RISK ASSESSMENT REPORT

OF THE GENETIC MODIFICATION ADVISORY COMMITTEE (GMAC)

FOR

AN APPLICATION FOR APPROVAL FOR RELEASE OF PRODUCTS OF X17 POTATO FOR SUPPLY OR OFFER TO SUPPLY

NBB REF NO: JBK(S) 600-2/1/10

APPLICANT: SIMPLOT PLANT SCIENCES INTERNATIONAL INCORPORATED (SPSII)

DATE: 7 JULY 2020

I - Summary of Assessment Process

On 13 February 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 X17 potato, with late blight protection as well as reduced acrylamide formation and browning. The application was filed by Simplot Plant Sciences International Incorporated (SPSII) (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 18 February 2020 to 17 March 2020 via advertisements in the local newspapers, e-mail announcements and social media Comments were received from Consumers Association of Penang (CAP) and Malaysian Palm Oil Board (MPOB). GMAC took into consideration comments regarding the use of RNAi mechanism and the efficacy to pass on the trait, insufficient safety information provided on the X17 potato, substantial non-equivalence as well as requirement for labelling of the X17 potato.

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, X17 potato, with late blight protection as well as reduced acrylamide formation and browning. 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, X17 potato has been registered in a number of countries for food, feed and for processing. X17 potato is approved in Australia, Canada, New Zealand and United States of America (FAO GM Foods Platform) and may be imported, stored and processed for use in food, animal feed and processing in the same way as other conventional, non-transgenic potato.

Potato is one of the world's largest food crop, following maize, wheat and rice (FAO, 2014). The total world potato production is estimated at 381,682,000 tonnes in 2014 (FAOSTAT, 2017) with over two thirds consumed directly by humans, either fresh (boiled, roasted, baked, fried) or as processed products such as fries, chips or dehydrated flakes or powder. The remaining is used for feed or for starch production. Although potatoes are not grown specifically for animal feed, a small percentage of total harvest is used to add to the feed of ruminant animals like cattle and sheep.

The applicant claims that X17 potato is compositionally and nutritionally equivalent to the potato variety Ranger Russet and other conventional potatoes. The type of expected use of X17 potato

and the products derived from X17 potato in Malaysia will be the same as the expected usage for conventional potatoes and products derived from conventional potatoes.

Information about X17 potato

The cultivated potato*, Solanum tuberosum,* originated from the South American region (Andean and Chilean landraces) and is presently cultivated worldwide in over one hundred countries throughout Africa, Asia, Australia, Europe and North and South America (USDA-ARS, 2014) and rarely exists as a wild plant other than as a volunteer (Burton, 1989; Simon *et al*., 2010). Environmental conditions under which *S. tuberosum* can be successfully grown are very diverse. In the tropics it is grown in the cool highlands, typically at elevations over 1000 m, and in the subtropics it is grown during the cooler winter, autumn, and spring seasons or at mid-elevations (Hijmans, 2001). *S. tuberosum* is not frost tolerant and will be killed at temperatures of -3°C or lower (Li, 1977). It can grow in a range of soil types, but is sensitive to drought stress and, therefore, can only be cultivated where there is adequate rainfall or the ability to irrigate (Bohl and Johnson, 2010; Haverkort, 1990). Differences in tolerance to frost and drought occur within the species.

Solanum sp. have an initial chromosome number of 12, but polyploidy is prevalent in both wild and cultivated potatoes. To facilitate cross-breeding and selfing, the presence of insects is necessary, in particular, bumblebees (White, 1983). Pollen dispersal is mainly limited by the distance pollinating insects fly. Bumblebees and bees do not fly much further than three kilometres (Reheul, 1987). Normal honeybees are not pollinators of potato, as the flowers are without any nectar (Sanford and Hanneman, 1981). An experiment carried out by White (1983) concluded that wind was of no importance for pollination of potatoes.

A large number of the tetraploid cultivated *S. tuberosum subsp*. *tuberosum* cultivars have a reduced fertility (Ross, 1986). Most cultivars show a reduced pollen fertility or even pollen sterility. Although reduced female fertility is not so common, a lot of cultivars flower less profusely than wild material. Flowers are dropped after pollination, resulting in few berries and seeds formed in most *S. tuberosum subsp. tuberosum* cultivars. Potato seeds cannot be disseminated by birds, but dissemination by small mammals is possible (Hawkes, 1988). Potato seeds can remain viable for several years (Love et al., 1994).

