Title

Summary of the Literature Review for FG72 soybean
October 1, 2019 – September 30, 2020

Report

Data or Guideline Requirement

Explanatory note on literature searching
conducted in the context of GMO applications for (renewed) market authorization
and annual post-market environmental monitoring reports on GMOs authorised in the EU market.
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Electronic database search	[redacted]
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Stage 2 assessment	Food and Feed safety [redacted] Molecular characterization [redacted] Environmental safety [redacted]
Report	[redacted]

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SUMMARY

FG72 (OECD unique identifier: MST-FGØ72-2) is a genetically modified (GM) soybean designed to provide new options for weed control in the crop. FG72 soybean expresses the 5-enolpyruvyl-shikimate-3-phosphate synthase protein (2mEPSPS) and the 4-hydroxyphenylpyruvate dioxygenase protein (HPPD W336), which confer tolerance to glyphosate and HPPD inhibiting herbicides, respectively.

A scoping review was performed for the FG72 soybean and its newly expressed proteins, 2mEPSPS and HPPD W336. The objective of this scoping review was to determine if there were studies about the molecular characterization of FG72 soybean, its effect on food and feed safety, or on environmental safety, that might require in-depth examination. A set of broad literature searches was performed using several bibliographic databases covering scientific literature from October 1, 2019 to September 30, 2020. Additional sources of information, such as web pages of food safety, agriculture, and biotechnology-related authorities were searched for the same time window, along with the bibliographies of relevant reviews. The references identified were evaluated for potential relevance to the scoping review questions according to pre-defined criteria.

These literature searches identified a total of 142 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of thirteen publications were progressed for detailed assessment. All but four publications were determined to be not relevant after detailed review. The four relevant publications found to be relevant did not have any negative impact on the safety assessment of FG72 soybean, and infact, support the existing safety assessment.

No other publications were found that contained new data on the molecular characterization of the FG72 and its newly expressed proteins, 2mEPSPS and HPPD W336. Similarly, no other publications were found that suggested any potential adverse effects of this event on human health, animal health, or the environment.

In summary, these literature searches and review of the retrieved publications identified four relevant publications that support the existing safety assessment of the FG72 soybean.

1. INTRODUCTION

FG72 (OECD unique identifier: MST-FGØ72-2) is a genetically modified (GM) soybean designed to provide new options for weed control in the crop. FG72 soybean expresses the 5-enolpyruvyl-shikimate-3-phosphate synthase protein (2mEPSPS) and the 4-hydroxyphenylpyruvate dioxygenase protein (HPPD W336), which confer tolerance to glyphosate and HPPD inhibiting herbicides, respectively.

The objective of the literature searches described here was to determine if there were publications published between October 1, 2019 and September 30, 2020 that mention the molecular characterization of the FG72 soybean, and/or any adverse effect of FG72 soybean in food, feed or the environment. In that context, a broad and inclusive literature search was performed and the articles retrieved were reviewed in a comprehensive and transparent manner. This was intended as a scoping review. The literature review was performed as recommended in the European Food Safety Authority (EFSA) explanatory note on literature searching conducted in the context of Genetically Modified Organisms (GMO)[1] applications and post-market environmental monitoring activities (2019).

The literature searches were performed for the FG72 soybean and its newly expressed protein 2mEPSPS and HPPD W336. The search terms also included relevant synonyms, trade name, intended trait, plant species and general GMO terms.

2. OVERALL METHODS

2.1. Objective of the scoping review

The objective of the scoping review was to survey the evidence base for the FG72 soybean and its newly expressed protein 2mEPSPS and HPPD W336, in order to identify any specific issues related to food or feed safety, molecular characterization or environmental safety that might require in-depth examination.

2.2. Review questions

Review questions were formulated to conform to PECO structure (Population, Exposure, Comparators, Outcome) if possible, and to address data requirements. They were modeled after the review question examples provided in the EFSA 2019 explanatory note[1].

Question 1: Were any studies published during the reporting period that describe adverse effects on human or animal health or the environment of the FG72 soybean and its newly expressed protein 2mEPSPS and HPPD W336?

Key elements:

Population: Human health; animal health; environmental safety

Exposure: FG72 soybean, derived food/feed products, newly expressed protein in FG72 soybean

Comparators: When applicable, comparable populations or subjects exposed to appropriate controls (e.g., vehicle only, innocuous control protein, non-GM comparator) or conventional counterpart used for comparative analysis of plant material

Outcome: Adverse effects

Question 2: Were any studies published during the reporting period that focus on molecular characterization the of FG72 soybean and its newly expressed protein 2mEPSPS and HPPD W336?

Key elements:

Population: FG72 soybean and newly expressed protein in FG72 soybean

Outcome: Molecular characterization (which would indicate the information/data requirement for molecular characteristics)

2.3. Criteria for relevance

Criteria for establishing the relevance of retrieved publications were defined prior to conduct of the search. These criteria were modeled after those given in the EFSA 2019 explanatory note[1] and are described in Table 1.

Table 1: Eligibility/inclusion criteria to establish the relevance of retrieved publications

Concepts	Criteria	Comment
Key elements of review questions with PECO structure		
Intervention/exposure	The publication addresses the GMO, derived food/feed products, and/or the intended trait(s) (e.g., newly expressed protein(s)) that are identical or like those under regulatory review	This enables the selection of publications that address the GMO, derived food/feed products, and/or the intended trait(s) under consideration
Population	The publication addresses human and animal health, and/or the environment (including biodiversity, ecosystem services, service providing units, and endangered species) as general protection goals	From the publications that address the GMO under consideration, those that address protection goals relevant to the risk assessment of the GMO are eligible
Outcome	The publication addresses effects/impacts on human and animal health, and/or the environment	Publications that address the GMO under consideration also need to address effects/impacts on entities of concern, and potential determinants of exposure that place these entities at risk, in order to be relevant to the risk assessment of the GMO
Comparator	If the publication reports a comparative study that uses plant material as test material, eligible publications must report a non-GM variety as comparator	In those cases where the publication addresses the GMO under consideration, reports a comparative analysis study and uses plant material as test material, eligible publications also need to include an appropriate non-GM line as comparator

