Renewal of the authorisation for import and processing of genetically modified soybean MON87769

COGEM advice CGM/241009-01

- The present application (GMFF-2023-21253) concerns the renewal of the authorisation for import and processing for use in feed and food of genetically of genetically modified (GM) soybean (*Glycine max*) MON87769;
- GM soybean MON 87769 was previously authorised for import and processing in 2015;
- COGEM has advised positively on the import and processing of GM soybean MON87769 in 2010;

- MON87769 expresses the *Pj.D6D* gene derived from *Primula juliae* and *Nc.Fad3* derived from *Neurospora crassa* resulting in the production of stearidonic acid (SDA), an omega3 fatty acid;

- In the Netherlands, feral soybean populations do not occur;
- Hybridisation of soybean with other species is not possible in the Netherlands, as there are no wild relatives of soybean;

- The molecular characterisation of GM soybean MON87769 has been updated and meets the criteria of COGEM;
- The updated bioinformatics analyses, literature review and monitoring reports do not give any indication of a potential environmental risk;

- COGEM is of the opinion that import and processing of GM soybean MON87769 poses a negligible risk to the environment in the Netherlands;
- As other organisations carry out a food/feed assessment, COGEM abstains from giving advice on the potential risks of incidental consumption.

1. Introduction

The present application (GMFF-2023-21253), filed by Bayer Agriculture BV on behalf of Bayer CropScience LP, concerns the renewal of the authorisation for import and processing for use in feed and food of genetically of genetically modified (GM) soybean (*Glycine max*) MON87769. This authorisation was granted in 2015.[1] As import and processing authorisations remain valid for a period of 10 years, the applicant has filed an application for the renewal of the authorisation granted in 2015. The application contains – among other things – monitoring reports, updated bioinformatics analyses, and a systematic literature search. The soybean MON87769 expresses the *Pj.D6D* gene derived from *Primula juliae* and *Nc.Fad3* derived from *Neurospora crassa*, resulting in the production of stearidonic acid (SDA), an omega3 fatty acid.

2. Previous COGEM Advice

The COGEM advised on the import and processing of GM soybean MON87769 in 2010, and concluded that it poses a negligible risk to the environment.[2] In addition, COGEM also advised positively on a stacked event containing MON87769: GM soybean MON87769 x MON89788 in 2014.[3]

3. Environmental risk assessment

The objective of an environmental risk assessment (ERA) is to identify and evaluate potential adverse effects of the genetically modified organism (GMO), direct or indirect, immediate or delayed, on human health and the environment. This ERA involves the import and processing of GM soybean. Any concerns relating to cultivation, management or harvesting practices are beyond the scope of this advice. When assessing the environmental risk of incidental spillage of GM soybean COGEM first considers the likelihood that the event could establish itself in the Netherlands or could hybridise with related species. Other so-called 'areas of concern' (e.g. effects on non-target organisms) are addressed only if there is a chance that the event could establish itself or if gene flow to other species might occur.

3.1 Characteristics of the crop

Soybean (*Glycine max*) belongs to the Leguminosae (Fabaceae) family and is cultivated from equatorial to temperate zones. The optimum temperature for soybean growth is between 25 °C and 30 °C. Soybean is sensitive to frost and therefore does not survive freezing conditions.[4,5,6] The soybean plant is not weedy in character.[5,6] To reduce yield losses during harvest, soybean plants with minimal seed scattering have been selected for breeding. Soybean seeds rarely display dormancy, survive poorly in soil, and do not form a persistent soil seed bank.[5,7] Soybean volunteers are rarely observed throughout the world and do not compete effectively with other cultivated plants or primary colonisers.[5,6] In addition, volunteers are easily controlled mechanically or chemically.[6]

Soybean is a predominantly self-pollinating species. The anthers mature in the bud and directly pollinate the stigma of the same flower.[5,6] Pollinators such as honeybees (*Apis mellifera* L.) may improve the distribution of pollen on the stigmatic surface, which is known to increase seed set in many crops, and may as well facilitate transfer of soybean pollen and enable cross-pollination.[8,9,10,11] The cross-pollination rate of soybean is low and on average between 1 to 3%.[5,6,12,13,14,15,16] Usually, soybean pollen only disperse over short distances.

