SOCIAL AND ENVIRONMENTAL BENEFITS FROM THE AGRICULTURAL BIOTECHNOLOGY IN BRAZIL: 1996 – 2009

Insect-resistant cotton
Insect-resistant corn
Herbicide-tolerant soy

Preface

This document has as purpose to comment on the main results of the study "Social and Environmental Benefits from Using Biotechnology: 1996/97 – 2008/09"[1/] eveloped by Céleres Ambiental[2/] in the second semester of 2009. Accordingly, the results of the general social and environmental benefits from using insect-resistant cotton, insect-resistant corn and herbicide-tolerant soy will be reviewed.

[1/] The complete report including the study "Social and Environmental Benefits from Using Biotechnology: 1996/97 – 2008/09" can be accessed from the website www.celeresambiental.com.br.

[2/] Céleres Ambiental® is an environmental consulting company operating in the agricultural industry seated in Uberlândia, Minas Gerais. While searching for adjusting to the market requirements, it has further reached an evidenced competence in the environmental management of the sugar and alcohol, forest and grain production industries.

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Social and environmental benefits from biotechnology in Brazil: 1996/97 a 2008/09

This article will discuss the social and environmental benefits inherent to the use of biotechnology in Brazil, taking the analysis of the period between 1996/97 and 2008/09 into account, and the future period between 2009/10 and 2018/19. For the analyses of the social and environmental benefits accomplished in the period from 1996/97 to 2008/09 the available and already traded events existing in the Brazilian market have been taken into account, namely: a HT[1/] soy, IR[2/] cotton and RI corn.

It is critical to mention that in the last decades the worldwide society has developed a greater concern with the environmental protection and the improved quality of the people´s lives. Such concern has gained force with the accelerated increase of the population and the instability as regards the feeding safety. In this sense, biotechnology shows as a tool able to contributing to the agricultural sustainable practices that reduce pressure exercised on the natural resources. Additionally, biotechnology shows efficient in fostering the biodiversity preservation and helps in the plantation of food in bordering areas, under an agronomic perspective.

When considering the use of water in agriculture, the use of biotechnology in Brazil has effectively contributed to a 12.6 billion liter decrease, which would mean the supply of a 287.2 thousand population in the period from 1996/97 through 2008/09 (Figure 1). Out of that total, soy had a 95% share, which can be explained by the extensive planted area and the fact that such technology is available in the trading market for a longer time, officially since 2003 and since 1997, when the producers brought the first GM soy seeds from Argentina. Cotton, which covers a plantation area much smaller than that of soy, stood for 2% of the reduced water volume; corn stands out, which in its first plantation year already showed a 3% volume share.

As regards the decreased consumption of diesel oil noticed in the plantations using biotechnology in Brazil, the benefit has reached 104.8 million liters saved. Such volume would be sufficient to supply a fleet of 43.7 thousand light vehicles in the period from 1996/97 through 2008/09 (Figure 2).

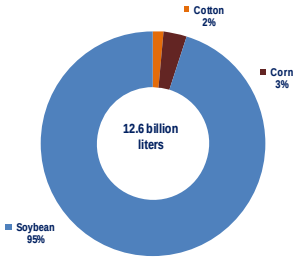
Another benefit that has been reviewed is that for the plantations using biotechnology, a CO2 release reduction occurred as a result of the burning of the diesel oil used in the agricultural machinery. In the period between 1996/97 and 2008/09, the plantations using biotechnology answered for a CO2 270.4 thousand tons reduction, which would stand for the preservation of 2 million trees of riparian forest (Figure 3). The percentages referred in the discussion of the previous benefits are maintained for each GM plantation.

Because of the amount of its release, CO2 is the gas that most contributes to the global warming. Its release stands for 55% of the total world releases of GEE. Accordingly, in view of the increasing concerns about the aggravation of the greenhouse effect, and, consequently, the worldwide efforts to try to reduce such gases, the benefits above re-assert the significance of biotechnology as a tool to preserve the natural resources and to keep the people´s quality of life.

