

**Review of literature for 305423 and 305423x40-3-2 soybeans in the  
scope of their authorisations for food and feed uses, import and  
processing in the EU  
(2023 update)**



**PHI-R180-Y23**

## **Table of contents**

1. SUMMARY .....	3
2. CONFIRMATION OF THE SUITABILITY OF THE SEARCH STRINGS .....	3
3. RESULTS OF THE SCOPING EXERCISE .....	3
3.1. OUTCOME OF LITERATURE SEARCHES .....	3
4. CONCLUSION .....	4
REFERENCES .....	4
APPENDIX 1. DETAILED SEARCH SYNTAXES FOR THE AUTHORIZED SOYBEANS.....	6
APPENDIX 2. ELIGIBILITY/INCLUSION CRITERIA .....	10
APPENDIX 3. NEW ENTRIES RETRIEVED BY THE PERFORMED SEARCHES TO LITERATURE DATABASES FOR 305423 AND 305423 × 40-3-2 SOYBEAN WITHIN THE INDICATED SEARCH PERIOD (EXCLUDING DUPLICATES RETRIEVED BY THE PREVIOUS SEARCHES CONDUCTED IN 2022) .....	11
APPENDIX 4. PUBLICATIONS SCREENED FOR RELEVANCE BASED ON THE FULL TEXT .....	13

## 1. Summary

An updated systematic search and review of peer-reviewed literature was conducted for 305423 soybean and 305423 × 40-3-2 soybean. This exercise was performed in line with the EFSA Guidance on conducting a systematic review (EFSA, 2010) and taking into account the explanatory note on literature searching (EFSA, 2019), with the following review question “Do the authorised GM soybean and derived food/feed products, or the intended traits (the newly expressed proteins or their combination) have adverse effects on human and animal health and the environment in the scope of their authorisation?”.

The current systematic search complements the searches previously performed in 2022. All portions of the search were conducted according to the methodologies outlined in the previous searches.

The outcome of this analysis showed that one publication relevant for the review question was identified during the selected time period. No safety concerns were identified for the authorised GM soybean by this literature search exercise.

## 2. Confirmation of the Suitability of the Search Strings

All portions of the search were conducted according to the methodologies outlined in the previous searches. It was confirmed that the search strategy utilized in the previous literature search report (2022) is still relevant and no updates were identified.

## 3. Results of the Scoping Exercise

### 3.1. Outcome of literature searches

In May 2023, searches against electronic bibliographic databases and manual searches in view of screening of reference lists were performed. The search process is reported in line with EFSA guidance (EFSA, 2010 Appendix B4(2)) in Table 1.

**Table 1.** Documenting and reporting the search process

Resources	Date of search	Period searched*	Other restrictions	Number of records retrieved
Web of Science Core collection <sup>§</sup>	26 May 2023	1 Jan 2022-26 May 2023	None	10
CAB Abstracts <sup>§</sup>	26 May 2023	1 Jan 2022-26 May 2023	None	8
MEDLINE <sup>§</sup>	26 May 2023	1 Jan 2022-26 May 2023	None	5
Europe PMC <sup>§</sup>	26 May 2023	1 Jan 2022-26 May 2023	None	6
Screening reference lists	NA	-	NA	NA

<sup>§</sup> The search syntaxes used for electronic bibliographic databases are reported in Appendix 1.

\* Period searched included an indexing date of 8 August 2022.

NA: Not applicable as no publications relevant for screening reference lists were identified.

The publications retrieved across all methods of searching (Web of Science Core collection, CAB Abstracts, MEDLINE, Europe PMC, and screening of reference lists) can be found in Appendix 3.

In the framework of the reference list screening exercise, no detailed risk assessments regarding the authorised GM soybean were retrieved that contained information on food and feed safety. Considering that no opinions were published within the selected time period no further screening was performed.

The publications grouped in the Endnote® library were deduplicated. Publications retrieved by the previous searches conducted in the frame of the 2022 annual monitoring report were also removed (see Appendix 3).

The results of the publication selection process are presented in Table 2.

**Table 2.** Results of the publication selection process, for the review question

<b>Review question: “Do the authorised GM soybean and derived food/feed products, or the intended traits (the newly expressed protein(s) or their combination), have adverse effects on human and animal health and the environment in the scope of their authorisation?”</b>	<b>Number of records</b>
Total number of publications retrieved after all searches of the scientific literature (excluding duplicates and publications retrieved by the previous searches conducted in the frame of the 2022 monitoring reports)	18
Number of publications excluded from the search results after rapid assessment for relevance based on title and abstract	18
Total number of full-text documents assessed in detail	0
Number of publications excluded from further consideration after detailed assessment for relevance based on full text	0
Total number of unobtainable/unclear publications	0
Total number of relevant publications	0

The 18 unique entries present in the Endnote database (Table 2) were manually screened for relevance to the review question by two independent reviewers using the *a priori* eligibility/inclusion criteria described in Appendix 2.

