

breeding over long periods of time. □



The resulting plant

is said to be

“genetically

modified”

although

in reality all

crops have been

“genetically

modified” from their original wild state by

domestication, selection, and controlled

breeding over long periods of time. □

### What is a GM crop?

A GM or transgenic crop is a plant that has a novel combination of genetic material obtained through the use of modern biotechnology.

For example, a GM crop can contain a gene(s) that has been artificially inserted instead of the plant acquiring it through pollination.

### Conclusion

Despite the current uncertainty over GM crops, one thing remains clear. This technology, with its potential to create economically important crop varieties, is simply too valuable to ignore. There are, however, some valid concerns. If these issues are to be resolved, decisions must be based on credible, science-based information.

Finally, given the importance people place on the food they eat, policies regarding GM crops will have to be based on an open and honest debate involving a wide cross-section of society.

### Reference:

James, C. 2005. Global Status of Commercialized Biotech/GM Crops: 2005. ISAAA Briefs No. 34. ISAAA: Ithaca, NY.

Photos courtesy of Lorri Alden (<http://www.foodsubds.com/>)

In developed countries, the new life sciences companies have dominated the application of GM technology to agriculture. These include Bayer CropScience, Dow AgroSciences, DuPont/Pioneer, Monsanto, and Syngenta. □

Recently, however, many developing countries have also established the capacity for genetic engineering.

Most of the research on GM crops has been carried out in developed countries, mainly in North America and Western Europe.

### Who produces GM crops?

for years—generate superior plant varieties—although it expands the possibilities beyond the limits imposed by conventional plant breeding. □

### Glossary

**Biotechnology:** Any technique that makes use of organisms (or parts thereof) to make or modify products, to improve plants or animals, or to develop microorganisms for specific purposes.

**DNA:** A molecule found in cells of organisms where genetic information is stored.

**Gene:** A biological unit that determines an organism's inherited characteristics.

**Genetic engineering:** The selective, deliberate alteration of genes by man.

**Genome:** The entire hereditary material in a cell.

**Modern biotechnology:** Application of *in vitro* nucleic acid techniques, including recombinant DNA and direct injection of nucleic acid into cells or organelles or fusion of cells beyond the taxonomic family.

**Traits:** Characteristics such as size, shape, taste, color, increased yields, or disease resistance.

**Transgene:** A gene that has been artificially inserted into an organism.

This powerful tool allows plant breeders to do faster what they have been doing to bring together in one plant useful genes from a wide range of living sources, not just from within the crop species or from closely related plants.

GM technology enables plant breeders to exchange genes between two plants to produce offspring that have desired traits. This is done by transferring the male (pollen) of one plant to the female organ of another.

Traditionally, a plant breeder tries to exchange genes between two plants to produce offspring that have desired traits. This is done by transferring the male (pollen) of one plant to the female organ of another.

### Why make GM crops?

Pocket Ks are Pockets of Knowledge, packaged information on crop biotechnology products and related issues available at your fingertips. They are produced by the Global Knowledge Center on Crop Biotechnology (<http://www.isaaa.org/kc>). For more information, please contact the International Service for the Acquisition of Agri-biotech Applications (ISAAA) SEASIA Center c/o IRRI, DAPO Box 7777, Metro Manila, Philippines. Tel: +63 2 580 5600; 845 0563 Fax: +63 2 580 5699 E-mail: [knowledge.center@isaaa.org](mailto:knowledge.center@isaaa.org)

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INTERNATIONAL SERVICE FOR THE ACQUISITION OF AGR-BIOTECH APPLICATIONS

about GM crops.

addressing several basic questions about GM crops.

light on the controversy by This Pocket “K” attempts to shed feel so strongly about this issue?

the future of food and why do people even in private homes. What is all supermarkets, coffee shops, and religious institutions, schools, newspaper editorial offices, boardrooms, legislative chambers, in research labs, corporate almost everywhere. It is going on even religion, is taking place science, economics, politics, and This debate, which features

genetically modified (GM) crops. This agriculture finds itself engrossed in a heated debate over genetically modified (GM) crops.