[1/] HT:herbicide tolerant

[2/] IR: insect resistant

Exhibition 1. Environmental benefits between 1996/97 and 2008/09: Water



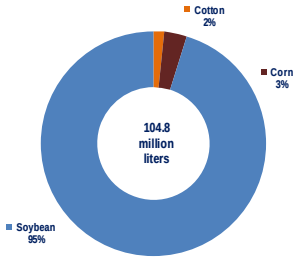
or 287.2

thousand people served in the period[1/]

[1/] Considering a daily 120 liter / individual consumption, as recommended by the UN.
Source: CÉLERES AMBIENTAL®, based on its own researches.

Note: Soy: 1996/97 through 2008/09; Cotton: 2004/05 through 2008/09; Corn: 2008/09.

Exhibition 2. Environmental benefits between 1996/97 and 2008/09: Diesel



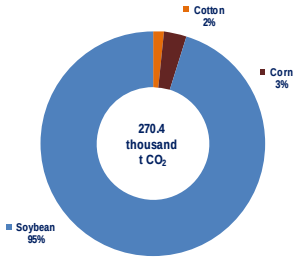
or 43.7

thousand diesel vehicles supplied in the period[2/]

[2/] Considering the average consumption of a light diesel vehicle, performing 24 thousand km / year and 10 km/l consumption.

Source: CÉLERES AMBIENTAL®, based on its own researches.

Exhibition 3. Environmental benefits between 1996/97 and 2008/09: CO_2.



or 2.0

million trees[3/]

3/ Considering riparian forest species.

Source: CÉLERES AMBIENTAL®, based on its own researches.

Biotechnology social and environmental attractiveness in Brazil

With a view to evaluate the social and environmental benefits, the concept of the attractiveness / social and environmental risk matrix has been discussed, based on the review of the producers´ perspective as related to general topics of social and environmental nature, in addition to specific topics of the transgenic technology studied herein. The addressed aspects had as purpose to analyze the rural producer´s understanding in connection with these issues, such as the influence of the transgenic products to the physical environment (soil, water and air) and to biodiversity, food safety aspects, the rural worker´s health and safety, quality of life, biosafety and agricultural production.

Having as purpose to provide information to help in the environmental impact studies on the agricultural biotechnology in Brazil, SWOT review methodology adjustments and Porter´s strategic positioning review have been discussed. Such methodologies have been used to develop prospective scenarios, with the definition of environmental indicators and the evaluation of the weaknesses, strengths, opportunities and threats that may affect the environment. In that study, strengths and opportunities were called environmental attractiveness, while weaknesses and threats were called environmental risks, with a view to show the advantages and disadvantages of genetically modified products.

During the interviews with the producers, significant values (weights) and effectiveness (answer) have been reviewed for each indicator, as relatively considered (taking the significance of each indicator as related to the others into account), so that the indexes for the intended evaluations were obtained. Such indexes are a result of the multiplications of the significance-attributed values (between 0 and 100%) by the effectiveness values (between 0: poor answer; and 10: higher answer) of each impact. Find below the mathematical ratio used to define the attractiveness and environmental risk analysis.

$$At = \sum_{1}^{n!} (N \times W) \qquad Ri = \sum_{1}^{n!} (N \times W)$$

Where:

At: social and environmental attractiveness

Ri : social and environmental risk

n! : total number of interviews with producers

N : Grade given to each variable defined for attractiveness and social and environmental risk, as a significance indicator

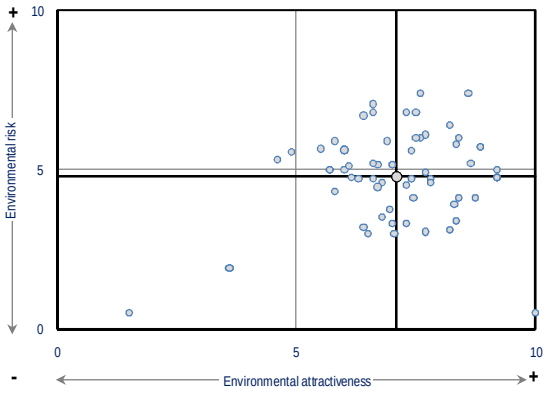
W : Weight given to each variable

With N for attractiveness as (Minimum: 0 and Maximum: 10), and N for risk as (Minimum: 10 and Maximum: 0), reminding that at least one variable must be given a 10 grade.

With W being the weight given to each variable oscillating between 0.0 and 1.0, the total being equal to 1.0.

