

**Consolidated Risk Assessment Report of Pioneer Hi-Bred Philippines, Inc.'s Corn TC1507  
x DAS5912-7 x MON 810 x MIR604 x NK603 Application for Direct Use as Food, Feed  
or for Processing (FFP)**

**EXECUTIVE SUMMARY**

On March 27, 2019 Pioneer Hi-bred Philippines Inc.'s filed for application of Corn TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603 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 TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603 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 TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603 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 Pioneer Hi-bred 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.

## **Information on the Applied Events**

Stacked corn TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603 is a product developed through conventional crossing of TC1507, DAS59122-7, MON 810, MIR604 and NK603 corn. It possesses resistance to insects of order Coleoptera and Lepidoptera, and tolerance to glufosinate ammonium and glyphosate herbicides.

Corn TC1507 contains the *Cry1F* gene which produces the Cry1F protein that when ingested by the insect, causes gut paralysis and eventual death. Event TC1507 also produces the PAT protein which provides tolerance to glufosinate herbicide.

Corn MIR604 contains the *mCry3A* gene which encodes the mCry3A protein that provides protection against rootworm and the *pmi* gene which allows the positive selection for the recovery of the transformed plants.

Corn DAS59122-7 contains *cry34Ab1* gene which produces the Cry34Ab1 delta-endotoxin and *Cry35Ab1* gene which produces Cry35Ab1 delta-endotoxin both of which provide resistance to coleopteran insects particularly corn rootworm by selectively damaging their midgut lining. The *pat* gene eliminates the herbicidal activity of glufosinate by acetylation.

Corn MON810 contains *cry1ab* gene which produces Cry1Ab delta-endotoxin which confers resistance to lepidopteran insects by selectively damaging their midgut lining.

Corn NK603 contains *cp4 epsps* gene which produces a herbicide tolerant form of 5-enolpyruvulshikimate-3-phosphate synthase (EPSPS) enzyme.

The single events of stacked corn TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603 have also been given individual approvals for FFP under the JDC No.1 s2016.

Table 1. Status of approvals of the single events of the stacked corn TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603 in the Philippines

| <b>Event</b> | <b>Date Approved</b> | <b>Expiry Date</b> |
|--------------|----------------------|--------------------|
| TC1507       | February 21, 2019    | February 20, 2024  |
| DAS 59122-7  | April 4, 2018        | April 3, 2023      |
| MON 810      | February 23, 2018    | February 22, 2023  |
| MIR604       | March 6, 2018        | March 5, 2023      |
| NK603        | May 29, 2019         | May 28, 2024       |

Other countries that have issued regulatory approvals for the stacked corn are listed in Table 2.

Table 2. Summary of Regulatory Approvals by Country, Year and Type of Approval of corn TC1507 x DAS59122-7 x MON 810 x MIR604 x NK603

| <b>Country</b> | <b>Food direct use or processing</b> | <b>Feed direct use or processing</b> | <b>Cultivation domestic or non-domestic use</b> |
|----------------|--------------------------------------|--------------------------------------|---|
| Canada         |                                      |                                      | 2011  |
| European Union | 2018                                 | 2018                                 |   |
| Japan          | 2012                                 | 2012                                 | 2012  |
| Mexico         | 2011                                 |                                      |   |
| Philippines    | 2014                                 | 2014                                 |   |
| South Korea    | 2012                                 | 2012                                 |   |
| Taiwan         | 2012                                 |                                      |   |

Source: <https://www.isaaa.org/gmapprovaldatabase/event/default.asp?EventID=273> (Last updated: August 8, 2018)

The assessment for the safety of the novel proteins focused on the gene interaction, effect on metabolic pathways, and differential gene expression due to stacking.

## **STRP, BPI-PPSSD, BAI (Safety Assessment)**

### *Gene Interaction*

The inserted eight proteins (Cry1F, Pat, Cry34Ab1, Cry35Ab1, Cry1Ab, Mcry3A, PMI And Cp4 EPSPS) will not interact to produce any new allergen or toxins. This is due to the different mode of action of each protein which is not likely to interact and will accumulate in the cytoplasm (e.g. Cry1F, PAT, Cry34Ab1, Cry35Ab1, Cry1Ab, mCry3A, and PMI) and chloroplast (e.g. CP4 EPSPS) of the regulated stacked event. Despite the co-localization of the major Cry proteins, they would not act on the same metabolic pathways and do not share any intermediate metabolites in the biochemical pathways that the proteins act on or interfere with.

