

Title

**Summary of the Literature Review for FG72 x A5547-127 Soybean
October 1, 2021 – June 30, 2022**

Final ReportData 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.
EFSA supporting publications 2019:EN-1614

Completion date

October 6, 2022

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Report number
22-RSSB0772

Activity ID
RSSB0772

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TABLE OF CONTENTS

STATEMENT OF NO DATA CONFIDENTIALITY CLAIMS	2
SIGNATURE PAGE	3
STUDY PERSONNEL	4
TABLE OF CONTENTS	5
TABLES	6
APPENDICES	6
SUMMARY	7
1. INTRODUCTION	8
2. OVERALL METHODS	8
2.1. Objective of the scoping review	8
2.2. Review questions	8
2.3. Criteria for relevance	9
2.4. Reference study searches	12
3. SEARCH METHODS AND OUTCOMES	12
3.1. Time window and date of the literature search	13
3.2. Databases used in the literature search	13
3.3. Search strategy	13
4. MANUAL SEARCHES	17
4.1. Manual searches of web pages of food safety, agriculture, and biotechnology-related authority webpages	17
4.2. Manual searches of reference lists of recent review articles	17
5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS	18
5.1. Screening of titles and abstracts to exclude obviously irrelevant references (Stage 1) ..	19
5.2. Detailed assessment of eligible references (Stage 2)	19
6. NARRATIVE SYNTHESIS/SUMMARY OF RELEVANT STUDIES	20
7. CONCLUSION	20
8. REFERENCES	20
9. APPENDICES	24

TABLES

Table 1:	Eligibility/inclusion criteria to establish the relevance of retrieved publications	9
Table 2:	Search profile for database search.....	13
Table 3:	Relevant controlled terms (CT) and index terms (IT) in each database.....	15
Table 4:	Overview of the selected databases and summary of search results from each database	16
Table 5:	Results of search of food safety, agriculture, and biotechnology-related authority websites.....	17
Table 6:	Documents for which reference lists were scanned for relevant studies	18
Table 7:	Results of the publication selection process	19
Table 8:	Report of all relevant publications retrieved after detailed assessment of full-text documents for relevance: ordered by category of information/data requirement(s)	21
Table 9:	Report of publications excluded from the risk assessment after detailed assessment of full-text documents.....	21
Table 10:	Report of unobtainable/unclear publications	22
Table 11:	Summary report for all relevant publications retrieved after detailed assessment of full-text documents for relevance and implications for the risk assessment: ordered by category of information/data requirement(s).....	23

APPENDICES

Appendix 1	Database descriptions	24
Appendix 2	Search history	26

SUMMARY

FG72 x A5547-127 is a genetically modified (GM) soybean designed to provide new options for weed control in the crop. FG72 x A5547-127 soybean was obtained by traditional breeding of two parental lines—one derived from FG72 and one derived from A5547-127. FG72 soybean expresses the 5-enolpyruvylshikimate-3-phosphate synthase protein (2mEPSPS) as well as the 4-hydroxyphenylpyruvate dioxygenase protein (HPPD W336), which confer tolerance to glyphosate and HPPD inhibitors such as isoxaflutole herbicides, respectively. A5547-127 soybean expresses the phosphinothricin acetyltransferase (PAT/pat) protein, which confers tolerance to glufosinate herbicides. FG72 x A5547-127 expresses all three proteins conferring tolerance to all three herbicides. The OECD identifier is MST-FGØ72-2 x ACS-GMØØ6-4.

A scoping review was performed for the FG72 x A5547-127 soybean and its newly expressed proteins, 2mEPSPS, HPPD W336 and PAT/pat. The objective of this scoping review was to determine if there were studies about the molecular characterization of FG72 x A5547-127 soybean, its effect on food and feed safety or 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, 2021 to June 30, 2022. 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 74 unique publications, which were subject to rapid assessment to exclude obviously irrelevant publications. A total of 5 publications were progressed for detailed assessment.

None of the 5 publications were determined to be relevant after detailed review. No publications were found that constitute new data on molecular characterization of FG72 x A5547-127 soybean, or the 2mEPSPS, HPPD W336 and PAT/pat proteins, or suggested any potential adverse effects on human and animal health or on the environment. No evidence was identified that would warrant conducting a systematic review.

In summary, these literature searches and review of the retrieved articles identified no relevant publication that supports the existing safety assessment of FG72 x A5547-127 soybean.

1. INTRODUCTION

FG72 x A5547-127 is a genetically modified (GM) soybean designed to provide new options for weed control in the crop. FG72 x A5547-127 soybean was obtained by traditional breeding of two parental lines—one derived from FG72 and one derived from A5547-127. FG72 soybean expresses the 5-enolpyruvylshikimate-3-phosphate synthase protein (2mEPSPS) as well as the 4-hydroxyphenylpyruvate dioxygenase protein (HPPD W336), which confer tolerance to glyphosate and HPPD inhibitors such as isoxaflutole herbicides, respectively. A5547-127 soybean expresses the phosphinothricin acetyltransferase (PAT/pat) protein, which confers tolerance to glufosinate herbicides. FG72 x A5547-127 expresses all three proteins conferring tolerance to all three herbicides. The OECD identifier is MST-FGØ72-2 x ACS-GMØØ6-4.

The objective of the literature searches described here was to determine if there were studies published between October 1, 2021 and June 30, 2022 that mention the molecular characterization of the FG72 x A5547-127 soybean, and/or any adverse effect of FG72 x A5547-127 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) applications and post-market environmental monitoring activities (2019)¹.

