

FACT SHEET
APPLICATION FOR APPROVAL FOR RELEASE OF PRODUCTS OF
MIR162 CORN
FOR SUPPLY OR OFFER TO SUPPLY FOR SALE OR PLACING IN THE MARKET

NBB REF NO: JBK(S) 602-1/1/23

The objective of the Biosafety Act is to protect human, plant and animal health, the environment and biological diversity. Under the Biosafety Act, the National Biosafety Board (NBB) is currently assessing an application for approval submitted by Syngenta Crop Protection Sdn. Bhd.

1. What is the application for?

This application is to import and release MIR162 corn (*Zea mays* L.) and its products.

2. What is the purpose of the import and release?

The purpose of the import and release is to supply or offer for sale/ placing on the market of MIR162 corn for direct use as food and feed and for processing (FFP).

3. How has the MIR162 corn been modified?

Corn derived from insertion event MIR162 (marketed under the brand name Syngenta Agrisure Viptera® corn) is genetically modified (GM) to produce a protein that controls a wide spectrum of lepidopteran pests. This protein, the vegetative insecticidal protein Vip3Aa20, is toxic to the following lepidopteran pests of corn: fall armyworm (*Spodoptera frugiperda*), armyworm (*Pseudaletia unipunctata*), beet armyworm (*Spodoptera exigua*), corn earworm (*Helicoverpa zea*), black cutworm (*Agrotis ipsilon*), and western bean cutworm (*Striacosta albicosta*). Additionally, a marker transgene, *pmi*, has been added to allow the selection of transformed plants during development. The gene *pmi* was isolated from the common bacterium *Escherichia coli*. The protein produced by this gene is the enzyme phosphomannose isomerase (PMI). MIR162 corn was produced by *Agrobacterium tumefaciens*-mediated transformation of a proprietary line of corn with the transformation plasmid vector pNOV1300.

4. Characteristics of MIR162 corn

(a) Details of the parent organism

The recipient or parental plant is *Zea mays* L. , also known as corn. Corn is one of the world's leading cereal crops, ranked after wheat and rice, and is grown in over 25 countries. Corn has a long history of safe use as food for consumption by humans and other animals. No significant native toxins are reported to be associated with the genus *Zea*. Corn is cultivated worldwide and represents a staple food for a significant proportion of the world's population. A major proportion of grain and forage derived from corn is used in animal feed. Corn-derived products are also routinely used in a large number and diverse range of foods for human consumption. Such products include flour, breakfast cereals, high fructose corn syrup and starch products. Corn grain is also used to produce industrial products, such as ethanol by fermentation.

(b) Details of the donor organism

The donor organism of the native gene *vip3Aa1* is *B. thuringiensis* strain AB88, originally isolated from sour milk. Insecticidal proteins from *B. thuringiensis* have been extensively studied and have a long history of safe use as active ingredients in a number of insecticide products used in commercial agriculture as well as home gardens. The gene *vip3Aa20* in MIR162 corn is a modified version of *vip3Aa1*.

The transgene *pmi*, also known as *manA*, was derived from *E. coli* strain K-12, a non-pathogenic strain. *E. coli* is a normal inhabitant of the intestinal flora of humans and other animals, where it doesn't normally cause disease.

(c) Description of the trait(s) and characteristics which have been introduced or modified

MIR162 corn contains the transgenes *vip3Aa20* and *pmi*. The transgene *vip3Aa20* encodes a vegetative insecticidal protein (Vip) that is toxic to the following lepidopteran pests: *Spodoptera frugiperda* (fall armyworm), *Pseudaletia unipunctata* (armyworm), *Spodoptera exigua* (beet armyworm), *Helicoverpa zea* (corn earworm / cotton bollworm), *Agrotis ipsilon* (black cutworm), and *Striacosta albicosta* (western bean cutworm). The toxicity of Vip3Aa20 to certain lepidopteran pests is due to the presence of gut binding sites in sensitive lepidopteran species that are absent in other species. The Vip3Aa20 insecticidal protein is approximately 89 kiloDaltons (kDa) molecular weight and 789 amino acids in length, differing by two amino acids from the native Vip3Aa1 protein.

The *pmi* transgene, also known as *manA*, which encodes the enzyme phosphomannose isomerase, was utilized as a plant selectable marker during development of MIR162 corn. The PMI enzyme catalyzes the isomerization of mannose-6-phosphate to fructose-6-phosphate. It allows transformed corn cells to utilize mannose as a primary carbon source in culture media, whereas cells that lack *pmi* expression will fail to proliferate.

(d) Safety of the expressed protein

The safety of Vip3Aa proteins, including Vip3Aa20, has been established previously, and they are exempt from food and feed tolerances in corn and cotton in the USA when used in plant-incorporated protectants (US Code of Federal Regulations 40 CFR §174.501).

