price, which are of benefit to the consumer.

The study also demonstrates that paying as much as US$ 13 million per year on testing at the export side, results in nothing more than the same type of information that can be provided today through "may contain" labels.

A strict implementation of the BSP would not only lead to high testing costs, but also fixed and variable costs for all participants in the transportation and storage chain. Demands for GM free shipments should be handled on an as needed basis as a contractual matter between buyer and seller; costs accrued through such requests could thus be offset by a premium in price.

Very low thresholds for adventitious presence (i.e. <1%) are impossible to meet when production occurs at a far distance from ports and requires different modes of transport and storage along the supply chain. If Brazil - where production does occur at significant distances from the ports - had to implement such low thresholds, increased costs would put it in a position of large disadvantage vis-à-vis countries that have production sites closer to their ports. It is easy for countries that are not interested in exporting commodities and that maintain GM free areas of cultivation, to call for such an approach, since the BSP does not extend to processed goods. In Brazil, however, GM crops are grown across the producing regions and the only GM free areas are the buffer areas required by its biosafety regulations.

More tolerant thresholds (i.e. 5 percent) reduce costs considerably, but not all countries wanting to import GM free commodities accept such a threshold. A 10 percent threshold could be implemented at low costs.

Considering the strict rules required for the transboundary movement of LMOs intended for introduction into the environment, a “may contain” documentation requirement for LMOs-FFP, along with the requirement to register authorized LMOs in the Biosafety Clearinghouse, is sufficient in meeting the objective of the BSP, namely the protection of biodiversity in grain importing countries.

Sources

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