RISK ASSESSMENT REPORT

OF THE GENETIC MODIFICATION ADVISORY COMMITTEE (GMAC)

FOR

AN APPLICATION FOR APPROVAL FOR RELEASE OF PRODUCTS OF

MON87419 MAIZE FOR SUPPLY OR OFFER TO SUPPLY

NBB REF NO: JBK(S) 600-2/1/11

APPLICANT: MONSANTO (MALAYSIA) SDN. BHD.

DATE: 13 JANUARY 2021

I - Summary of Assessment Process

On 18 August 2020, the Genetic Modification Advisory Committee (GMAC, please refer to Appendix 1 for details of GMAC), received from the Department of Biosafety an application for the approval for importation for release [sale/placing on the market for direct use as food, feed and for processing (FFP)] of a product of a Living Modified Organism dicamba and glufosinate tolerant MON87419 maize. The application was filed by Monsanto (Malaysia) Sdn. Bhd. (hereafter referred to as "the applicant"). After an initial review, GMAC requested for additional information from the applicant.

A public consultation for this application was conducted from 27 May 2020 to 25 June 2020 via advertisements in the local newspapers, e-mail announcements and social media. Comments were received from Consumer Association Penang (CAP), Sahabat Alam Malaysia (SAM), Malaysian Agroecology Society (Sri-Mas) and Malaysian Palm Oil Board (MPOB). GMAC took into consideration the comments from CAP regarding toxicity, effects of the herbicide residues, safety assessment, and risk of contamination. GMAC also took into consideration the comment from MPOB and Sri-Mas on the need for proper emergency response plan, labelling, post-market monitoring and surveillance on MON87419 maize. Sri-Mas also express their concern about effect on food and livestock industry and risk to national economy. GMAC also took into consideration the comment from SAM regarding herbicide residues of Dicamba, safety assessment, and cancelation of registration of Dicamba in the US.

GMAC had four (4) meetings pertaining to this application and prepared the Risk Assessment Report and Risk Assessment Matrix along with its recommended decision, for consideration by the National Biosafety Board.

II - Background of Application

This application is for approval to import and release products of a Living Modified Organism dicamba and glufosinate tolerant MON87419 maize. The aim of the import and release is to supply or offer to supply for sale/placing on the market for direct use as food, feed and for processing (FFP). According to the applicant, MON87419 maize has been registered in a number of countries for cultivation as well as for food, feed and for processing. MON87419 maize is approved in the United States of America, Australia, New Zealand, Canada, Colombia, Japan, Korea, Mexico and Taiwan and may be imported, stored and processed for use in food, animal feed and industrial products in the same way as other conventional, non-transgenic maize. The type of expected use of the products derived from MON87419 maize in Malaysia will be the same as the expected usage for products derived from conventional maize. Potential users of products derived from MON87419 maize such as grains are feed millers, food processors and other industrial use.

Information about MON87419 maize

The recipient or parental plant is *Zea mays* L.spp *mays* (field or sweet corn). Corn is extensively cultivated and has a long history of safe use as a food or feed. It is one of the largest cultivated crop in the world followed by wheat (*Triticum* sp.) and rice (*Oryza sativa* L.) in total global metric ton production (FAOSTAT, 2016). Maize is widely consumed in Latin America, Asia, Africa and the Balkans. In Latin America, maize is processed into tortillas, arepas, couscous, polenta, porridges and various meals and gruels that are the basis for traditional foods (Rooney and Serna-Saldivar, 2003). In Africa and Asia, maize is generally dry miled into grits, meals and flours for the production of flat breads, steamed foods, snacks and alcoholic and non-alcoholic beverages.

MON87419 maize contains a demethylase gene from *Stenotrophomonas maltophilia (S.maltophilia)* that expresses a dicamba mono-oxygenase (DMO) protein to confer tolerance to dicamba herbicide and the phosphinothricin N-acetyltransferase (pat) gene from *Streptomyces viridochromogenes (S. viridochromogenes)* that expresses the PAT protein to confer tolerance to glufosinate herbicide.

