Plant Products of Biotechnology have been available in the market for 23 years in 2018. These modified crops look like their traditional counterparts, but they possess special characteristics that make them better. These crops offer several benefits 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:

- Insect resistance (IR)
- Disease resistance (DR)
- Herbicide tolerance (HT)
- Altered nutritional profile
- Enhanced storage life

Examples of Plant Products of Biotechnology

Product	Trait
Alfalfa	Herbicide tolerance, altered lignin production
Apple	Non-browning
Bean	Virus disease resistance
Canola	Herbicide tolerance, modified oil/fatty acid, pollination control system, phytase production
Cotton	Herbicide tolerance, insect resistance, low gossypol
Eggplant	Insect resistance
Flax, linseed	Herbicide tolerance
Maize	Abiotic stress tolerance, altered growth/yield, herbicide tolerance, insect resistance, modified product quality (modified alpha amylase, lysine boost, phytase production), pollination control system
Melon	Delayed ripening
Papaya	Disease resistance
Pineapple	Delayed ripening, modified fruit color
Plum	Disease resistance
Potato	Disease resistance, herbicide tolerance, insect resistance, modified product quality (modified starch, reduced acrylamide potential, non-bruising), fungal disease resistance
Rice	Herbicide tolerance, insect resistance, anti-allergy, modified product quality (biofortified with Provitamin A, anti-allergy)
Rose	Modified flower color
Safflower	Modified product quality
Soybean	Herbicide tolerance, insect resistance, modified product quality, altered growth/yield, abiotic stress tolerance, modified oil/fatty acid
Squash	Disease resistance
Sugar beet	Herbicide tolerance
Sugarcane	Disease resistance, drought tolerance
Sweet pepper	Disease resistance
Tomato	Disease resistance, insect resistance, delayed ripening, delayed fruit softening
Wheat	Herbicide tolerance

Biotech Soybean

Soybean is the oil crop with greatest economic relevance in the world. Its beans contain more essential amino acids than meat, thus making it one of the most important food crops today. Processed soybeans are important ingredients in many food products.

Herbicide tolerant soybean

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

This modified soybean provides better weed control and reduces crop injury. It 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 adoption of no-till farming - an important part of soil conservation practice. These varieties are the same as other soybeans in nutrition, composition, and in the way they are processed into food and feed. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Bolivia, Brazil, Canada, Chile, China, Colombia, Costa Rica, European Union, India, Indonesia, Iran, Japan, Malaysia, Mexico, New Zealand, Nigeria, Paraguay, Philippines, Russia, Singapore, South Africa, South Korea, Switzerland, Taiwan, Thailand, Turkey, United States of America (USA), Uruguay, and Vietnam.*

Insect resistant soybean

This biotech soybean exhibits resistance to lepidopteran pests through the production of Cry1Ac protein. Insect resistant soybean was developed to reduce or replace high insecticide applications and maintain soybean yield potential at the same time. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Brazil, Canada, China, Colombia, EU, India, Indonesia, Iran, Japan, Malaysia, Mexico, New Zealand, Nigeria, Paraguay, Philippines, Russia, Singapore, South Africa, South Korea, Taiwan, Turkey USA, Uruguay, 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, cheese, 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%. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Brazil, Canada,China, Columbia, EU, Indonesia, Iran, Japan, Malaysia, Mexico, New Zealand, Nigeria, Philippines, Singapore, South Africa, South Korea, Taiwan, Turkey, US, and Vietnam.*

Conclusion

In developed countries , the use of GM crops has evidently 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. With the "second generation" of GM crops, the focus has been on increased nutritional, pharmaceutical, and/or industrial traits. These varieties should prove valuable in countries where millions of people suffer from dietary deficiencies and have difficulties in accessing vaccines and medicines.

Reference

ISAAA. 2018. Global Status of Commercialized Biotech/GM Crops: 2018. ISAAA Brief No. 54. ISAAA: Ithaca, NY. http://www.isaaa.org.

ISAAA GM Approval Database. http://www.isaaa.org/gmapprovaldatabase/.

Glossary

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

Coat protein (CP): a major component of viruses whose primary function 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 oils

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.

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, Los Baños, Laguna, 4031 Philippines.
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Updated March 2020 (No. 2)

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Pocket K

Plant Products of Biotechnology

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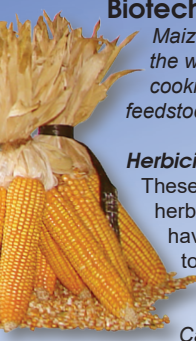

Maize is one of the three most important grains in the world. It is used as livestock feeds, processed as cooking oil and food additives, and currently used as feedstocks for biofuels.