The literature searches were performed for the FG72 x A5547-127 soybean and its newly expressed proteins, 2mEPSPS, HPPD W336 and PAT/pat. The search terms also included relevant synonyms, trade name and intended traits, 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 x A5547-127 soybean and its newly expressed proteins, 2mEPSPS, HPPD W336 and PAT/pat, 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 PE(I)CO structure (Population, Exposure (Intervention), Comparators, Outcome) if possible, and to address data requirements. They were modeled after the review question examples provided in the EFSA 2019 explanatory note¹.

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 x A5547-127 soybean and its newly expressed proteins 2mEPSPS, HPPD W336 and PAT/pat?

Key elements:

Population: Human health; animal health; environmental safety

Exposure: FG72 x A5547-127 soybean, derived food/feed products, newly expressed proteins in FG72 x A5547-127 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 of the FG72 x A5547-127 soybean and its newly expressed proteins 2mEPSPS, HPPD W336 and PAT/pat in soybean?

Key elements:

Population: FG72 x A5547-127 soybean and newly expressed proteins in FG72 x A5547-127 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 note¹ 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		
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
Exposure (Intervention)	The publication addresses the GMO, derived food/feed products, and/or the intended trait(s) (e.g., newly expressed proteins(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
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

Concepts	Criteria	Comment
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
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

Concepts	Criteria	Comment
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(s), 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

Concepts	Criteria	Comment
Reporting format	The publication presents original/primary data, or it is a risk assessment from a relevant key organisation (such as regulatory agencies and risk assessment bodies involved in the risk assessment of GMOs)	This permits the exclusion of publications that do not present original/primary data (e.g., editorials, position papers), and the inclusion of relevant risk assessments performed and reported by relevant key organisations. 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 related to FG72 x A5547-127 soybean were previously identified and used to test and validate the search strategy:

- 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* 97:170-185
- Naegeli, H.; Bresson, J. L.; Dalmay, T.; Dewhurst, I. C.; Epstein, M.; Firbank, L. G.; Guerche, P.; Hejatko, J.; Moreno, F. J.; Mullins, E.; Nogue, F.; Rostoks, N.; Serrano, J. J. S.; Savoini, G.; Veromann, E.; Veronesi, F.; Alvarez, F.; Dumont, A. F.; Papadopoulou, N.; Ardizzone, M.; Devos, Y.; Gennaro, A.; Gomez, J. A. R.; Lanzoni, A.; Neri, F. M.; Paraskevopoulos, K. (2019). Assessment of genetically modified soybean MON 87708 x MON 89788 x A5547-127, for food and feed uses, under regulation (EC) no 1829/2003 (application EFSA-GMO-NL-2016-135). *EFSA Journal* 17(7):e05733

These two articles are not directly relevant to FG72 x A5547-127 soybean, but they were selected because they mention the event names (FG72 and A5547-127), one of the newly expressed proteins (HPPD W336), the intended traits (herbicide resistance) and the crop (soybean). Since these references were published outside the searched time, the profile was tested without applying the time limits used in the final search profile (UP>=20211001 and UP<=20220630).

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 activities¹.

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 August 19, 2022. Only documents updated between October 1, 2021 and June 30, 2022, 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 stack 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 additional profiles: a 'general GMO' profile as well as a 'plant species' profile. The reference publication ([Section 2.4](#)) was identified by the search profiles, confirming the validity of the applied search strategy. See [Table 2](#) for a detailed search profile.

Table 2: Search profile for database search

Set	Search string	Concepts
1	FG72 or MST(w)FG072 or MST(w)FGO72 or or MST(w)FG072x or MST(w)FGO72x	Event FG72
2	LL55 or A5547(w)127 or A(w)5547(w)127 or ACS-GM006-4 or ACS-GMOO6-4 or ACSGM006(w)4 or ACSGMOO6(w)4 or xA5547(w)127 or xA(w)5547(w)127 or xACS-GM006-4 or xACS-GMOO6-4 or xACSGM006(w)4 or xACSGMOO6(w)4	Event A5547-127
3	FG72? or ?FG72 or LL55? or ?LL55 or FG72.time#.LL55 or MST(w)FG072-3xA5547(w)12 or MSTFG072-3xA5547(w)12 or MST(w)FG072-3xA(w)5547(w)12 or MSTFG072-3xA(w)5547(w)12	Event FG72 x A5547-127
4	(1 and 2) or 3	Event all
5	GT27 or GT27TM	Trade name FG72

6	libertylink? or liberty(w)link or liberty(w)linktm or liberty(w)linkrtm or LL or LLTM or LLRTM	Trade name A5547-127
7	5 and 6	Trade name all
8	((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 ENOLPYRUVVOYLSHIKAMATE or ENOYLPYRUVVOYLSHIKIMATE 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)PYRUVVOYLSHIKIMATE 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 ENOLPYRUVVOYL(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 FG72
9	((bar or pat)(2a)(gene# or protein# or enzyme#) or ppt(2w)acetyltransferase or ppt(2w)acetyl(w)transferase or pt(w)n(2w)acetyltransferase or pt(w)n(2w)acetyl(w)transferase or phosphinothricin(w)n(w)acetyltransferase or phosphinothricin(2w)acetyltransferase or phosphinothricin(2w)acetyl(w)transferase or phosphinothricinacetyl(w)transferase	Newly expressed protein A5547-127
10	8 and 9	Newly expressed proteins all
11	(herbicid? or HPPD(w)inhibitor# or isoxaflutole# or diketonitrile# or pyrazolone# or triketone# or GLIPHOSATE# or GLIFOSATE# OR G360 or g(w)360 or roundup? or round(w)up?)(5a)(resist? or toleran? or protect?)	Intended trait FG72
12	(herbicid? or bialaphos or basta or glufosinate or phosphinothricin or liberty?)(5a)(resist? or toleran? or protect?)	Intended trait A5547-127
13	11 and 12	Intended trait all
14	soy or soya or soja or soybean# or soyabean# or sojabean# or glycine(w)max or g(w)max	Plant species

