THE ECONOMIC BENEFITS OF AGRICULTURAL BIOTECHNOLOGY IN BRAZIL: 1996 – 2009

The case of insect-resistant cotton

The case of insect-resistant corn

The case of herbicide-tolerant soy

Preface

This document has as purpose to comment the main results of the study "Economic benefits of biotechnology adoption: 1996/97 – 2008/09"[1/] carried out by Céleres[2/] in the second half of 2009. The focus of this document is to examine the results of the general economic benefits obtained from the adoption of insect-resistant cotton, insect-resistant corn, and herbicide-tolerant soy.

[1/] The full report with the study "Economic benefits from the adoption of biotechnology: 1996/97 – 2008/09" can be seen on www.celeres.com.br

[2/] Céleres is a Brazilian consultancy company specialized in agribusiness with head offices in Uberlândia, Minas Gerais. Céleres carries out independent studies in the fields of agricultural economics and business intelligence.

Content

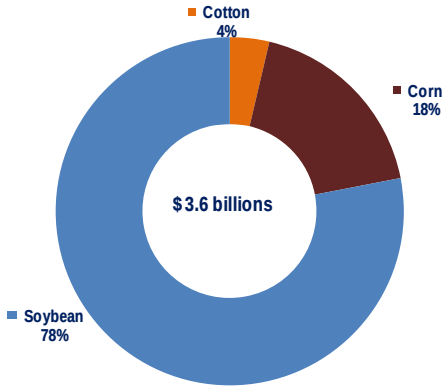
Economic benefits of biotechnology in Brazil: 1996/97 to 2008/09

Thirteen years after the introduction of agricultural biotechnology in Brazil, the economic benefits achieved by rural producers using this technology and the industry holding the technology reaches the amount of USD 3.6 billion.

As for the economic benefit generated, soy, for being the culture which has been using biotechnology for the longest period of time, accounts for the largest share of this benefit, namely 78% of the total. However, it is remarkable that corn, which adopted biotechnology for the first time in the 2008/09 crop, already accounts for 18% of the economic benefit generated in such period of time, what shows how meaningful biotechnology is to the output of this cereal. Cotton, which adopted biotechnology in 2004/05, is responsible for 4% of the total benefit, reminding that one of the reasons for the smallest share of cotton in the total economic benefit is that the area planted with cotton is quite smaller than the one with soy and corn.

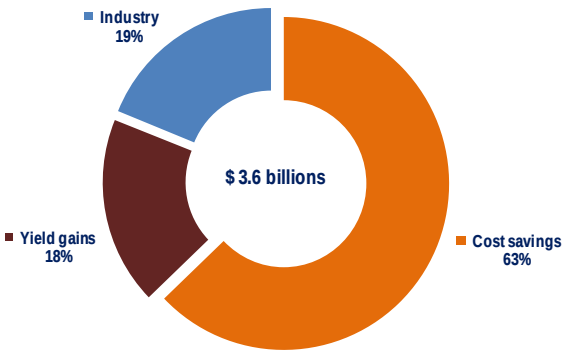
Another important aspect in the analysis of the economic benefits from adopting biotechnology in Brazil in the last thirteen years is that out of such USD 3.6 billion created as benefits, a substantial share of 63% was created by reducing production costs throughout this period of time, and 18% resulted from the excess of output originating from the adoption of biotechnology. This is an aspect occurring especially in the case of cotton and corn.

Exhibition 1. Economic benefits of biotechnology in Brazil: 1996/97 to 2008/09, by crop



Source: CÉLERES® (2010)

Exhibition 2. Economic benefits of biotechnology in Brazil: 1996/97 to 2008/09, by benefit



Source: CÉLERES® (2010)

Such two benefit factors are directly achieved by rural producers, what means then that producers achieved precisely 81% of the direct economic benefit generated in the period of time under review. The technology owners achieved the remaining benefit, or 19% of the total benefit.

It is important to point out that the "output surplus" benefit is considered in this case as a direct benefit achieved by rural producers. However, it is important to mention that such output surplus turns into indirect benefits achieved throughout the value chain in the animal and human food industry, to the extent that such surplus ensures the supply of the animal food industry, contributing to maintain the prices of feed raw materials and, accordingly, the production of meat under control, benefiting ultimately consumers at supermarket shelves.