In the first stage of screening, entries were screened based on title/abstract. Records that were deemed to be irrelevant were not further retained.

In this literature search exercise, no publications seemed relevant, and therefore no publications were progressed to the second stage and assessed for relevance at the level of the full text.

#### 4. Conclusion

No publications were identified as relevant for the molecular characterisation, food/feed and environmental safety of the authorised GM soybean within the scope of the authorisations for the defined time period. No safety concerns have been identified for the authorised GM soybeans by this literature search exercise.

#### References

EC, 2009. Commission Decision 2009/770/EC of 13 October 2009 establishing standard reporting formats for presenting the monitoring results of the deliberate release into the environment of genetically modified organisms, as or in products, for the purpose of placing on the market, pursuant to Directive 2001/18/EC of the European Parliament and of the Council. Official Journal of the European Union 275, 9-27.

- EFSA, **2010**. Application of systematic review methodology to food and feed safety assessments to support decision making. *EFSA Journal* 8(6):1637. [90 pp.].
- EFSA, **2019**. Explanatory note on literature searching conducted in the context of GMO applications for (renewed) market authorisation and annual post-market environmental monitoring reports on GMOs authorised in the EU market. EFSA supporting publication 2019:EN-1614. [62 pp.].
- Tu ML, Sun QC, Zhang JA and Zhang GD, **2022**. Comparative Effects of Traditional Versus Genetically Modified Soybean Oils on Colon Tumorigenesis in Mice. *Foods* 11. 10.3390/foods11131937

**Appendix 1. Detailed search syntaxes for the authorized soybeans****Web of Science Core collection**

Search Part	Search Syntax <sup>1</sup>	Results
Event #1	TS=(3ø5423* OR 3-circle-divide-5423* OR 3empty-set5423* OR 305423* OR dp305423* OR dp3ø5423* OR dp3-circle-divide-5423* OR dp3empty-set5423* OR plenish*)	44
Stack #2	TS=( <b>*DP-3ø5423-1xMON-ø4ø32-6*</b> OR <b>*DP-3-circle-divide-5423-1xMON-circle-divide-4-circle-divide-32-6*</b> OR <b>*DP-3empty-set5423-1xMON-empty-set4empty-set32-6*</b> OR <b>*305423x40-3-2*</b> OR <b>*3ø5423x40-3-2*</b> OR <b>Plenish*</b> )	17
#3	#1 OR #2	44
Proteins #4	TS=((gm-fad2 OR gmfad2 OR gm-hra OR gmhra OR Glycine-max-HRA OR fad2 OR fatty-acid-desaturase-2-1 OR omega-6-fatty-acid-desaturase OR (hra AND acetolactate-synthase)) AND (soy* OR soja* OR glycine OR Rnai OR rna-interference OR siRNA OR small-RNA OR *silencing OR double-stranded-rna OR dsrna OR (((herbicide* AND (genetic* NEAR/3 (modif* or engineer*))) OR GMHT) AND (crop OR plant OR food OR feed)) OR gmo OR gmos OR lmo OR lmos OR gm OR ge OR stack))	184
Traits #5	TS=(((high NEAR/1 oleic) OR (oleic NEAR/1 acid) OR sul*onylurea* OR ALS-inhibiting-herbicide*) AND (toler* OR resist* OR protec* OR Rnai OR rna-interference OR siRNA OR small-RNA OR *silencing OR double-stranded-rna OR dsrna) AND (soy* OR soja* OR Glycine OR max) AND (gmo OR gmos OR lmo OR lmos OR living-modified OR transgen* OR GMHT OR ((GM OR GE OR genetic*) NEAR/3 (modif* OR transform* OR manipulat* OR engineer* OR stack))))	55
#6	#3 OR #4 OR #5	253
Reporting Period #7	PY=(2022-2100) (and added to the database on or since date of 2022 PMEM search ran on Aug 8)	2,592,873
<b>Final Results #8</b>	#6 AND #7	10

<sup>1</sup> Terms indicated in yellow highlight are additional variants compared to the previously conducted search

