

Bt-Corn: What it is and How it Works

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Bt-corn is a type of genetically modified organism, termed GMO. A GMO is a plant or animal that has been genetically modified through the addition of a small amount of genetic material from other organisms through molecular techniques. Currently, the GMOs on the market today have been given genetic traits to provide protection from pests, tolerance to pesticides, or improve its quality. Examples of GMO field crops include Bt-potatoes, Bt-corn, Bt-sweet corn, Roundup Ready soybeans, Roundup Ready Corn, and Liberty Link corn.

Genetically modified foods are foods derived from GMO crops. For example, corn produced through biotechnology is being used in many familiar foods, including corn meal and tortilla chips. In addition, corn is used to make high fructose corn syrup, which is used as a sweetener in many foods such as soft drinks and baked goods. While the FDA (U.S. Food and Drug Administration) regulates genetically modified foods, it considers Bt-corn to be nutritionally equivalent to traditional corn.

To transform a plant into a GMO plant, the gene that produces a genetic trait of interest is identified and separated from the rest of the genetic material from a donor organism. Most organisms have thousands of genes, a single gene represents only a tiny fraction of the total genetic makeup of an organism.

A donor organism may be a bacterium, fungus or even another plant. In the case of Bt corn, the donor organism is a naturally occurring soil bacterium, *Bacillus thuringiensis*, and the gene of interest produces a protein that kills Lepidoptera larvae, in particular, European corn borer. This protein is called the Bt delta endotoxin. Growers use Bt corn as an alternative to spraying insecticides for control of European and southwestern corn borer.

Bt Delta Endotoxin

The Bt delta endotoxin was selected because it is highly effective at controlling Lepidoptera larvae, caterpillars. It is during the larval stage when most of the damage by European corn borer occurs. The protein is very selective, generally not harming insects in other orders (such as beetles, flies, bees and wasps). For this reason, GMOs that have the Bt gene are compatible with biological control programs because they harm insect predators and parasitoids much less than broad-spectrum insecticides. The Bt endotoxin is considered safe for humans, other mammals, fish, birds, and the environment because of its selectivity. Bt has been available as a commercial microbial insecticide since the 1960s and is sold under many trade names. These products have an excellent safety record and can be used on many crops until the day of harvest.

To kill a susceptible insect, a part of the plant that contains the Bt protein (not all parts of the plant necessarily contain the protein in equal concentrations) must be ingested. Within minutes, the protein binds to the gut wall and the insect stops feeding. Within hours, the gut wall breaks down and normal gut bacteria invade the body cavity. The insect dies of septicaemia as bacteria multiply in the blood. Even among Lepidoptera larvae, species differ in sensitivity to the Bt protein.

Genetic Modification

Do Bt-corn hybrids differ only in that they possess the genetic code to produce the Bt protein? Not exactly. To add a trait to a crop plant, the gene must be inserted along with some additional genetic material. This additional genetic material includes a promoter sequence that, in part, determines how the new trait is expressed in the plant. For example, the promoter may cause to protein to be expressed in certain parts of the plants or only during a particular period of time. There is a marker gene

that allows plant breeders to easily determine which plants have been transformed. Herbicide and antibiotic tolerance promoters are commonly used to identify transformed plants. There may also be a plasmid or vector sequence that allows for rapid multiplication of the gene of interest in a bacterial host prior to insertion in the crop plant.

FDA Approval

Federal food law requires premarket approval for food additives, whether or not they are the products of biotechnology. FDA treats substances added to food products through recombinant DNA techniques as food additives if they are significantly

different in structure, function or amount than substances currently found in food.

However, if a new food product developed through biotechnology does not contain substances that are significantly different from those already in the diet, it does not require premarket approval. Products that are genetically engineered to provide pesticide traits, such as resistance to the corn borer, are also subject to regulation by the Environmental Protection Agency. Currently, genetically modified foods in the United States do not require special labeling to notify consumers.

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