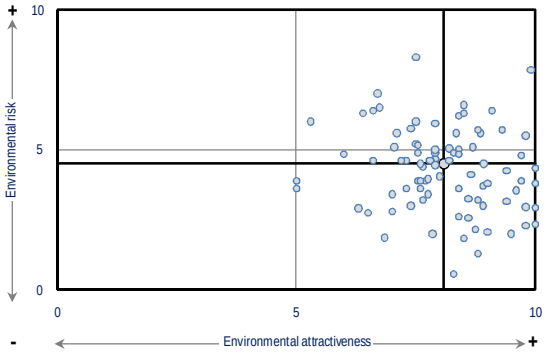
Based on the method above, individual matrixes for each culture have been studied, the results of which as shown in the following graphs have been obtained from the interviews with the rural producers. In the aggregate, 360 rural producers were interviewed, who were distributed among the main States where cotton, corn and soy are produced in Brazil.

Exhibition 4. GM Cotton: Attractiveness/social and environmental risk matrix in the 2008/09 crop



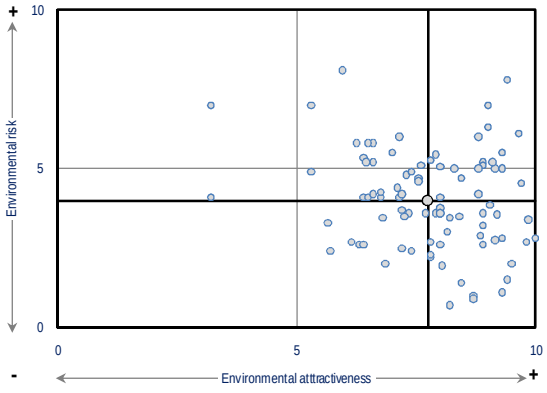
Source: CÉLERES AMBIENTAL®, based on Field survey in 2008/09 crop year.

Exhibition 5. GM Corn: Attractiveness/social and environmental risk matrix in the 2008/09 crop



Source: CÉLERES AMBIENTAL®, based on Field survey in 2008/09 crop year.

Exhibition 6. GM Soy: Attractiveness/social and environmental risk matrix in the 2008/09 crop



Source: CÉLERES AMBIENTAL®, based on Field survey in 2008/09 crop year.

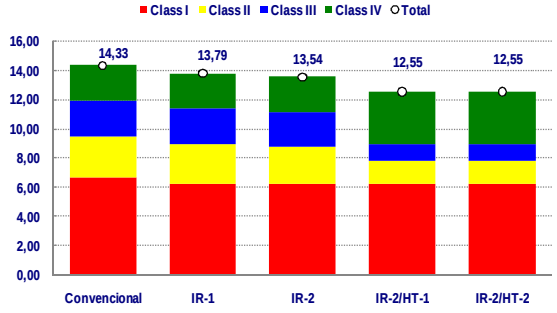
Although they show different levels in the attractiveness / risk relation, the matrixes indicate that the 3 cultures, where biotechnology is already used in Brazil, show very favorable characteristics under the social and environmental perspective. The average point of the 3 cultures as evidenced in the pertinent matrixes is located in the best attractiveness level quadrant and the lowest social and environmental risk level quadrant.

Efficiency in the use of Ag chemical by using biotechnology

Within the scope hereof, in addition to rural producers, technical assistance and research entities have been interviewed, with a view to define a benchmark for the production models in the 3 cultures. The main reason to review the benchmarks is to compare an ideal production model with the existing practices in the field.

In order to review the cotton case, the States of Mato Grosso and Bahia regions have been selected as benchmarks, taking the different technological packages recommended for each such region into account. As regards Mato Grosso, the results of the use of active ingredient are described in Figure 7.

Exhibition 7. GM Cotton: Comparative use of defensives in Mato Grosso. 2008/09 Crop

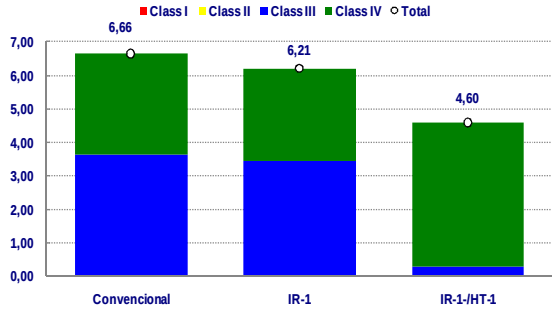


Source: CÉLERES AMBIENTAL®. Values in kg de a.i./hectare.

