

Renewal of the authorisation for import and processing of genetically modified soybean A2704-12

COGEM advice CGM/180515-01

- The present application (EFSA/GMO/RX/009) concerns the renewal of the authorisation for import and processing of genetically modified (GM) soybean (*Glycine max*) A2704-12;
- GM soybean A2704-12 was previously authorised for import and processing in 2008;
- COGEM has advised positively on the import and processing of soybean A2704-12 in 2007;
- A2704-12 expresses the *pat* gene, which confers tolerance to herbicides containing the active ingredient glufosinate-ammonium;

- In the Netherlands, feral soybean populations do not occur and hybridisation of soybean with other species is not possible;

- The updated bioinformatics analysis of soybean A2704-12 meets the criteria of COGEM;
- There are no indications that the introduced trait alters the fitness of soybean A2704-12 or allows soybean A2704-12 to survive in the Dutch environment;
- The updated bioinformatics analysis, 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 soybean A2704-12 pose 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 carried out by other organisations.

1. Introduction

The present application (EFSA/GMO/RX/009), filed by Bayer CropScience LP, concerns the renewal of the authorisation for import and processing of GM soybean A2704-12. This authorisation was granted in 2008 (2008/730/EC).¹ Since import and processing authorisations remain valid for a period of 10 years, the applicant filed an application for the renewal of the authorisation granted in 2008. The application contains amongst others monitoring reports, an updated molecular characterisation and an updated literature search.

2. Previous COGEM advices

In 2006 COGEM advised negatively on the import and processing of soybean A2704-12 because data regarding the molecular characterisation were missing, in particular information on the 5' flanking sequence of the insert.² After the applicant delivered additional information, COGEM considered A2704-12 adequately characterised, and issued a positive advice in 2007.³

3. Environmental risk assessment

3.1 Aspects of the wild-type 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} In the Netherlands, frost is common. On average 58 days a year have minimum temperatures below 0°C.^{7,8} Although the Dutch climate is not optimal, soybean is cultivated on a small scale (about 1000 acres in 2017).⁹

The soybean plant is not weedy in character.^{5,6} To reduce yield losses during harvesting, soybean has been selected for minimal seed scattering. Soybean seeds rarely display dormancy, poorly survive in soil, and do not form a persistent soil seed bank.^{5,10} Soybean volunteers are rarely observed throughout the world and do not effectively compete with other cultivated plants or primary colonisers.^{5,6} In addition, volunteers are easily controlled mechanically or chemically.⁶ To the best of COGEM's knowledge, there are no reports of feral soybean populations in Europe. Soybean volunteers are very uncommon in the Netherlands and have never resulted in establishment of wild populations.¹¹

Soybean is predominantly a self-pollinating species. The anthers mature in the bud and directly pollinate the stigma of the same flower.^{5,6} The cross-pollination rate of soybean is low and on average between 1 to 3%.^{5,6,12,13,14,15,16} Pollen disperses only over short distances. In Europe, hybridisation with other species is not possible because there are no wild relatives of soybean.^{5,6}

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

3.2 Description of the introduced gene and trait

A2704-12 was developed by means of a particle acceleration method using vector pB2/35SacK. As a result two copies of the *pat* gene were inserted.

Introduced gene	Encoded protein	Trait
<i>pat</i>	Encodes the phosphinothricin-N-acetyl transferase (PAT) enzyme. ¹⁷	Confers tolerance to glufosinate-ammonium herbicides
For a detailed description of the introduced gene and trait, see reference		

3.3 Molecular characterisation and updated bioinformatics analyses

The current application provides updated sequence data for the A2704-12 soybean event. Newly generated sequences of the insert and insertion locus, derived from an early generation seed of A2704-12 and a commercially available variety of 2016, were compared with each other. The comparison shows that they are 100% identical to each other. The newly generated sequence was

also compared with the sequence submitted in the frame of the EFSA-GMO-NL-2005-18 application on which the previous COGEM advice was based. The applicant states that a few nucleotide differences were observed at the 3' and 5' flanking regions of the insert, and that these differences are due to a lower quality of the obtained sequence in the earlier studies. The applicant introduces the newly generated sequence as the reference sequence.

Using the new reference sequence and recent databases, the applicant updated the bioinformatics analyses of the inserted element and the sequences spanning the 5' and 3' junctions of the insert and its flanking regions. The sequences spanning the insertion site at the 5' and 3' flanking regions and the entire insert were screened to identify all open reading frames (ORFs) between stop codons. According to the applicant, the ORFs did not generate any protein sequence similarities with known allergens or toxins. Bioinformatics analysis of the locus of integration shows that, due to the insertion of the transgenic sequence, a *Glycine max* sieve element occlusion (SEO) e protein encoding gene belonging to the SEO gene family was disrupted. These genes encode for SEO proteins which have a function in wound sealing of the phloem of the plant upon injury.¹⁸ According to the applicant, gene redundancy in the soybean genome is very likely, as the disrupted gene is part of a multi-gene family.

