Pocket K No. 2

Plant products of biotechnology

Global Knowledge Center on Crop Biotechnology

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) SE*Asia*Center c/o IRRI, DAPO Box 7777, Metro Manila, Philippines.
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International Service for the Acquisition of Agri-biotech Applications

GLOSSARY

Bt: short for *Bacillus thuringiensis*, a common soil bacterium that produces a protein toxic to certain insects

Coat protein (CP): a major component of viruses. The primary function of CPs is to protect viral genetic information

Enzyme: a protein that regulates chemical reactions inside every living cell and organism

Gene: a biological unit that determines an organism's inherited characteristics

Herbicides: chemicals frequently used in agriculture to control weeds that compete with crops for soil nutrients, water, and sunlight

Laurate: an important fatty acid used in the food industry, mainly sourced from coconut and palm oil

Oleic acid: a monounsaturated fatty acid found in animal and vegetable oils. Monounsaturated fats are the most benign of the fat sources and are generally considered safe as they do not cause disease or other health problems.

CONCLUSION

In the developed world, it is evident that the use of GM crops has resulted in significant benefits. These "first generation" crops have proven their ability to increase crop yields, reduce farm costs, increase farm profit, and help protect the environment.

Current research is focused on "second generation" GM crops that will feature increased nutritional and/or industrial traits. These varieties should prove valuable in countries where millions of people suffer from dietary deficiencies.

For more information, please visit http://www.isaaa.org/kc

Photos courtesy of Lori Alden (http://www.foodsubs.com), Canola Council of Canada (http://www.canola-council.org), and the United States Department of Agriculture (http://www.usda.gov)

Plant products of biotechnology have been available in the market for some time now. These modified crops look like their traditional counterparts, but they possess special characteristics that make them better. These crops benefit both farmers and consumers. Farmers gain higher crop yields and have increased flexibility in management practices while consumers have "healthier crops" (i.e., crops grown with fewer pesticides and/or with healthier nutritional characteristics).

Plant products of biotechnology approved for food use have been modified to contain traits such as:

- Disease resistance
- Herbicide tolerance
- Altered nutritional profile
- Enhanced storage life

BIOTECH SOYBEAN

Soybean is the oil crop of greatest economic relevance in the world. Its beans contain proportionally more essential amino acids than meat, thus making it one of the most important food crops today.

Herbicide-tolerant soybean

Herbicide-tolerant soybean varieties contain a gene that provides resistance to one of two broad spectrum, environmentally benign herbicides.

This modified soybean provides better weed control and reduces crop injury. It also improves farm efficiency by optimizing yield, using arable land more efficiently, saving time for the farmer, and increasing the flexibility of crop rotation. It also encourages the adoption of no-till farming-an important part of soil conservation practice.

These varieties are the same as other soybeans in nutrition, composition, and the way they are processed into food and feed. ** Argentina, Australia, Brazil, Canada, Czech Republic, EU, Japan, Korea, Mexico, Philippines, Russia, South Africa, Switzerland, Taiwan, UK, US, and Uruguay.*

Oleic acid soybean

This modified soybean contains high levels of oleic acid, a monounsaturated fat. According to health nutritionists, monounsaturated fats are considered "good" fats compared with saturated fats found in beef, pork, hard cheeses, and other dairy products.

Oil processed from these varieties is similar to that of peanut and olive oils. Conventional soybeans have an oleic acid content of 24%. These new varieties have an oleic acid content that exceeds 80%. **Australia, Canada, Japan, and the US.* ❑

** Approved for food use.*

Examples of plant products of biotechnology

CROP NAME	PHENOTYPIC TRAIT
Canola	Herbicide tolerance
Canola	Modified fatty acid content
Cotton	Insect resistance
Cotton	Herbicide tolerance
Flax, Linseed	Insect resistance & herbicide tolerance
Lentil	Herbicide tolerance
Maize	Herbicide tolerance
Maize	Insect resistance & herbicide tolerance
Maize	Herbicide tolerance & male sterility
Maize	Herbicide tolerance & fertility restored
Maize	Modified amino acid content
Melon	Delayed ripening
Papaya	Virus resistance
Potato	Insect resistance
Potato	Insect & virus resistance
Rice	Herbicide tolerance
Soybean	Herbicide tolerance
Soybean	Modified fatty acid content
Squash	Virus resistance
Sugar Beet	Herbicide tolerance
Tomato	Delayed ripening
Tomato	Insect resistance
Wheat	Herbicide tolerance

Source: http://www.agbios.com, 2006.

BIOTECH CORN

Corn is one of the three most important grains of the world.