15	GMO OR GMOs OR LMO OR LMOs OR GM OR GE OR transgen? OR (genetic?(3w)(modif? OR transform? OR manipulat? OR improv? OR engineer?)) or (stacked(w)(gene# or trait# or event#))	GMO general
16	13 and 14 and 15	Intended trait AND Plant species AND GMO general
17	4 or 7 or 10 or 16	Event name all OR Trade name all OR Newly expressed proteins all OR (Intended traits all AND Plant species AND GMO general)

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

Relevant controlled terms ([Table 3](#)) were not searched separately because they are included in the Basic Index and were captured by the free-text searches.

Table 3: Relevant controlled terms (CT) and index terms (IT) in each database

Database	Event	New proteins	Intended traits	Plant species	GM plants
Agricola	None	None	"HERBICIDE RESISTANCE"	"GLYCINE MAX"	"TRANSGENIC PLANTS"
Biosis	None	None	No terms for herbicide resistance	none	None
CABA	None	None	"HERBICIDE RESISTANCE"	SOYABEANS	"TRANSGENIC PLANTS"

Database	Event	New proteins	Intended traits	Plant species	GM plants
CAS	None	None	"HERBICIDE RESISTANCE"	"GLYCINE MAX"	"GENETICALLY MODIFIED PLANTS"
Medline	None	None	"HERBICIDE RESISTANCE"	SOYABEANS/CT	"PLANTS, GENETICALLY MODIFIED"

The search results were limited to documents updated between October 1, 2021 and June 30, 2022 (UP>=20211001 and UP<=20220630), and to non-patent documents (not P/DT). To ensure that documents with indexing errors where two document types (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 4](#) summarizes the number of results obtained from each of the databases searched.

See [Appendix 2](#) for a complete search history.

Table 4: Overview of the selected databases and summary of search results from each database

Database	AGRICOLA	BIOSIS	CAB Abstracts	CAPLUS	MEDLINE
Database Provider	STN International				
Coverage	1970-present	1926-present	1973-present	1907-present	1946-present
Date of search	19 Aug 2022				
Datespan of the search	1 Oct 2021 – 30 Jun 2022				
Latest database update	8 Aug 2022	17 Aug 2022	16 Aug 2022	18 Aug 2022	18 Aug 2022
Number of records retrieved	6	16	28	26	20
Number of records after duplicate removal	4	12	21	17	20
Number of relevant records after rapid assessment	0	1	1	1	2

4. INTERNET and MANUAL SEARCHES

4.1. Internet searches of food safety, agriculture, and biotechnology-related authority webpages

A search of the web pages of food safety, agriculture, and biotechnology-related authorities was conducted. Search results were manually examined for relevant records that were either published during the time period under consideration (date span of search: October 1, 2021 to June 30, 2022) or refer to relevant records published during this time frame. Relevance of results were determined based on the criteria listed in [Table 1](#) and they were summarized in [Table 5](#). All web pages searched were justified by their recommendation in the EFSA 2019 explanatory note¹. Of the 13 key organisations cited in the EFSA 2019 explanatory note¹, Environment and Climate Change Canada and Intersecretarial Commission on Biosafety of GMOs (CIBIOGEM) were excluded, since they are not involved in the risk assessment of GM plants. The US-EPA website was excluded, since the FG72 x A5547-127 soybean does not contain an insect-resistant trait. The USDA, FDA, CFIA, Health Canada, FSANZ and MAFF websites were excluded, since these agencies do not regulate GM stacked products obtained by conventional breeding techniques. The GEAC website was excluded, since this agency has only regulated GM cotton products. Therefore, the internet search was limited to 3 key organisations relevant for FG72 x A5547-127 soybean. Search terms consisted of FG72xA5547-127 or MST-FGØ72-2xACS-GMØØ6-4 or 2mEPSPS or double mutant 5-enolpyruvyl shikimate-3-phosphate synthase enzyme or HPPD W336 or modified-hydroxyphenylpyruvate dioxygenase or PAT/pat or Phosphinothricin in FG72 x A5547-127 soybean (all searched singly, with no search limits applied).

Table 5: 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
Office of the Gene Technology Regulator (OGTR) Australia	http://www.ogtr.gov.au/	8/1/2022	8/29/2022	0
National Technical Commission on Biosafety (CTNBio) Brazil	http://ctnbio.mcti.gov.br/en	8/1/2022	8/29/2022	0
National Advisory Commission on Agricultural Biotechnology (CONABIA) Argentina	https://www.argentina.gob.ar/agroindustria/bioeconomia/biotecnologia	9/8/2022	9/8/2022	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, 2021 and June 30, 2022. The resulting number of relevant studies found within the bibliographies of these review articles is given in [Table 6](#).