Additional concepts		
Information/data requirements	The publication reports information pertaining to one or more information/data requirement(s) outlined in Appendix A for the GMO and derived food/feed products under consideration, including the intended trait(s)	Publications that potentially contribute to the knowledge informing the risk assessment of the GMO under consideration, and thus the risk hypotheses addressed, taking account of both hazard and exposure, can be considered relevant according to this eligibility/inclusion criterion. Publications addressing other issues such as benefits, socio-economics, ethics, crop protection, detection methods, efficacy, public perception and risk communication can be excluded, as they are not necessarily relevant to the risk assessment of GMOs
Plant species	The publication addresses the same plant species as the GMO under consideration	This eligibility/inclusion criterion permits the exclusion of publications on GMOs that contain the same intended trait(s) as the GMO under consideration, but which are introduced in another plant species
Scope of GMO application	The publication addresses pathways and levels of exposure to the GMO, derived food/feed products, and the intended trait(s) that are relevant for the intended uses of the GMO and derived food/feed products under regulatory review	From the publications that address the GMO under consideration, those that consider pathways and levels of exposure relevant to the scope of the GMO application (i.e., import and processing for food/feed uses, cultivation) are eligible
Target pests/organisms	The publication addresses target pests/organisms that are established in the EU	This permits the exclusion of publications that address interactions between the GMO and target pests/organisms that do not occur in the EU

Stacked events obtained by conventional crosses/subcombinations	The publication addresses the higher stacked event and/or a subcombination or subcombinations of the single events of the higher stacked event, independently of its/their origin	This permits the selection of publications on the higher stacked event and/or subcombinations of the single events of the higher stacked event that are in the scope of the GMO application(e), independently of their origin. This permits the exclusion of publications on the single events of the higher stacked event, because the risk assessment of GMO applications for stacked events covers only the products in the scope of the GMO application – i.e., the higher stacked event and subcombinations of the singles involved, independently of their origin
Molecular stacks	The publication addresses: the molecular stack; all newly expressed proteins in the molecular stack; and/or one or several of the newly expressed proteins in the molecular stack that has/have not been previously risk assessed by EFSA and/or its GMO Panel and for which no safe use has been determined yet by EFSA and/or its GMO Panel	This permits the exclusion of publications that address one or several (not all) of the newly expressed proteins in the molecular stack that has/have been previously risk assessed by EFSA and/or its GMO Panel and for which the safe use has been determined by EFSA and/or its GMO Panel
Previously risk assessed publications	The publication has not been previously risk assessed by EFSA and/or its GMO Panel and is not cited/referenced in an EFSA/GMO Panel output	This permits the exclusion of publications that have been previously risk assessed by EFSA and/or its GMO Panel and cited/referenced in an EFSA/GMO Panel output
Access	Full-text document is accessible	If potentially relevant full-text documents cannot be obtained, they should be listed in a table with a description of the (unsuccessful) methods that have been used to try to obtain a copy

Reporting format	The publication presents original/primary data	This permits the exclusion of publications that do not present original/primary data (e.g., editorials, position papers). Reviews should only be included if they present data that are not available from a primary research study.
Reporting format	A study in a publication should only be presented once, but if it is presented in more than one publication, all publications should be listed and grouped	Duplicate publications should be excluded at the screening stage. Only one copy of a study is required even if it is reported in different publications, and identified in more than one database.

Table adapted from 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.

2.4. Reference publication

Two publications relevant for FG72 soybean were previously identified and used to test and validate the search strategy:

- Dreesen R; Capt A; Oberdoerfer R; Coats I; Pallett KE (2018). Supplementary data on the characterization and safety evaluation of HPPD W336, a modified 4-hydroxyphenylpyruvate dioxygenase protein, which confers herbicide tolerance, and on the compositional assessment of field grown MST-FGO72-2 soybean expressing HPPD W336. *Data in brief,* Vol. 21, pp. 111-121
- Dreesen R; Capt A; Oberdoerfer R; Coats I; Pallett KE (2018). Characterization and safety evaluation of HPPD W336, a modified 4-hydroxyphenylpyruvate dioxygenase protein, and the impact of its expression on plant metabolism in herbicide-tolerant MST-FGO72-2 soybean. *Regulatory Toxicology and Pharmacology*, Vol. 97, pp. 170-185.

These two articles were selected as reference publications because they mention the event name (FG72), one of the newly expressed proteins (HPPD W336), the intended trait (herbicide tolerance) and the crop (soybean). Since these two articles were published outside the search period of this report, the search profile was tested without applying the time filters used in the final profile (UP>=20191001 and UP<=20200930).

3. SEARCH METHODS AND OUTCOMES

The search strategies used here followed the 2019 EFSA explanatory note on literature searching conducted in the context of GMO applications and post-market environmental monitoring activities[1]. The search strategies were designed to be broad and sensitive enough to capture any relevant publications, if available.

An information specialist with background in plant biotechnology selected the databases, identified relevant search terms, developed search profiles, designed search strategies and conducted the searches.

3.1. Time window and date of the literature search

The database searches were performed on October 13, 2020. Only documents updated between October 1, 2019 and September 30, 2020, were considered in the search. The dates of most recent database updates are provided in Table 3.

3.2. Databases used in the literature search

All searches were performed in the host STN (Scientific and Technical Information Network), an online database service operated jointly by CAS and FIZ Karlsruhe. STN provides access to a broad range of databases from the most renowned database producers worldwide.

The searches described here were performed in five databases: three multidisciplinary/large databases (Biosis, Medline and CA-Plus) and two subject-specific databases focused on agriculture-related topics (Agricola and CABA).

See Appendix 1 for detailed database descriptions.

3.3. Search strategy

The search profiles were designed to cover event name, trade name, newly expressed proteins and intended traits. Since the 'intended trait' profile produced too many results when used on their own, it was combined with a 'general GMO' profile as well as with a 'plant species' profile. See Table 2 for a detailed search profile.

All searches were performed in the Basic Index (BI) field, which includes the following subject headings/field names:

- **Agricola**: title (TI), controlled term (CT), supplementary term (ST), abstract (AB), named person (NA), corporate name (CO), note (NTE), geographic term, CABA and other fields (GT)

- **Biosis**: title (TI), abstract (AB), biosystematic codes (BC), chemical name (CN), controlled term (CT), gene name (GEN), geographic term (GT), organism (ORGN) and supplementary term (ST); as well as CAS Registry Numbers (RN)

- **CA-Plus**: title (TI), supplementary term (ST), index term (IT) and abstract (AB); as well as CAS Registry Numbers

- **CABA**: title (TI), controlled term (CT), supplementary term (ST), broader term (BT), abstract (AB), organism name (ORGN) and geographic term (GT); as well as CAS Registry Numbers

- **Medline**: title (TI), chemical name (CN), gene name (GEN), controlled term (excluding MeSH numbers) (CT), supplementary term (ST), named person (NA), other source (OS), and abstract (AB), as well as CAS Registry Numbers and GenBank Numbers

The search results were limited to documents updated between October 1, 2019 and September 30, 2020 (UP>=20191001 and UP<=20200930), and to non-patent documents (not P/DT). To ensure that documents with indexing errors where two DTs (one eligible and one ineligible) were attached to a single record were not missed, documents with both 'journal' and 'patent' as *document type* were also kept. These putative documents would be identified with (P/DT AND J/DT) in CABA and CAPlus.
Table 3 summarizes the number of results obtained from each of the databases searched.
See Appendix 2 for a complete search history.