Much has been discussed in this study on the benefits of adopting technology. However, as mentioned individually per culture, we must keep in mind what the extent of the opportunity costs incurred by not adopting biotechnology would be. Thus, when considering all the delay to adopt biotechnology in Brazil, we can estimate that the potential benefit that biotechnology could have brought to cotton, corn and soy producers from 1996/97 to 2008/09 would reach USD 28.4 billion, or nearly eight times the amount of benefits actually achieved.

The difference between the potential and the actual is USD 24.8 billion, a figure which failed to be achieved, especially by the very rural producers, who are the main beneficiaries of this technology.

The review of previous results shows that during the last thirteen years the adoption of agricultural biotechnology resulted in meaningful direct and indirect gains for rural producers, technology holders and consumers in general. It is also clear that in the case of biotechnology the cost of its non-adoption – measured as opportunity cost – ends up being substantially higher than the own benefit arising from its use.

Then, from the standpoint of opportunity cost, the slowness and the delay to clear transgenic technologies in Brazil have cost so far such USD 24.8 billion of the difference between actual and potential benefit, although other intangible costs also have their economic value, such as well-being and time spent in agricultural activities.

Hence, the importance of the improvement and continuous monitoring of public policies which ensure an institutional atmosphere favorable to the development of biotechnology in Brazil, as a way of contributing to preserve the competitiveness of the domestic agricultural production at a moment where expectation on the growing demand for food in the world is present in local and international discussions.

In this context, agricultural biotechnology has the potential to play an essential role in the supply of food and biofuel to a growing world population, both in quantity and purchasing power.

Growth foreseen for agricultural output

The current forecasts for the growth of world population, concomitantly with the improvement in income, particularly in developing countries, creates challenging conditions for farmers worldwide, on how to increase substantially the availability of food in the next ten years. Based on different studies, Earth will have a population of 9.1 billion inhabitants in 2050, 2 billion more than today. And the world demand for food is expected to increase by about 50% in the next 20 years (IFPRI, 2009). Norman Borlaug confirmed this statement when he calculated that in order to meet the requirements of food foreseen until 2025, the average yield of all the cereals has to be 80% higher than the average yield seen in 1990.

Based on the forecasts of economic and demographic growth for the years to come, we estimate that the world cotton output is to grow from the current 23.8 million tons to 37.4 million tons in 2018/19. In such scenario, China, India and the United States would continue to have a decisive position in the cotton production (Exhibition 3), but Brazil also has the potential to increase its share in the total volume produced, provided competitiveness conditions are enhanced (CÉLERES, 2009).

In view of such opportunity, the Brazilian cotton output is assumed to grow in the next ten years as a manner to meet the increasing world demand. Indeed, more areas will be necessary in the next decade to meet such demand, even considering that the Brazilian cotton productivity has been growing consistently in recent years. Thus, the area planted with cotton is expected to grow from the current 840 thousand hectares (2008/09) to 1,911 million hectares in 2018/19. In the same period of time, we consider that the GM cotton is expected to increase from the current 118.1 thousand hectares in the 2008/09 crop to 1.6 million hectares in the 2018/19 crop (Exhibition 4).

In the case of corn, also based on the forecasts of economic and demographic growth for the next years, the world output it estimated to grow from the current 788.6 million tons to 954.1 million tons in 2018/19 (Exhibition 5). Since the countries around the world have different degrees of competitiveness, we consider that the United States, China, EU-27, Brazil and Argentina will keep being, in accordance with this analysis, the world's five largest corn producers (CÉLERES, 2009).

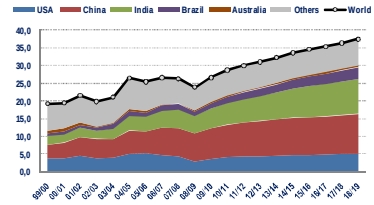
Under the assumption that the Brazilian corn output is expected to grow during the next ten years, as a manner to meet the growing demand not only locally, but also globally, we will also need larger areas to meet such demand during the next ten years. However, not unlike the case of soy, the growth of the corn output in Brazil is based especially on more expressive gains in the average productivity of such cereal, although there will be also some expansion in the planted area.