The cultivated potato is an annual crop, and commercial potato plants are propagated vegetatively using tuber pieces instead of seed (Rowe, 1993). Tubers are formed under the ground and can remain viable for long periods of time as long as there is not a major frost period.

X17 potato was developed by transforming the conventional potato variety Ranger Russet with pSIM1278 and pSIM1678 using *Agrobacterium*-mediated transformation. No selectable markers, such as antibiotic or herbicide markers were used. The insert from pSIM1278 is made up of genetic elements only from potato and down regulates polyphenol oxidase and asparagine

synthetase transcripts in the potato plant using RNA interference. The insert from pSIM1678 is also made up of genetic elements from wild and cultivated potatoes. The inserts down regulate vacuolar invertase transcripts using the RNA interference technique and also contains a late blight resistance gene. Lower polyphenol oxidase in X17 potato results in reduced black spot, which improves potato quality and reduces waste. Lower asparagine synthetase and vacuolar invertase contribute to lower free asparagine and reducing sugars, which in turn results in lower acrylamide levels in cooked potatoes. Expression of the late blight resistance gene results in protection against foliar late blight disease, which caused the Irish potato famine. Summary of the genetic modification as in Table 1 below:

Table 1. Summary of X17 potato: Genes, Traits, and Benefits

Construct	Inserted DNA	Gene Target	Mechanism	Trait	Benefit
pSIM1278	Asparagine synthetase-1 gene fragment (Asn1 fragment)	*Asn1* gene (Asparagine synthetase)	RNAi down regulation	Reduces free asparagine	Contributes to low acrylamide potential
	Starch-related R1 gene promoter fragment (R1 fragment)	*R1*: gene (water dikinase)	RNAi down regulation	Lowers reducing sugars	Contributes to low acrylamide potential
	Phosphorylase-L gene promoter fragment (PhL fragment)	*PhL* gene (Phosphorylase L)	RNAi down regulation	Lowers reducing sugars	Contributes to low acrylamide potential
	Polyphenol oxidase-5 3' untranslated region fragment (Ppo5 fragment)	*Ppo5* gene (Polyphenol oxidase)	RNAi down regulation	Lowers polyphenol oxidase	Reduces black spot, which improves potato quality and reduces waste
pSIM1678	Vacuolar invertase gene fragment (VInv fragment)	*VInv gene* (Vacuolar invertase)	RNAi down regulation	Lowers reducing sugars	Contributes to low acrylamide potential
	Rpi-vnt1 (*Vnt1*): R- gene	Not Applicable	Protein expression	Protection against *P. infestans*	Late blight protection

X17 potato may enter Malaysia as food, food/feed ingredients for processing or packaging, or as finished products ready for distribution.

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

(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 content.

(ii) **Effects on animal health**

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

(iii) **Effects on the environment**

Issues pertaining to accidental release of the GM potato, 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 potato and cross pollination leading to transfer of transgene

Based on the above, a final list of 19 potential hazards were 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 X17 potato tubers

Tubers may be accidentally released during transportation. These tubers may germinate and grow along transportation routes and in areas surrounding storage and processing facilities. However, the environmental conditions in Malaysia is not suitable for growth and successful perpetuation of potatoes.

b) Planting of X17 potato tubers

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) Compromised nutritional content

The potential risk of X17 potato was evaluated in equivalence to, and above any potential risk reported for unmodified Ranger Russet potato. Analyses of tubers from several studies demonstrate that X17 potato is nutritionally and compositionally similar to conventional potatoes.

However as a precautionary measure GMAC recommends that the proposed terms and conditions under section IV should be adhered to.

IV - Proposed Terms and Conditions for Certificate of Approval

Based on the 19 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 receives any credible and/or scientifically proven information that indicates any adverse effect of X17 potato, 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.

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 X17 potato 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 X17 potato with late blight protection as well as reduced acrylamide formation and browning 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

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Appendix I

GENETIC MODIFICATION ADVISORY COMMITTEE (GMAC) MEMBERS INVOLVED IN SPECIFIC RISK ASSESSMENT AREAS FOR THE APPROVAL FOR RELEASE OF PRODUCTS OF X17 POTATO 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)
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- Dr. Teo Tze Min (Entomological Society of Malaysia)
- Madam Atikah binti Abdul Kadir Jailani (Department of Agriculture - retired)
- Madam Norizan Jaafar (Department of Chemistry Malaysia)
- Madam Shafini Abu Bakar (Ministry of Health)