3.2 Receiving environment

As mentioned previously, soybean is sensitive to frost. Temperatures below 0 °C are common in the Netherlands, with an average of 51 frost days a year between 1991 and 2020.[17] Although the Dutch climate is not optimal, soybean is cultivated on a small scale (442 hectares in 2023).[18] Soybean volunteers are very uncommon in the Netherlands and have never resulted in establishment of wild populations.[19,20] To the best of COGEM's knowledge, there are no reports of feral soybean populations in Europe. Additionally, hybridisation with other species is not possible in Europe because there are no wild relatives of soybean.[5,6]

Conclusion: In the Netherlands feral soybean populations do not occur and hybridization of soybean with other species is not possible.

3.3 Description of the introduced genes and traits

MON87769 was developed by *Agrobacterium*-mediated transformation of the conventional soybean line A3525 with the binary vector PV-GMPQ1972. PV-GMPQ1972 contains two T-DNA regions (T-DNA I and II). T-DNA I contains the *Pj.D6D* and *Nc.Fad3t* expression cassettes, resulting in the production of stearidonic acid (SDA), an omega-3 fatty acid. T-DNA-II contains the cassette that expresses the *cp4 epsps* gene derived from *Agrobacterium* sp., conferring tolerance to glyphosate containing herbicides.[21] Glyphosate tolerance was used as a tool to select transformed plants. This cassette was subsequently removed from the line by conventional breeding and selection, resulting in MON87769 soybean which is tolerant to dicamba herbicides, but sensitive to herbicides containing glyphosate.[22]

A description of the inserted genetic elements is listed in the table below. The list is limited to information on the introduced genes, corresponding traits, and regulatory elements (promotors and terminators). For a more detailed description, see the previous COGEM advise.[2]

Introduced gene	**Encoded protein**	**Regulatory elements**	**Traits**
Pj.D6D	Delta-6 desaturase from *Primula juliae* (PjΔ6D)	7Sα' seed-specific promoter and leader sequence from the *Sphas1* gene of *Glycine max* The tml 3' non-translated region of the *tml* gene from *Agrobacterium tumefaciens* octopine-type Ti plasmid	Seed specific production of the PjΔ6 desaturase proteins
Nc.Fad3t	Delta-15 desaturase from *Neurospora crassa* (NcΔ15D)	7Sα promotor and leader sequence from the *Sphas2* gene from *G. max* The E9 3' non-translated region from the *rbcS2* gene of *Pisum sativum* for polyadenylation of the mRNA.	Seed specific production of the NcΔ15 desaturase proteins

3.4 Updated bioinformatic analyses

The bioinformatic analysis performed for the previous application regarding MON87769 was repeated with updated databases – assembled in 2023 – containing sequences from allergens, toxins, and proteins. According to the applicant there were no biologically relevant amino acid sequence similarities to

known allergens, toxins, or other biologically active proteins with adverse effects for human or animal health.

COGEM is of the opinion that the molecular characterisation of GM soybean MON87769 has been performed correctly and meets the requirements of COGEM.[23]

Conclusion: The bioinformatics analyses of GM soybean MON87769 been updated and performed adequately. No indications for potential environmental risks were identified.

3.5 Systematic literature search and unpublished studies

The applicant performed a literature search using several bibliographic databases and internet pages of relevant key organisations involved in the risk assessment of GM plants covering a publication period from 1 January 2014 to 4 January 2024. The literature search was performed for multiple GM soybean events at once and addressed the question "Does the Bayer GM soybean products, derived food/feed products and the introduced improved fatty acid profile and dicamba tolerance traits have adverse effects on human and animal health and the environment?". The applicant states that they are not in possession of unpublished studies that could influence the risk assessment of GM soybean MON87769.

The literature search identified 1865 publications in electronic databases and 520 records of internet pages of relevant key organisations. Four studies were considered relevant for soybean MON87769.[24,25,26,i] According to the applicant, none of these studies were found to contain new data relevant to the risk assessment. Overall, no adverse effects on human and animal health, or the environment were identified in the literature searches of the applicant.