Table 6: Documents for which reference lists were scanned for relevant studies

No	Author(s) and Year	Title	Source	Number of relevant bibliographic references retrieved
1	Ahmad A, Munawar N, Khan Z, Qusmani AT, Khan SH, Jamil A, Ashraf S, Ghouri MZ, Aslam S, Mubarak MS, Munir A, Sultan Q, Abd-Elsalam KA, Qari SH. 2021	An Outlook on Global Regulatory Landscape for Genome-Edited Crops	Int J Mol Sci. 2021 Oct 29;22(21):11753.	0
2	Halder K, Chaudhuri A, Abdin MZ, Majee M, Datta A. 2022	RNA Interference for Improving Disease Resistance in Plants and Its Relevance in This Clustered Regularly Interspaced Short Palindromic Repeats-Dominated Era in Terms of dsRNA-Based Biopesticides	Front Plant Sci. 2022 May 13;13:885128.	0
3	Kawall K. 2021	The Generic Risks and the Potential of SDN-1 Applications in Crop Plants	Plants (Basel). 2021 Oct 22;10(11):2259.	0
4	Lafiandra D, Sestili F, Sissons M, Kiszonas A, Morris CF. 2022	Increasing the Versatility of Durum Wheat through Modifications of Protein and Starch Composition and Grain Hardness	Foods. 2022 May 24;11(11):1532.	0
5	Nagamine A, Ezura H. 2022	Genome Editing for Improving Crop Nutrition	Front Genome Ed. 2022 Feb 9;4:850104.	0
6	Niraula PM, Fondong VN. 2021	Development and Adoption of Genetically Engineered Plants for Virus Resistance: Advances, Opportunities and Challenges	Plants (Basel). 2021 Oct 29;10(11):2339.	0
7	Okoli AS, Blix T, Myhr AI, Xu W, Xu X. 2022	Sustainable use of CRISPR/Cas in fish aquaculture: the biosafety perspective	Transgenic Res. 2022 Feb;31(1):1-21.	0
8	Then C. 2022	Deficiencies in the Risk Assessment of Genetically Engineered Bt Cowpea Approved for Cultivation in Nigeria: A Critical Review	Plants (Basel). 2022 Jan 29;11(3):380.	0
9	Van Vu T. 2022	Genome editing and beyond: what does it mean for the future of plant breeding?	Planta. 2022 May 19;255(6):130.	0

5. RESULTS OF THE STUDY IDENTIFICATION AND SELECTION PROCESS

The database searches ([Section 3](#)) identified a total of 96 references, which were reduced to 74 after removal of duplicates ([Table 4](#)). No additional studies were identified in the manual searches ([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, both evaluator were in 100 % agreement.

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, other insect resistant GM crops, unrelated topics, etc.

Publications which appeared 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 7](#) 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 Biology, 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.

In the relevance assessment of the literature review for the FG72 x A5547-127 soybean, reviewers agreed in 100% of the Stage 2 evaluations.

[Table 7](#) gives an overview of the reference selection process and results of the detailed assessment.

Table 7: Results of the publication selection process

Total number of publications retrieved after all searches of the scientific literature (excluding duplicates)	74
Number of publications excluded from the search results after rapid assessment for relevance (Stage 1)	69
Total number of full-text documents assessed in detail	5
Number of publications excluded from further consideration after detailed assessment for relevance (Stage 2)	5
Total number of unobtainable/unclear publications	0
Total number of relevant publications	0

[Table 8](#) 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 9](#). [Table 10](#) lists the publications for which full-text documents were unobtainable for detailed assessment or for which relevance was unclear after detailed assessment.

6. NARRATIVE SYNTHESIS/SUMMARY OF RELEVANT STUDIES

A total of 5 publications were selected during Stage 1 evaluation (rapid assessment based on title and abstract). After Stage 2 evaluation (detailed review based on full text), it was determined that the publications were not relevant for the safety assessment of the FG72 x A5547-127 soybean and its newly expressed proteins 2mEPSPS, HPPD W336 and PAT/pat.

[Table 11](#) lists the relevant publication along with a summary of any adverse effects reported and the reliability of the publications.

7. CONCLUSION

The literature searches performed for the FG72 x A5547-127 soybean and its newly expressed proteins, 2mEPSPS, HPPD W336 and PAT/pat, for the period from October 1, 2021 to June 30, 2022, identified a total of 74 unique publications (after duplicate removal). A total of 5 publications were progressed for detailed assessment after excluding 69 obviously irrelevant publications during Stage 1 evaluation (rapid assessment based on title and abstract).

The 5 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](#). No relevant reference with bearing on molecular characterization, human and animal safety or environmental safety was identified. The data and knowledge generated from this study does not impact the safety assessment of FG72 x A5547-127 soybean. 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. |
|----|---|

Table 8: 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
No publications in this category			