In this scenario, the area planted with corn is expected to go from the current 13.8 million hectares (2008/09) to 16.5 million hectares in 2018/19. In such period of time, we consider that the adoption of GM corn is to grow from the current 1.5 million hectares in the 2008/09 crop to 11.2 million hectares in the 2018/19 crop (Exhibition 6). Such figures are a baseline to calculate the economic benefits estimated for the next ten years, through the adoption of biotechnology in Brazil in corn plantations.

Finally, as for soy culture, based on the forecasts of economic and demographic growth for the next years, the world output is estimated to go from the current 211.8 million tons to 294.1 million tons in 2018/19 (Exhibition 7). Considering the different degrees of competitiveness among producing countries, we consider that the United States, Brazil, and Argentina will keep being, in accordance with this analysis, the three largest soy producers, but with different shares with time (CÉLERES, 2009).

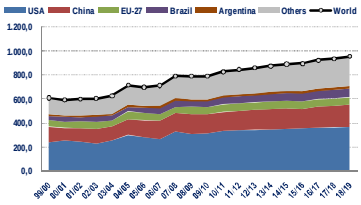
With Brazil still ranking as number two in the world soy output, we will also need larger areas in the next ten years to meet such demand. Thus, the area planted with soy is expected to grow from the current 21.5 million hectares (2008/09) to 27.5 million hectares in 2018/19. In the same period of time, we consider that the GM soy is to increase from the current 13.9 million hectares in the 2008/09 crop to 25.2 million hectares in the 2018/19 crop.

Exhibition 3. Global cotton production



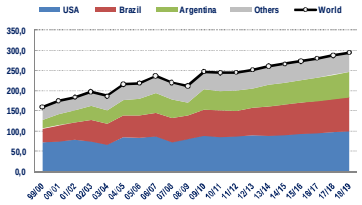
Source: USDA/CÉLERES values in million t

Exhibition 5. Global corn production



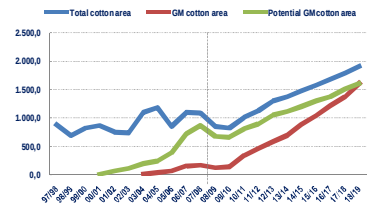
Source: USDA/CÉLERES values in million t

Exhibition 7. Global soybean production



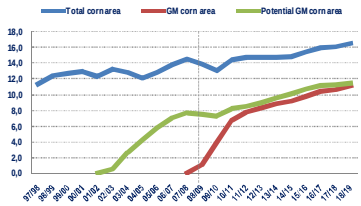
Source: USDA/CÉLERES values in million t

Exhibition 4. Cotton area in Brazil



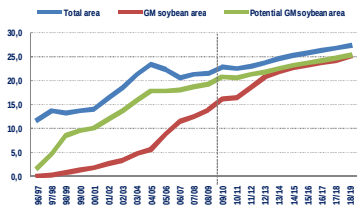
Source: CÉLERES values in million ha

Exhibition 6. Corn area in Brazil



Source: CÉLERES values in million ha

Exhibition 8. Soybean area in Brazil



Source: CÉLERES values in million ha

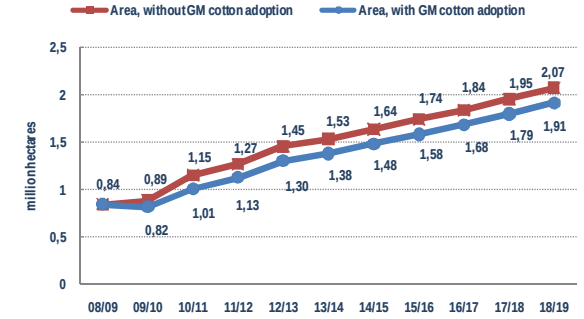
The potential impact from not adopting biotechnology

We made comments at the beginning of this summary on the losses suffered due to the slowness to adopt biotechnology in Brazil since the mid-nineties, when the potential loss was nearly seven times higher than the total benefits.

In a scenario of non-adoption of biotechnology in Brazil for the next ten years, and considering only cotton and corn cultures, where productivity impacts are quite clear and accordingly, entail visible pressure on the requirement of additional areas, we can see that the effort of additional areas to be planted reaches 32.4 million hectares (30.9 million for corn and 1.44 million for cotton) during the next ten years.