Herbicide-tolerant corn
These corn varieties work in a similar manner to herbicide-tolerant soybean. They allow growers better flexibility in using certain herbicides to control weeds that can damage crops. ** Argentina, Australia, Canada, China, European Union (EU), Japan, Korea, Philippines, South Africa, Switzerland, and the US.*

Insect-resistant corn
This modified corn contains a built-in insecticidal protein from a naturally occurring soil microorganism (*Bt*) that gives corn plants season-long protection from corn borers. The *Bt* protein has been used safely as an organic insect control agent for over 40 years. This means most farmers do not have to spray insecticide to protect corn from harmful pests, which can cause significant damage and yield loss in many areas. Bt corn also reduces toxin contamination arising from fungal attack on the damaged grain. ** Argentina, Australia, Canada, China, EU, Japan, Korea, Mexico, Philippines, Russia, South Africa, Switzerland, Taiwan, UK, US, and Uruguay.* ❑

BIOTECH CANOLA

Canola is a genetic variation of rapeseed and was developed by Canadian plant breeders specifically for its nutritional qualities, particularly its low level of saturated fat.

Herbicide-tolerant canola
Herbicide-tolerant canola works in a manner similar to other such crops. For benefits, see herbicide-tolerant soybean. ** Australia, Canada, EU, Japan, Philippines, and the US.*

High laurate canola
These canola varieties contain high levels of laurate. Oil processed from these novel varieties is similar to coconut and palm oils.

This new canola oil is being sold to the food industry for use in chocolate candy coatings, coffee whiteners, icings, frostings, and whipped toppings. Benefits extend even to the cosmetic industry. **Canada and the US.*

Oleic acid canola
This new type of canola contains high levels of oleic acid. For benefits, see oleic acid soybean. ** Canada.* ❑

BIOTECH COTTON

Herbicide-tolerant cotton
This cotton works in a manner similar to other such crops. For benefits, see herbicide-tolerant soybean. **Argentina, Australia, Canada, Japan, Mexico, Philippines, and the US.*

Insect-resistant cotton
This modified cotton works in a manner similar to insect-resistant corn. It contains a protein that provides the plant with season-long protection from budworms and bollworms. The need for additional insecticide applications for these pests is reduced or eliminated. ** Argentina, Australia, Brazil, Canada, China, Japan, Mexico, Philippines, South Africa, and the US. (Approved for planting in India.)* ❑

Dominant GM crops in the world, 2005

CROPS	M/ha*
Herbicide tolerant soybean	54.4
Bt maize	11.3
Bt cotton	4.9
Herbicide tolerant maize	3.4
Herbicide tolerant canola	4.6
Bt/Herbicide tolerant maize	6.5
Bt/Herbicide tolerant cotton	3.6
Herbicide tolerant cotton	1.3
Total	90.0

*Million hectares

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

BIOTECH POTATO

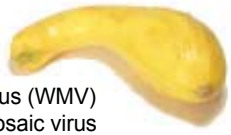
Insect-resistant potato

This biotech potato works like insect-resistant corn. It contains a protein that provides the plant with a built-in protection from the Colorado potato beetle. Thus, this potato needs no additional protection for this pest, benefiting farmers, consumers, and the environment. **Australia, Canada, Japan, Philippines, and the US.*

Virus-resistant potato
Several potato varieties have been modified to resist potato leafroll virus (PLRV) and potato virus Y (PVY). In the same way as people get inoculations to prevent disease, these potato varieties are protected through biotechnology from certain viruses. Furthermore, virus resistance often results in reduced insecticide use, which is needed to control insect vectors that transmit viruses. **Australia, Canada, Philippines, and the US.* ❑

BIOTECH SQUASH

Virus-resistant squash



A biotech yellow crookneck squash is now able to resist watermelon mosaic virus (WMV) and zucchini yellow mosaic virus (ZYMV). These new varieties contain the coat protein genes of both viruses. This biotech approach bypasses aphid control, which may reduce or eliminate the use of insecticides. ** Canada and US.* ❑

BIOTECH TOMATO

Delayed-ripening tomato

The delayed-ripening tomato became the first genetically modified food crop to be produced in a developed country. These tomatoes spend more days on the vine than other tomatoes, thus resulting in better flavor. Furthermore, the longer shelf life has commercial advantages in harvesting and shipping that can reduce the costs of production. ** Canada, Japan, Mexico, and the US.* ❑

BIOTECH PAPAYA

Virus-resistant papaya

This Hawaiian-developed papaya contains a viral gene that encodes for the coat protein of papaya ringspot virus (PRSV). This protein provides the papaya plant with built-in protection against PRSV. This biotech papaya works in a manner similar to virus resistant potato. ** Canada and the US.* ❑

** Approved for food use. Approvals in China are for marketing purposes.*