III - Risk Assessment and Risk Management Plan

GMAC evaluated the application with reference to the following documents:

(i) CODEX Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants**.**

(ii) Roadmap for Risk Assessment of Living Modified Organisms, (according to Annex III of the Cartagena Protocol on Biosafety produced by the *Ad Hoc* Technical Expert Group (AHTEG) on Risk Assessment and Risk Management of the Convention on Biological Diversity).

(iii) The risk assessment and risk management plan submitted by the applicant.

GMAC also referred to the following recommendations within the AHTEG guidelines:

(i) That the risk assessment exercise be specific to the details of this particular application

(ii) That the risk assessment exercise be specific to the receiving environment in question, and

(iii) That any risk identified be compared against that posed by the unmodified organism.

In conducting the risk assessment, GMAC identified potential hazards, and then added a value/rank for the likelihood of each hazard as well as its consequences. The likelihood of each hazard occurring was evaluated qualitatively on a scale of 1 to 4, with 1 for 'highly unlikely', and

4 for ‘highly likely’. The consequences of each hazard, if it were to occur, were then evaluated on a scale of 1 to 4, with 1 for ‘marginal’ and 4 to denote a ‘major consequence’. A value was finally assigned for the overall risk from the identified potential hazard. The general formula: Overall Risk = Likelihood x Consequence was employed. GMAC also proposed risk management strategies for potential hazards, where appropriate. This methodology of assessment follows the procedure of Risk Assessment in Annex III of the Cartagena Protocol on Biosafety.

The potential hazards were identified in three main areas:

(i) **Effects on human health**

Relevant scientific publications on the genetic modifications were reviewed for potential human health risks and issues pertaining to acute toxicity of novel protein / altering / interference of metabolic pathways, potential allergenicity of the novel protein, reproductive toxicity, potential transfer of antibiotic resistance genes in digestive tract, pathogenic potential of donor microorganisms, nutritional equivalence and anti-nutritional properties.

(ii) **Effects on animal health**

Issues pertaining to allergenicity, toxicity, anti-nutritional, survivability and animal product contamination.

(iii) **Effects on the environment**

Issues pertaining to accidental release of seeds, unintentional release and planting, potential of transgenes being transferred to bacteria (soil bacteria, bacterial flora of animal gut), increased fitness, weediness and invasiveness, accumulation of the protein in the environment via feces from animals fed with the GM plant/grain, cross pollination leading to transfer of transgenes and toxic effect on non-target organisms were examined.

Based on the above, a final list of 21 potential hazards was identified. All of these hazards were rated as having an Overall Risk of 1 or “negligible”.

GMAC also took caution and discussed a few of the hazards that required further evaluation and data acquisition. Some of these risks are expected to be managed effectively with the risk management strategies proposed (please refer to section IV of this document).

Some of the potential hazards are highlighted below along with the appropriate management strategies:

a) Accidental release of viable seeds

Seeds may be accidentally released during transportation. These seeds can germinate and grow along transportation routes and in areas surrounding storage and processing facilities (JBK Report No. 04, 2015). In the conducive warm and humid climate of Malaysia, there is a high likelihood of these volunteers maturing to the flowering and seed-setting stages. Although corn is not grown as an economic crop in Malaysia and there are no wild relatives, some varieties of baby corn and sweet corn are cultivated on small scales. Thus, there is a likelihood of outcrossing of the GM corn with these cultivated corns. Repeated cycles of spill-and-growth also increase the likelihood for the development of feral GM populations.

b) Planting of seeds

Plants may be grown by uninformed farmers and perpetuated through small scale cultivations. These GM corn may pollinate the non-GM baby corn and/or sweetcorn. There should also be clear labeling of the product to state that it is only for the purpose of food, feed and processing, and is not to be used as planting material.

c) Nutritional equivalence

No major significant differences between MON87419 and conventional maize were observed from proximate analysis, analysis of fibre, amino acids, key nutrients and anti-nutrients present in maize. The composition of MON87419 is comparable to that of the conventional maize control.

