

Determination of the Safety of Monsanto's
New Leaf Potato Events BT6 (RBBT02-06) and SPBT02-05 (Insect-Resistant Potato)
for Direct Use as Food, Feed and for Processing

Food and Feed Safety:

The product dossier on New Leaf Potato Events BT6 (RBBT02-06) and SPBT02-05 (Insect-Resistant Potato) were reviewed for safety and nutritional differences compared with the conventional potato. The focus of the review was on any new or altered expression trait and changes in composition and nutritional content or value relative to the conventional potato. At the end of the safety assessment, a conclusion was made that the New Leaf Potato Events BT6 (RBBT02-06) and SPBT02-05 (Insect-Resistant Potato) is as safe as the conventional potato taking into account dietary impact of any changes in nutritional content or value.

A biosafety permit # 03-013 for New Leaf Potato Events BT6 and SPBT02-05 and all progenies derived from crosses of the product with any conventionally-bred potato and/or containing approved-biotech events for direct use as food, feed and for processing was issued to Monsanto Philippines Inc. on December 5, 2003. The permit is valid for five years and shall expire on December 4, 2008 subject to the terms and conditions set forth in DA Administrative Order No. 8, Series of 2002. The said potato events (BT6 and SPBT02-05) was included in the Lists of Approval Registry (Delisting) 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 New Leaf Potato Events BT6 and SPBT02-05 in the Philippines. Food, Feed and use of its by-products is therefore authorized as of December 5, 2003. The biosafety permit (No. 03-013) stated that "New Leaf Potato Event BT6 and SPBT02-05 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)

Designation:	New Leaf Potato Events BT6 and SPBT02-05
Applicant:	MONSANTO PHILIPPINES, INC. 7 th Floor, Ayala-FGU Center Alabang-Zapote Rd., cor Acacia Avenue Madrigal Business Park Alabang 1770 Muntinlupa City.
Plant Species:	
Name:	Potato (<i>Solanum tuberosum</i> L.)
Parent Material:	Russet Burbank and Superior Varieties
Center of Origin:	Mexico and South America

Toxic Factors/Allergen(s): Toxicants that are naturally occurring in the potato tubers such as glycoalkaloids, solanine, and chaconine are within the standard levels established previously for potatoes

Trait Description: Insect Resistance against Colorado Potato Beetle

Trait Introduction Method: *Agrobacterium*-mediated transformation method

Donor Organism: *Bacillus thuringiensis* subsp. *tenebrionis* source of *cry3A* which confers resistance to the colorado potato beetle.

Pathogenicity: *Bacillus thuringiensis* subsp. *tenebrionis*, is a common soil bacterium that has a long history of safe use as a microbial insecticide with no reported allergenic and toxic responses, establishing basis for the lack of allergenic or toxic concern for the Cry3A protein. *B.t* based products have shown that the proteins produce toxic effects only in the gut of chewing insects and are not activated in human digestive tracts. The *cry3A* encodes for a protein, normally produced by the bacterium during sporulation, that is toxic only to targeted leaf feeding beetles.

Proposed Use: For direct use as food, feed of for processing

II. Background Information

Potato is grown in over 120 countries primarily for human consumption in its processed form. For direct consumption it is cooked before eaten and its processed form are potato fries, crisps and dehydrated potatoes. It is also used as raw material for starch manufacturing. The starch can be used for coating of papers, sizing of cotton and as finishing in textile industry. By-products (pulp, coagulated protein from fruit water) are normally used in animal feeding, but trends exist for food use too. Potatoes are also used for industrial alcohol production. In countries with a significant potato processing industry (for both human food and industrial use), the residues and by-products (peel, trimmings, rejected potatoes, separated pulp and proteins) are used as feedstuff (often after dehydration).

Monsanto Philippines Inc. has developed a New Leaf Potato Events BT6 derived from the Russet Burbank and Superior Variety. This potato, referred to in this document as New Leaf Potato events BT6 (RBBT02-06) and SPBT02-05 (Insect-Resistant Potato) were developed to provide a method to control yield losses from insect feeding damage caused by Colorado potato beetle, *Leptinotarsa decemlineata*, without the use of conventional pesticides.

On June 12, 2003, Monsanto Philippines Inc. submitted an application to the Bureau of Plant Industry requesting for biosafety permit under AO#8 for New Leaf Potato Events BT6 and SPBT02-05 which has been genetically modified for insect resistance against Colorado Potato Beetle (CPB).