Table 2: Search profile for database search

Set	Search string	Concepts
1	FG72 or FG(w)72 or MST(w)FGØ72 or MST(w)FG072 or MST(w)FGO72	Event name
2	GT27 or GT27TM	Trade name
3	(2MEPSPS or 2(w)MEPSPS or 2M(w)EPSPS or 2(w)M(w)EPSPS or EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVOYLSHIKAMATE or ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE) or (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKIMATE OR PHOSPHOSHIKIMIC or ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(SYNTHASE OR SYNTHETASE) or (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE)(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE) or (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIKIMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)PHOSPHOSYNTHASE) (s) ((DOUBL# or DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)) or (HPPDW336 or HPPD(w)W336 or HPPD(w)W(w)336 or HPPDW(w)336 or ((hydroxyphenylpyruvate or hydroxy(w)phenylpyruvate or hydroxyphenyl(w)pyruvate or hydroxy(w)phenyl(w)pyruvate)(w)(dehydrogenase or dioxygenase) or hppd)(s)(modif? or MUTANT# OR MUTAT?))	Newly expressed proteins
4	(herbicid? or HPPD(w)inhibitor# or isoxaflutole# or diketonitrile# or pyrazolone# or triketone# or GL!PHOSATE# or GL!FOSATE# OR G360 or g(w)360 or roundup? or round(w)up?)(5a)(resist? or toleran? or protect?)	Intended trait
5	soy or soya or soja or soybean# or soyabean# or sojabean# or glycine(w)max or g(w)max	Plant species
6	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3a)(modif? OR transform? OR manipulat? OR improv? OR engineer?))	GMO general
7	4 and 5 and 6	Intended trait AND Plant species AND GMO general
8	1 or 2 or 3 or 7	Event name OR Trade name OR Newly expressed proteins OR (Intended trait AND Plant species AND GMO general)

Table 3: Overview of the selected databases and summary of search results from each database

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Database Provider	STN International	STN International	STN International	STN International	STN International
Coverage	1970-present	1926-present	1973-present	1907-present	1946-present
Date of search	13 Oct 2020	13 Oct 2020	13 Oct 2020	13 Oct 2020	13 Oct 2020
Datespan of the search	1 Oct 2019 – 30 Sept 2020	1 Oct 2019 – 30 Sept 2020	1 Oct 2019 – 30 Sept 2020	1 Oct 2019 – 30 Sept 2020	1 Oct 2019 – 30 Sept 2020
Latest database update	22 Jul 2020	7 Oct 2020	7 Oct 2020	12 Oct 2020	12 Oct 2020
Number of records retrieved	18	42	45	56	36
Number of records after duplicate removal	10	33	33	30	36
Number of *relevant* records after rapid assessment	0	2	4	3	4

4. MANUAL SEARCHES

4.1. Manual searches of web pages of food safety, agriculture, and biotechnology-related authority webpages

In accordance with the EFSA 2019 explanatory note[1] the search in electronic bibliographic databases has been complemented with an internet search in webpages of relevant key organisations involved in the risk assessment of GM plants. Of the 13 key organisations cited in the EFSA 2019 explanatory note[1], two (Environment and Climate Change Canada and CIBIOGEM) are not involved in the risk assessment of GM plants. US-EPA regulates only GM plants with Plant-Incorporated Protectant (PIP), and Genetic Engineering Approval Committee (GAEC) is included only for cotton. Therefore, the internet search focused on nine key organisations as listed below in Table 4. Search results were manually examined for relevant records that were either published during the time period under consideration (date span of search: October 1, 2019 to September 30, 2020) or refer to relevant records published during this time frame. Relevance of results were determined based on the criteria listed in Table 1. Search terms consisted of FG72, MST-FG072-2; HPPD W336, modified-hydroxyphenylpyruvate dioxygenase, 2mEPSPS or double mutant 5-enolpyruvyl shikimate-3-phosphate synthase enzyme in FG72 soybean. (All searched singly, with no search limits applied).

Table 4: Results of search of food safety, agriculture, and biotechnology-related authority websites

Source Site Name	Website URL	Date of Most Recent Site Update	Date of Search	No. of Relevant Records
US Department of Agriculture (USDA)	https://www.usda.gov/	Oct 30 2020	Nov 2-3 2020	0
US Food and Drug Administration (FDA)	https://www.fda.gov/	Oct 30 2020	Nov 2-3 2020	0
Health Canada	https://www.canada.ca/en/health-canada.html	Oct 30 2020	Nov 2-3 2020	0
Canadian Food Inspection Agency	https://www.canada.ca/en/food-inspection-agency.html	Oct 31 2020	Nov 2-3 2020	0
Food Standards Australia New Zealand (FSANZ)	http://www.foodstandards.gov.au/Pages/default.aspx	Oct 30 2020	Nov 2-3 2020	0
Office of the Gene Technology Regulator (OGTR)	http://www.ogtr.gov.au/	Oct 15 2020	Nov 2-3 2020	0
National Technical Commission on Biosafety (CTNBio)	http://ctnbio.mcti.gov.br/en	Oct-20	Oct 22-28 2020	0
National Advisory Commission on Agricultural Biotechnology (CONABIA)	http://www.agroindustria.gob.ar/sitio/areas/biotecnologia/conabia/	later than Aug 21 2020	Oct 21-22 2020	0
Ministry of Agriculture, Forestry and Fisheries (MAFF)	http://www.maff.go.jp/	Oct 26 2020	Oct 26 2020	0

4.2. Manual searches of reference lists of recent review articles

Recent review articles as sources of reference lists to search for potentially relevant studies were identified via searches of PubMed.gov for general terms such as “GMO” or “GM crops” in the titles and abstracts. The search of PubMed.gov was also restricted to recent reviews published between October 1, 2019 and September 30, 2020. The resulting number of relevant studies found within the bibliographies of these review articles is given in Table 5.