However, applicant is required to update the National Biosafety Board immediately if additional tests indicate potential adverse effects or the possible presence of toxin or allergenic proteins.

IV - Proposed Terms and Conditions for Certificate of Approval

Based on the 21 potential hazards identified and assessed, GMAC has drawn up the following terms and conditions to be included in the certificate of approval for the release of this product:

a) There shall be clear documentation by the exporter describing the product which shall be declared to the Royal Malaysian Customs.

b) There shall be clear labeling of the product from importation to all levels of marketing stating that it is only for the purpose of food, feed and processing, and is not to be used as planting material.

c) Should the approved person receive any credible and/or scientifically proven information that indicates any adverse effect of MON87419 maize, the National Biosafety Board shall be informed immediately.

d) Any spillage (during loading/unloading/transportation) shall be collected and cleaned up immediately.

e) Transportation of the consignment from the port of entry to any destination within the country shall be in secured and closed condition.

V - Other Regulatory Considerations

a) Administrative regulatory procedures shall be arranged between the Department of Biosafety, Royal Malaysian Customs Department and relevant agencies to ensure accurate declaration of product information and clear labeling of the product is implemented.

b) Administrative regulatory procedures shall be arranged between the Department of Biosafety and the Malaysian Quarantine and Inspection Services (MAQIS) to impose post entry requirements for accidental spillage involving the GM product.

c) Administrative regulatory procedures shall be arranged between the Department of Biosafety and the Malaysian Quarantine and Inspection Services (MAQIS) and other competent agencies to impose post entry requirements for food safety compliance.

d) Administrative regulatory arrangements shall be carried out between the Department of Biosafety and the Department of Veterinary Services (DVS) so that any unanticipated adverse effects in animals caused by any consumption of the GM products shall be reported immediately.

e) Administrative regulatory arrangements shall be carried out by Food Safety and Quality of Ministry of Health to monitor compliance to the Food Act 1983 and Food Regulations 1985; and GM food labelling guidelines.

f) Administrative regulatory procedures shall be arranged between Department of Biosafety and Ministry of Health to ensure that herbicide residues in maize consignments are below the acceptable maximum residual level established. It is recommended that importers are required to provide certificate of analysis for herbicide residues prior to shipment.

VI - Identification of issues to be addressed for long term use release of this product

a) Continuous monitoring is required from the approved person and any unanticipated adverse effect caused by the MON87419 maize shall be reported to the National Biosafety Board.

VII –Conclusion and Recommendation

GMAC has conducted a thorough evaluation of the application for approval for importation for release [sale/placing on the market for direct use as food, feed and for processing (FFP)] of a product of a Living Modified Organism dicamba and glufosinate tolerant MON87419 maize and has determined that the release of this product does not endanger biological diversity or human, animal and plant health. GMAC recommends that the proposed application for release be **APPROVED WITH TERMS AND CONDITIONS** as listed in section IV - Proposed Terms and Conditions for Certificate of Approval.