Monsanto Philippines Inc has provided data on the identity of the New Leaf Potato events BT6 (Insect-Resistant Potato), a detailed description of the modification method, data and information on the gene insertion sites, copy numbers and levels of expression in the plant, the role of the inserted genes and regulatory sequences in donor organisms, and full nucleotide sequences. The novel proteins were identified, characterized, and compared to the original bacterial proteins, including an evaluation of their potential toxicity to livestock. Relevant scientific publications were also supplied.

Potato Bt6 has been evaluated according to BPI's safety assessment by concerned agencies [(Bureau of Animal Industry (BAI), Bureau of Agriculture, Fisheries and Product Standards (BAFPS)] and Scientific Technical Review Panel (STRP). The process involves an intensive analysis of the nature of the genetic modification together with a consideration of general safety issues, toxicological issues and nutritional issues associated with the modified potato.

As part of the evaluation procedure, the petitioner/applicant published the Public Information n/sheet of the said application on two widely circulated newspapers (Malaya and Daily Tribune) on July 16, 2003 for public comment/review. BPI received no comment on the petition during the 30-day comment period.

The STRP assessment and 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

The *cry3A* gene was isolated from the DNA of *B. thuringiensis* subsp. *tenebrionis*. The *cry3A* gene encodes an insecticidal protein produced by the bacterium during sporulation. The protein is selectively active against a narrow spectrum of Coleoptera. Upon ingestion by susceptible species, feeding is inhibited with disruption of the gut epithelium, which results in the eventual death of the insect. In addition to the full-length protein, the bacterium also produces a second, lower molecular weight form of the protein called *B.t.t.* band 3. The *B.t.t.* band 3 protein results from an internal translational initiation event within the same gene starting at amino acid 48 and has been shown to maintain full insecticidal activity against CPB larvae. The gene encoding the *B.t.t.* band 3 protein, modified with plant preferred codons for increased plant expression, was introduced into potato plants. This modified gene encodes the nature identical protein sequence for the *B.t.t.* band 3 protein.

Safety of the Expressed Proteins

Food and feed safety evaluations of the tubers produced by New Leaf potato plants took into consideration the safety of the expressed proteins and assessment of the composition and wholesomeness of the tubers produced by the transformed plants. On the basis of results derived from studies performed to evaluate the integrity of the T-DNA insert, it was concluded that no proteins other than the Cry3A and NPTII proteins were produced from the inserted transgenes. The proteins produced by the genes (*cry3a* and *nptII*) have been thoroughly tested for potential mammalian toxicity and have a history of safe human consumption. The allergenic potential of the Cry3A and NPTII proteins was assessed and found to be of no concern. Both Cry3A and NPTII proteins are rapidly digested in gastric fluids and do not contain amino acid sequences matching those of known allergens or toxins.

IV. Nutritional Composition (Compositional Analysis)

Compositional studies of the potato tubers derived from New Leaf lines showed that the nutritional properties of the potato tubers were substantially equivalent to those of conventional white potato varieties and that the tubers have normal low levels of naturally occurring anti-nutrients. Key potato constituents (total solids, sugars, vitamin C, and protein) and proximate analysis (ash, moisture, calories) were well within the expected range for commercially produced potato tubers as reported in the scientific literature.

V. Anti-Nutritional Factors

Levels of glycoalkaloids (solanines and chaconines) in CBP resistant potatoes were found to be within the acceptable range. Potato tubers contain several protease inhibitors that inhibit the activity of trypsin, chymotrypsin and other proteases, thus decreasing the digestibility and the biological value of the ingested protein. Protease inhibitors in potatoes are largely inactivated by boiling and other thermal processes. Serious anti-nutritional reactions could occur, however, if raw or inadequately cooked potatoes are consumed or fed.

Lectins are (glyco)proteins which occur in virtually all living organisms and have the common property of binding to specific carbohydrate structures on cell surfaces, e.g. on intestinal or blood cells. As lectins are inactivated during heating, only consumption and feeding of raw or inadequately cooked potatoes may cause adverse effects.

VI. Regulatory Decision

After reviewing the scientific data and information relevant to the application of Monsanto Philippines Inc., it is concluded that New Leaf events BT6 and SPBT02-05 and all progenies derived from crosses of the product with any conventionally-bred potato, and potato containing approved-biotech events for direct use as food, feed and for processing is as safe and substantially equivalent to its unmodified counterpart, and is therefore approved for direct use as food, or feed or for processing. Monsanto shall duly inform the public of this approval by way of publishing in any one (1) of the top three (3) leading newspapers in the country that imports of this product is covered by conditions for approval as provided in Department of Agriculture Memorandum Circular No. 8, Series of 2003.