Table 5: Documents for which reference lists were scanned for relevant studies

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
1	Ansari WA, Chandanshive SU, Bhatt V, Nadaf AB, Vats S, Katara JL, Sonah H, Deshmukh R. 2020	Genome Editing in Cereals: Approaches, Applications and Challenges	Int J Mol Sci. 2020 Jun 5;21(11):4040. doi: 10.3390/ijms21114040.	0
2	Arpaia S, Christiaens O, Giddings K, Jones H, Mezzetti B, Moronta-Barrios F, Perry JN, Sweet JB, Taning CNT, Smagghe G, Dietz-Pfeilstetter A. 2020	Biosafety of GM Crop Plants Expressing dsRNA: Data Requirements and EU Regulatory Considerations	Front Plant Sci. 2020 Jun 24;11:940. doi: 10.3389/fpls.2020.00940. eCollection 2020.	0
3	Babar U, Nawaz MA, Arshad U, Azhar MT, Atif RM, Golokhvast KS, Tsatsakis AM, Shcerbakova K, Chung G, Rana IA. 2020	Transgenic crops for the agricultural improvement in Pakistan: a perspective of environmental stresses and the current status of genetically modified crops	GM Crops Food. 2020;11(1):1-29. doi: 10.1080/21645698.2019.1680078. Epub 2019 Nov 3.	0
4	Bachtarzi H, Farries T. 2019	The Genetically Modified Organism Medicinal Framework in Europe, United States, and Japan: Underlying Scientific Principles and Considerations Toward the Development of Gene Therapy and Genetically Modified Cell-Based Products	Hum Gene Ther Clin Dev. 2019 Sep;30(3):114-128. doi: 10.1089/humc.2019.042. Epub 2019 Jun 21.	0
5	Bedair M, Glenn KC. 2020	Evaluation of the use of untargeted metabolomics in the safety assessment of genetically modified crops	Metabolomics. 2020 Oct 9;16(10):111. doi: 10.1007/s11306-020-01733-8.	0
6	Feng XJ, Yi HM, Ren XX, Ren JL, Ge JR, Wang FG. 2020	Digital PCR and its application in biological detection	Yi Chuan. 2020 Apr 20;42(4):363-373. doi: 10.16288/j.yczz.19-351.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
7	Giraldo PA, Shinozuka H, Spangenberg GC, Cogan NOI, Smith KF. 2019	Safety Assessment of Genetically Modified Feed: Is There Any Difference From Food?	Front Plant Sci. 2019 Dec 11;10:1592. doi: 10.3389/fpls.2019.01592. eCollection 2019.	0
8	Hameed A, Mehmood MA, Shahid M, Fatma S, Khan A, Ali S. 2020	Prospects for potato genome editing to engineer resistance against viruses and cold-induced sweetening	GM Crops Food. 2020 Oct 1;11(4):185-205. doi: 10.1080/21645698.2019.1631115. Epub 2019 Jul 6.	0
9	Holme IB, Gregersen PL, Brinch-Pedersen H. 2019	Induced Genetic Variation in Crop Plants by Random or Targeted Mutagenesis: Convergence and Differences	Front Plant Sci. 2019 Nov 14;10:1468. doi: 10.3389/fpls.2019.01468. eCollection 2019.	0
10	Jyoti A, Kaushik S, Srivastava VK, Datta M, Kumar S, Yugandhar P, Kothari SL, Rai V, Jain A. 2019	The potential application of genome editing by using CRISPR/Cas9, and its engineered and ortholog variants for studying the transcription factors involved in the maintenance of phosphate homeostasis in model plants	Semin Cell Dev Biol. 2019 Dec;96:77-90. doi: 10.1016/j.semcdb.2019.03.010. Epub 2019 Apr 7.	0
11	Kadoić Balaško M, Mikac KM, Bažok R, Lemic D. 2020	Modern Techniques in Colorado Potato Beetle (Leptinotarsa decemlineata Say) Control and Resistance Management: History Review and Future Perspectives	Insects. 2020 Sep 1;11(9):581. doi: 10.3390/insects11090581.	0
12	Kamle M, Mahato DK, Devi S, Soni R, Tripathi V, Mishra AK, Kumar P. 2020	Nanotechnological interventions for plant health improvement and sustainable agriculture	3 Biotech. 2020 Apr;10(4):168. doi: 10.1007/s13205-020-2152-3. Epub 2020 Mar 14.	0
13	Kauffmann F, Van Damme P, Leroux-Roels G, Vandermeulen C, Berthels N, Beuneu C, Mali S. 2019	Clinical trials with GMO-containing vaccines in Europe: Status and regulatory framework	Vaccine. 2019 Sep 30;37(42):6144-6153. doi: 10.1016/j.vaccine.2019.08.018. Epub 2019 Sep 4.	0
14	Kenter MJH, Clevers JC, Cornelissen J, Medema RH. 2019	[Environmental regulations impede cancer research and treatment]	Ned Tijdschr Geneeskd. 2019 Dec 5;163:D4267.	0

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
15	Keshani P, Sharifi MH, Heydari MR, Joulaei H. 2020	The Effect of Genetically Modified Food on Infertility Indices: A Systematic Review Study	ScientificWorldJournal. 2020 Aug 13;2020:1424789. doi: 10.1155/2020/1424789. eCollection 2020.	0
16	Kumar K, Gambhir G, Dass A, Tripathi AK, Singh A, Jha AK, Yadava P, Choudhary M, Rakshit S. 2020	Genetically modified crops: current status and future prospects	Planta. 2020 Mar 31;251(4):91. doi: 10.1007/s00425-020-03372-8.	0
17	Papadopoulou N, Devos Y, Álvarez-Alfageme F, Lanzoni A, Waigmann E. 2020	Risk Assessment Considerations for Genetically Modified RNAi Plants: EFSA's Activities and Perspective	Front Plant Sci. 2020 Apr 21;11:445. doi: 10.3389/fpls.2020.00445. eCollection 2020.	0
18	Pottinger SE, Innes RW. 2020	RPS5-Mediated Disease Resistance: Fundamental Insights and Translational Applications	Annu Rev Phytopathol. 2020 Aug 25;58:139-160. doi: 10.1146/annurev-phyto-010820-012733. Epub 2020 Apr 13.	0
19	Rumin J, Nicolau E, Junior RGO, Fuentes-Grünewald C, Picot L. 2020	Analysis of Scientific Research Driving Microalgae Market Opportunities in Europe	Mar Drugs. 2020 May 18;18(5):264. doi: 10.3390/md18050264.	0
20	Woźniak E, Waszkowska E, Zimny T, Sowa S, Twardowski T. 2019	The Rapeseed Potential in Poland and Germany in the Context of Production, Legislation, and Intellectual Property Rights	Front Plant Sci. 2019 Nov 5;10:1423. doi: 10.3389/fpls.2019.01423. eCollection 2019.	0

5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS

The database searches (Section 3) identified a total of 197 references, which were reduced to 142 after removal of duplicates (Table 3). The manual search identified one publication which had already been identified in the automated search (Section 4).