### Genetically Modified Crops—Take Part in the Dialogue



Questions and Answers about Genetically Modified Crops

A pocketful of information

GLOBAL KNOWLEDGE CENTER ON CROP BIOTECHNOLOGY

Pocket K No. 1

## Where are GM crops currently grown?

In 1994, Calgene's delayed-ripening tomato (Flavr-Savr™) became the first genetically modified food crop to be produced and consumed in an industrialized country. Since then several countries have contributed to more than a 47-fold increase in the global area of transgenic crops.



The area planted to GM crops shot up from 1.7 million hectares in 1996 to 90 million hectares in 2005, with an increasing proportion grown by developing countries. In 2005, there were 14 biotech mega-countries, growing 50,000 hectares or more, 10 developing countries and four industrial countries; they were, in order of hectareage, *USA, Argentina, Brazil, Canada, China, Paraguay, India, South Africa, Uruguay, Australia, Mexico, Romania, Philippines, and Spain* (James, 2005). □

## How are GM crops made?

GM crops are made through a process known as genetic engineering. Genes of commercial interest are transferred from one organism to another. Two primary methods currently exist for introducing transgenes into plant genomes.

The first involves a device called a 'gene gun.' The DNA to be introduced into the plant cells is coated onto tiny particles. These particles are then physically shot onto plant cells. Some of the DNA comes off and is incorporated into the DNA of the recipient plant. The second method uses a bacterium to introduce the gene(s) of interest into the plant DNA. □

## What are the potential benefits of GM plants?

In the developed world, there is clear evidence that the use of GM crops has resulted in significant benefits. These include:

- Higher crop yields
- Reduced farm costs
- Improved farm profit
- Improvement in health and the environment

These "first generation" crops have proven their ability to lower farm-level production costs.



Now, research is focused on "second-generation" GM crops that will

feature increased nutritional and/or industrial traits.

These crops will have more direct benefits to consumers.

Examples include:



- Rice enriched with iron and vitamin A
- Potatoes with higher starch content
- Edible vaccines in maize and potatoes
- Maize varieties able to grow in poor conditions
- Healthier oils from soybean and canola

## Are GM crops appropriate for developing countries?

While most of the debate over transgenic crops has taken place mainly in the developed nations in the North, the South stands to benefit from any technology that can increase food production, lower food prices, and improve food quality.

In countries where there is often not enough food to go around and where food prices directly affect the incomes of majority of the population, the potential benefits of GM crops cannot be ignored. It is true that nutritionally enhanced foods may not be a necessity in developed countries but they could play a key role in helping to alleviate malnutrition in developing countries.

Although the potential benefits of GM crops are large in developing countries, they would require some investments. Most developing countries lack the scientific capacity to assess the biosafety of GM crops, the economic expertise to evaluate their worth, the regulatory capacity to implement guidelines for safe deployment, and the legal systems to enforce and punish transgressions in law. Fortunately, several organizations are working to build local capacity to manage the acquisition, deployment, and monitoring of GM crops. □



## What are the potential risks of GM crops?

With every new emerging technology, there are potential risks. These include:

- The danger of unintentionally introducing allergens and other nutrition factors in foods
- The likelihood of transgenes escaping from cultivated crops into wild relatives
- The potential for pests to evolve resistance to the toxins produced by GM crops
- The risk of these toxins affecting nontarget organisms.

Where legislation and regulatory institutions are in place, there are elaborate steps to precisely avoid or mitigate these risks. It is the obligation of the technology innovators (i.e., scientists), producers, and the government to assure the public of the safety of the novel foods that they offer as well as their benign effect on the environment.

There are also those risks that are neither caused nor preventable by the technology itself. An example of this type of risk is the further widening of the economic gap between developed countries (technology users) versus developing countries (nonusers). These risks, however, can be managed by developing technologies tailor made for the needs of the poor and by instituting measures so that the poor will have access to the new technologies. □