

Embrapa Biosafety Project - BioSeg

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Since the 90's Brazil has been a hotbed of discussion over the merits and risks of genetically modified organisms (GMO). Critics question its contribute and safety; scientists struggle to develop rigorous evaluations; proponents argue for its benefits.

Within this dynamic exchange, Brazilian Agricultural Research Corporation–Embrapa - established a project to study environment and food safety of its GMOs under development. The project BioSeg intends to establish the biosafety of Embrapa GMOs and also to generate scientific information and analysis that contribute to a more constructive and interactive decision making process.

The Embrapa Biosafety Network is composed of more than 100 researchers distributed among 12 decentralized Centers established in different regions of Brazil, and some Universities and Research Institutes. They constitute a multidisciplinary team to study, till the moment, 5 transgenic crops – beans, papaya, potato, cotton and soybean. The GM plant characteristics are specific virus's resistance, for the three first cases, insect resistance in the cotton study and herbicide tolerance for the soybean case.

The environmental risk assessment will evaluate the impact of each GMO on organisms (target and non-target) within the cultivated area. The Food Safety experiments will study factors like: composition, effects of processing and cooking, protein expression product of the novel DNA (effects on function, potential toxicity and potential allergenicity), and other aspects Both environmental and food safety studies will be extended depending on the nature of the differences/impacts and whether or not they are well characterized. Laboratory and field tests are proposed under the Brazilian regulatory system.

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Since the 90's Brazil has been a hot pan of discussion over the potential benefits and risks of genetically modified organisms (GMO). Safety, competitiveness, development, intellectual property rights & public goods are issues being being discussed by scientists, industry proponents, NGO's, Government and policy officials, and congressmen, to mention some.

Within this scenario, the Brazilian Agricultural Research Corporation – Embrapa – recognized the need to contribute to the development of a genetically modified (GM) organisms, environmental risk assessment and food safety platform due to the urgency of in-country produced safety results and the importance of carefully designed research protocols that can meet the confidence standards by decision makers and the general public. In this direction, Embrapa approved a project – **BioSeg** - to generate protocols and scientific information through the analysis of Embrapa's developed GM-plants, which aim to contribute to a more constructive and interactive biosafety analysis, presenting data that refer explicitly to specific crops, genes, ecological settings and production systems.

Embrapa's GM-plants and the BioSeg Project

The portfolio of GM plants developed by Embrapa, with many partners, includes different genes inserted into Brazilian crop cultivars for specific features. These GM crops must comply with the biosafety law requirements to ensure that they present the necessary level of food safety and quality, contributing to agriculture sustainability.

There are many GMOs under development in the laboratories of Embrapa's 38 Research Stations, but only those which "elite" event had been identified till 2001 are part of this project. Besides, the selected GM plants meet at least one of the following criteria: variety of production systems throughout the country or region, special concern for local wild relatives, diversity of food processes.

They comprise:

- Papaya (*Carica papaya* L.) resistant to *Papaya ringspot virus* (PRSV)
- Bean (*Phaseolus* sp.) resistant to Bean golden mosaic virus (BGMV)
- Potato (*Solanum tuberosum* L.) resistant to Potato virus Y (PVY)
- Cotton (*Gossypium hirsutum* L. r. *latifolium*) resistant to insects
- Soybean (*Glycine max*) tolerant to herbicide (glyphosate)

The key elements in the BioSeg are:

- to develop and implement biosafety protocols through a dynamic network, involving capacities already established (Embrapa and partner institutions);
- to improve scientific communication within complimentary knowledge areas;
- to allow a quick and frequent review of the proposed methodology and analysis of the GM-plants, by the network specially incorporating new important aspects for human and environment safety as soon as they are detected by any national or international groups.

Structure of the BioSeg Project

The project has been designed in such a way as to promote cooperation. The managing, administrative and research structure is based on :

- an External Committee (coordinated by Embrapa R&D Department at Headquarters) that follows up the overall technical development and results attained;
- an Executive Committee composed of one principal project coordinator, two adjunct coordinators, each Subproject Leader and two executive secretaries, that is supposed to deal with the disbursement of funds, interactive research meetings, progress reports, administration of conflicts, policy implementation, preparation of files for Government authorities and media contact;
- Subproject Leaders (one for each GM crop) who are responsible for the respective Crop Core Group that develops and reports on the experiments.

Initially based on the need to provide the data required by the National Technical Biosafety Committee, the group also pays attention to the identification of training needs and to the increasing demand for better public awareness. BioSeg relays on the existing capacity within Embrapa Centers (12 Research Centers and Service Centers, established in different regions of Brazil, are involved till now). Besides this, well-known national and international experts from Universities and other Research Institutes provide valuable collaboration. All together they constitute a multidisciplinary team to study the selected GM crops mentioned before – beans, papaya, potato, cotton and soybean.

The environmental risk assessment team aims to evaluate the impact of each GM-plant on organisms (target and non-target, crop-associated biodiversity) within the cultivated area of each crop, above and below ground effects, considering the production system in use and the specific agro-ecosystem. The food safety group studies factors like: composition, effects of processing and cooking, protein expression product of the novel DNA (effects on function, potential toxicity and potential allergenicity), and other aspects. Laboratory and field tests are proposed under the Brazilian regulatory system.

Both environmental and food safety studies will be extended depending on the nature of the differences/impacts.

Goals

With the development of BioSeg, some results and impacts can be expected.

Direct impact: Embrapa will have enough data to submit to national authorities for consideration of safety (food and environment safety) on some of the GM crops under study, allowing Embrapa to make a petition

for their experimental field release at first and probably for their commercial release in a later phase.

Indirect impact: once established, the network, with the acquired experience, will be a reliable group for further consultation within the Country, which will be able to rapidly organize a discussion and prepare a robust report previewing impacts of other GMOs under development.

Final considerations

The rapid advances in modern biotechnology will shape the coming decades of economic development. As more GM crops and products are field tested and eventually approved for commercialization, scientists will also learn more about how to manage the risks and the socioeconomic implications. As more developing countries begin to evaluate the in-house applications of the technology, each country will have to develop its own approach for societal discussion.

For the past fifteen years, in Brazil, a range of other issues have been associated with the use of biotechnology in such a way that lately politicized discussions dominate the scenario and science seldom prevails in the final considerations. At the same time as different sectors of society are debating these issues, the “illegal” expansion of transgenic soybeans predicts that environmental risk assessment may become a reactive science, rather than a proactive science.

The coming years, in particular for the case of Brazil, will be a challenging period to address issues such as the need for better training of scientists (including in the areas of risk assessment and monitoring of GM-experiments) and in-house investments needed to continue the development of capacity in the area of biotechnology.

A biosafety network like the one being developed by BioSeg at Embrapa, can strengthen the consideration of critical problems, addressing them, with greater confidence, to predict potential positive and negative environmental and food safety impacts.

Acknowledgements

The BioSeg Project is supported by Embrapa (linked to the Ministry of Agriculture) and by FINEP / Biotechnology Fund (financial agency linked to the Ministry of Science and Technology).

The authors thanks the core group of the project for their collaboration in different steps of the development of the Bioseg, especially the Leaders and members of the Executive Committee: Marilia R. Nutti, Eliana M. G. Fontes, Josias C. Faria, Paulo Meissner, André N. Dusi, Mariângela Hungria, Edson Watanabe and Mônica Amâncio.