5.1. Screening of titles and abstracts to exclude obviously irrelevant references (Stage 1)

All references identified in the database searches described in Section 3 were assessed for relevance based on information in their title and abstract by two reviewers independently. If opinions of relevance differed, the discrepancies were discussed between the reviewers and if a disagreement persisted, the publication under the discussion was transferred to Stage 2 for detailed evaluation by the experts. In this search, there was a 100% agreement in evaluations between both stage 1 revievers.

Clearly irrelevant records were tagged as “Not Relevant”. These included:

- Duplicated entries
- Secondary literature (reviews), other than assessments from Regulatory Agencies
- Articles on non-relevant topics like detection methods, socio-economic implications of GM crops, GM policy, agronomical performance, other herbicide resistant GM crops, unrelated topics, etc.

Publications which appear to be relevant and those of unclear relevance were tagged as “Relevant” and progressed to Stage 2 (detailed assessment; see Section 5.2).

The number of publications excluded after rapid assessment for relevance is presented in Table 6 documenting the selection process.

5.2. Detailed assessment of eligible references (Stage 2)

Publications tagged as “Relevant” in Stage 1 were assessed in detail independently by two scientific experts in each of three corresponding areas (i.e., Molecular Characterization, Food and Feed Safety, Environmental Safety), based on the full text of the publications.

If opinions of relevance differed between reviewers within each area, the initial reviewers discussed the discrepancy as necessary and consulted additional reviewers to resolve the discrepancy if needed. All eligible references were assessed in detail. This detailed assessment included evaluation of the scope of the article and the study quality and reliability. Categorization of reliability (as described in the EFSA 2019 explanatory note[1] and reported in Table 11) was dependent upon the following:

- appropriateness of methodology
- whether the description of methodology would allow independent repetition of the study
- extent of characterization of test materials
- reporting of evidence of reproducibility

Table 6 gives an overview of the reference selection process and results of the detailed assessment.

Table 6: Results of the publication selection process

Total number of publications retrieved after all searches of the scientific literature (excluding duplicates)	142
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	129
Total number of full-text documents assessed in detail	13
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	9
Total number of unobtainable/unclear publications	0
Total number of relevant publications	4

Table 7 lists the publications determined to be relevant along with their potential impact on the safety assessment based on detailed evaluation. Publications that were clearly not relevant after a detailed assessment are listed in Table 8. Table 9 lists the publications for which full-text documents were unobtainable for detailed assessment or for which relevance was unclear after detailed assessment.

Table 7: Report of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s)

Main category of information/data requirement	Study (Author(s) and year)	Title	Source
Molecular characterization	Liu Weixiao Li Liang Dong Mei Wan Yusong Jin Wujun Xu Wentao He Xiaoyun Huang Kunlun. 2018.	iTRAQ-based quantitative tissue proteomic analysis of differentially expressed proteins (DEPs) in non-transgenic and transgenic soybean seeds.	Scientific reports, (20181205), 8(1): 17681.
Food and feed safety	Xie, Zixin Zou, Shiying Xu, Wentao Liu, Xu Huang, Kunlun He, Xiaoyun [Reprint Author]. 2018.	No subchronic toxicity of multiple herbicide -resistant soybean FG72 in Sprague-Dawley rats by 90-days feeding study.	Regulatory Toxicology and Pharmacology, 94;299-305.
Food and feed safety	Dreesen, Rozemarijn [Reprint Author] Capt, Annabelle Oberdoerfer, Regina Coats, Isabelle Kenneth, Edward Pallett. 2018.	Characterization and safety evaluation of HPPD W336 , a modified 4-hydroxyphenylpyruvate dioxygenase protein, and the impact of its expression on plant metabolism in herbicide -tolerant MST -FGO72 -2 soybean.	Regulatory Toxicology and Pharmacology, 97;170-185.
Food and feed safety	Dreesen, R. Capt, A. Oberdoerfer, R. Coats, I. Pallett, K. E. 2018.	Supplementary data on the characterization and safety evaluation of HPPD W336 , a modified 4-hydroxyphenylpyruvate dioxygenase protein, which confers herbicide tolerance, and on the compositional assessment of field grown MST -FGO72 -2 soybean expressing HPPD W336 .	Data in Brief (2018), 21:111-121.

Table 8: Report of publications excluded from the risk assessment after detailed assessment of full-text documents

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Fast Brandon J Shan Guomin Herman Rod A Gampala Satyalinga Srinivas. 2020.	Transgene expression in sprayed and non-sprayed herbicide -tolerant genetically engineered crops is equivalent.	Regulatory toxicology and pharmacology, 111:104572.	FG72 soybean was not included in the study.
Sahin, Olcay Karlik, Elif Meric, Sinan Ari, Sule Gozukirmizi, Nermin 2020.	Genome organization changes in GM and non-GM soybean [Glycine max (L.) Merr.] under salinity stress by retro-transposition events.	Genetic Resources and Crop Evolution (2020), 67(6).	Study was not a safety assessment. In addition, FG72 soybean was not specifically mentioned in the study.
Shi Zongyong Lu Chao Wu Boze Zou Shiying Huang Kunlun He Xiaoyun Zhao Changhui. 2019.	Evaluation of the effects of feeding glyphosate -tolerant soybeans (CP4 EPSPS) on the testis of male Sprague-Dawley rats.	GM crops + food, (2019), 10(3): 181-190.	FG72 soybean was not included in the study.
Xia YiMiao; Chen FuSheng; Liu KunLun; Zhang LiFen; Duan XiaoJie; Zhang Xin; Zhu ZhenYa; Xia, Y. M.; Chen, F. S.; Liu, K. L.; Zhang, L. F.; Duan, X. J.; Zhang, X.; Zhu, Z. Y. 2019.	Compositional differences between conventional Chinese and genetically modified Roundup Ready soybeans .	Crop + Pasture Science (2019), 70(6): 526-534.	FG72 soybean was not included in the study.
Lin, Huan-Yu. Chen, Bo-Chou Chao, Mei-Li Chang, Hui-Wen Lin, Hsin-Tang Chu, Wen-Shen 2019.	Comparison of compositions of imported genetically modified and organic soybeans purchased from Taiwan market	Journal of Food and Nutrition Research (Newark, DE, United States) (2019), 7(10); 701-708.	The study used FG72 soybean as a PCR control only.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Carpentieri-Pipolo Valeria de Almeida Lopes Karla Bianca Degrassi Giuliano. 2019	Phenotypic and genotypic characterization of endophytic bacteria associated with transgenic and non-transgenic soybean plants.	Archives of microbiology, (2019), 201(8):1029-1045.	Phenotypic and genotypic characterization of endoyphytic bacteria associated with BRS245 RR and BRS133. The study did not report any findings on the environmental risk assessment of FG72 soybean.
Stenoien, C. Nail, K. R. Zalucki, J. M. Parry, H. Oberhauser, K. S. Zalucki, M. P. Editor(s): Lovei, G. L. 2018.	Monarchs in decline: a collateral landscape-level effect of modern agriculture. Special Section: The impact of transgenic crops on protected arthropods.	Insect Science (2018) 25(4); 528-541.	This review article did not report or discuss any findings regarding the environmental risk assessment of FG72 soybean.
Ricroch, A. Akkoyunlu, S. Martin-Laffon, J. Kuntz, M. Editor(s): Kuntz, M. 2018.	Assessing the environmental safety of transgenic plants: honey bees as a case study. Special Issue: Transgenic plants and beyond.	Advances in Botanical Research (2018), 86:111-167.	This review article did not report or discuss any findings regarding the environmental risk assessment of FG72 soybean.
Kim, Hye Jin; Kim, Do Young; Moon, Ye Seul; Pack, In Soon; Park, Kee Woong; Chung, Young Soo; Kim, Young Joong; Nam, Kyong-Hee; Kim, Chang-Gi 2019.	Gene flow from herbicide resistant transgenic soybean to conventional soybean and wild soybean.	Applied Biological Chemistry (2019), 62(1); 1-8.	The study examined gene flow from Bert-4-3 soybean to wild cultivars. There was no environmental risk assessment of FG72 soybean in the study.

