

## Embrapa and the New Plant Biotech Products

The Brazilian Agricultural Research Corporation (Embrapa) has dedicated more than three decades to the search for sustainable solutions for the agricultural and food challenges of the current and future generations. The genetic improvement of crops in Brazil is one of the most solid results of the research developed by Embrapa and its impacts have led to a reshaping of the country's agriculture.

Biotechnology has emerged in the 1980s at Embrapa as a tool to accelerate the genetic improvement of crops. Genetic engineering, the genetic transformation of plants by means of gene transfer, is an evolution of plant breeding in favor of a more productive and healthy agriculture.

Over the past years, research has become more sophisticated and besides having to meet the technical and agricultural needs, it must respond to the requirements of the modern society that is increasingly demanding in terms of nutritional, environmental and public health standards.

Genetic engineering research at Embrapa, especially at Embrapa Genetic Resources and Biotechnology, which is one of the 43 research units of Embrapa and the flagship for biotechnology research in Brazil, focuses on the development of plants that are resistant / tolerant to biotic (pests) and abiotic stresses.

The main goal is not only to reduce the use of pesticides, but also increase productivity and the quality of the food that is on every Brazilian table.



# Embrapa

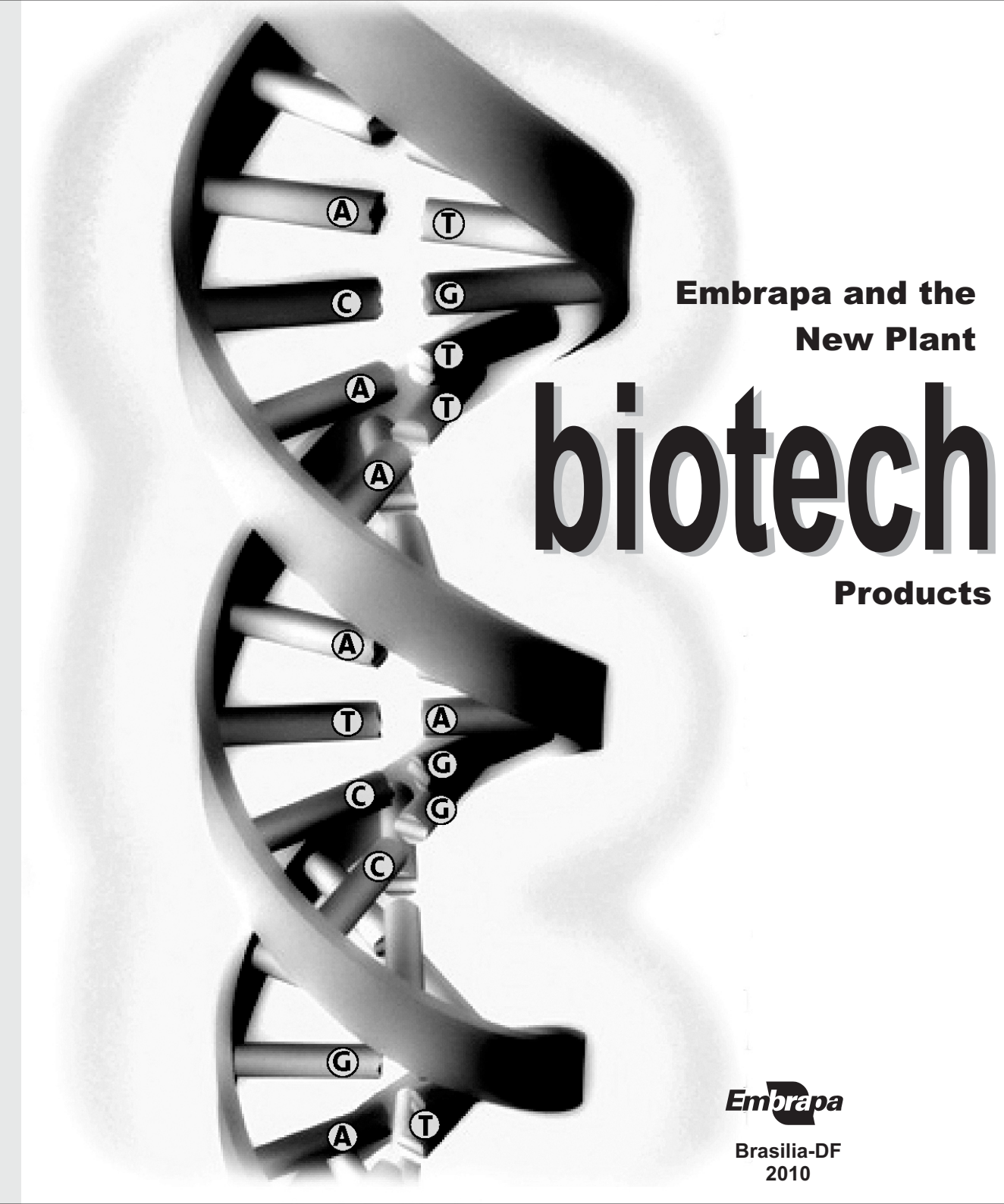
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**BRASIL**  
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# Soybean

## Soy herbicide-tolerant

The herbicide-tolerant soybean, developed by Embrapa Genetic Resources and Biotechnology in partnership with BASF, was the first GM crop approved for commercial cultivation in Brazil.