**CABI**

Search Part	Search Syntax <sup>2</sup>	Results
Event #1	TS=(3ø5423* OR 3<o>5423* OR 305423* OR dp305423* OR dp3ø5423* OR dp3<o>5423* OR plenish*)	36
Stack #2	TS=(*DP-3Ø5423-1xMON-Ø4Ø32-6* OR *DP-3-circle-divide-5423-1xMON-circle-divide-4-circle-divide-32-6* OR *DP-3empty-set5423-1xMON-empty-set4empty-set32-6* OR *305423x40-3-2* OR *3Ø5423x40-3-2* OR Plenish*)	10
#3	#1 OR #2	36
Proteins #4	TS=((gm-fad2 OR gmfad2 OR gm-hra OR gmhra OR Glycine-max-HRA OR fad2 OR fatty-acid-desaturase-2-1 OR omega-6-fatty-acid-desaturase OR (hra AND acetolactate-synthase)) AND (soy* OR soja* OR glycine OR Rnai OR rna-interference OR siRNA OR small-RNA OR *silencing OR double-stranded-rna OR dsrna OR (((herbicid* AND (genetic* NEAR/3 (modif* or engineer*))) OR GMHT) AND (crop OR plant OR food OR feed)) OR lmo OR lmos OR ge OR "genetically engineered foods" OR stack))	167
Traits #5	TS=(((high NEAR/1 oleic) OR (oleic NEAR/1 acid) OR sul*onylurea* OR ALS-inhibiting-herbicide*) AND (toler* OR resist* OR protec* OR Rnai OR rna-interference OR siRNA OR small-RNA OR *silencing OR double-stranded-rna OR dsrna) AND (soy* OR soja* OR Glycine OR max) AND (GMHT OR transgen* OR engineer* OR lmo or lmos OR ge OR manipulat* OR transform* OR stack OR "genetically engineered foods"))	51
#6	#3 OR #4 OR #5	228
Reporting Period #7	PY=(2022-2100) (and added to the database on or since date of 2022 PMEM search ran on Aug 8)	360,901
<b>Final Results</b> #8	#6 AND #7	8

<sup>2</sup> Terms indicated in yellow highlight are additional variants compared to the previously conducted search

**MEDLINE**

Search Part	Search Syntax <sup>3</sup>	Results
Event #1	TS=(305423* OR 305423* OR dp305423* OR dp305423* OR plenish*)	17
Stack #2	TS=(*DP-305423-1xMON-04032-6* OR *305423x40-3-2* OR *305423x40-3-2* OR Plenish*)	6
#3	#1 OR #2	17
Proteins #4	TS=((gm-fad2 OR gmfad2 OR gm-hra OR gmhra OR Glycine-max-HRA OR fad2 OR fatty-acid-desaturase-2-1 OR omega-6-fatty-acid-desaturase OR (hra AND acetolactate-synthase)) AND (soy* OR soja* OR glycine OR Rnai OR rna-interference OR siRNA OR small-RNA OR *silencing OR double-stranded-rna OR dsrna OR "RNA, Double-Stranded" OR (((herbicide* AND (genetic* NEAR/3 (modifier* or engineer*))) OR GMHT) AND (crop OR plant OR food OR feed)) OR Imo OR Imos OR ge OR "Food, Genetically Modified" OR stack))	105
Traits #5	TS=(((high NEAR/1 oleic) OR (oleic NEAR/1 acid) OR sul*onylurea* OR ALS-inhibiting-herbicide*) AND (toler* OR resist* OR protec* OR Rnai OR rna-interference OR siRNA OR small-RNA OR *silencing OR double-stranded-rna OR dsrna OR "RNA, Double-Stranded") AND (soy* OR soja* OR Glycine OR max) AND (GMHT OR transgen* OR engineer* OR Imo or Imos OR ge OR manipul* OR transform* OR stack OR "Food, Genetically Modified"))	28
#6	#3 OR #4 OR #5	136
Reporting Period #7	PY=(2022-2100) (and added to the database on or since date of 2022 PMEM search ran on Aug 8)	1,261,461
<b>Final Results</b> #8	#6 AND #7	5

<sup>3</sup> Terms indicated in yellow highlight are additional variants compared to the previously conducted search

### **Europe PMC**

(plenish OR 305423x40-3-2 OR dp305423 OR dp3ø5423 OR 305423 OR 3ø5423) AND (FIRST\_PDATE:[2022-01-01 TO 2100-12-31]) AND (FIRST\_IDATE:[2022-08-08 TO 2100-12-31])