Table 9: Report of unobtainable/unclear publications

Study (Author(s) and year)	Title	Source	Description of (unsuccessful) methods used to try and obtain a copy of the publication
No publications in this category.			

6. NARRATIVE SYNTHESIS/SUMMARY OF RELEVANT STUDIES

A total of thirteen publications were selected during Stage 1 evaluation (rapid assessment based on title and abstract) and progressed to stage 2 evaluation based on detailed review of full text. After Stage 2 evaluation, it was determined that four publications were relevant for the safety assessment of the FG72 soybean and its newly expressed proteins 2mEPSPS and HPPD W336.

Among the four articles identified as relevant, Liu *et al.*, (2018) used a proteomic analysis to identify differently expressed proteins in FG72 in comparison to the non-GM counterpart. The findings of Liu et al. (2018) showed that genetic modification did not have any unintended consequences on the common protein levels. Furthermore, the subchronic toxicological study findings reported by Xie et al. (2018) showed that FG72 soybean is safe. Dreesen et al. (2018) reported no adverse effects of HPPD W336 protein in FG72 soybean and thus, concluded that it is as safe as other common food proteins.

Table 10 and Table 11 list the relevant publication along with a summary of any adverse effects reported and the reliability of the publications.

Table 10: Report of the summary of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s)

Main category of information/data requirement	Study (Author(s) and year)	Intervention/ test materials used	Adverse effects reported	Which adverse effect reported
Molecular Characterization	Liu Weixiao Li Liang Dong Mei Wan Yusong Jin Wujun Xu Wentao He Xiaoyun Huang Kunlun. 2018.	FG72 soybean	No adverse effects reported.	Not applicable.
Food and Feed Safety	Xie, Zixin Zou, Shiying Xu, Wentao Liu, Xu Huang, Kunlun He, Xiaoyun [Reprint Author]. 2018.	FG72 soybean	No adverse effects reported.	Not applicable.
Food and Feed Safety	Dreesen, Rozemarijn [Reprint Author] Capt, Annabelle Oberdoerfer, Regina Coats, Isabelle Kenneth, Edward Pallett. 2018.	FG72 soybean	No adverse effects reported.	Not applicable.
Food and Feed Safety	Dreesen, R. Capt, A. Oberdoerfer, R. Coats, I. Pallett, K. E. 2018.	FG72 soybean	No adverse effects reported.	Not applicable.

Table 11: Report of the reliability and implications for the risk assessment of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s)

Main category of information/data requirement	Study (Author(s) and year)	Summary of reliability appraisal	Implications for risk assessment
Molecular Characterization	Liu Weixiao: Li Liang Dong Mei; Wan Yusong Jin Wujun; Xu Wentao; He Xiaoyun; Huang Kunlun. 2018.	The assessment presented reliable methods and findings.	Report findings and conclusions support the safe status of FG72 soybean.
Food and Feed Safety	Xie, Zixin Zou, Shiying Xu, Wentao Liu, Xu Huang, Kunlun He, Xiaoyun [Reprint Author]. 2018.	The assessment presented reliable methods and findings.	Report findings and conclusions support the safe status of FG72 soybean
Food and Feed Safety	Dreesen, Rozemarijn [Reprint Author] Capt, Annabelle Oberdoerfer, Regina Coats, Isabelle Kenneth, Edward Pallett. 2018.	The assessment presented reliable methods and findings.	Report findings and conclusions support the safe status of FG72 soybean
Food and Feed Safety	Dreesen, R. Capt, A. Oberdoerfer, R. Coats, I. Pallett, K. E. 2018.	The assessment presented reliable methods and findings.	Report findings and conclusions support the safe status of FG72 soybean

7. CONCLUSION

The literature searches performed for the FG72 soybean and its newly expressed protein 2mEPSPS and HPPD W336 for the period from October 1, 2019 to September 30, 2020, identified a total of 142 unique publications (after duplicate removal). A total of thirteen publications were progressed for detailed assessment after excluding 129 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract).

The thirteen publications that progressed to Stage 2 were evaluated in detail, based on full text, for potential relevance, following the pre-established criteria listed in Table 1. Four relevant publications reporting on the molecular characterization and/or food safety of FG72 soybean were identified. No adverse effects on human and animal safety were identified in these relevant publications. The findings support the safe status of FG72 soybean with respect to molecular characterization, food and feed safety assessment. No relevant publications with bearing on environmental safety were identified. No issues or topics were identified that would trigger or warrant more specific question formulation.

8. REFERENCES

No.	Author(s), title, source, edition, year, pages
1.	Devos Y, Guajardo IM, Alvarez F and Glanville J. 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 publications 2019:EN-1614. 62 pages. doi:10.2903/sp.efsa.2019.EN-1614.

