

Import of genetically modified soybean FG72xA5547-127 with three herbicide tolerance traits

COGEM advice CGM/151104-01

Summary

The present application (EFSA/GMO/NL/2013/120) concerns import and processing for use in feed and food of the genetically modified soybean line FG72 xA5547-127. Cultivation is not part of this application.

Soybean FG72xA5547-127 was produced by conventional crossbreeding of the genetically modified parental soybean lines FG72 and A5547-127, and expresses the hppdPFW336, 2mepsps and pat genes. As a result, soybean FG72xA5547-127 is tolerant to the active ingredients isoxaflutole, glufosinate-ammonium and glyphosate, which are commonly used in herbicides.

In Europe, there are no wild relatives of soybean and therefore, hybridisation with other species is not possible. Soybean does not possess any of the attributes commonly associated with problematic weeds such as seed shattering, dormancy or cold resistance. Establishment of feral soybean populations has never been observed in Europe. There are no reasons to assume that the introduced traits will allow FG72 xA5547-127 soybean to establish feral populations.

Previously the parental lines were assessed, including the molecular characterisation. The applicant has updated the molecular characterisation of FG72xA5547-127. The characterisation meets the criteria of COGEM.

In conclusion, COGEM is of the opinion that import and processing of soybean line FG72xA5547-127 poses a negligible risk to the environment in the Netherlands. COGEM abstains from giving advice on the potential risks of incidental consumption since a food/feed assessment is already carried out by other organisations.

Introduction

The scope of the present application filed by Bayer CropScience AG (EFSA/GMO/NL/2013/120), concerns import and processing of genetically modified (GM) soybean line FG72xA5547-127. This line expresses the *hppdPFW336* gene derived from *Pseudomonas fluorescens*, the *2mepsps* gene derived from maize, and the *pat* gene derived from *Streptomyces viridochromogenes*. These genes confer tolerance to the active ingredients isoxaflutole, glyphosate and glufosinate-ammonium, respectively, which are commonly used in herbicides.

Soybean line FG72xA5547-127 was produced by conventional crossbreeding of GM soybean lines FG72 and A5547-127. EFSA issued positive opinions for the placing on the market of both parental lines for food and feed uses, import and processing.^{1,2} The scientific opinion on FG72 was issued recently. Parental line A5547-127 has an EU approval for import, food and feed since 2012.³ FG72 has no EU approval yet.

Parental lines FG72 and A5547-127 have been authorised for use in food or feed, and processing in a number of countries including Australia, Malaysia, Mexico, and the United States. Additionally, A5547-127 has been authorised for use in food and feed, and for environmental release in several countries including Argentina, Japan and the Russian Federation.^{4,5}

Previous COGEM advices

COGEM advised positively on the import and processing of parental lines A5547-127 and FG72 in 2008 and 2012, respectively.^{6,7}

Aspects of the crop

Soybean (*Glycine max*) belongs to the *Fabaceae (Leguminosae)* family and is grown from equatorial to temperate zones. The optimum temperature for soybean growth is between 25°C and 30°C. Soybean seeds will germinate at soil temperatures above 10°C. Under favourable conditions a seedling will emerge in a 5-7 day period. Soybean is sensitive to frost and therefore does not survive freezing conditions.^{8,9,10} In the Netherlands, frost is common. On average 58 days in a year have minimum temperatures below 0°C.^{11,12}

The Dutch climate is not optimal for cultivation of soybean. However, field trials with a number of soybean varieties have shown that cultivation of soybean under temperate climatic conditions is possible.^{13,14} In 2014 soybean was cultivated on a very small scale (approximately 250 acres).¹⁵

The soybean plant is not weedy in character.^{9,10} Like for all domesticated crops, soybean has been selected for minimal seed scattering to reduce yield losses during harvesting. Soybean seeds rarely display dormancy, poorly survive in soil and do not form a persistent soil seed bank.^{9,16} Soybean volunteers are not often observed throughout the world and do not effectively compete with other cultivated plants or primary colonisers.^{9,10} In addition, volunteers are easily controlled mechanically or chemically.¹⁰ To the best of COGEM's knowledge there are no reports of feral soybean populations in Europe.

Soybean is predominantly a self-pollinating species. The cross-pollination rate of soybean is low and on average between 1 to 3%.^{9, 10, 17,18,19,20,21,22} The pollen disperses only over short distances. The anthers mature in the bud and directly pollinate the stigma of the same flower.^{9,10} In Europe, hybridisation with other species is not possible because there are no wild relatives of soybean.^{9,10}

Molecular characterisation of FG72xA5547-127

Soybean line FG72xA5547-127 was produced by crossbreeding of the two genetically modified parental lines FG72 and A5547-127. In its previous advices concerning import and processing of both parental lines, COGEM described the inserted elements in detail and evaluated the molecular characterisation.^{6,7} COGEM concluded that the molecular characterisation of the individual lines was adequate.