The safety of PMI has been established previously, and it is exempt from food and feed tolerances in all crops in the USA (US Code of Federal Regulations 40 CFR §174.527). Small amounts of PMI enzymes from various sources have always been present in the food and feed supply as a result of their ubiquitous occurrence in nature, including in food plants and animals. PMI enzymes occur in mammals, humans, yeast, fungi and bacteria, and have been found in such diverse plant species as tobacco, walnut and *Brassica* species as well as in seeds of soybeans and other legumes.

5. Assessment of Risks to Human Health

Food and feed products derived from MIR162 corn are not materially different from food and feed products derived from conventional corn.

(a) Nutritional Data

MIR162 corn grain is compositionally equivalent to nontransgenic corn grain in terms of proximate composition, key nutrients, vitamins, minerals, and anti-nutrients. There are no biologically significant differences (including nutritional differences) between MIR162 corn and nontransgenic corn, with the exception of the intended traits conferred by expression of the Vip3Aa20 and PMI proteins, which have been demonstrated to be safe for food and feed uses.

(b) Toxicology

Both Vip3Aa20 and PMI were demonstrated to be nontoxic at high doses in acute oral toxicity tests in mammals. PMI is a nontoxic enzyme involved in sugar metabolism. Exposure to Vip3Aa20 and PMI is expected to be minimal because very low concentrations are present in MIR162 corn and because both proteins are rapidly digested in simulated mammalian gastric and intestinal fluids. MIR162 corn grain supported normal animal growth and was not toxic in animal feeding studies, and is compositionally equivalent to conventional corn grain.

(c) Allergenicity

Neither Vip3Aa20 nor PMI is likely to be allergenic, based on their derivation from nonallergenic source organisms (bacteria), a lack of biologically relevant sequence similarity to known allergens, minimal exposure following rapid digestion, and lack of glycosylation (a characteristic observed in some allergens). Exposure to Vip3Aa20 and PMI is expected to be negligible, because very low concentrations are present in MIR162 corn and because each protein is rapidly digested in simulated mammalian gastric and intestinal fluids.

6. Assessment of Risks to the Environment

The application does not cover an environmental release. The release is intended only to cover the import of the MIR162 corn and its products from countries where the corn is already approved and commercially grown, and that may enter Malaysia as food, feed and for further processing (FFP).

7. What is the Emergency Response Plan?

(a) First Aid Measures

No special first aid measures are required for exposure to this product.

(b) Accidental Release Measures

It is possible for seed to be accidentally released during transport, however, corn (*Zea mays*) is not weedy in character. Corn has lost the ability to survive without cultivation and is very uncompetitive against perennial vegetation. The agronomic and phenotypic characteristics of MIR162 corn were compared to those of conventional corn. No differences indicative of increased weediness potential were observed in plant growth habit, vegetative vigor, flowering characteristics or yield. Further, the environmental safety of the introduced Vip3Aa20 protein in MIR162 corn has been established. Exposure in laboratory studies of nontarget invertebrates and mammals to Vip3Aa20 at concentrations equal to or greater than estimated environmental concentrations via

cultivation of MIR162 corn showed no adverse effects. Further, the PMI enzyme lacks toxic properties and was confirmed to be nontoxic in mammals. Species that might be exposed to PMI from MIR162 corn tissues are highly likely to have had prior exposure to similar PMI proteins. No harmful effects of such exposure are known or expected.

(c) Handling and Storage

There are no specific instructions or recommendations for use, storage and handling of MIR162 corn. The characteristics of MIR162 corn and products derived from it are not different from those of conventional corn, apart from the introduced traits. The same measures for handling and storage for conventional corn are valid for MIR162 corn.

(d) Disposal Considerations

MIR162 corn has been assessed as being as safe as its conventional non-GM corn counterpart. Waste grain and processed products from MIR162 corn may be disposed of and treated in the same way as grain and processed products of non-GM corn.

8. How can I comment on this application?

Any member of the public may submit their comments or queries on publicly notified information about the application. Before submission of comments or queries, the person should review the information provided. Comments and queries on any possible impacts/risks to the health and safety of the people and the environment that may be posed by the proposed release are appreciated. The submission of comments or queries should be prepared carefully as it will be given the same scrutiny as the application by the NBB. The submission of comments and clarifications or queries should contribute to the NBB's assessment. Even if the submission is not science-based, and focuses on cultural or other values, it should still be developed in the form of a well-founded argument.

Please note that the consultation period closes on **30th October 2015** and written submissions are required by that date. Submissions must be addressed to:

**Director General, Department of Biosafety
Ministry of Natural Resources and Environment
Level 1, Podium 2, Wisma Sumber Asli
No. 25, Periaran Perdana, Presinct 4, 62574
Putrajaya, MALAYSIA.
E-mail: biosafety@nre.gov.my.
Fax: 03-88904935.**

Please include your full name, address and contact details in your submission.

References

US Code of Federal Regulations 40 CFR §174.501

US Code of Federal Regulations 40 CFR §174.527