Conclusion: The systematic literature search did not provide any indications that import and processing of soybean MON87769 poses an environmental risk.

3.6 Annual monitoring reports

The applicant supplied annual reports of the post-market monitoring (PMEM) conducted between October 2015 and November 2023. These reports contain, amongst other things, information on the monitoring that is conducted by operators involved in import, handling, and processing of viable GM soybean. These operators are members of the European trade associations COCERAL, UNISTOCK or FEDIOL, and have agreed to participate in the PMEM. They are expected to report any occurrence of unanticipated adverse effects arising from soybean MON87769, including adventitious populations

[i] Out of the four identified relevant studies one was not accessible to the COGEM. This concerns the reference: Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF) (2014) ステアリドン酸産生ダイズ, MON87769 https://www.maff.go.jp/j/syouan/nouan/carta/torikumi/attach/pdf/index-53.pdf. This is described by the applicant as a weblink dedicated to a list of approved genetically modified agricultural crops. The applicant states that no adverse effects on human and animal health, or the environment were identified in this document.

resisting routine eradication procedures. No adverse health or environmental effects were reported by the trade associations involved in the monitoring of import and processing of MON87769 soybean.

According to the monitoring reports, no relevant publications that invalidate the initial conclusions on the risk assessment of MON87769 soybean were identified in the annual literature search.

Conclusion: The information in the annual monitoring reports gives no indication of adverse effects or incidents resulting from import and/or processing of MON87769.

4. Food/feed assessment

This application is submitted under Regulation (EC) 1829/2003[27], therefore a food/feed assessment is conducted by European Food Safety Authority (EFSA) and national organisations involved in the assessment of food safety. In the Netherlands, Wageningen Food Safety Research (WFSR) conducts a food and/or feed assessment for Regulation (EC) 1829/2003 applications. The outcome of the assessment by other organisations (EFSA, WFSR) was not known when this advice was completed.

5. Post-market environmental monitoring

The applicant did not propose any changes to the existing post-market environmental monitoring (PMEM) plan for soybean MON87769. COGEM has published several recommendations for further improvement of the general surveillance (GS) plan[28,29] – which is part of a PMEM plan – but considers the current GS plan adequate for import and processing of soybean MON87769.

Conclusion: The current PMEM plan is sufficient for the import and processing of GM soybean MON87769.

6. Overall conclusion

Overall, COGEM is of the opinion that import and processing of soybean MON87769 poses a negligible risk to the environment in the Netherlands. COGEM abstains from giving advice on the potential risks of incidental consumption since other organisations carry out a food/feed assessment.

References

1. Commission Implementing Decision (EU) 2015/686 of 24 April 2015 authorising the placing on the market of products containing, consisting of, or produced from genetically modified soybean MON 87769 (MON-87769-7) pursuant to Regulation (EC) No 1829/2003 of the European Parliament and of the Council (2015/686/EC). OJEU L 112/16
2. COGEM (2010). Import and processing of genetically modified soybean MON87769 expressing two desaturase genes. COGEM advice CGM/100414-01
3. COGEM (2014). Import and processing of the genetically modified soybean line MON87769 x MON89788. COGEM advice CGM/140716-01
4. Bramlage WJ *et al*. (1978). Chilling stress soybeans during inhibition. Plant Physiol. 61: 525-529