Herbicide tolerant maize

These maize varieties work in a similar manner as herbicide tolerant soybean. They allow growers to have better flexibility in using certain herbicides to control weeds that can damage crops. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Brazil, Canada, China Colombia, Costa Rica, Cuba, EU, Honduras, Indonesia, Iran, Japan, Malaysia, Mexico, New Zealand, Nigeria, Pakistan, Panama, Paraguay, Philippines, Russia, Singapore, South Africa, South Korea, Switzerland, Taiwan, Thailand, Turkey, USA, Uruguay, Vietnam, and Zambia.*

Insect resistant maize

This modified maize contains a built-in insecticidal protein from a naturally occurring soil microorganism (*Bacillus thuringiensis*), which gives maize plants season-long protection from corn borers. This means most farmers do not have to spray insecticide to protect maize from harmful pests, which can cause significant damage and yield loss in many maize-planting areas. Bt maize also reduces toxin contamination arising from fungal attack on the damaged grain. The Bt protein has been used safely as an organic insect control agent for over 50 years. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Egypt, European Union, Honduras, Indonesia, Iran, Japan, Malaysia, Mexico, New Zealand, Nigeria, Pakistan, Panama, Paraguay, Philippines, Russia, Singapore, South Africa, South Korea, Switzerland, Taiwan, Thailand, Turkey, USA, Uruguay, Vietnam, and Zambia.*

Biotech Papaya

Virus resistant papaya

This Hawaiian-developed papaya contains a viral gene that encodes for the coat protein of papaya ringspot virus (PRSV), which provides the papaya plant with built-in protection against PRSV. This biotech papaya works in a manner similar to virus resistant potato. **Approved (for import or cultivation) in the following countries: Canada, China, Japan, and the USA.*

Biotech Squash

Virus resistant squash

The biotech yellow crookneck squash can resist watermelon mosaic virus (WMV) and zucchini yellow mosaic virus (ZYMV). These new varieties contain the coat protein genes of both viruses, allowing farmers to bypass aphid control and reduce or eliminate the use of insecticides. **Approved (for import or cultivation) in the following countries: Canada and the USA.*

Biotech Cotton

Herbicide tolerant cotton

This cotton works in a manner similar to other herbicide tolerant crops. For its benefits, see herbicide tolerant soybean. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Brazil, Canada, China, Colombia, Costa Rica, EU, Japan, Malaysia, Mexico, New Zealand, Paraguay, Philippines, Singapore, South Africa, South Korea, Taiwan and the USA.*

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. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Brazil, Burkina Faso, Canada, China, Colombia, Costa Rica, eSwatini, Ethiopia, EU, India, Japan, Malaysia, Mexico, Myanmar, New Zealand, Nigeria, Pakistan, Paraguay, Philippines, Singapore, South Africa, South Korea, Sudan, Taiwan, and the USA.*

Biotech Rice

Rice is life for more than half of humanity. It is the staple food of over 3 billion people, more than 90% of whom are Asians.

Herbicide tolerant rice

These rice varieties work in a similar manner to herbicide-tolerant soybean. They contain a gene that provides resistance to one of two broad spectrums and environmentally benign herbicides. **Approved (for import or cultivation) in the following countries: Australia, Canada, Colombia, Honduras, Mexico, New Zealand, Philippines, Russia, South Africa, and the USA.*

Biotech Alfalfa

Alfalfa is one of the most important legumes used in agriculture.

Herbicide tolerant alfalfa

This alfalfa works in a manner similar to other HT crops. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Canada, Japan, Mexico, New Zealand, Philippines, Singapore, South Korea and the USA.*

Biotech Sugar beet

Herbicide tolerant sugar beet

In 2008, an herbicide tolerant sugar beet variety was planted in Canada and USA for the first time. The herbicide-tolerant sugar beet allows farmers to cut the number of required cultivations by half. **Approved (for import or cultivation) in the following countries: Australia, Canada, China, Colombia, EU, Japan, Mexico, New Zealand, Philippines, Russian Federation, Singapore, South Korea, Taiwan, and the USA..*

Biotech Canola

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

Herbicide tolerant canola

Herbicide tolerant canola contains transgenes conferring tolerance to herbicides. The trait exhibited is similar to herbicide tolerant soybean. **Approved (for import or cultivation) in the following countries: Australia, Canada, Chile, China, EU, Japan, Malaysia, Mexico, New Zealand, Philippines, Singapore, South Africa, South Korea, Taiwan, and the USA.*

High laureate 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 cosmetics industry. ** Approved (for import or cultivation) in the following countries: Australia, Canada, New Zealand, and the USA.*

Biotech Potato

Insect resistant potato

This biotech potato works like insect resistant corn. It contains a protein that provides the plant with built-in protection from the Colorado potato beetle. Thus, this potato needs no additional protection from this pest, thereby benefiting farmers, consumers, and the environment. **Approved (for import or cultivation) in the following countries: Australia, Canada, Japan, Mexico, New Zealand, Philippines, Russia, South Korea, and the USA.*

Virus resistant potato

Several potato varieties have been modified to resist potato leafroll virus (PLRV) and potato virus Y (PVY). In the same way that people get inoculation to prevent disease, these potato varieties are protected through biotechnology using certain viruses. Furthermore, virus resistance often results in reduced insecticide use, which is needed to control insect vectors that transmit viruses. **Approved (for import or cultivation) in the following countries: Argentina, Australia, Canada, Indonesia, Japan, Mexico, New Zealand, Philippines, South Korea, and the USA.*

Low acrylamide potato

Innate™ potato, developed by Simplot, was approved for commercialization in the U.S. in November 2014. This biotech potato has 50-75% lower levels of acrylamide (a potential carcinogen in humans) produced when potatoes are exposed to high temperatures. It is also less susceptible to bruising. **Approved (for import or cultivation) in the following countries: Australia, Canada, EU, Japan, Malaysia, Mexico, New Zealand and the USA.*

Biotech Tomato

Delayed ripening tomato

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, its longer shelf life characteristic has commercial advantages in harvesting and shipping and can reduce the costs of production. **Approved (for import or cultivation) in the following countries: China, Canada, Mexico, and the USA.*

** Approved for food, feed, and/or cultivation.*