For the molecular characterisation of FG72xA5547-127 the applicant provided updated bioinformatics analyses using recent databases. The analyses confirmed the earlier results obtained for both parental

lines.^{6,7} In conclusion the molecular characterisation meets COGEM's criteria for the molecular characterisation of GM crops.²³

Expressed proteins

FG72xA5547-127 soybean contains the *hppdPfw336* gene, which expresses a modified 4-hydroxyphenylpyruvate dioxygenase (HPPD) enzyme originating from the bacterium *P. fluorescens*. The HPPD enzyme is naturally occurring in plants. Isoxaflutole inhibits the HPPD enzyme leading to a depletion of plastoquinone, a co-factor of phytoene desaturase. This results in a depletion of carotenoids and an absence of chloroplast development in emerging foliar tissues which appear bleached and stunted.²⁴ FG72xA5547-127 soybean is less sensitive for isoxaflutole containing herbicides due to the presence of the modified HPPD enzyme.

FG72xA5547-127 soybean also expresses the *2mepsps* gene. The *2mepsps* gene is a modified version of the naturally occurring 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) enzyme of maize. EPSPS is an enzyme involved in the biosynthesis of aromatic amino acids and is active in the chloroplasts of a plant cell. Glyphosate inhibits EPSPS, resulting in a lack of amino acids essential for growth and development of plants.^{25,26} The 2mEPSPS enzyme has a decreased binding affinity for glyphosate resulting in tolerance for glyphosate containing herbicides.

Additionally, FG72xA5547-127 soybean expresses the *pat* gene originating from the bacterium *S. viridochromogenes*, which encodes phosphinothricin-N-acetyl transferase (PAT). PAT inactivates L-phosphinothricin, the active isomer of the herbicide glufosinate-ammonium.²⁷ As a result FG72xA5547-127 is tolerant to glufosinate-ammonium containing herbicides.

In non-transgenic plants the herbicide glufosinate-ammonium inhibits the activity of glutamine synthetase, an enzyme necessary for the production of glutamine and for ammonia detoxification.²⁷ Photosynthesis is inhibited and eventually the plant dies.²⁸

Environmental risk assessment

The current notification concerns import and processing of soybean line FG72xA5547-127. In case of spillage, FG72xA5547-127 soybean seed may be released into the environment. Soybean seeds rarely display dormancy, poorly survive in soil and do not survive freezing winter conditions.

Soybean volunteers are not often observed throughout the world and do not effectively compete with other cultivated plants, weeds or primary colonisers. In addition, volunteers are easily controlled mechanically or chemically. Modern soybean cultivars do not possess any of the characteristics commonly associated with problematic weeds. Establishment of feral soybean populations in Europe has never been observed.

There are no indications that the introduced genes in soybean line FG72xA5547-127 increase the potential to survive or attribute to the establishment of feral populations in case of incidental spillage. Wild relatives of soybean are not present in Europe and therefore introgression of the inserted sequences into closely related species cannot occur. COGEM is of the opinion that incidental spillage of soybean FG72xA5547-127 poses a negligible risk in the Netherlands.

General Surveillance

COGEM has published several recommendations for further improvement of the general surveillance (GS) plan,^{29,30} but considers the current GS plan adequate for import and processing of FG72xA5547-127 soybean.

Food/ feed assessment

COGEM abstains from giving advice on the potential risks of incidental consumption since a food/feed assessment is already carried out by other organisations.³¹ This application is submitted under Regulation (EC) 1829/2003, therefore a food/feed assessment is carried out by EFSA and national organisations involved in the assessment of food safety. In the Netherlands, a food and/or feed assessment for Regulation (EC) 1829/2003 applications is carried out by RIKILT. Regarding the risks for food and feed, the outcome of the assessment by other organisations (EFSA, RIKILT) was not known when this advice was completed.

Advice

COGEM has been asked to advise on import and processing for use in food and feed of soybean line FG72xA5547-127. This soybean line expresses the *hppdPfw336*, *2mepsps* and *pat* genes conferring tolerance to the active ingredients isoxaflutole, glyphosate and glufosinate-ammonium, respectively, which are commonly used in herbicides.

Based on the aspects discussed, COGEM is of the opinion that import and processing of soybean FG72xA5547-127 poses a negligible risk to the environment in the Netherlands. A food/feed safety assessment is carried out by other organisations. Therefore, COGEM abstains from advice on the potential risks of incidental consumption.

Additional remark

The Post-Market Environmental Monitoring (PMEM) plan for import and processing of FG72xA5547-127 contains an URL for operators, which provides an overview of approved GM plant products. COGEM notes that the URLs in the main dossier and the supplementary data are different. Apparently the URL given in the main dossier is outdated. Only the URL <http://www.europabio.org/information-operators> in the PMEM plan of the supplementary data is accessible.

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