

Decision for the Safety Assessment of
Monsanto's Combined Trait Product corn MON 89034 x MON 88017,
for Direct Use as Food and Feed or for Processing

Food and Feed Safety

The product dossiers of Monsanto Philippines' combined trait product: corn MON 89034 x MON 88017 were reviewed for safety and nutritional differences compared with the conventional corn. The focus of the food/feed safety assessment is based on three major issues/concerns regarding stacked genes from different sources namely a) gene interaction; b) effect on metabolic pathways and c) differential gene expression due to stacking.

A biosafety notification for combined trait product: corn MON 89034 x MON 88017 and all progenies derived from crosses of the product with any conventionally bred corn and corn containing approved-biotech events for direct use as food, feed or for processing was issued to Monsanto on the 19th day of October 2009. The notification is valid for five years and shall expire on October 18, 2014 subject to the terms and conditions set forth in DA Administrative Order No. 8 (DA A08), Series of 2002, and Memorandum Circulars Nos. 6 and 8, Series of 2004. The said combined trait product was included in the Lists of Approval Registry being prepared by the Department of Agriculture – Bureau of Plant Industry.

This approval is for use as Food, Feed and Processing only. This does not include cultivation of combined trait product corn MON 89034 x MON 88017 in the Philippines. Food and Feed use of combined trait product corn: MON 89034 x MON 88017 and its by-products is therefore authorized as of 19th of October 2009. The biosafety notification (No. 09-020) stated that combined trait product corn: MON 89034 x MON 88017 is as safe for human food, livestock feed and for processing as its conventional counterparts".

I. Brief Identification of the Genetically Modified Organism (Living Modified Organism)

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| Designation: | Combined trait product corn: MON 89034 x MON 88017 |
| Applicant: | Monsanto Philippines, Inc. |
| Plant Species: | |
| Name: | corn (<i>Zea mays</i> L.) |
| Parent Material: | Inbred corn lines (and/or isolines) developed and produced by Monsanto |
| Center of Origin: | Mexico and Central America |
| Toxic Factors/Allergen(s): | Corn is not a common allergenic food. Phytic acid raffinose are antinutrients included in corn. |
| Trait Description: | Insect resistance and herbicide tolerance |
| Trait Introduction Method: | Conventional breeding |
| Donor Organisms: | <i>Bacillus thuringiensis</i> - a source of (Bt) <i>cry1A.105</i> and <i>cry2Ab2</i> genes which confer resistance to lepidopteran insects. |

Bacillus thuringiensis subs *kumamotoensis*, is a non-pathogenic spore-forming Gram positive bacterium that is found naturally in soil. It is a source of the *cry3Bb1* gene which produces a Cry3Bb1 protein with insecticidal activity against the coleopteran pest, corn rootworm.

cp4 epsps coding sequence from *Agrobacterium tumefaciens* which confers tolerance to glyphosate.

Pathogenicity:

Bacillus thuringiensis (*Bt*) has been used commercially in the US for over four decades to produce microbial pesticides. Cry proteins produced from *Bt* have a history of safe use since 1958 as active ingredients either in *Bt* microbial pesticides or in biotechnology derived food and feed crops.

The assessment of potential allergenicity and toxicity showed that there was a reasonable certainty of no harm to mammals from exposure to the Cry1A.105 and Cry2Ab2 proteins.

Bacillus thuringiensis subsp. *kumamotoensis* is a spore -forming, gram-positive bacterium found naturally in soil. *Bt* strains have been used to produce products with insecticidal activity. Many *Bt* strains have shown to produce protein crystals or inclusion bodies that are selectively toxic to certain species of insect pests.

Agrobacterium sp. strain CP4 is not known human and animal pathogens and not commonly allergenic. There is no known population of individuals sensitized to bacterial proteins.