### *Metabolic Pathways*

Based on the descriptions provided Cry1F, Cry34Ab1, Cry35Ab1, Cry1Ab, mCry3A proteins have similar end-results or desired traits, however their modes of action have similarities to some extent and they differ only on the receptors sites in the insect gut, where they take action. Specificity at the molecular level is very much distinct among the three Cry proteins. With respect to the molecular mechanisms, these novel proteins do not act on the same metabolic pathways and do not share any intermediate metabolites in the biochemical pathways that the proteins act on or interfere with. Hence, there is no expected adverse effect on the target trait that the transgenes confer, more so, no new allergen nor toxin will be produced.

### *Gene Expression*

Expression levels of the novel proteins were not biologically different between the stacked transgenic plant under evaluation and its parental genotypes. The measurements done by the proponents using ELISA and subsequent statistical analysis. There is a low expression of the novel proteins in the regulated stacked event under evaluation and its parental genotypes. The stability of the genome/partial genome of the parentals in the stacked transgenic corn was demonstrated by the applicant.

### *Conclusion*

After a thorough and scientific review and evaluation of the documents provided by Pioneer Hi-Bred INC. relevant to Corn TC1507 x 59122 x MON 810 x MIR604 x NK603, The BAI, BPI-PPSSD and STRP find scientific evidence that the regulated article applied for direct use has no evidence of interaction on the resulting gene products.

## **DENR Biosafety Committee (Environmental Safety)**

The DENR-BC has reported that the direct use of the regulated article whether for food, feed or for processing will not cause any significant diverse effect on the environment and biodiversity.

The individual events of the gene stacked corn TC1507 x 59122 x MON 810 x MIR604 x NK603 have biosafety permits for direct use, which were previously issued. Therefore, each event has undergone rigorous safety assessment, and is considered safe to the environment, biodiversity, and non-target organisms. Similarly, it is less likely to pose any significant adverse effect on the environment.

The incorporation of gene stacked event is through conventional breeding, which is regarded innocuous for its long history of safe use. Furthermore, the method of crossing individual transgenic parents is similar with that of non-transgenic parents. This method does not introduce any greater variation in the genome beyond what is obtained (Weber et al., 2012); and

The project description report (PDR) discusses the specified environmental management plan indicating the possible risk and harm to the environment and non-target organisms as well as the mitigating measures and contingency plan. Furthermore, the chances of unintended release or planting of the regulated article is very minimal and will not cause any damaging and lasting effects because the receiving environment (areas near the port, roads, railways, etc.) is not conducive for plant growth. Also, corns are very highly domesticated and does not survive well without human intervention (FAO, 2014).

After a comprehensive review and evaluation of the documents including the scientific evidence from references and literature submitted by Pioneer Hi-Bred Philippines Inc. its application for Direct Use as food and feed or for processing of corn TC1507 x 59122 x MON 810 x MIR604 x NK603, the DENR-BC considered the regulated article safe to the environment particularly on biodiversity, and hereby recommends for the approval of application of Pioneer Hi-Bred Philippines, Inc. for Biosafety Permit for direct use as food, feed or for processing of corn TC1507 x 59122 x MON 810 x MIR604 x NK603.

### **DOH Biosafety Committee (Environmental Health Safety)**

After a thorough review and evaluation of the documents provided by the proponent, Pioneer Hi-Bred Philippines, Inc., through the Bureau of Plant Industry (BPI), in support of their application for approval for Direct Use as Food, Feed or for Processing of corn TC1507 x 59122 x MON 810 x MIR604 x NK603, the DOH Biosafety Committee find that the regulated article applied for Direct Use as Food, Feed or for Processing (FFP) is safe as its conventional counterpart and shall not pose any significant risk to human and animal health.

The DOH-BC has reported that scientific pieces of evidences from Toxicity studies and references, find that the regulated article will not cause significant adverse health effects to human and animal health. Dietary exposure to the regulated article of unlikely to result in allergic reactions. The regulated article is not materially different from nutritional composition from that of the non-transgenic potato or the conventional corn.

Based on the above considerations and with the submitted sworn statement and accountability of the proponent, the DOH-BC has submitted the evaluation to the BPI relative to the application of a Biosafety Permit for direct use as food and feed or for processing (FFP) of corn TC1507 x 59122 x MON 810 x MIR604 x NK603

### **SEC Expert (Socio-Economic Considerations)**

The SEC expert accepts as satisfactory the answers of the applicant pertaining to commodity trends and is not expected to change drastically the current patterns of production, consumption/utilization and trade. The GM product also does not contain any components that may affect the cultural practices of a specific ethnic and cultural group in the country.

After a thorough and scientific review and evaluation of the documents provided by Pioneer Hi-Bred Philippines Inc. For Corn TC1507 x 59122 x MON 810 x MIR604 x NK603, the SEC Expert recommends for the approval and issuance of biosafety permit of the said GM product.