9. APPENDICES

Appendix 1 Database descriptions

Host	File	Description
STN	AGRICOLA	Agriculture Online Access is a bibliographic database containing selected worldwide literature of agriculture and related fields. AGRICOLA is the locator and bibliographic access and control system of the National Agricultural Library (NAL) collections and also includes records from other cooperating institutions. Coverage of the database includes agricultural economics and rural sociology, agricultural production, animal sciences, chemistry, entomology, food and human nutrition, forestry, natural resources, pesticides, plant science, soils and fertilizers, and water resources. Also covered are related areas such as biology and biotechnology, botany, ecology, and natural history. The database draws on bibliographies, serial articles, book chapters, monographs, computer files, serials, maps, audiovisuals, and reports. Bibliographic information, abstracts, geographic terms, controlled terms, and supplementary terms are searchable.
STN	BIOSIS	BIOSIS Previews® is the largest and most comprehensive life science database in the world. Amongst others subject coverage includes Agriculture, Biochemistry, Biophysics, Botany, Environmental Biology, Physiology, Toxicology. Sources include periodicals, journals, conference proceedings, reviews, reports, patents, and short communications. Nearly 6,000 life source journals, 1,500 international meetings as well as review articles, books, and monographs are reviewed for inclusion. Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are all searchable.
STN	CABA/CAB	The CAB Abstracts database covers worldwide literature from all areas of agriculture and related sciences including Agriculture, Agricultural chemicals, Animal sciences and production, Crop protection, Crop sciences and production, Environment, Soils and fertilizers. Sources for CABA include journals, books, reports, published theses, conference proceedings, and patents. Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are searchable.
STN	CAS-CA/CAPLUS	The Chemical Abstracts (CA) database covers all areas of Biochemistry, Chemistry and Chemical engineering, and related sciences. Sources include over 8,000 journals, patents from 38 national patent offices and two international patent organizations, technical reports, books, conference proceedings, and dissertations. Electronic only journals and Web preprints are also covered. Bibliographic terms, indexing terms, roles, CAS Registry Numbers, International Patent Classification, and abstracts are searchable.

Host	File	Description
STN	MEDLINE	MEDLINE contains information on every area of medicine. The MEDLINE database corresponds to Index Medicus, Index to Dental Literature, and International Nursing Index; OLDMEDLINE, with data from NLM's from the Cumulated Index Medicus (1960-1965) and Current List of Medical Literature (1958-1959); and, since August 2001, IN-PROCESS records, the latest documents before they have been completely indexed for inclusion on MEDLINE. Sources include journals and chapters in books or symposia. Bibliographic information, indexing terms, abstracts, chemical names, and CAS Registry Numbers are all searchable. Online thesauri are available for the Medical Subject Headings (/MN), Controlled Terms (/CT) and Chemical Name (/CN) fields.

Appendix 2 Search history

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      FILE 'MEDLINE' ENTERED AT 09:02:02 ON 13 OCT 2020
L1             7 SEA FG72 OR FG(W)72 OR MST(W)FGØ72 OR MST(W)FG072 OR MST(W)FGO7
                 2
L2             4 SEA GT27 OR GT27TM
L3            12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L4          4134 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
                 ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
                 OYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(
                 4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)
L5             0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKI
                 MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(S
                 YNTHASE OR SYNTHETASE)
L6           357 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
                 ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE
                 )(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)
L7           458 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
                 IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(
                 3W)PHOSPHOSYNTHASE)
L8         23575 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)
L9            18 SEA L3 OR (((L4 OR L5 OR L6 OR L7))(S)L8)
L10            4 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336
L11           35 SEA ((HYDROXYPHENYLPYRUVATE OR HYDROXY(W)PHENYLPYRUVATE OR
                 HYDROXYPHENYL(W)PYRUVATE OR HYDROXY(W)PHENYL(W)PYRUVATE)(W)(DEH
                 YDROGENASE OR DIOXYGENASE) OR HPPD)(S)(MODIF? OR MUTANT# OR
                 MUTAT?)
L12           36 SEA (L10 OR L11)
L13           52 SEA L9 OR L12
L14         3241 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLUTOLE# OR
                 DIKETONITRILE# OR PYRAZOLONE# OR TRIKETONE# OR GL!PHOSATE# OR
                 GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(R
                 ESIST? OR TOLERAN? OR PROTECT?)
L15        63508 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
                 OR GLYCINE(W)MAX OR G(W)MAX
L16      3602322 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                 (GENETIC?(3A)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                 ENGINEER?))
L17          290 SEA L14 AND L15 AND L16
L18          337 SEA L1 OR L2 OR L13 OR L17
L19           72 SEA L18 AND PY>=2018
L20           36 SEA L19 AND UP>=20191001 AND UP<=20200930

     FILE 'BIOSIS' ENTERED AT 09:02:37 ON 13 OCT 2020
L21            8 SEA FG72 OR FG(W)72 OR MST(W)FGØ72 OR MST(W)FG072 OR MST(W)FGO7
                 2
L22            4 SEA GT27 OR GT27TM
L23           12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L24         4941 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
                 ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
                 OYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(
                 4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)
L25            0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKI
                 MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(S
                 YNTHASE OR SYNTHETASE)
L26          681 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
                 ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE
                 )(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)
L27           27 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
                 IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(
                 3W)PHOSPHOSYNTHASE)
L28        26115 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)
L29           18 SEA L23 OR (((L24 OR L25 OR L26 OR L27))(S)L28)
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L30           3 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336
L31          49 SEA ((HYDROXYPHENYLPYRUVATE OR HYDROXY(W)PHENYLPYRUVATE OR
                HYDROXYPHENYL(W)PYRUVATE OR HYDROXY(W)PHENYL(W)PYRUVATE)(W)(DEH
                YDROGENASE OR DIOXYGENASE) OR HPPD)(S)(MODIF? OR MUTANT# OR
                MUTAT?)
L32          49 SEA (L30 OR L31)
L33          66 SEA L29 OR L32
L34       10500 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLUTOLE# OR
                DIKETONITRILE# OR PYRAZOLONE# OR TRIKETONE# OR GL!PHOSATE# OR
                GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(R
                ESIST? OR TOLERAN? OR PROTECT?)
L35      162007 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
                OR GLYCINE(W)MAX OR G(W)MAX
L36      446752 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3A)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?))
L37         527 SEA L34 AND L35 AND L36
L38         592 SEA L21 OR L22 OR L33 OR L37
L39          90 SEA L38 AND PY>=2018
L40          42 SEA L39 AND UP>=20191001 AND UP<=20200930