Table 9: 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
Mullins Ewen, Bresson Jean-Louis, Dalmay Tamas, Dewhurst Ian Crawford, Epstein Michelle M, Firbank Leslie George, Guerche Philippe, Hejatko Jan, Moreno Francisco Javier, Naegeli Hanspeter, Nogue Fabien, Rostoks Nils, Sanchez Serrano Jose Juan, Savoini Giovanni, Veromann Eve, Veronesi Fabio, Ardizzone Michele, Fernandez Antonio, Kagkli Dafni Maria, Lewandowska Aleksandra, Raffaello Tommaso, Streissl Franz 2022	Assessment of genetically modified soybean A5547-127 for renewal authorisation under Regulation (EC) No 1829/2003 (application EFSA-GMO -RX-020).	EFSA journal. European Food Safety Authority. (2022 Jun) Vol. 20, No. 6, pp. e07340. Electronic Publication Date: 20 Jun 2022 Journal code: 101642076. E-ISSN: 1831-4732. L-ISSN: 1831-4732. Report No.: PMC-PMC9207747.	EFSA evaluation of BASF soybean A5547-127. Single events are not considered relevant for stacks. Not relevant for FG72 X A5547-127.
Fast, Brandon J., Shan, Guomin, Gampala, Satyalinga Srinivas, Herman, Rod A. 2020	Transgene expression in sprayed and non-sprayed herbicide -tolerant genetically engineered crops is equivalent.	Regulatory Toxicology and Pharmacology. (MAR 2020) Vol. 111, pp. Article No.: 104572. http://www.journals.elsevier.com/regulatory-toxicology-and-pharmacology/#description. CODEN: RTOPDW. ISSN: 0273-2300. E-ISSN: 1096-0295.	FG72 x A5547-127 soybean was not considered in this paper.

Study (Author(s) and year)	Title	Source	Reason(s) for exclusion based on eligibility/inclusion criteria listed in Table 1
Benevenuto, Rafael Fonseca, Zanatta, Caroline Bedin, Guerra, Miguel Pedro, Nodari, Rubens Onofre, Agapito-Tenfen, Sarah Z.a 2021	Proteomic Profile of Glyphosate-Resistant Soybean under Combined Herbicide and Drought Stress Conditions	Plants (2021), 10(11), 2381 CODEN: PLANCD; ISSN: 2223-7747 URL: https://www.mdpi.com/journal/plants	FG72 x A5547-127 soybean not was considered in this paper.
Liu Laipan, Zhang Li, Fu Jianmei, Shen Wenjing, Fang Zhixiang, Dai Ying, Liu Biao, Jia Ruizong, Liang Jingang 2022	Fitness and Ecological Risk of Hybrid Progenies of Wild and Herbicide-Tolerant Soybeans With EPSPS Gene.	Frontiers in plant science, (2022) Vol. 13, pp. 922215. Electronic Publication Date: 9 Jun 2022 Journal code: 101568200. ISSN: 1664-462X. L-ISSN: 1664-462X. Report No.: PMC-PMC9224928.	FG72xA5547-127 soybean was not considered in this paper.
Hu YuQi, Sheng ZeWen, Liu JinYue, Liu Qi, Qiang Sheng, Song XiaoLing, Liu Biao, Hu, Y. Q., Sheng, Z. W., Liu, J. Y., Liu, Q., Qiang, S., Song, X. L., Liu, B. 2022	Sexual compatibility of transgenic soybean and different wild soybean populations.	Journal of Integrative Agriculture (2022), Volume 21, Number 1, pp. 36-48, 75 refs. ISSN: 2095-3119 DOI: https://doi.org/10.1016/S2095-3119(20)63385-8 Published by: Elsevier B.V., Amsterdam	FG72xA5547-127 soybean was not considered in this paper.

Table 10: 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.			

Table 11: Summary report for all relevant publications retrieved after detailed assessment of full-text documents for relevance and implications for the risk assessment: 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	Implications for risk assessment
No publications in this category.					

9. APPENDICES

Appendix 1 Database descriptions

Host	File	Description
STN	AGRICOLA	<p>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.</p> <p>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.</p>
STN	BIOSIS	<p>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.</p> <p>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.</p> <p>Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are all searchable.</p>
STN	CABA/CAB	<p>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.</p> <p>Sources for CABA include journals, books, reports, published theses, conference proceedings, and patents.</p> <p>Bibliographic information, indexing terms, abstracts, and CAS Registry Numbers are searchable.</p>
STN	CAS-CA/CAPLUS	<p>The Chemical Abstracts (CA) database covers all areas of Biochemistry, Chemistry and Chemical engineering, and related sciences.</p> <p>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.</p> <p>Bibliographic terms, indexing terms, roles, CAS Registry Numbers, International Patent Classification, and abstracts are searchable.</p>

Host	File	Description
STN	MEDLINE	<p>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.</p> <p>Sources include journals and chapters in books or symposia. Bibliographic information, indexing terms, abstracts, chemical names, and CAS Registry Numbers are all searchable.</p> <p>Online thesauri are available for the Medical Subject Headings (/MN), Controlled Terms (/CT) and Chemical Name (/CN) fields.</p>

Appendix 2 Search history

FILE 'MEDLINE' ENTERED AT 14:41:13 ON 19 AUG 2022

L1 6 SEA FG72 OR MST(W)FG072 OR MST(W)FG072 OR MST(W)FG072X OR
MST(W)FG072X

L2 8 SEA LL55 OR A5547(W)127 OR A(W)5547(W)127 OR ACS-GM006-4 OR
ACS-GMO06-4 OR ACSGM006(W)4 OR ACSGMO06(W)4

L3 0 SEA XA5547(W)127 OR XA(W)5547(W)127 OR XACS-GM006-4 OR
XACS-GMO06-4 OR XACSGM006(W)4 OR XACSGMO06(W)4

L4 10 SEA FG72? OR ?FG72 OR LL55? OR ?LL55 OR FG72.TIME#.LL55 OR
MST(W)FG072-3XA5547(W)12 OR MSTFG072-3XA5547(W)12 OR MST(W)FG07
2-3XA(W)5547(W)12 OR MSTFG072-3XA(W)5547(W)12

