

**ASSESSORS' CONSOLIDATED REPORT ON MONSANTO PHILIPPINES INC.'S STACKED
INSECT RESISTANT AND HERBICIDE TOLERANT CORN MON87769 x MON89788
APPLICATION FOR DIRECT USE AS FOOD AND FEED, OR FOR PROCESSING**

EXECUTIVE SUMMARY

On March 31, 2017 Monsanto Philippines Inc.'s filed for application of corn MON87769 x MON89788 for direct use as food and feed, or for processing, as original application under the DOST-DA-DENR-DOH-DILG Joint Department Circular (JDC) No. 1 Series of 2016. After reviewing the Risk Assessment Report and attachments submitted by the applicant, the assessors namely: Scientific and Technical Review Panel (STRP), BPI Plant Products Safety Services Division (BPI-PPSSD) and Bureau of Animal Industry- Biotech Team (BAI-BT), concurred that corn MON87769 x MON89788 is as safe for human food and animal feed as its conventional counterpart.

The Department of Environment and Natural Resources - Biosafety Committee (DENR-BC), after a thorough scientific review and evaluation of the documents related to Environmental Risk along with the submitted sworn statement and accountability of the proponent, recommended the issuance of a biosafety permit for this regulated event provided the conditions set by DENR are complied. Also, the Department of Health - Biosafety Committee (DOH-BC), after a thorough scientific review and evaluation of documents related to Environmental Health Impact, concluded that corn MON87769 x MON89788 will not pose any significant risk to the health and environment and that any hazards could be managed by the measures set by the department. DOH-BC also recommended for the issuance of biosafety permit for the transformation event.

Furthermore, the Socio-economic, Ethical and Cultural (SEC) Considerations expert also recommended for the issuance of biosafety permit for this regulated article after assessing the socio-economic, social and ethical indicators for the adoption of Genetically Modified Organisms.

BACKGROUND

In accordance with Article VII. Section 20 of the JDC, no regulated article, whether imported or developed domestically, shall be permitted for direct use as food and feed, or for processing, unless: (1) the Biosafety Permit for Direct Use has been issued by the BPI; (2) in the case of imported regulated article, the regulated article has been authorized for commercial distribution as food and feed in the country of origin; and (3) regardless of the intended use, the regulated article does not pose greater risks to biodiversity, human and animal health than its conventional counterpart.

The BPI Biotech Office provided the assessors the complete dossier submitted by Monsanto Philippines, Inc. Upon receipt of the individual reports from the assessors, the BPI Biotech Secretariat prepared this consolidated risk assessment report for the information of the public.

STRP, PPSSD AND BAI ASSESSMENT

Gene Interaction

MON 87764 which contains the Pj. $\Delta 6D$ and Nc.Fad3 proteins are members of a family of integral membrane fatty acid found in all eukaryotic organisms and some prokaryotes while MON 89788 which contains CP4 EPSPS belongs to the family of EPSPS synthases which are involved in the shikimic acid pathway producing aromatic amino acids in the chloroplasts of the plants.

Based on the list of genetic elements, the expression cassette of Pj $\Delta 6D$ and Nc.Fad3 does not have specific transit peptide unlike CP4 EPSPS which indicates that Pj $\Delta 6D$ and Nc.Fad3 will accumulate in the cytoplasm. CP4 EPSPS is targeted to accumulate in the chloroplast due to the presence of chloroplast transit peptide. This indicates that the gene products will accumulate in different subcellular compartments of the plant parts.

Metabolic Pathways

Pj. $\Delta 6D$ is a single polypeptide $\Delta 6$ desaturase which creates double bond at the 6th position from the carboxyl end of a fatty acid yielding significant levels of stearidonic Acid (SDA) in the seeds of MON 87769 while Nc.Fad3 is a single polypeptide $\omega 3$ desaturase which creates a double bond between the third and fourth carbon from the methyl end of a fatty acid yielding significant levels of SDA.