= 6 results

## Appendix 2. Eligibility/Inclusion Criteria<sup>4</sup>

Concept	Criteria
Population (taking into account scope of the authorisation)	<p>Publication addressing human and animal health, and/or the environment relevant for the scope of the authorisation.</p> <p>The pathways and level of exposure to the GMO, derived food/feed products, and the intended traits addressed in the study (as assessed under the Intervention/exposure part) are relevant for the intended uses of the GMO and derived food/feed products under regulatory review (e.g. in case of an authorisation for food, food, import, efficacy of the traits, pest susceptibility, etc. are not considered relevant).</p>
Intervention/exposure	305423, 305423 × 40-3-2 soybeans and derived food/feed products, and/or the intended traits (newly expressed protein(s) or their combination).
Intervention/exposure Plant species	In case of studies using GM plants, only studies using soybean are considered eligible. This criterion is not employed for studies regarding the newly expressed proteins.
Intervention/exposure Source organism of the protein	In case of publications using the protein of interest, only publications with the protein from the specific source organism will be considered eligible.
Comparator	If the study is a comparative study that uses plant material as test material, eligible publications must report a non-GM variety.
Outcomes	<p>Effects/impacts on human and animal health, and/or the environment are addressed.</p> <p>Publications addressing other issues such as benefits, socio-economics, ethics, crop protection, detection methods, efficacy, public perception and risk communication are to be excluded using this criterion, as they are not relevant to the risk assessment of GMOs.</p>
Reporting format	<p>Original/primary data are presented in the study. This permits the exclusion of publications that do not present original/primary data (e.g., reviews, editorial, position papers).</p> <p>However, risk assessments from relevant risk assessment bodies (excluding EFSA) will not be excluded.</p>

<sup>4</sup> This table is provided for ease of reference, no updates have been introduced since the previous report.

---

**Appendix 3. New entries retrieved by the performed searches to literature databases for 305423 and 305423 × 40-3-2 soybean within the indicated search period (excluding duplicates retrieved by the previous searches conducted in 2022)**

- Al-Amin MD, Mastrotto F, Subrizi A, Sen M, Turunen T, Arango-Gonzalez B, Ueffing M, Malfanti A, Urtti A, Salmaso S and Caliceti P, **2023**. Tailoring surface properties of liposomes for dexamethasone intraocular administration. *Journal of controlled release : official journal of the Controlled Release Society* 354, 323-336. <http://dx.doi.org/10.1016/j.jconrel.2023.01.027>
- Cunha AA, Quispe-Cornejo AA, Pereira J, Araujo E and Pereira E, **2022**. *Campylobacter coli* cellulitis in X-linked agammaglobulinemia. *Gazzetta Medica Italiana Archivio Per Le Scienze Mediche* 181, 378-382. <http://dx.doi.org/10.23736/s0393-3660.20.04533-7>
- Derbyshire MC, Marsh J, Tirnaz S, Nguyen HT, Batley J, Bayer PE and Edwards D, **2023**. Diversity of fatty acid biosynthesis genes across the soybean pangenome. *Plant Genome*. <http://dx.doi.org/10.1002/tpg2.20334>
- Fu MX, Chen L, Cai YP, Su Q, Chen YY and Hou WS, **2022**. CRISPR/Cas9-Mediated Mutagenesis of GmFAD2-1A and/or GmFAD2-1B to Create High-Oleic-Acid Soybean. *Agronomy-Basel* 12. <http://dx.doi.org/10.3390/agronomy12123218>
- Fulvio F, Martinelli T, Bassolino L, Pietrella M and Paris R, **2022**. A single point mutation in a member of FAD2 multigene family resulted in the generation of a high oleic line of *Silybum marianum* (L.) Gaertn. *Industrial Crops and Products* 182. <http://dx.doi.org/10.1016/j.indcrop.2022.114930>
- Guo Y, Yang Y, Hu X and Du S, **2023**. Comparison of codon usage patterns of delta8-FAD2 gene in 15 plant species. *Journal of Shanxi Agricultural Sciences* 51, 356-365. <http://dx.doi.org/10.3969/j.issn.1002-2481.2023.04.02>
- Jo H, Woo C, Norah N, Song JT and Lee JD, **2022**. Novel Allele of FAD2-1A from an EMS-Induced Mutant Soybean Line (PE529) Produces Elevated Levels of Oleic Acid in Soybean Oil. *Agronomy-Basel* 12. <http://dx.doi.org/10.3390/agronomy12092115>
- Kim H, Jo H and Lee J, **2023**. Combining a mutant allele of FAD2-1A with HD improves the omega-6/omega-3 ratio in soybeans. *Agronomy* 13. <http://dx.doi.org/10.3390/agronomy13030913>
- Kumar V, Goyal V, Mandlik R, Kumawat S, Sudhakaran S, Padalkar G, Rana N, Deshmukh R, Roy J, Sharma TR and Sonah H, **2023**. Pinpointing Genomic Regions and Candidate Genes Associated with Seed Oil and Protein Content in Soybean through an Integrative Transcriptomic and QTL Meta-Analysis. *Cells* 12. <http://dx.doi.org/10.3390/cells12010097>
- Li Y, Xiao F, Zhai C, Li X, Wu Y, Gao H, Li J, Zhai S, Liu B and Wu G, **2022**. Qualitative and Quantitative Real-Time PCR Methods for Assessing False-Positive Rates in Genetically Modified Organisms Based on the Microbial-Infection-Linked *HPT* Gene. In: *International journal of molecular sciences*. p 10000. <http://dx.doi.org/10.3390/ijms231710000>
- Liang J, Yang X, Jiao Y, Wang D, Zhao Q, Sun Y, Li Y and Wu K, **2022**. The evolution of China's regulation of agricultural biotechnology. In: *aBIOTECH*. p 237-249. <http://dx.doi.org/10.1007/s42994-022-00086-1>
- Ludvikova M, Griga M and Hanacek P, **2022**. The creation of vector construct for RNA-interference of the *fad2-1* gene in flax
- Tvorba konstruktů pro indukci RNA interference genu *fad2-1* u lnu. *Vyzkum v Chovu Skotu* 64, 15-27. <http://dx.doi.org/>