Considering the above, COGEM is of the opinion that the molecular characterisation of soybean A2704-12 has been performed correctly and meets the requirements of COGEM.¹⁹ No new elements that would invalidate the conclusions of the initial risk assessment were identified.

Conclusion: The molecular characterisation of soybean A2704-12 is adequate and no indications for potential environmental risks were identified.

3.4 Systematic literature search

The applicant performed a literature search using several bibliographic databases covering a publication period from September 2007 to January 2018. The literature search did not yield reports on adverse effects on human and animal health, or the environment.

Conclusion: The systematic literature search does not give any indication of potential environmental risks resulting from import and/or processing of soybean A2704-12.

3.5 Annual monitoring reports

The applicant supplied annual reports on the monitoring carried out between September 2008 and June 2016. Monitoring was performed by operators involved in the import, handling and processing of viable soybean A2704-12 i.e., COCERAL, UNISTOCK and FEDIOL. To monitor the safety of soybean A2704-12, the applicant performed also a yearly review of the scientific literature. The monitoring results and literature search do not provide indications of adverse health or environmental effects associated with import or use of soybean A2704-12.

Conclusion: The information in the annual monitoring reports gives no indication of adverse effects or incidents resulting from import and processing of soybean A2704-12.

4. Food/feed assessment

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, RIKILT carries out a food and/or feed assessment for Regulation (EC) 1829/2003 applications. The outcome of the assessment by other organisations (EFSA, RIKILT) was not known when this advice was completed.

5. Post-market environmental monitoring (PMEM)

The applicant does not consider it necessary to update or change the monitoring post-market environmental monitoring (PMEM) plan of the initial authorisation. COGEM has published several recommendations for further improvement of the general surveillance (GS) plan^{20,21} but considers the initial GS plan adequate for import and processing of soybean A2704-12.

6. Overall conclusion

There are no indications that expression of the introduced trait will alter the fitness of soybean A2704-12. COGEM is of the opinion that import and processing of soybean A2704-12 pose 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 Decision (2008/730/EC) authorising the placing on the market of products containing, consisting of, or produced from genetically modified soybean A2704-12 (ACS-GMØØ5-3) pursuant to Regulation (EC) No 1829/2003 of the European Parliament and of the Council. Official Journal of the European Union 16.9.2008 L 247/50
2. COGEM (2006). Import and processing of herbicide tolerant soybean A2704-12. COGEM advice CGM/060410-04
3. COGEM (2007). Molecular characterization of soybean A2704-12. COGEM advice CGM/070904-01
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. Compendium voor de leefomgeving, meteorologische gegevens 1990-2015.
www.compendiumvoordeleefomgeving.nl/indicatoren/nl0004-Meteorologische-gegevens-in--Nederland.html?i=9-54 (visited: March 14, 2017)
8. Koninklijk Nederlands Meteorologisch Instituut (KNMI). Klimaatatlas.
www.klimaatatlas.nl/klimaatatlas.php?wel=temperatuur (visited: April 6, 2018) [in Dutch]
9. Agrifirm. [Sojateelt in Nederland](http://www.sojateelt.nl) (visited April 6, 2018) [in Dutch]
10. 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
11. FLORON Verspreidingsatlas Vaatplanten. *Glycine max* (L.) Merr. www.verspreidingsatlas.nl/1809 (visited: April 6, 2018)
12. Wang K & Li X (2013). Pollen dispersal of cultivated soybean into wild soybean under natural conditions. *Crop Science* 53: 2497-2505
13. Ahrent DK & Caviness CE (1994). Natural cross-pollination of twelve soybean cultivars in Arkansas. *Crop Science Society of America* 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. Organisation for Economic Co-operation and Development (OECD) (1999). Consensus document on general information concerning the genes and their enzymes that confer tolerance to phosphinothricin herbicide. ENV/JM/MONO(99)13
18. Rüping B *et al.* (2010). Molecular and phylogenetic characterization of the sieve element occlusion gene family in *Fabaceae* and non-*Fabaceae* plants. *BMC Plant Biology* 10: 219-233
19. COGEM (2014). Reconsideration of het molecular characterisation criteria for marketing authorisation of GM crops. COGEM topic report CGM/140929-02
20. COGEM (2010). General Surveillance. COGEM report CGM/100226-01
21. COGEM (2015). Advice on improving the general surveillance of GM crops. COGEM advice CGM/150601-02