VIII – Bibliography

1. Berg, G., N. Roskot and K. Smalla. 1999. Genotypic and phenotypic relationships between clinical and environmental isolates of *Stenotrophomonas maltophili*a. Journal of Clinical Microbiology 37:3594-3600.
2. Burge, J.J.; Burzio, L.A.;Finnessy, J.F. (2010). Assessment of the in vitro digestibility of the dicamba mon-oxygenase (DMO) enzyme in simulated gastric and simulated intestinal fluids. Study ID# MSL0022502, Monsanto Company.
3. Chen, B and Wang, Cunxi (2015). Amended Report for MSL0025998: Assessment of the in vitro Digestibility of Phosphinothricin N-Acetyltransferase (pat) Protein by Pepsin and Pancreatin. Monsanto Technical Report no MSL0026362.
4. Conner, A.J., Glare, T.R. and Nap, J.P. (2003). The release of genetically modified crops into the environment. II. Overview of ecological risk assessment. Plant J. 33, 19–46.
5. Crawley, M.J., S.L. Brown, R.S. Hails, D.D. Koh and M. Rees. 2001. Transgenic crops in natural habitats. Nature 409:682-683.
6. Cross, T. 1989. Other genera. Pages 2586-2615 in Bergey's Manual of Systematic Bacteriology. Volume 4. S.T. Williams and M.E. Sharpe (eds.). Williams & Wilkins, Balitmore, Maryland.
7. Cunha, B.A. 2009. *Stenotrophomonas maltophilia*. WebMD, LLC, New York, New York. http://emedicine.medscape.com/article/237024-print [Accessed August 6, 2010].
8. Denton, M. and K.G. Kerr. 1998. Microbiological and clinical aspects of infection associated with *Stenotrophomonas maltophilia*. Clinical Microbiology Reviews 11:57-80.
9. Denton, M., N.J. Todd, K.G. Kerr, P.M. Hawkey and J.M. Littlewood. 1998. Molecular epidemiology of *Stenotrophomonas maltophilia* isolated from clinical specimens from patients with cystic fibrosis and associated environmental samples. Journal of Clinical Microbiology 36:1953-1958.
10. de Vries J, Wackernagel W (2004) Microbial horizontal gene transfer and the DNA release from transgenic crop plants. Plant Soil 266:91–104.
11. Echemendia, Y. 2010. Microorganism of the month: *Stenotrophomonas maltophilia*. Environmental Microbiology Laboratory, Inc., Cherry Hill, New Jersey. http://www.emlab.com/s/sampling/env-report-07-2007.html [Accessed August 10, 2010].

12. Edrington,T. and Calcaterra, J.(2015).Amended Report for MSL0025997: Assessment of the in vitro Digestibility of Escherichia coli-Produced MON 87419 DMO Protein by Pepsin and Pancreatin. Monsanto Technical Report no MSL0026364.
13. FAO-WHO. 2001. Evaluation of allergenicity of genetically modified foods. Report of a joint FAO/WHO expert consultation on allergenicity of foods derived from biotechnology. Food and Agriculture Organization of the United Nations, Rome, Italy.
14. FAO-WHO. 2001. Evaluation of allergenicity of genetically modified foods. Report of a joint FAO/WHO expert consultation on allergenicity of foods derived from biotechnology. Food and Agriculture Organization of the United Nations, Rome, Italy.
15. Goodfellow, M. and S.T. Williams. 1983. Ecology of actinomycetes. Annual Review of Microbiology 37:189-216.
16. Kämpfer, P. 2006. The family *Streptomycetaceae,* Part I: Taxonomy. Pages 538-604 in The Prokaryotes. A Handbook on the Biology of Bacteria: Archaea. Bacteria: Firmicutes, Actinomycetes. Volume 3. M.Dworkin, S. Falkow, E. Rosenberg, K.-H. Schleifer, and E. Stackebrandt (eds.). Springer+ Business Media, LLC., New York, New York.
17. Keese, P.2008. Risks from GMOs due to Horizontal Gene Transfer. Environmental Biosafety Research 7(3):123-49.
18. Kutzner, H.J. 1981. The family *streptomycetaceae.* Pages 2028-2090 in The Prokaryotes: A Handbook on Habitats, Isolation, and Identification of Bacteria. Volume 2. M.P. Starr, H. Stolp, H.G. Trüper, A. Balows, and H.G. Schlegel (eds.). Springer-Verlag, Berlin, Germany.
19. Locci, R. 1989. *Streptomycetes* and related genera. Pages 2451-2508 in Bergey's Manual of Systematic Bacteriology. Volume 4. S.T. Williams and M.E. Sharpe (eds.). Williams & Wilkins, Baltimore, Maryland.
20. OECD. 2000. Report of the task force for the safety of novel foods and feeds. C(2000)86/ADD1. Organisation of Economic Co-operation and Development, Paris, France.
21. Paul, JH.1999.Microbial Gene Transfer: An Ecological Perspective. J Mol Microbiol. Biotechnol 1 (1):45-50.
22. Qureshi, A., L. Mooney, M. Denton and K.G. Kerr. 2005. *Stenotrophomonas maltophilia* in salad. Emerging Infectious Diseases 11:1157-1158.
23. Raybould, A., G. Graser, K. Hill and K. Ward. 2012. Ecological risk assessments for transgenic crops with combined insect-resistance traits: The example of Bt11 x MIR604 maize. Journal of Applied Entomology 136:27-37.
24. Roberts, A., Y. Devos, A. Raybould, P. Bigelow and A. Gray. 2014. Environmental risk assessment of GE plants under low-exposure conditions. Transgenic Research 23:971-983.
25. Ryan, R.P., S. Monchy, M. Cardinale, S. Taghavi, L. Crossman, M.B. Avison, G. Berg, D. van der Lelie and J.M. Dow. 2009. The versatility and adaptation of bacteria from the genus *Stenotrophomonas.* Nature Reviews Microbiology 7:514-525.
26. Schmidt, C.L and Shaw, L .2001.A Comprehensive Phylogenetic Analysis of Rieske and Rieske-Type Iron-Sulfur Proteins. Journal of Bioenergetics and Biomembranes, Vol. 33, No. 1, 2001.