L5 10 SEA (L1 AND (L2 OR L3)) OR L4

L6 0 SEA (GT27 OR GT27TM) AND (LIBERTYLINK? OR LIBERTY(W)LINK OR
LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM OR LLRTM)

L7 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L8 4282 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)

L9 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L10 402 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W)SHIKIMATE
) (3W)PHOSPHATE(W) (SYNTHASE OR SYNTHETASE)

L11 504 SEA (PHOSPHOSHIKIMATE(2W)CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE(2W)CARBOXYVINYL(W)TRANSFERASE OR ENOLPYRUVOYL(W)SHIKIMIC(3W)
PHOSPHOSYNTHASE)

L12 25144 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L13 20 SEA L7 OR ((L8 OR L9 OR L10 OR L11)) (S)L12)

L14 5 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336

L15 45 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?)

L16 46 SEA (L14 OR L15)

L17 63 SEA L13 OR L16

L18 1522 SEA ((BAR OR PAT) (2A) (GENE# OR PROTEIN# OR ENZYME#)) OR
PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR
PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE

L19 204 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L20 1596 SEA (L18 OR L19)

L21 8 SEA L17 AND L20

L22 3785 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLOTOLE# 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?)

L23 3589 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L24 3311 SEA L22 AND L23

L25 70407 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
OR GLYCINE(W)MAX OR G(W)MAX

L26 4023749 SEA GMO OR GMOS OR LMO OR LMO5 OR GM OR GE OR TRANSGEN? OR
(GENETIC?(3W) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?)) OR (STACKED(W) (GENE# OR TRAIT# OR EVENT#))

L27 254 SEA L24 AND L25 AND L26

L28 265 SEA L5 OR L6 OR L21 OR L27

L29 38 SEA L28 AND PY>=2020

L30 20 SEA L29 AND UP>=20211001 AND UP<=20220630

FILE 'BIOSIS' ENTERED AT 14:41:25 ON 19 AUG 2022

L31 6 SEA FG72 OR MST(W)FG072 OR MST(W)FG072 OR MST(W)FG072X OR
MST(W)FG072X

L32 16 SEA LL55 OR A5547(W)127 OR A(W)5547(W)127 OR ACS-GM006-4 OR
ACS-GMO06-4 OR ACSGM006(W)4 OR ACSGMO06(W)4

L33 0 SEA XA5547(W)127 OR XA(W)5547(W)127 OR XACS-GM006-4 OR
XACS-GMO06-4 OR XACSGM006(W)4 OR XACSGMO06(W)4

L34 13 SEA FG72? OR ?FG72 OR LL55? OR ?LL55 OR FG72.TIME#.LL55 OR
MST(W)FG072-3XA5547(W)12 OR MSTFG072-3XA5547(W)12 OR MST(W)FG07
2-3XA(W)5547(W)12 OR MSTFG072-3XA(W)5547(W)12

L35 13 SEA (L31 AND (L32 OR L33)) OR L34

L36 0 SEA (GT27 OR GT27TM) AND (LIBERTYLINK? OR LIBERTY(W)LINK OR
LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM OR LLRTM)

L37 12 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L38 5113 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) (4
W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L39 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L40 746 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)

L41 28 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (3
W) PHOSPHOSYNTHASE)

L42 27470 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L43 19 SEA L37 OR ((L38 OR L39 OR L40 OR L41)) (S)L42)

L44 3 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336

L45 66 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?)

L46 66 SEA (L44 OR L45)

L47 84 SEA L43 OR L46

L48 2905 SEA ((BAR OR PAT) (2A) (GENE# OR PROTEIN# OR ENZYME#)) OR
PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR
PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE

L49 334 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L50 3009 SEA (L48 OR L49)

L51 8 SEA L47 AND L50

L52 11534 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLOTOLE# 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?)

L53 10286 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L54 9864 SEA L52 AND L53

L55 173517 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
OR GLYCINE(W)MAX OR G(W)MAX

L56 458484 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC?(3W) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?)) OR (STACKED(W) (GENE# OR TRAIT# OR EVENT#))

L57 408 SEA L54 AND L55 AND L56

L58 425 SEA L35 OR L36 OR L51 OR L57

L59 38 SEA L58 AND PY>=2020

L60 16 SEA L59 AND UP>=20211001 AND UP<=20220630

FILE 'AGRICOLA' ENTERED AT 14:41:37 ON 19 AUG 2022

L61 5 SEA FG72 OR MST(W)FG072 OR MST(W)FG072 OR MST(W)FG072X OR
MST(W)FG072X

L62 7 SEA LL55 OR A5547(W)127 OR A(W)5547(W)127 OR ACS-GM006-4 OR
ACS-GMO06-4 OR ACSGM006(W)4 OR ACSGMO06(W)4

L63 0 SEA XA5547(W)127 OR XA(W)5547(W)127 OR XACS-GM006-4 OR
XACS-GMO06-4 OR XACSGM006(W)4 OR XACSGMO06(W)4

L64 4 SEA FG72? OR ?FG72 OR LL55? OR ?LL55 OR FG72.TIME#.LL55 OR
MST(W)FG072-3XA5547(W)12 OR MSTFG072-3XA5547(W)12 OR MST(W)FG07
2-3XA(W)5547(W)12 OR MSTFG072-3XA(W)5547(W)12

L65 4 SEA (L61 AND (L62 OR L63)) OR L64

L66 0 SEA (GT27 OR GT27TM) AND (LIBERTYLINK? OR LIBERTY(W)LINK OR
LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM OR LLRTM)

L67 4 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L68 727 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) (4
W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L69 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L70 333 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)

L71 265 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (3
W) PHOSPHOSYNTHASE)

L72 6893 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L73 9 SEA L67 OR ((L68 OR L69 OR L70 OR L71)) (S)L72)

L74 1 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336

L75 43 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?)