Proposed Use:

For direct use as food, feed or for processing

II. Background Information

Monsanto Philippines has filed an application with attached technical dossiers to the Bureau of Plant Industry (BPI) on April 30, 2009 for a biosafety notification for direct use as food, feed and for processing under Administrative Order (AO) No. 8 Part 5 for stacked trait product corn: MON 89034 x MON 88017 which has been genetically modified for insect resistance and herbicide tolerance.

A safety assessment of combined trait product corn: MON 89034 x MON 88017 was conducted as per Department of Agriculture Administrative Order No. 8 Series of 2002 and Memorandum Circulars Nos. 6 and 8, Series of 2004. The focus of risk assessment is the gene interactions between the transgenes.

Review of results of evaluation by the BPI Biotech Core Team in consultation with DA-Biotechnology Advisory Team (DA-BAT) completed the approval process.

III. Description of Novel (Introduced) Traits

Corn MON 89034 produces the *Bt* insecticidal proteins Cry1A.105 and Cry2Ab2 through *Agrobacterium*-mediated transformation. The introduction of corn MON 89034 is expected to provide enhanced benefits for the control of lepidopteran insects pests such as *Ostrinia furnacalis* (ACB) and *Spodoptera frugiperda* (FAW) and *Helicoverpa zea* (CEW) compared to existing products.

Corn MON 88017 contains *cry3Bb1* gene which was derived from the common soil bacterium *Bacillus thuringiensis* subsp. *kumamotoensis* conferring resistance to corn rootworm larvae, coleopteran species,

Diabrotica virgifera virgifera, *D. barberi*, and *D. virgifera zea*. It also encodes *cp4 epsps* gene, which was derived from the common soil bacterium, *Agrobacterium* strain CP4, conferring tolerance to glyphosate.

The transgenic traits from Event MON 89034 and MON 88017 were combined through conventional breeding to produce the MON 89034 x MON 88017 corn. This stacked hybrid produces the four (Cry1A.105, Cry2Ab2, Cry3Bb1 and CP4 EPSPS) transgenic proteins present in MON 89034 x MON 88017 corn plants.

Safety of the Expressed Proteins

The three *Bt* proteins (Cry1A.105, Cry2Ab2 and Cry3Bb1) and CP4 EPSPS protein accumulate in different subcellular compartments of the corn plant cells.

Based on the modes of action of the Cry1A.105, Cry2Ab2, Cry3Bb1 and CP4 EPSPS proteins, and location of these proteins' accumulation in the plant cells, any likelihood of interaction with one another is not considered to be significant that could lead to production of a new allergen or toxin. There is no known mechanism of interaction among the gene products that could lead to adverse effects in human and animals and there are no possible unexpected effects of the stacked genes on the metabolism of the plant.

IV. Nutritional Composition (Compositional Analysis)

Based on the modes of action of the Cry1A.105, Cry2Ab2, Cry3Bb1, and CP4 EPSPS proteins expressed in MON 89034 x MON 88017, there is no known mechanism of interaction among the gene products that could lead to adverse effects in human and animals. The prior safety assessments of the individual events are directly applicable to the combined trait product. Compositional assessments of the corn from MON 89034 and MON 88017 demonstrated that MON 89034 and MON 88017 are nutritionally and biologically equivalent to their conventional counterpart.

V. Anti-Nutritional Factors

There were no interactions identified in MON 89034 x MON 88017, and the prior safety assessments of these individual events are directly applicable to the combined trait product. Compositional assessments for the antinutrients in the corn from MON 89034 and MON 88017 demonstrated that they are nutritionally and biologically equivalent to their conventional counterpart.

VI. Regulatory Decision

After reviewing the scientific data and information relevant to the combined trait product corn MON 89034 x MON 88017 application of Monsanto Philippines, it is concluded that no interaction found between/among the combined traits, hence this plant product was found to be as safe as its conventional corn and can substitute for its traditional counterpart for direct use as food, feed and for processing and is therefore approved for direct use as food, or feed or for processing. Monsanto Philippines is hereby notified that it may proceed with the activities for the above product for direct use as food and feed or for processing following all existing rules and regulations consistent with DA AO #8.