5. Andersson MS & de Vicente MC (2010). Soybean (*Glycine max* (L.) Merr.). In: Gene flow between crops and their wild relatives. Eds: Andersson MS *et al*., The Johns Hopkins University Press, Baltimore
6. Organisation for Economic Co-operation and Development (OECD) (2000). Consensus document on the biology of *Glycine max* (L.) Merr. (Soybean)
7. Organisation for Economic Co-operation and Development (OECD) (1993). Traditional crop breeding practices: An historical review to serve as baseline for assessing the role of modern biotechnology
8. Kim DY *et al*. (2021). Natural hybridization between transgenic and wild soybean genotypes. Plant Biotechnol. Rep. 15: 299-308
9. Yook MJ *et al*. (2021). Environmental risk assessment of glufosinate-resistant soybean by pollen-mediated gene flow under field conditions in the region of the genetic origin. Sci. Total Environ. 762: 143073
10. Garibaldi LA *et al*. (2021). Time to integrate pollinator science into soybean production. Trends Ecol. Evol. 36: 573-575
11. Blettler DC *et al*. (2018). Contribution of honeybees to soybean yield. Apidolog. 49: 101-111
12. Wang K & Li X (2013). Pollen dispersal of cultivated soybean into wild soybean under natural conditions. Crop Sci. 53: 2497-2505
13. Ahrent DK & Caviness CE (1994). Natural cross-pollination of twelve soybean cultivars in Arkansas. CSSA 34: 376-378
14. Carlson JB & Lersten NR (1987). Reproductive morphology. In: Soybeans improvement, production, and uses Second edition. Ed. Willcox JR, American Society of Agronomy, Madison
15. Ray JD *et al*. (2003). Soybean natural cross-pollination rates under field conditions. Environ. Biosafety Res. 2: 133-138
16. OECD (2008). Safety assessment of transgenic organisms. OECD consensus documents. Volume 1
17. Koninklijk Nederlands Meteorologisch Instituut (KNMI) Klimaatviewer periode 1991-2020. https://www.knmi.nl/klimaat-viewer/grafieken-tabellen/langjarige-gemiddelden/lh15/lh15_1991-2020 [In Dutch] (accessed: 5 August 2024)
18. Centraal Bureau voor de Statistiek (CBS) Landbouw; gewassen, dieren en grondgebruik naar regio. https://opendata.cbs.nl/#/CBS/nl/dataset/80780ned/table [In Dutch] (accessed: 5 August 2024)
19. FLORON Verspreidingsatlas Vaatplanten. *Glycine max* (L.) Merr. https://www.verspreidingsatlas.nl/1809 [In Dutch] (accessed: 5 August 2024)
20. Waarneming.nl. Sojaboon *Glycine max* (L.) https://waarneming.nl/species/6841/observations/?-date_after=2017-01-01&date_before=2024-05-01&country_division=&search=&user=&location=&sex=-&month=&life_stage=&activity=&method= [In Dutch] (accessed: 5 August 2024)
21. Funke T *et al*. (2006). Molecular basis for the herbicide resistance of Roundup Ready crops. PNAS 103: 13010-13015
22. Behrens MR *et al*. (2007). Dicamba resistance: Enlarging and preserving biotechnology-based weed management strategies. Science 316: 1185-1188
23. COGEM (2014). Reconsideration of the molecular characterisation criteria for marketing authorisation of GM crops. COGEM topic report CGM/140929-02
24. Elkin RG *et al*. (2015). Feeding laying hens stearidonic acid-enriched soybean oil, as compared to flaxseed oil, more efficiently enriches eggs with very long-chain n-3 polyunsaturated fatty acids. J Agric Food Chem. 63: 2789-2797

25. Elkin RG *et al*. (2016). Influence of feeding stearidonic acid (18: 4n-3)-enriched soybean oil, as compared to conventional soybean oil, on tissue deposition of very long-chain omega-3 fatty acids in meat-type chickens. Animal Feed Science and Technology. 217: 1-12
26. Canadian Food Inspection Agency (CFIA) (2017) Decision Document DD2011-85: Determination of the Safety of Monsanto Canada Inc.'s Soybean (Glycine max (L.) Merr.) Event MON 87769. https://inspection.canada.ca/plant-varieties/plants-with-novel-traits/approved-under-review/decision-documents/dd2011-85/eng/1331564416836/1331576381607 (accessed: 26 August 2024)
27. European Commission (2003). Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003 on genetically modified food and feed. OJEU L 268/1
28. COGEM (2010). General Surveillance. COGEM report CGM/100226-01
29. COGEM (2015). Advice on improving the general surveillance of GM crops. COGEM advice CGM/150601-02