Since biotechnology is expected to be adopted in the cotton culture between 2009/10 and 2018/19, a cumulative 14.1 million hectares should be planted with such culture. As occurred in other countries, improvement in the use of biotechnology for cotton has the potential to leverage the growth curve in the product yield, leading consequently to the need of fewer areas planted with time, as shown in Figure 11.

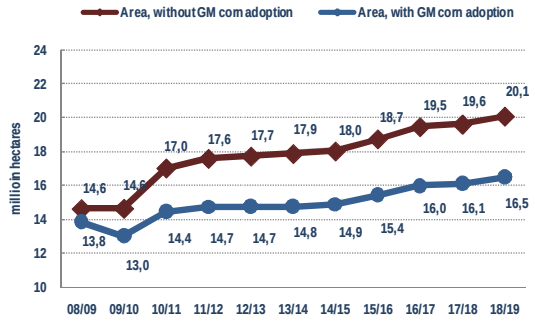
Exhibition 9. Growth pattern of the cotton area. 2009/10 to 2018/19



Source: CÉLERES® Values in million hectares

From the same standpoint, in the case of corn between 2009/10 and 2018/19, a cumulative 150.6 million hectares should be planted with corn in this period of time, assuming the biotechnology adoption rates shown in Figure 6. However, the non-adoption of transgenic corn would make the total planted area to be 181.3 million hectares, as accrued in such period, or virtually 20% more than the required assuming the use of biotechnology (Figure 12).

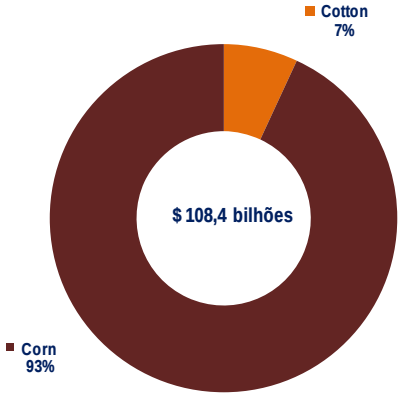
Exhibition 10. Growth pattern of the corn area. 2009/10 to 2018/19.



Source: CÉLERES® Values in million hectares

As result of the additional area to be planted in a scenario without biotechnology, the financial amount necessary to cultivate such area would reach USD 108.4 billion during the next ten years, considering not only the production cost of such hectares, but also additional investments in machines, equipment and agricultural infrastructure necessary.

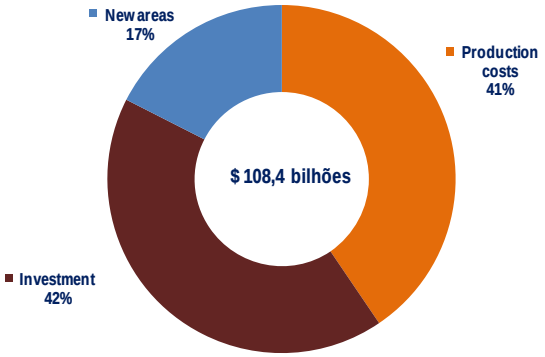
Exhibition 11. Estimate of costs with the non-adoption of biotechnology: 2009/10 to 2018/19, by crop



Source: CÉLERES® based on own data and research

We also consider the expenses necessary to open new areas, both in unexplored areas and in pasture areas, which would have to be necessarily fitted for agricultural purposes, as a way to keep balanced the supply × demand relations of agricultural products regarded balanced here.

Exhibition 12. Estimate of costs with the non-adoption of biotechnology: 2009/10 to 2018/19, by cost item



Source: CÉLERES® based on own data and research

Another important aspect, although not discussed in this analysis, the economic value of environmental assets, in this case the deforestation of unexplored areas and the use of natural resources such as water, soil and fossil fuel required to cultivate additional hectares that would be required.

We conclude then that the cost of not adopting biotechnology–measured as opportunity cost–ends up being substantially higher than the very benefit originating from its use.

Assumptions considered to calculate the additional cost	
Item	US/hectare
Direct production cost[1/]	$ 1.289,9
CAPEX[2/]	$ 1.151,9
Opening of new areas[3/]	$ 908,6

[1/] Considering the production cost for one hectare of soy under the conditions of Western Bahia
[2/] Investment in machines and equipment for the conditions of Western Bahia
[3/] Standard investment to open one hectare of unexplored "cerrado" under the conditions of Western Bahia
Source: CÉLERES®