     FILE 'AGRICOLA' ENTERED AT 09:03:06 ON 13 OCT 2020
L41           3 SEA FG72 OR FG(W)72 OR MST(W)FGØ72 OR MST(W)FG072 OR MST(W)FGO7
                2
L42           1 SEA GT27 OR GT27TM
L43           2 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L44         593 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
                ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
                OYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(
                4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)
L45           0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKI
                MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(S
                YNTHASE OR SYNTHETASE)
L46         286 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
                ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE
                )(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)
L47         209 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
                IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(
                3W)PHOSPHOSYNTHASE)
L48        6092 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)
L49           7 SEA L43 OR (((L44 OR L45 OR L46 OR L47))(S)L48)
L50           0 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336
L51          28 SEA ((HYDROXYPHENYLPYRUVATE OR HYDROXY(W)PHENYLPYRUVATE OR
                HYDROXYPHENYL(W)PYRUVATE OR HYDROXY(W)PHENYL(W)PYRUVATE)(W)(DEH
                YDROGENASE OR DIOXYGENASE) OR HPPD)(S)(MODIF? OR MUTANT# OR
                MUTAT?)
L52          28 SEA (L50 OR L51)
L53          35 SEA L49 OR L52
L54        7989 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLUTOLE# OR
                DIKETONITRILE# OR PYRAZOLONE# OR TRIKETONE# OR GL!PHOSATE# OR
                GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(R
                ESIST? OR TOLERAN? OR PROTECT?)
L55       85417 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
                OR GLYCINE(W)MAX OR G(W)MAX
L56       93955 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3A)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?))
L57         403 SEA L54 AND L55 AND L56
L58         439 SEA L41 OR L42 OR L53 OR L57
L59          40 SEA L58 AND PY>=2018
L60          18 SEA L59 AND UP>=20191001 AND UP<=20200930

     FILE 'CABA' ENTERED AT 09:03:38 ON 13 OCT 2020
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L61           9 SEA FG72 OR FG(W)72 OR MST(W)FGØ72 OR MST(W)FG072 OR MST(W)FGO7
                2
L62           3 SEA GT27 OR GT27TM
L63          12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L64        1020 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
                ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
                OYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(
                4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)
L65           0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKI
                MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(S
                YNTHASE OR SYNTHETASE)
L66         400 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
                ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE
                )(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)
L67         151 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
                IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(
                3W)PHOSPHOSYNTHASE)
L68        6857 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)
L69          17 SEA L63 OR (((L64 OR L65 OR L66 OR L67))(S)L68)
L70           3 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336
L71          51 SEA ((HYDROXYPHENYLPYRUVATE OR HYDROXY(W)PHENYLPYRUVATE OR
                HYDROXYPHENYL(W)PYRUVATE OR HYDROXY(W)PHENYL(W)PYRUVATE)(W)(DEH
                YDROGENASE OR DIOXYGENASE) OR HPPD)(S)(MODIF? OR MUTANT# OR
                MUTAT?)
L72          51 SEA (L70 OR L71)
L73          66 SEA L69 OR L72
L74       18031 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLUTOLE# OR
                DIKETONITRILE# OR PYRAZOLONE# OR TRIKETONE# OR GL!PHOSATE# OR
                GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(R
                ESIST? OR TOLERAN? OR PROTECT?)
L75      184857 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
                OR GLYCINE(W)MAX OR G(W)MAX
L76      173769 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3A)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?))
L77         863 SEA L74 AND L75 AND L76
L78         925 SEA L61 OR L62 OR L73 OR L77
L79         108 SEA L78 AND PY>=2018
L80          45 SEA L79 AND UP>=20191001 AND UP<=20200930
L81          45 SEA L80 NOT P/DT
L82           0 SEA L80 AND (P/DT AND J/DT)
L83          45 SEA L81 OR L82

     FILE 'HCAPLUS' ENTERED AT 09:04:10 ON 13 OCT 2020
L84          15 SEA FG72 OR FG(W)72 OR MST(W)FGØ72 OR MST(W)FG072 OR MST(W)FGO7
                2
L85           7 SEA GT27 OR GT27TM
L86          29 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS
L87        4246 SEA EPSPS OR EPSP(W)SYNTHASE OR (ENOL(W)PYRUVYLSHIKIMATE OR
                ENOL(W)PYRUVYL(W)SHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR ENOLPYRUV
                OYLSHIKAMATE OR ENOYLPYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMIC)(
                4W)(PHOSPHATE OR PHOSPHORIC)(2W)(SYNTHASE OR SYNTHETASE)
L88           9 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL)(W)(PHOSPHOSHIKI
                MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE)(2W)(S
                YNTHASE OR SYNTHETASE)
L89        1039 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
                ENOLPYRUVYLSHIKIMIC OR ENOL(W)(PYRUVYL OR PYRUVOYL)(W)SHIKIMATE
                )(3W)PHOSPHATE(W)(SYNTHASE OR SYNTHETASE)
L90          87 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
                IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(
                3W)PHOSPHOSYNTHASE)
L91       73361 SEA ((DOUBL# OR DOBL#)(W)(MUTANT# OR MUTAT?) OR 2M)
L92          41 SEA L86 OR (((L87 OR L88 OR L89 OR L90))(S)L91)
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L93           4 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336
L94         189 SEA ((HYDROXYPHENYLPYRUVATE OR HYDROXY(W)PHENYLPYRUVATE OR
                HYDROXYPHENYL(W)PYRUVATE OR HYDROXY(W)PHENYL(W)PYRUVATE)(W)(DEH
                YDROGENASE OR DIOXYGENASE) OR HPPD)(S)(MODIF? OR MUTANT# OR
                MUTAT?)
L95         189 SEA (L93 OR L94)
L96         227 SEA L92 OR L95
L97       27548 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLUTOLE# OR
                DIKETONITRILE# OR PYRAZOLONE# OR TRIKETONE# OR GL!PHOSATE# OR
                GL!FOSATE# OR G360 OR G(W)360 OR ROUNDUP? OR ROUND(W)UP?)(5A)(R
                ESIST? OR TOLERAN? OR PROTECT?)
L98      391396 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
                OR GLYCINE(W)MAX OR G(W)MAX
L99      664058 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
                (GENETIC?(3A)(MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
                ENGINEER?))
L100       5877 SEA L97 AND L98 AND L99
L101       6020 SEA L84 OR L85 OR L96 OR L100
L102       1486 SEA L101 AND PY>=2018
L103        467 SEA L102 AND UP>=20191001 AND UP<=20200930
L104         56 SEA L103 NOT P/DT
L105          0 SEA L103 AND (P/DT AND J/DT)
L106         56 SEA L104 OR L105

     FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 09:04:48 ON 13
     OCT 2020
L107        142 DUP REM L20 L40 L60 L83 L106 (55 DUPLICATES REMOVED)
                ANSWERS '1-36' FROM FILE MEDLINE
                ANSWERS '37-69' FROM FILE BIOSIS
                ANSWERS '70-79' FROM FILE AGRICOLA
                ANSWERS '80-112' FROM FILE CABA
                ANSWERS '113-142' FROM FILE HCAPLUS
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