The review of the benchmark data in the State of Mato Grosso showed that the use of RI-1 cotton suggests a 3.8% reduction in the total active ingredient volume used as related to the conventional cotton. When comparing the conventional RI-1 cotton, a 6.4% reduction is verified in the use of active ingredients of toxicological class I, which cause greater damage to the environment and the human health. The RI-2/TH-1 and/or RI-2/TH-2 cotton approval would bring even more environmental benefits, since it would allow for a 12.4% reduction in the total volume of active ingredients used in the culture.

As for the summer crop corn, the review of the benchmark data in the State of Paraná showed a 6.8 % reduction in the total volume of active ingredients used in the plantations that adopted the RI-1 summer corn, when compared to the volume of active ingredients used in the agronomical handling of the conventional corn, as shown in Figure 8.

Exhibition 8. GM Corn: Comparative use of defensives in Paraná. 2008/09 Summer Crop



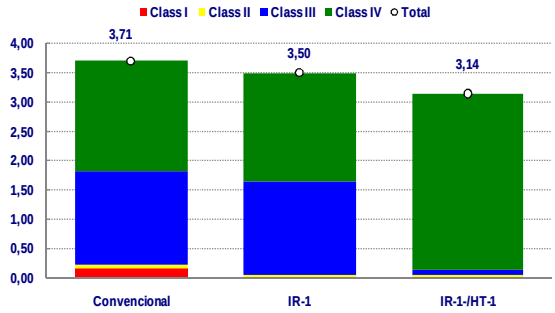
Source: CÉLERES AMBIENTAL®. Values in kg de a.i./hectare.

In a scenario where the use of RI-1/TH-1 corn was already being used, the use of active ingredient would potentially reach a 31% reduction in the total volume used in the culture. It is worth stressing that in the case of the State of Paraná benchmark, the technological package verified both for the RI-1 corn culture and the conventional corn showed no toxicological class I and II products.

When reviewing the active ingredient in the winter corn in the State of Mato Grosso, the technological package considered as benchmark indicates that the use of RI-1 corn favors a reduction in the total volume of active ingredients by 5.7%, when compared to the conventional corn (Figure 9). This fact boosts the significance of the approval of new technologies, as by using the RI-1/TH-1 corn the reduction in the total volume of active ingredients can be in excess of 15%.

It is required to stress the reduction of active ingredients with more aggressive toxicological classes as related to environment and the rural worker´s health, such as classes I and III. The use of RI-1/TH-1 corn, in addition to suppress the toxicological class I products, would allow for a 94.9% fall in the use of toxicological class III products, if compared to the conventional corn in the winter crop (Figure 9).

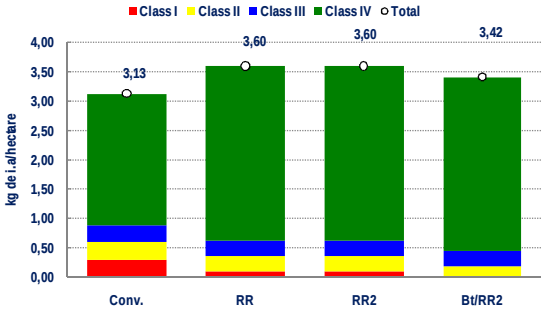
Exhibition 9. GM Corn: Comparative use of defensives in Mato Grosso. 2008/09 Winter Crop



Source: CÉLERES AMBIENTAL®. Values in kg de a.i./hectare.

The review of the soy production in the State of Paraná showed that the use of RR® soy has resulted in an increased volume of the active ingredient used in the culture handling, although such increase falls on active ingredients with lower environmental impact to the environment and the rural worker´s health. By adding the RR2® soy technology, a 64.3% decrease can also be noticed in the use of active ingredients of toxicological class I products. (Figure 10).

Exhibition 10. GM Soy: Comparative use of defensives in Paraná.



Source: CÉLERES AMBIENTAL®. Values in kg de a.i./hectare.