The new genetically modified (GM) variety, named Cultivance, with tolerance to herbicides of the imidazolinone class, will be marketed in Brazil and in 20 other soybean-producing countries.

This product represents an additional option for soybean producers, and contributes to the reduction of atmospheric carbon emissions. The GM seeds should be available for producers for the 2011/2012 harvest.

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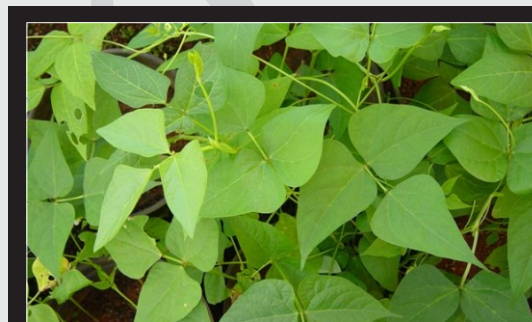
## Beans resistant the golden mosaic virus

The transgenic bean developed through the partnership between Embrapa Genetic Resources and Biotechnology and Embrapa Rice and Beans (Goiânia, GO) is able to control the worst threat to the bean crop in South America: the golden mosaic virus. In Brazil, the disease is present in all regions and can cause up to 100% loss of production when it reaches the crop at an early stage.

The plants were produced by a novel strategy for genetic transformation of beans, based on RNA interference, a technique that promotes selective inhibition of the expression of a specific gene.

Transgenic varieties of beans offer economic and environmental advantages, including reduction of losses, greater crop security and decreased application of chemicals in agriculture.

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# Coffee

## Coffee Resistant to the Coffee Berry Borer

Coffee is a product consumed on a daily basis by about 40% of world population. It is responsible for a US\$ 70 billion/year in revenue, making it the largest natural commodity, second only to oil. Brazil is the world's leading producer, accounting for 34% of coffee sold. Insect-pest attack is one of the worst problems faced by coffee growers, and the most damaging pest is the coffee berry borer (*Hypothenemus hampei*), capable of causing annual losses of about US \$ 500 million. In order to control this insect- pest, Embrapa Genetic Resources and Biotechnology has developed plants of *Coffea arabica* GM containing a protein that confers resistance to coffee berry borer. This protein interferes with the insect's digestive enzymes, thus preventing it from feeding on the seeds (or "coffee beans"). The generated GM coffee plants are now undergoing regulatory studies (molecular characterization, food safety and environmental assays). Their use by Brazilian farmers will bring benefits including reduced production costs and lower environmental damage caused by the huge use of insecticides.

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## Sugarcane resistant to insect-pests and drought -tolerant

Embrapa Genetic Resources and Biotechnology is also focused on the development of sugarcane plants resistant to the giant sugarcane borer (*Telchin licus licus*), the worst pest in northeastern Brazil, where the insect-pest causes annual losses of about R\$ 34 million. Aiming to control giant sugarcane borer, the Plant-Pest Molecular Interaction laboratory (LIMPP) is applying two different strategies for GM sugarcane plants: the use of genes for Bt toxins, highly specific to the giant sugarcane borer, and the silencing of genes that are vital to the insect, via RNA interference techniques.

Embrapa' research also focuses on the development of GM sugarcane for drought-tolerance. Both research fields will directly benefit the producer, society and the environment, since the farmer will use less water to grow the crop, reducing costs. Moreover, degraded areas with low rainfall can be used to produce sugarcane. These changes will significantly increase productivity and reduce the need for expanded acreage.

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# Sugar Cane

# Cotton

## Cotton

One of the worst problems faced by cotton farmers in Brazil is an insect-pest known as the cotton boll weevil (*Anthonomus grandis*). Costs to control this insect-pest can reach 25% of the total production costs.

Embrapa Genetic Resources and Biotechnology has focused on the development of GM cotton plants with enhanced resistance to the boll weevil. Different strategies are being applied aiming to control this insect-pest, including the expression of Cry proteins from *Bacillus thuringiensis*, the silencing of the insect's vital genes using the RNA interference technique, and the expression of proteinaceous inhibitors for insect's digestive enzymes. The generated GM cotton plants resistant to the boll weevil are under evaluation in greenhouses for molecular characterization and biosafety studies.

Embrapa are also developing cotton Brazilian varieties for drought-tolerant, in partnership with BASF company.

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