Pj $\Delta 6D$ is required to convert alpha linolenic acid (ALA) to SDA in the omega 3-fatty acid biosynthetic pathway. Expression of the introduced delta -6 desaturase gene (Pj.D6D) also results in the conversion of linoleic acid (LA) to gamma linolenic acid (GLA), in the omega-6 fatty acid pathway. While Nc $\Delta 15D$ catalyses the conversion of Linoleic acid (LA) to alpha linolenic acid (ALA), thereby increasing the pool of ALA available for conversion to SDA and gamma linolenic acid (GLA) to SDA.

CP4 EPSPS proteins are involved in the biochemical shikimic pathway producing aromatic amino acid in the chloroplasts. It catalyzes the transfer of enolpyruvyl group from phosphoenol pyruvate (PEP) to the 5-hydroxyl of shikimate-3-phosphate (S3P) producing inorganic phosphate and 5-enolpyruvylshikimate-3-phosphate. This mechanism is being inhibited with glyphosate binding which blocks the binding of EPSPS to PEP. CP4 EPSPS, on the other hand, has higher affinity for PEP thus allowing the catalysis. This enzyme catalyzes the reaction wherein the enolpyruvyl group from phosphoenol pyruvate (PEP) is transferred to the 5-hydroxyl of shikimate-3-phosphate (S3P) to form 5-enolpyruvylshikimate-3-phosphate (EPSPS) and inorganic phosphate (Pi). Based on these information, the gene products have different mode of action and are involved in different metabolic pathway.

Gene Expression

The analysis of protein levels in soybean seeds produced in the United States (2007) showed that the expression of Pj. $\Delta 6D$ Nc.Fad3 and CP4 EPSPS in MON 87769 x MON 89788 are equivalent to the protein expression in both single events, MON 87769 and MON 89788, which were detected in low levels (0.00043, 0.0023 and 0.037% total protein). The marker gene, cp4 epsps, used in the transformation of MON 87769 was segregated away from the T-DNA I of the single event by conventional breeding (Monsanto Philippines, Inc., 2017). This was being supported by the data on CP4 EPSPS expression in MON 87769 x MON 89788 which showed that the level of CP4 EPSPS in the combined trait product (70-160 $\mu\text{g/g}$ dry weight) was equivalent to the MON 89788 (33-140 $\mu\text{g/g}$ dry weight), the single event expressing the novel protein (Monsanto Philippines, Inc.

2014, Table 2. p. 10). The data indicates that the cp4 epsps marker gene in MON 87769 was not being expressed in MON 87769 x MON 89788 since the CP4 EPSPS expressed in the combined trait product was from MON 89788.

Based on the documents provided by the proponent, there is no possible interaction that would affect the stability and expression level of either one of the genes. The expression of the genes in the stacked trait is inherited and functioning properly indicating that there is no gene interaction.

Conclusion

After a thorough and scientific evaluation of the documents provided by Monsanto Philippines Inc. and other related literatures, scientific evidence indicates that the Combined Trait Product, Soybean MON 87769 x MON 89788 applied for direct use as food and feed or for processing has no evidence of interaction on the resulting gene products and as safe as it's conventional counterpart.

DENR RECOMMENDATION

Upon extensive review and evaluation of the application for direct use as food and feed or for processing, including the scientific evidences from provided references, literature and other studies the DENR-BC finds that the regulated article is safe as its conventional counterpart and is not expected to pose any significant risk to the environment.

DOH RECOMMENDATION

After a thorough and scientific evaluation of the documents provided by the applicant in support for their application for a biosafety permit for direct use as food and feed or for processing, the DOH-BC finds that the regulated article is as safe as its conventional counterpart and shall not pose any significant risk to human health and the environment. The regulated article does not require changes in the usual practices in unloading, and loading, hauling transport, storage and processing.

SEC RECOMMENDATION

The SEC Expert has stated that to date, no empirical studies have yet shown that import restrictions (or bans) on GM soybean in the Philippines may benefit local soybean producers facing foreign competition but may reduce the welfare of domestic consumers and GM importers.

After a thorough and scientific evaluation of the documents provided by the applicant for the application for direct use as food and feed or for processing of soybean MON87769 x MON 89788, the SEC Expert recommends for the approval and issuance of biosafety permit for the said GM product.