L76 43 SEA (L74 OR L75)

L77 52 SEA L73 OR L76

L78 815 SEA ((BAR OR PAT) (2A) (GENE# OR PROTEIN# OR ENZYME#)) OR
PPT (2W) ACETYLTRANSFERASE OR PPT (2W) ACETYL (W) TRANSFERASE OR
PT (W) N (2W) ACETYLTRANSFERASE OR PT (W) N (2W) ACETYL (W) TRANSFERASE

L79 255 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE

L80 896 SEA (L78 OR L79)

L81 4 SEA L77 AND L80

L82 9216 SEA (HERBICID? OR HPPD(W)INHIBITOR# OR ISOXAFLOTOLE# 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?)

L83 8711 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L84 8520 SEA L82 AND L83

L85 98424 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
OR GLYCINE (W) MAX OR G (W) MAX

L86 108804 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC? (3W) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?)) OR (STACKED (W) (GENE# OR TRAIT# OR EVENT#))

L87 400 SEA L84 AND L85 AND L86

L88 405 SEA L65 OR L66 OR L81 OR L87

L89 21 SEA L88 AND PY>=2020

L90 6 SEA L89 AND UP>=20211001 AND UP<=20220630

FILE 'CABA' ENTERED AT 08:41:52 ON 19 AUG 2022

L91 10 SEA FG72 OR MST(W)FG072 OR MST(W)FG072 OR MST(W)FG072X OR
MST(W)FG072X

L92 18 SEA LL55 OR A5547(W)127 OR A(W)5547(W)127 OR ACS-GM006-4 OR
ACS-GMO06-4 OR ACSGM006(W)4 OR ACSGMO06(W)4

L93 0 SEA XA5547(W)127 OR XA(W)5547(W)127 OR XACS-GM006-4 OR
XACS-GMO06-4 OR XACSGM006(W)4 OR XACSGMO06(W)4

L94 11 SEA FG72? OR ?FG72 OR LL55? OR ?LL55 OR FG72.TIME#.LL55 OR
MST(W)FG072-3XA5547(W)12 OR MSTFG072-3XA5547(W)12 OR MST(W)FG07
2-3XA(W)5547(W)12 OR MSTFG072-3XA(W)5547(W)12

L95 11 SEA (L91 AND (L92 OR L93)) OR L94

L96 2 SEA (GT27 OR GT27TM) AND (LIBERTYLINK? OR LIBERTY(W)LINK OR
LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM OR LLRTM)

L97 14 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L98 1204 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) (4
W) (PHOSPHATE OR PHOSPHORIC) (2W) (SYNTHASE OR SYNTHETASE)

L99 0 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L100 463 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)

L101 192 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (3
W) PHOSPHOSYNTHASE)

L102 7692 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L103 22 SEA L97 OR ((L98 OR L99 OR L100 OR L101)) (S) L102)

L104 4 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336

L105 67 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?)

L106 67 SEA (L104 OR L105)

L107 86 SEA L103 OR L106

L108 1587 SEA ((BAR OR PAT) (2A) (GENE# OR PROTEIN# OR ENZYME#)) OR
PPT (2W) ACETYLTRANSFERASE OR PPT (2W) ACETYL (W) TRANSFERASE OR
PT (W) N (2W) ACETYLTRANSFERASE OR PT (W) N (2W) ACETYL (W) TRANSFERASE

L109 381 SEA PHOSPHINOTHRICIN (W) N (W) ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N (2W) ACETYLTRANSFERASE OR PHOSPHINOTHRICIN (2W) ACETYL (W) TRANSFER
ASE OR PHOSPHINOTHRICINACETYL (W) TRANSFERASE

L110 1690 SEA (L108 OR L109)

L111 9 SEA L107 AND L110

L112 19868 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?)

L113 19074 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L114 18668 SEA L112 AND L113

L115 201703 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
OR GLYCINE (W) MAX OR G (W) MAX

L116 190383 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC? (3W) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?)) OR (STACKED (W) (GENE# OR TRAIT# OR EVENT#))

L117 795 SEA L114 AND L115 AND L116

L118 808 SEA L95 OR L96 OR L111 OR L117

L119 83 SEA L118 AND PY>=2020

L120 28 SEA L119 AND UP>=20211001 AND UP<=20220630

L121 28 SEA L120 NOT P/DT

L122 0 SEA L120 AND (P/DT AND J/DT)