27. Smedley, J.W.2012.An Acute Toxicity Study of E.Coli-produced Phosphinothricin N-acetyltransferase(PAT [bar]) Protein Administered by the Oral Gavage Route to Mice.Monsanto Technical Report CRO-2011-007. St. Louis, Missouri.
28. Smedley, J.W.2012.An Acute Toxicity Study of E. coli-produced MON 88701 DMO Administered by the Oral Gavage Route to Mice.Monsanto Technical Report CRO-2011-035. St. Louis, Missouri.

Appendix 1

GENETIC MODIFICATION ADVISORY COMMITTEE (GMAC) MEMBERS INVOLVED IN SPECIFIC RISK ASSESSMENT AREAS FOR THE APPROVAL FOR RELEASE OF PRODUCTS OF MON87419 MAIZE FOR SUPPLY OR OFFER TO SUPPLY

Genetic Modification Advisory Committee (GMAC) members divided the task of looking up more information for the Risk Assessment matrix based on three broad categories which were environment, human health and animal health. Each sub-committee had a nominated leader to coordinate the work and report back to the main GMAC. The GMAC members involved in the risk assessment are as below:

- **Prof. Dr. Mohd. Faiz Foong bin Abdullah (Universiti Teknologi MARA) (GMAC Chairman)**
- **Dr. Kodi Isparan Kandasamy (Industry Representative) (Environment sub-committee Leader)**
- **Madam T.S. Saraswathy (Institute of Medical Research - retired) (Human Health sub-committee Leader)**
- **Prof. Dr Jothi Malar Panandam (Universiti Putra Malaysia - retired) (Animal Health sub-committee Leader)**
- **Dr. Rahizan Issa (Institute of Medical Research - retired) (Notification Assessment sub-committee Leader)**
- Dato' Dr. Sim Soon Liang (Academy of Sciences Malaysia)
- Prof. Dr. Abd Rahman Milan (Universiti Malaysia Sabah - retired)
- Assoc. Prof. Dr. Chan Kok Gan (Universiti Malaya)
- Assoc. Prof. Dr. Choong Chee Yen (Universiti Kebangsaan Malaysia)
- Dr. Adiratna Mat Ripen (Institute of Medical Research)
- Dr. Norliza Tendot Abu Bakar (Malaysian Agricultural Research & Development Institute)
- Dr. Norwati Muhammad (Forest Research Institute of Malaysia)
- Dr. Saifullizam bin Abdul Kadir (Department of Veterinary Services)
- Dr. Teo Tze Min (Entomological Society of Malaysia)
- Dr. Mohd Hefni Rusli (Malaysian Palm Oil Board)
- Madam Shafini Abu Bakar (Ministry of Health)
- Madam Sabariah Kamis (Department of Agriculture)
- Mr. Harun bin Ahmad (Department of Chemistry Malaysia)