- 
- Qi YT, Wang QM, Xie QX, Wu C, Xu MH, Han SF, Zhou T, Li J, Xia LB, Li WC and Pan WS, **2022**. Safety evaluation of FAD2 RNAi transgenic *Brassica napus* L. based on microbial diversity and metabonomic analysis. *Frontiers in Plant Science* 13. <http://dx.doi.org/10.3389/fpls.2022.953476>
- Seol MA, Cho S and Jung YJ, **2022**. Efficiency verification of CRISPR-Cas9-mediated mutagenesis of target gene sgRNA using soybean protoplasts. *Plant Biotechnology Reports* 16, 599-611. <http://dx.doi.org/10.1007/s11816-022-00790-w>
- Shin MK, Jeon SM and Koo YE, **2023**. Detection method for genetically modified potato using an ultra-fast PCR system. *Food science and biotechnology* 1-7. <http://dx.doi.org/10.1007/s10068-023-01258-5>
- Waiblinger H-U, Eichner CA, Näumann G and Busch U, **2023**. GMO analysis results from official food control laboratories in Germany from 2017 to 2021. *Journal für Verbraucherschutz und Lebensmittelsicherheit = Journal of consumer protection and food safety* 18, 93-99. <http://dx.doi.org/10.1007/s00003-023-01425-0>
- Ye Z, Ganesan K, Wu M, Hu Y, She Y, Tian Q, Ye Q and Chen J, **2022**. Crosstalk between Depression and Breast Cancer via Hepatic Epoxide Metabolism: A Central Comorbidity Mechanism. In: *Molecules* (Basel, Switzerland). p 7269. [^http://dx.doi.org/10.3390/molecules27217269](http://dx.doi.org/10.3390/molecules27217269)
- Zhou JM, Li ZY, Li Y, Zhao QZ, Luan XC, Wang LX, Liu YX, Liu HJ, Zhang J and Yao D, **2023**. Effects of Different Gene Editing Modes of CRISPR/Cas9 on Soybean Fatty Acid Anabolic Metabolism Based on GmFAD2 Family. *International Journal of Molecular Sciences* 24. <http://dx.doi.org/10.3390/ijms24054769>

**Appendix 4. Publications screened for relevance based on the full text**

**Table 4.1.** Report of all relevant publications retrieved after detailed assessment of full-text documents for relevance

<b>Category of info/ data requirement(s)</b>	<b>Publication</b>
None	Not applicable

**Table 4.2.** Report of publications excluded from the risk assessment after detailed assessment of full-text documents

<b>Reference (Author, year, title, source)</b>	<b>Reason(s) for exclusion based on eligibility/inclusion criteria</b>
None	Not applicable

**Table 4.3.** Report of unobtainable/unclear publications

<b>Reference (Author, year, title, source)</b>	<b>Description of (unsuccessful) methods used to try to obtain a copy of the publication</b>
None	Not applicable