L123 28 SEA L121 OR L122

FILE 'HCAPLUS' ENTERED AT 08:42:07 ON 19 AUG 2022

L124 16 SEA FG72 OR MST(W)FG072 OR MST(W)FG072 OR MST(W)FG072X OR
MST(W)FG072X

L125 24 SEA LL55 OR A5547(W)127 OR A(W)5547(W)127 OR ACS-GM006-4 OR
ACS-GMO06-4 OR ACSGM006(W)4 OR ACSGMO06(W)4

L126 0 SEA XA5547(W)127 OR XA(W)5547(W)127 OR XACS-GM006-4 OR
XACS-GMO06-4 OR XACSGM006(W)4 OR XACSGMO06(W)4

L127 26 SEA FG72? OR ?FG72 OR LL55? OR ?LL55 OR FG72.TIME#.LL55 OR
MST(W)FG072-3XA5547(W)12 OR MSTFG072-3XA5547(W)12 OR MST(W)FG07
2-3XA(W)5547(W)12 OR MSTFG072-3XA(W)5547(W)12

L128 28 SEA (L124 AND (L125 OR L126)) OR L127

L129 0 SEA (GT27 OR GT27TM) AND (LIBERTYLINK? OR LIBERTY(W)LINK OR
LIBERTY(W)LINKTM OR LIBERTY(W)LINKRTM OR LL OR LLTM OR LLRTM)

L130 30 SEA 2MEPSPS OR 2(W)MEPSPS OR 2M(W)EPSPS OR 2(W)M(W)EPSPS

L131 4515 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)

L132 9 SEA (ENOLPYRUVYL OR ENOLPYRUYL OR ENOLPYRUVOYL) (W) (PHOSPHOSHIKI
MATE OR PHOSPHOSHIKIMIC OR ENOLPYRUVYLSHIKIMATEPHOSPHATE) (2W) (S
YNTHASE OR SYNTHETASE)

L133 1111 SEA (ENOL(W)PYRUVOYLSHIKIMATE OR ENOLPYRUVYLSHIKIMATE OR
ENOLPYRUVYLSHIKIMIC OR ENOL(W) (PYRUVYL OR PYRUVOYL) (W) SHIKIMATE
) (3W) PHOSPHATE (W) (SYNTHASE OR SYNTHETASE)

L134 84 SEA (PHOSPHOSHIKIMATE (2W) CARBOXYVINYLTRANSFERASE OR PHOSPHOSHIK
IMATE (2W) CARBOXYVINYL (W) TRANSFERASE OR ENOLPYRUVOYL (W) SHIKIMIC (
3W) PHOSPHOSYNTHASE)

L135 76018 SEA ((DOUBL# OR DOBL#) (W) (MUTANT# OR MUTAT?) OR 2M)

L136 43 SEA L130 OR ((L131 OR L132 OR L133 OR L134)) (S) L135)

L137 4 SEA HPPDW336 OR HPPD(W)W336 OR HPPD(W)W(W)336 OR HPPDW(W)336

L138 221 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?)

L139 221 SEA (L137 OR L138)

L140 261 SEA L136 OR L139

L141 5435 SEA ((BAR OR PAT) (2A) (GENE# OR PROTEIN# OR ENZYME#)) OR
PPT(2W)ACETYLTRANSFERASE OR PPT(2W)ACETYL(W)TRANSFERASE OR
PT(W)N(2W)ACETYLTRANSFERASE OR PT(W)N(2W)ACETYL(W)TRANSFERASE

L142 794 SEA PHOSPHINOTHRICIN(W)N(W)ACETYLTRANSFERASE OR PHOSPHINOTHRICI
N(2W)ACETYLTRANSFERASE OR PHOSPHINOTHRICIN(2W)ACETYL(W)TRANSFER
ASE OR PHOSPHINOTHRICINACETYL(W)TRANSFERASE

L143 5742 SEA (L141 OR L142)

L144 30 SEA L140 AND L143

L145 30501 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?)

L146 29251 SEA (HERBICID? OR BIALAPHOS OR BASTA OR GLUFOSINATE OR
PHOSPHINOTHRICIN OR LIBERTY?) (5A) (RESIST? OR TOLERAN? OR
PROTECT?)

L147 28645 SEA L145 AND L146

L148 429780 SEA SOY OR SOYA OR SOJA OR SOYBEAN# OR SOYABEAN# OR SOJABEAN#
OR GLYCINE(W)MAX OR G(W)MAX

L149 647138 SEA GMO OR GMOS OR LMO OR LMOS OR GM OR GE OR TRANSGEN? OR
(GENETIC?(3W) (MODIF? OR TRANSFORM? OR MANIPULAT? OR IMPROV? OR
ENGINEER?)) OR (STACKED(W) (GENE# OR TRAIT# OR EVENT#))

L150 6336 SEA L147 AND L148 AND L149

L151 6375 SEA L128 OR L129 OR L144 OR L150

L152 1355 SEA L151 AND PY>=2020

L153 316 SEA L152 AND UP>=20211001 AND UP<=20220630

L154 26 SEA L153 NOT P/DT



We create chemistry

L155 0 SEA L153 AND (P/DT AND J/DT)
L156 26 SEA L154 OR L155

FILE 'MEDLINE, BIOSIS, AGRICOLA, CABA, HCAPLUS' ENTERED AT 08:42:19 ON 19
AUG 2022

L157 74 DUP REM L30 L60 L90 L123 L156 (22 DUPLICATES REMOVED)
 ANSWERS '1-20' FROM FILE MEDLINE
 ANSWERS '21-32' FROM FILE BIOSIS
 ANSWERS '33-36' FROM FILE AGRICOLA
 ANSWERS '37-57' FROM FILE CABA
 ANSWERS '58-74' FROM FILE HCAPLUS